APPLICATION DEVELOPMENT IN THE AGE OF BUSINESS AUTOMATION: FAST, FLEXIBLE AND FLOWING

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Chapter 1:
Rise of the Citizen Developer

In the emerging digital enterprise, there's a good chance some application development will be taking place outside the information technology department. It's not that the role of IT is in any way being diminished – in fact, IT managers are getting busier than ever, overseeing the technology strategies of their enterprises. Rather, the pieces are in place for business users to build and configure the essential business applications they need, on a self-service basis, with minimal or no involvement of their IT departments.

As the world moves deeper into an era of ongoing disruption from digital players – be they startups, or teams within established enterprises – technology has become an essential part of every job, from the boardroom to the boiler room. Accordingly, the discipline of IT is no longer confined to the data center or development shop. Many business managers and professionals are building, launching or downloading their own applications to achieve productivity and respond quickly to problems and opportunities.

Welcome to the age of the "citizen developer" and the tech-savvy process expert.

The citizen developer is typically an individual outside of the IT department (though he or she could potentially be an IT employee as well) who constructs business applications, but these applications remain within the guardrails established by IT. Citizen developers deeply understand what their business needs to succeed, and can identify and pursue the innovations that can take their businesses in new directions.

The momentum toward business-powered IT is building, recent studies show. A survey of 324 executives by Information Today, Inc., finds 76 percent indicate that at least some portion of their applications were already developed outside of their traditional IT department or IT service. The main reasons business-side users are moving to oversee their own applications include speed of application delivery and the sharing of data and analytics, both areas in which IT support is seen as weak.[1]

Similarly, a report from Citi brands the rise of "citizen developers" as one of the top 10 trends reshaping enterprises, and is helping "bridge the present gap between supply and demand in developer resources. Gartner predicts that demand for application development will grow five times faster than the related IT capacity through 2021."[2]

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[1] *The Rise of the Empowered Citizen Developer: 2017 Low-Code Adoption Survey*, Unisphere Research, a Division of Information Today, Inc., November 2017.

[2] *Disruptive Innovations V: Ten More Things to Stop and Think About*, Citi GPS: Global Perspectives & Solutions, November 2017.

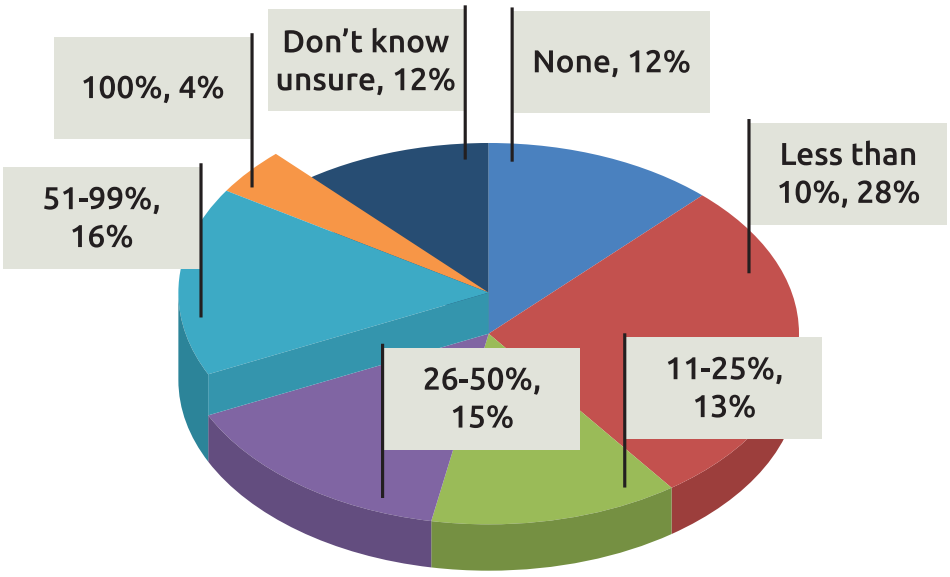
Citizen developers may be members of the millennial generation (born after 1990), having been exposed to computing and the internet for their entire lives, and thus are very comfortable with working with computers. The ranks of citizen developers aren't limited to millennials, however – end users of all ages recognize the power of computing and their ability to leverage their own approaches and solutions. The bottom line is they are building applications that work for their immediate business purposes, unlike the monolithic or inflexible applications that have run core processes in enterprises up to this point.

