

The State Of Mobile App Development

by Julie A. Ask and Jeffrey S. Hammond, March 23, 2015

KEY TAKEAWAYS

The Pace Of App Enhancement Challenges eBusiness Professionals

Only 25% of digital business professionals feel they update their apps frequently enough to keep pace with their own or customers' expectations. Operating system (OS) and device upgrades break apps if they're not updated.

Infrastructure -- Not Budget -- Inhibits Update Frequency

Only 20% of digital business professionals update their apps frequently enough to fix bugs and react to OS updates. A lack of resources to natively support multiple platforms and build infrastructure services inhibits their pace.

Too Few Build Apps In-House

Just shy of half of the digital business professionals surveyed build native applications in-house. They rely on a combination of middleware solutions and third parties to fill their budget and resource gaps -- which is a good approach but only if they can still operate as a virtual, agile team.

Build IDEA Teams With Creative Developers That Are Mobile Natives

When building your own in-house mobile app development teams, look for cross-skilled, creative developers who have cut their teeth on mobile development. That includes recent computer science graduates and veterans from design agencies.

The State Of Mobile App Development

Few eBusiness Teams Keep Pace With Customer App Expectations

by [Julie A. Ask](#) and [Jeffrey S. Hammond](#)
with [Carrie Johnson](#) and Laura Naparstek

WHY READ THIS REPORT

eBusiness professionals struggle to keep pace with consumer expectations of mobile apps. Competitors, entrepreneurs, and brands outside their industry push the envelope on what defines “best in class” each day. Teams with best-in-class Agile development practices update their apps every two to three weeks while releasing more substantial upgrades several times each year. Those eBusiness professionals who feel they are set up for success own their mobile app development resources, but only a minority of those we surveyed do (or plan to do) so. This report helps eBusiness professionals create a tactical plan to set themselves up for success independent of their budget or how they are building mobile apps today.

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[Developers Are The St. Bernard For Mobile Projects](#)
September 17, 2014

[Organize For Mobile Development Success](#)
April 22, 2014



EBUSINESS PROS HAVE MORE IRONS IN THE FIRE THAN THEY CAN MANAGE

Mobile has shifted consumers' expectations. They expect instant access to information and services, simple task flows, and relevant experiences. They also expect mobile experiences to improve continuously, whether they are standalone apps or apps associated with connected products. The more a consumer shares with you, the more relevant they expect their next experience to be. When USAA rolled out remote deposit capture in 2009, consumer delight spread like wildfire.¹ Within months, consumers who didn't bank with USAA began by asking their own banks why they couldn't match that level of convenience and then demanding it. They then asked, what's next?

eBusiness professionals have upended their cultures, processes, and approaches to digital development to meet the demands of consumers. They know that every interaction with their brand — including the mobile app — is part of their customer experience. And switching costs have never been lower for their customers: If consumers don't find what they need in one app, they can find, download, and configure another app to give them what they need in less than 2 minutes. The stakes have never been higher in terms of keeping pace with emerging technology and shifting consumer expectations.

Apps Are Multiplying Like Rabbits Rather Than Products

eBusiness professionals have rolled out apps for their companies, both to have a presence on the most important personal device that consumers own as well as to engage consumers in their mobile moments with the ultimate experience. Nearly half of the digital business professionals we surveyed have fewer than three mobile apps, but an astonishing 9% have more than 21 (see Figure 1)! Beyond launching apps to support short-term campaigns, eBusiness professionals launch additional apps to:

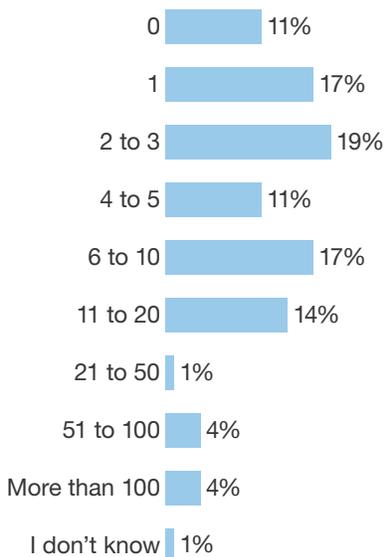
- **Serve new or different audiences.** A single enterprise's customers could be segmented by age, income, products purchased, brand preferences, or geographies. Banks may launch separate apps for banking, credit card, and investment customers, while each brand within a larger CPG conglomerate may launch apps by both brand and geography to account for customers' preferences and language. Nestlé, for example, has more than 200 apps in the Apple App Store. New audiences may also include employees or business partners serving customers in new ways in traditional channels. For example, store associates at Rebecca Minkoff use iPad minis to search inventory and collect payment from customers.²
- **Simplify the user experience. Consumers expect simplicity on mobile devices.** The discipline of simplicity forces digital professionals to have a razor-sharp focus on the needs and motivations of their best customers on the go rather than building a one-stop app for every service offered through the company's desktop website for every customer. Rather than continuing to jam more functionality and content into a single app, brands like eBay, Facebook, and Google have launched apps dedicated to a single customer experience, such as maps, navigation, and email, or around product categories, such as cars and pets.

- **Pilot new features.** Consumers need time to adjust to new experience paradigms. Before Amazon.com incorporated daily deals, 2D bar code scans, and augmented reality into its core app, it piloted the use of the technology in standalone apps. At times, the hardware dictates the availability of new features, such as using near field communications (NFC) for payments.

Figure 1 The Majority Of eBusiness Pros Use Multiple Apps To Engage Consumers

“How many total mobile apps does your company have across regions and brands?”

(Select one)



Base: 72 digital business professionals

Source: Forrester's Q2 2014 Global Mobile Executive Online Survey

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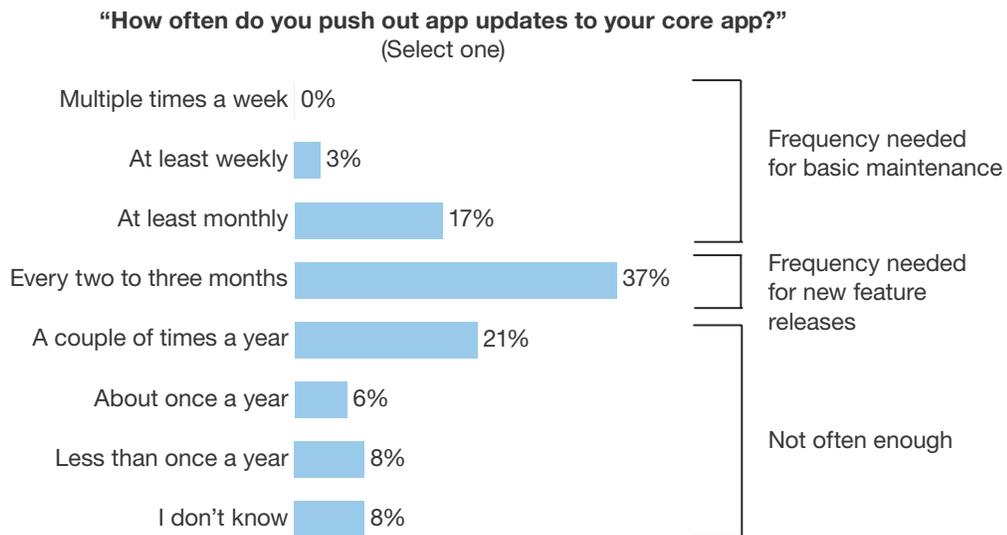
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eBusiness Professionals Struggle To Keep Pace

More is not always better. More mobile apps means hiring more developers, performing more testing, and maintaining more code. With mobile platforms and ecosystems evolving at breakneck speed, the combined complexity is more than most of you can handle. You struggle to quickly take advantage of the latest hardware features, software services, and built-in mobile platform services like Apple Pay, Cortana, or Google Now. You need to update apps continually for three core reasons: 1) to fix bugs and improve performance; 2) to roll out new features; and 3) to improve the user experience through app redesign and the use of context to streamline tasks. Your priorities are shifting constantly, however — affected by unexpected defects that have an impact on app ratings, new OS and device releases, as well as shifting consumer expectations when your competition “one-ups” you. Continuous delivery of mobile apps is also easier said than done: Only 20% of digital business professionals push out app updates at least monthly — which is not often enough when bug fixes are on the list, as they well know (see Figure 2). Only 25% of digital business professionals surveyed feel that they update their apps as often as they need to. Why are they struggling?