Citizen developers most likely possess some rudimentary knowledge of programming or related technology abilities. Even if they don't, they inherently understand the power of technology to solve their business problems or queries. While they probably lack formal computer training, their "just-enough" degree of understanding is enough to enable them to know where and how to apply new solutions. In addition, they want to learn and are hungry for the tools and capabilities that will improve their worklives.

While traditional application developers may be focused on technology issues and challenges, citizen developers are almost purely concerned with the business issues at hand. The role of IT departments is to put policies and standards in place to guide their efforts, along with a back-end infrastructure to assure uptime, high availability and security.

The question becomes, how can enterprises best support the work of this emerging class of citizen developers? They can open up the power of technology – through low-code and no-code platforms, business process modeling, and mobile – to decision-makers at all levels, enabling them to respond quickly to changes in customer preferences, markets, and operational trends. Success is also about the power of teams in building today's applications – working collaboratively, with each member providing his or her expertise and experience to conceive, design and build applications that meet the needs of the business.

One in Five Executives Say Majority of Their Apps are Developed Outside of IT



Applications in Use Developed Outside of IT Department/IT Service

Source: Information Today, Inc., survey of 324 executives

Chapter 2:
Disrupt, or Be Disrupted: The Case for Business Automation

So, why is it so important to nurture and encourage citizen developers in today's business? If you speak with some seasoned IT professionals, you may hear complaints of citizen developers slowing things down, or creating messes that professional IT staff needs to go in and clean up.

At the same time, there's a recognition that IT departments – already stretched thin and under-staffed as it is – can only accomplish so much. As enterprises embrace the digital vision, there's going to be even greater dependency on tech-savvy and analytic capabilities.

In the emerging enterprise, application or software development is going to look very different from application development as we've known it over the years. No longer will software building be confined to cloistered groups of programmers who meet with business users at the beginning of the process to gather requirements, then send a finished product over the wall near the end of the process.

Application development in the emerging digital business is a highly collaborative and ongoing process, involving constant interaction between technology and business teams.

Instead, application development in the emerging digital business is a highly collaborative and ongoing process, involving constant interaction between technology and business teams. At the same time, the rise of self-service capabilities means business users will have more leeway to design and generate their own applications, managed within the guardrails set by IT specialists.

The bottom line is that businesses need to move fast. Businesses seek to be disruptors – versus being disrupted – and need to have fast, responsive technology that will support their efforts. This technology may come from IT professionals, or it may come from business professionals. It no longer matters.

There are a number of reasons why the time for business automation is now:

Alleviating skills shortages

Every business seeks to evolve, to some degree, into a digital enterprise. Demand for technology capabilities is outpacing available programming and development skills. Overall, it is estimated that there are three million more STEM jobs than available professionals, according to research compiled by The Software Guild. It is also estimated that by 2020, there will be one million more computing jobs than workers who can fill those positions.[3]

[3] "Bridging the Software Gap: The Growing Need for Tech Workers," The Software Guild.

Faster responses to business needs

The rising sophistication of digital businesses requires IT staff to commit time and resources to back-end infrastructure requirements, such as integration, security and scalability, and thus less availability to quickly meet user requests. Business users are getting involved in application development because they are concerned with time to market, and their existing IT departments may be delivering too slowly. Don't blame IT, though – they are tasked with keeping enterprise infrastructures up running, secure and responsive, which is not an easy task. What happens, however, is individual or departmental requests don't get priority, and are backlogged. Often, it may take months until an application is made available by IT. For a fast-moving digital business, even a week may be too long.

Aligning IT away from internal efficiencies to the customer

In today's digital era, IT has become the business and the business has become IT. As a result, business leaders are looking to their IT departments to help them advance to the next level. IT leaders need to help their organizations become disruptors and innovators. The emphasis of IT activities can shift from cost control and efficiency to customer acquisition and revenue generation. The goals of technology implementations are shifting toward an emphasis on business-driven imperatives, such as customer acquisition, revenue generation and innovation.

IT leaders need to help their organizations become disruptors and innovators.

Develop truly agile teams

This is an era when applications need to be updated or deployed on an almost-daily basis – if not even more frequently. For example, Amazon releases new software every second,[4] and the pace for releases within mainstream businesses is accelerating – one in five now release software every day.[5] These applications are being built collaboratively, by teams of IT developers, business experts and citizen developers. The genesis of this collaborative trend began with the first formulation of "agile" computing, designed around the idea that developers and business users working together, closely, will produce ongoing iterations of software that are of value to the business.