- **Too many mobile platforms slow updates . . .** We face a fragmented mobile platform world, due to multiple manufacturers, screen sizes, hardware feature sets (e.g., sensors, cameras), and operating system (OS) versions. Consider apps that use a fingerprint to unlock an app or NFC to make a payment: These are cutting-edge features that only a few phone platforms support today. Customers with the latest handsets, however, want the convenience that these features offer, which requires you to create multiple versions or conditional logic for your app — even for the same OS, screen size, and hardware design. Among the digital business professionals we surveyed, 35% state that they simply don’t have the resources to keep up (see Figure 3). Native app development compounds this lack of resources, as you need to keep pace on at least two platforms — iOS and Android.
- **. . . while an inability to update back-end infrastructure inhibits new features.** For years, we’ve known that mobile app innovation would come to a screeching halt at those companies that failed to invest in back-end mobile infrastructure services to support anticipated features and access to customer data. Today, 30% of digital business professionals say that a lack of investment in back-end infrastructure inhibits them, second only to a lack of resources. Limited budgets have forced them to trade long-term investment for short-term gains, and they haven’t had the political capital to coerce support from their tech management counterparts to put the necessary infrastructure in place.

Figure 2 Too Few Digital Business Professionals Update Their Mobile Apps Frequently



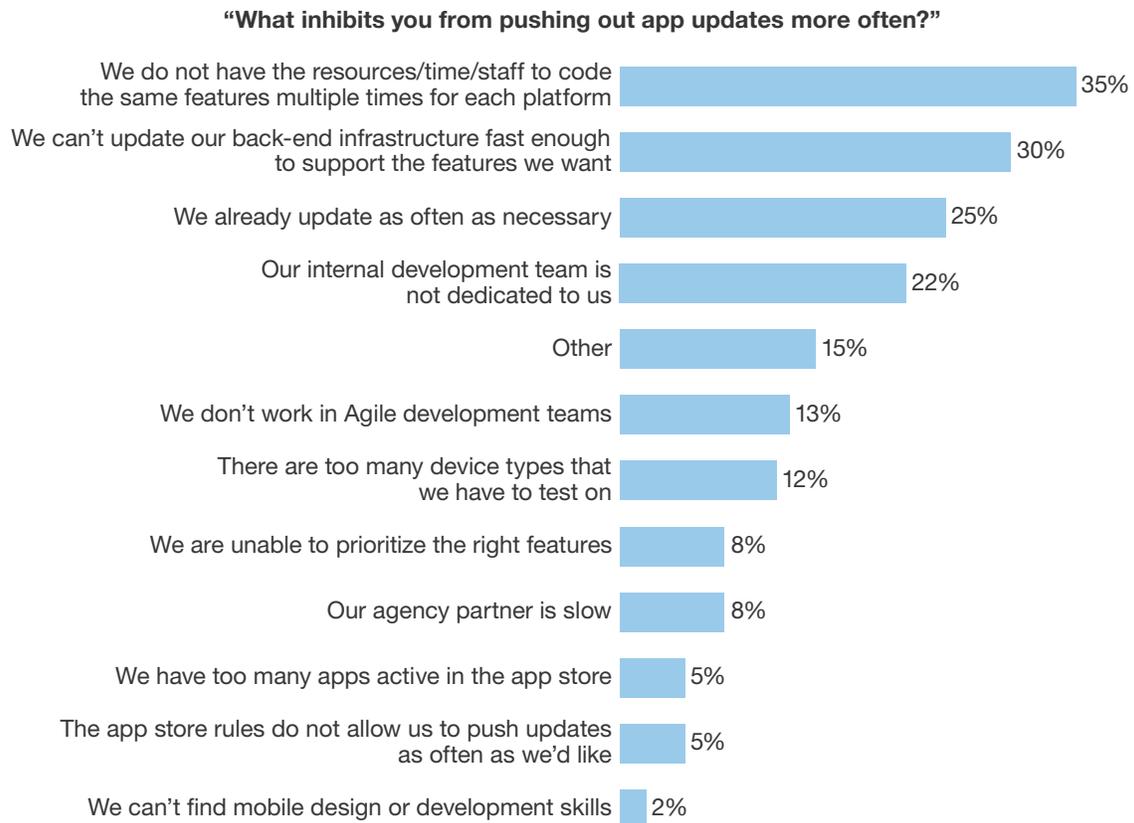
Base: 63 digital business professionals

Source: Forrester’s Q2 2014 Global Mobile Executive Online Survey

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Figure 3 Mobile Fragmentation And Lack Of Resources Slow App Updates



Base: 63 digital business professionals
(multiple responses accepted)

Source: Forrester's Q2 2014 Global Mobile Executive Online Survey

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Too Many eBusiness Pros Do Not Control Their Development Resources

When it comes to feeling confident that they are set up to succeed, no factor is more important to eBusiness professionals than control of the mobile app development team. Today, 22% of digital business professionals feel their ability to roll out apps is inhibited because their internal development team isn't dedicated to them. Their situation is exacerbated by:

- **The lack of developer talent in-house.** Half of the digital business professionals we surveyed have fewer than five developers in-house (see Figure 4). That's barely enough to field a single mobile IDEA team, especially if the app is native-built for both iOS and Android.³ More often

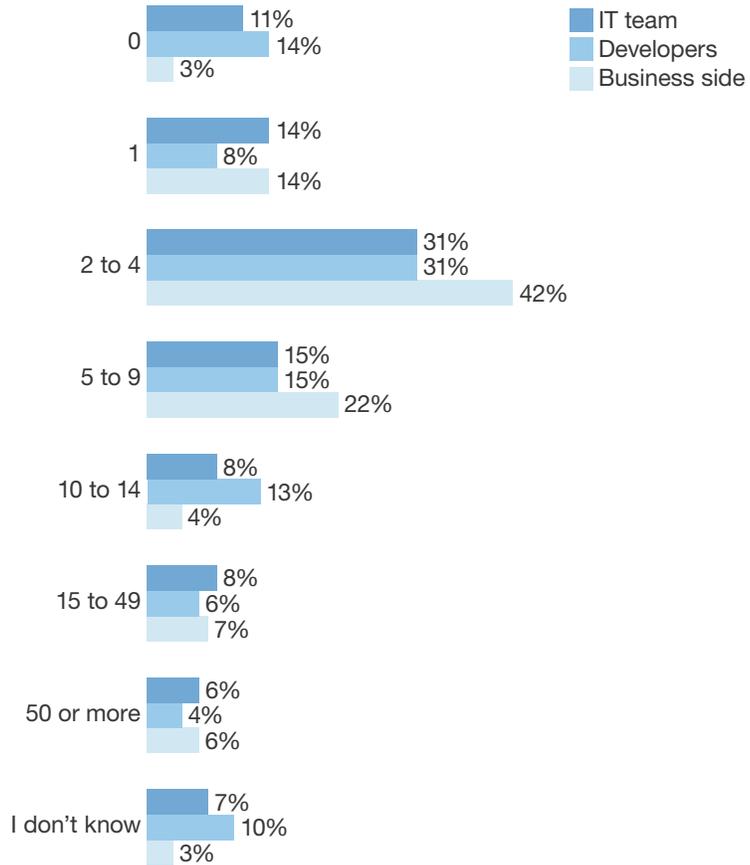
than not, teams that want to have development talent in-house can neither find nor afford it. Talented mobile app developers with five to 10 years of experience usually command salaries reserved for director-level positions and above — not individual contributors. Moreover, in-house tech shops can't match the working environments of a Facebook, Google, or Twitter, which offer developers perks, community, and a high level of autonomy.⁴

- **Their dependency on external expertise.** Spending money is often easier than building the business case for adding headcount (even if you could find it). It's also faster. We found that even those eBusiness professionals who develop mobile apps and websites in-house lean on strategic partners for spot expertise they can't afford, find, or justify as a full-time position. While outsourcing one-time initiatives can drive fast results, relying on external partners for ongoing maintenance or updates can prove tricky without dedicated staff. Digital business professionals are most likely to outsource design and development (see Figure 5). Strategic partners often have the advantage of expertise gained through working with many clients, but it will come at a price.

Figure 4 Few eBusiness Teams Have The Resources To Handle All Development In-House

“Approximately how many full-time equivalents within your company are working on your company’s mobile efforts globally?”

(Select one per row)



Base: 72 digital business professionals

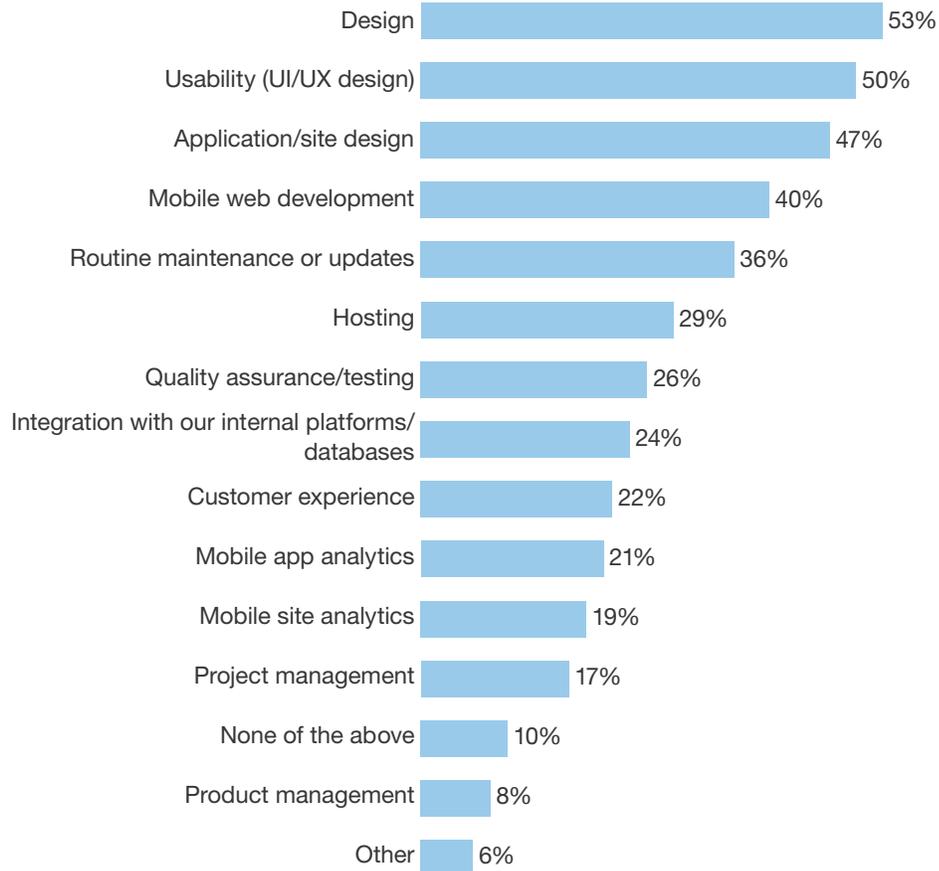
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Figure 5 Design Assistance Tops The List Of Outsourced Expertise

“Which, if any, of the following functions involving the design, development, or deployment of mobile services do you outsource?”