The Agile Manifesto itself seems to have been written with citizen developers in mind, with the guiding principle of "building projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done." This extends to everyone, not just software developers. Technology needs to enable high levels of collaboration. The rise of the team-built application is taking agile practices to the next level, while staying true to the intent of the manifesto: "We are uncovering better ways of developing software by doing it and helping others do it." The manifesto's authors also talk about the ideal of "sustainable development," with all parties – sponsors, developers, and users – being able to "maintain a constant pace indefinitely."[6]

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[4] "The Story of Apollo - Amazon's Deployment Engine," Werner Vogels, November 12, 2014.
[5] "The 2016 DevOps Pulse, November 2016," Werner Vogels, November 12, 2014.
[6] The Manifesto for Agile Software Development

Digital Shifts the Focus of Application Development

APPLICATION DEVELOPMENT	IN THE TRADITIONAL ENTERPRISE	IN THE DIGITAL ENTERPRISE
GOAL	Efficiency and cost control	Customer acquisition, revenue generation
USERS	Employees	Employees and customers
EXAMPLE	Record an insurance claim	Sell an insurance policy
BUILT BY	IT developers	IT developers, business experts, citizen developers
TOOLS & PLATFORMS	IDEs, programming language, scripting languages	Graphical business process mapping, mobile frameworks, prebuilt open source modules, cloud services
DEPLOYED & MAINTAINED BY	IT operations	DevOps teams

Chapter 3:
The Building Blocks of Business Automation

A new generation of technology – business automation solutions – is contributing to the capabilities and growth of application development. Business users need to have the tools and capabilities to build applications they require, and the process needs to be simple, intuitive and as automated as possible.

Business automation is made possible through a constellation of solutions and technology sets, including the following:

Artificial intelligence and robotic process automation

Advances in artificial intelligence (AI) and robotic process automation (RPA) not only make it easier to deploy smarter business processes, but also for citizen developers to build the applications that make it possible. "It won't be too long before we can use AI to improve development, thanks to smarter tools that learn based on the individual developer's style and application and help write better, higher-quality code," notes Diego Lo Giudice, analyst with Forrester.[7]

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AI automatically can do all the behind-the-scenes work involved in writing applications, including planning, testing, bug remediation, documentation, workflow, integration, and process development, which all can be automatically be delivered by AI-driven development systems.

RPA, which first appeared on the enterprise scene just a couple of years ago, employs AI to enable software bots to make decisions at key points within business processes, especially those that involve back-end processes, such as data management and meeting compliance obligations. The advantage is that RPA can be employed quickly, cheaply and easily to automate processes – by business users themselves, without the need for IT staff to develop scripts or algorithms to accomplish the same level of automation.

Business process modeling

Business and technology users need to be able to see the big picture – to map technology to their business requirements. Business process modeling (also including business process mapping) abstracts corporate workflows and processes in a graphical format, so citizen developers can immediately get a complete picture of how they are arranged. Business process modeling provides a view of how processes flow across enterprises, who is involved, and what resources may be required. Business process modeling helps improve the efficiency of business processes, and BP modeling provides a graphic representation that makes potential improvements visible. The enhanced transparency, in turn, provides for more informed decision-making about what applications are best suited for which processes.

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[7] "Developers: Will AI Run You Out Of Your Job?," Diego Lo Giudice, Forrester Research

Business decision management and business rules

Many of the common, day-to-day decisions associated with business processes can be automated, employing AI, RPA, and guided by a rules engine and repository. Citizen developers can quickly access these pre-built, pre-determined decision points to include within the process development. A key emerging technology is Decision Modeling and Notation (DMN), a new standard for representing the rules that govern business decisions. DMN enables decisions to be modeled in the same way as processes, providing transparency into the rules and policies that determine business outcomes.

Low-code and no-code platforms

With the increasing digitization of business functions within every corner of the enterprise, there is accelerating demand for highly targeted applications that enable business users to quickly address problems or act on opportunities. Low-code and no-code platforms enable business users to build their own applications quickly, as needs are determined. They enable citizen developers (or professional developers, for that matter) to build solutions in a highly graphic, flowchart-like fashion. No coding is required, or visible. Low-code platforms are designed to enable development across a range of environments, from core business processes to websites.

Cloud and serverless computing

Cloud computing puts a world of resources – both technology and business-focused – at the hands of business users. There is a robust market of cloud providers providing infrastructure, including compute processing power, storage, databases and middleware. Today's business users have access to the same sophisticated tools and capabilities that were limited to data center operators in times gone by.

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With cloud, formerly monolithic enterprise applications – which are difficult or impervious to change – are recast as configurations of services that can be called, reused and redeployed as needed. The result is that applications can now be designed and built completely independently of underlying hardware, infrastructure and networks. They are configured via software controls, often automatically, eliminating the need for coding or scripting to help applications fit into existing infrastructures.

Serverless computing takes this abstraction a step further. Serverless means all underlying details are automatically managed behind the scenes. Developers can develop without worrying about what's on the back end, and thus focus entirely on the business functionality of the applications they are working on. The next logical step is businesspeople being able to do the same. Citizen developers do not need to worry about technical details, such as embedding commands that assure higher performance or less network latency. With serverless computing, citizen developers can design and build applications that are already and automatically supported at the back end to servers or cloud instances.

Microservices and containers

Microservices and containers also make applications even more portable and easier to build. Microservices represent and abstract discrete, fine-grained aspects of application functionality, and are capable of running on their own, with no dependencies. Thus, they can be "loosely coupled" to other services, such as issuing a purchase order or linking to a mobile interface, without the need to revise or disrupt existing applications. Microservices are then easily bundled into containers that can be moved to any environment, whether it's cloud or an on-premises server. With containerization, key functions are automatically incorporated into a single, self-contained package that includes the application, configuration files and a runtime environment.

Application programming interfaces (APIs)

APIs – both public and internal – enable connectivity to a range of functions. There are two types of APIs: public APIs and private APIs. A public API is a connective snippet of code to aspecific service, such as the well-known APIs from Amazon, Google, Twitter or Facebook. Typically, they serve as gateways to vendors' application sets or services, and are intended to build ecosystems around these existing solutions. ProgrammableWeb, the site that tracks public APIs, estimates there are now more than 18,000 APIs publicly available for development, and more than 2,000 are created and published every year.

Private APIs are much more common than public APIs, as there are likely many in existence within the millions of enterprises across the globe. (Exact numbers are not readily available.) A private API is a snippet of code used within the walls of an enterprise, providing ways for developers to access and draw from their organizations' back-end infrastructures, core applications, and data. This helps reduce the chances of duplication of effort, as functionality for a particular application may already exist elsewhere in the enterprise. The credo of private APIs is self-service – citizen developers across enterprises can access the functionality they need in their own applications via the common, tested and documented services accessible through the corporate APIs.

The 12 Principles of Agile Development

When the Agile Manifesto was crafted, its authors had citizen developers in mind, as the document acknowledges that application development is an activity in which the business side is a full and active partner.

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximizing the amount of work not done – is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

Source: The Manifesto for Agile Software Development

Chapter 4:
Case Studies

The following describe how leading and forward-thinking organizations have employed the latest generation of business automation tools and platforms to accelerate application development and provide agility to the enterprise.

AVIVA

Aviva Asia Streamlines System Migration, Reduces Costs

Aviva plc, a major international insurance group based in the UK, serves 34 million customers. As part of an expansion of its international operations, Aviva plc acquired Friends Provident International (FPI), a provider of life insurance, pension, and investment products in Asia, the Middle East, and the UK. After this acquisition, Aviva Asia Pte. Ltd. started an initiative to review FPI's IT systems and upgrade or replace components as needed to ensure successful integration with its own IT systems. As part of this initiative, FPI's existing imaging and bond management workflow system needed to be integrated into Aviva's infrastructure, but the system did not conform to Aviva's IT standards. In addition, the software's renewal and maintenance was costly and inflexible.

Aviva sought a new solution that would not only address existing business needs but also use innovative technologies to support faster time to market for new services. In addition, Aviva wanted a solution that would prevent vendor lock-in with a cost-effective subscription model. "The system was coming into a renewal process and needed to be upgraded. It didn't meet the needs of the company," said Sam Simopoulos, regional CIO at Aviva Asia Pte. Ltd.

Aviva decided to migrate from FPI's existing system to a new imaging and workflow application based on Red Hat® JBoss® Middleware. Aviva had previous success working with Red Hat and open source technology, and the potential security, flexibility, and cost benefits appealed to the project team. As part of its new automated workflow distribution application, Aviva deployed several Red Hat software products, including:

- Red Hat JBoss Web Server and Red Hat JBoss Enterprise Application Platform to host its case management system and provide a front-end interface for business users' daily operation activities.