Base: 72 digital business professionals
(multiple responses accepted)

Source: Forrester's Q2 2014 Global Mobile Executive Online Survey

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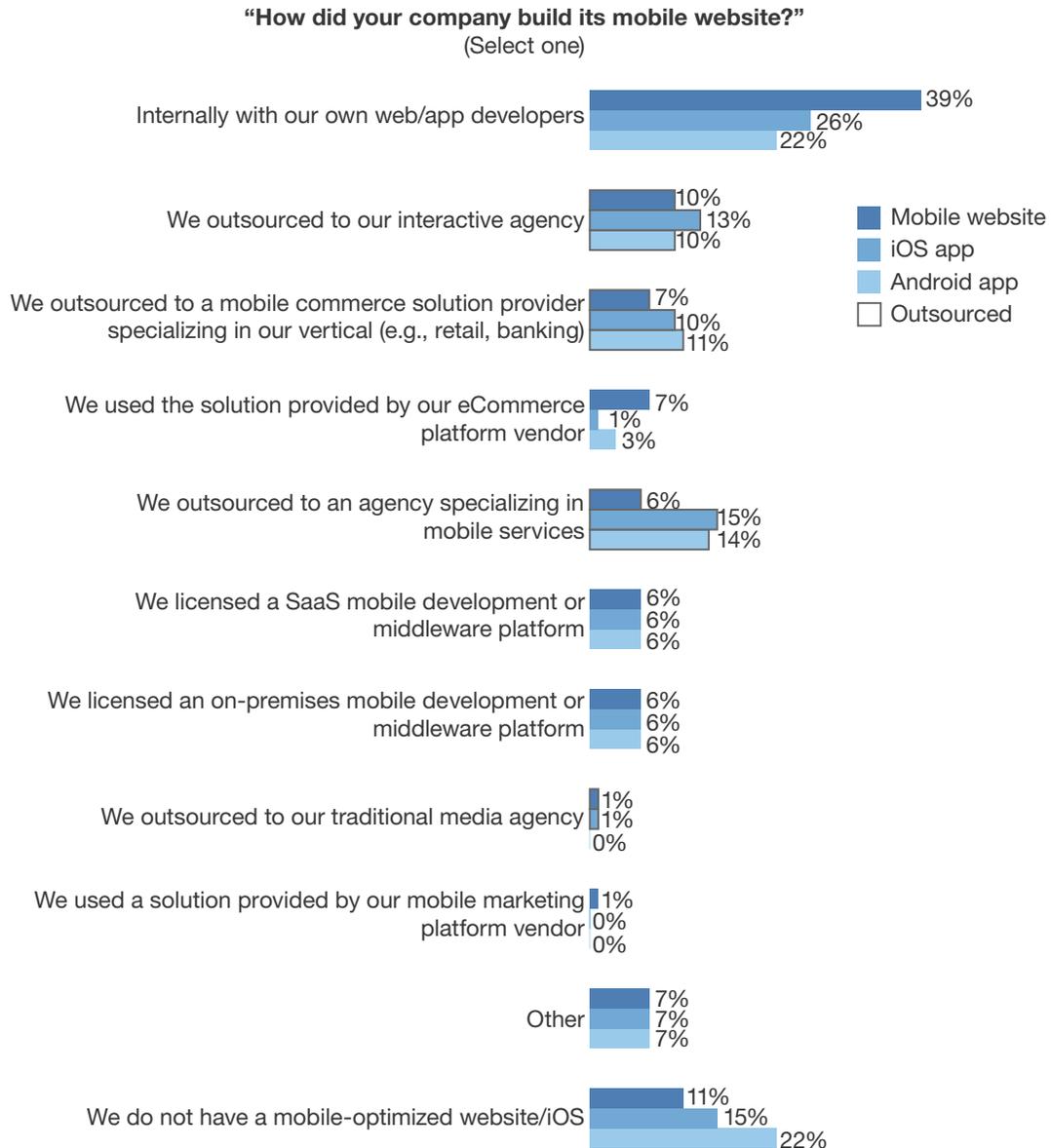
A Lack Of Internal Skills And Resources Leads To A Complex Sourcing Approach