- Red Hat JBoss Fuse to manage additional service end points and establish a service gateway for routing and service integration with third-party vendor systems, such as Kofax and IBM FileNet.

- Red Hat JBoss BPM Suite to manage and automate business processes as the main workflow engine.

- Red Hat JBoss BRMS to manage business rules, business resource optimization, and complex event processing.

Aviva's new application was created using a new combination of software. As part of implementation, the company migrated processes from its previous proprietary system and migrated eight million images from its UK data center to its Asia-based data center.

LogistiCare®

LogistiCare Accelerates Flexibility and Speed of Business

LogistiCare is the largest provider of non-emergency medical transportation in the United States. The company manages more than 70 million non-emergency medical rides for 27 million customers every year through its network of contracted transportation companies, mass transit partnerships, mileage reimbursement programs, and independent drivers. To better manage rider eligibility and scheduling – including making scheduling rides easier through more efficient transportation provider selection – LogistiCare wanted to improve its app. The company also needed to monitor rides via GPS tracking (including display of drivers and riders on a real-time map, like other ride-sharing apps) and random checks by field monitors.

The company relied on an app with business processes, rules, and workflows locked into costly technology from a proprietary vendor. In addition, after years of updates and modifications, the app contained business logic that made meeting the evolving needs of clients, partners, and service providers increasingly difficult.

"Customers and business partners were always asking for new functionality from the system, and it was taking months to deliver," said Michael Quintero, enterprise solutions architect at LogistiCare. "To better serve our clients and members, we have to make it easier for people to access our service," he added.

LogistiCare sought to automate rules-based business processes, scale its IT environment, and ensure consistent releases and provisioning. The company used technology from across Red Hat's enterprise portfolio to modernize its app processes and establish an agile platform for more adaptive services. The company deployed Red Hat JBoss Middleware – including Red Hat JBoss Fuse, Red Hat JBoss BPM Suite, and Red Hat JBoss BRMS – to create a micro-services architecture to develop applications as ndependent, modular services; automate end-to-end business processes; define complex rules within each service or process for regulatory compliance, routing, payment processing, and ride scheduling; and establish a lightweight, flexible integration platform for creating and connecting application programming interfaces (APIs) quickly.

In the past, LogistiCare could not respond as quickly as desired to frequent requests for new features from customers and business partners. With Red Hat technology, the company has accelerated its releases of desired updates and additional features. As a result, LogistiCare's application development and IT operations teams can create and deploy apps with the speed and consistency that business demands.

"We anticipate moving from large software releases quarterly to functional releases monthly, with system refinements happening as often as weekly," said Quintero. "Our IT organization is now a responsive partner with a business focus."

In addition, the company's previous application took up to eight weeks for call center agents to learn – and due to high industry turnover rate, new agents constantly needed training. With simplified, easy-to-understand business rules provided by its new application, LogistiCare has cut the length of its formal training curriculum to just one week.

"Our IT organization is now a responsive partner with a business focus."

Michael Quintero, Enterprise Solutions Architect, LogistiCare

With a microservices-based integration strategy supported by Red Hat JBoss Middleware, LogistiCare can not only better connect its internal systems and resources, but also take advantage of systems and APIs from external, third-party service providers. For example, its customers can now schedule rides on demand with Lyft. LogistiCare can book and monitor those rides in real time.

Chapter 5:
Summary and Recommendations

To succeed in today's digital economy, organizations need to support application development at all levels, when and where required by decision makers. Here are a few recommendations on how to move on this journey:

- Educate key business experts on application development practices and technology. Ensure that they are familiar with the methods and practices that their IT developers use to build applications.
- Educate key IT developers on the disciplines and practices used to model business architectures, processes and decisions, and how these models can be used to automate business activities.
- Develop a team-oriented culture for application development, involving IT and business professionals.
- Select tools and platforms that enable business users and IT developers to work together onnew applications that combine business models with code. Evaluate the applicabilty of technologies like containers, microservices, digital process automation, decision management, robotic process automation, etc., to the future needs of the business
- Select an initial project as a proof of concept. Choose an application with value to the business that IT and business users can build together. Seek guidance and help from a consulting organization or technology vendor with appropriate experience and knowledge of modern application development techniques.
- Adopt and articulate policies that encourage business application development while ensuring security and consistency.

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