Crafting an approach to mobile apps is an ongoing effort. eBusiness professionals initially outsourced app development because they didn't have the expertise in-house and viewed apps as a project or something to complete once. As they have come to realize that an app is more akin to a website or product than a one-time media buy, they've had to change their approach to put resources in place internally or externally to provide ongoing innovation, maintenance, and renewable customer engagement. Today, digital business professionals choose to:

- **Develop business-critical apps internally when their budget allows.** If they can afford to do so, eBusiness professionals build native apps in-house when they depend on them for revenue or service. These apps have a direct, measurable impact on the bottom line so suffer less from the skepticism that plagues pure marketing apps. The more eBusiness pros view a mobile app as a product, the more likely they are to use native in-house development. Large airlines and banks, for example, lean toward in-house development. We see this ownership evolving on the ground today, with eBusiness professionals already asserting more ownership of the mobile platforms most adopted by consumers — iOS and Android: 26% build iOS apps in-house, and 22% build Android apps in-house (see Figure 6).
- **Develop mobile-optimized sites because they can.** While firms struggle to find and staff native iOS and Android app projects with internal developers, 39% are using internal developers to build mobile websites. Our take on the difference? It's easier to redirect existing web developers already under the control of digital groups to mobile. It's also easier for these developers to adapt to mobile web development because they don't have to learn new programming languages, while popular open source JavaScript frameworks like Angular, Ionic, and jQuery are mobile-ready.
- **Outsource to agencies if they don't have in-house talent.** Agencies develop and continue to build on their mobile expertise more quickly than enterprises thanks to iterations with many clients. Mobile specialists offer a safe bet to deliver exceptional mobile apps, but they come at a price.⁵ Using agencies for one-time builds can produce short-term results, but depending on external partners for routine updates and bug fixes can be expensive, though fast. Only 8% of the digital business professionals interviewed claimed that a slow agency partner inhibited their update pace.
- **Use a cross-platform approach if their budget and internal bandwidth is limited.** “Build once, port everywhere” solutions appeal to 12% of digital business professionals. These products reduce the amount of code that teams have to build and maintain by consolidating development into a single, cross-platform code base. While design agencies and platform providers criticize cross-platform approaches for degrading to the lowest common denominator, that's often an acceptable tradeoff for content-centric apps offering simple functionality and for teams with limited budgets but the desire to serve a broad swath of consumers — especially geographically. Anecdotally, we see some digital business professionals migrating away from these solutions due to platform limitations, propriety code, and usage-based fees; other shops that are struggling to make native development scale (and to pay for it) are reconsidering this approach.
- **Use existing eCommerce platform providers if they're desperate to check the box.** A minority of digital business professionals — 1% for iOS and 3% for Android — use existing eCommerce solution providers for apps — and with good reason. Although they are relatively inexpensive and quick to create, these apps tend to be built on standard templates, lack differentiation, and assume the same consumer needs and motivations on mobile devices as they do on PCs. These

solutions are good if you want to simply “check the box,” but don’t view them as long-term solutions for large enterprises that depend heavily on mobile for revenue or customer self-service. The advantage of affordability will outweigh the disadvantages in terms of quality for small and midsize players, however.

Figure 6 No One Approach Dominates Digital Business Professionals’ Mobile App Development



Base: 72 digital business professionals

Source: Forrester’s Q2 2014 Global Mobile Executive Online Survey

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AVOID TECHNICAL DEBT BY TAKING CONTROL OF APP TECHNOLOGY DECISIONS

In the past year, we've had an increasing number of conversations with eBusiness professionals about their mobile strategy, with many voicing uncertainty over their current course and seeking advice on alternative tactics and strategy. We take these conversations as a sign of the increasing pain created by growing mobile app technical debt, brought on by the continued focus on short-term goals and need for speed.⁶ If you're not already drowning in the consequences of past decisions, you can still avoid the pain that many veteran shops are experiencing. Here's how:

- **Increase your internal mobile capabilities and responsibilities.** It's a well-established business practice to keep core, differentiating functions in-house while outsourcing commodity functions. As mobile devices become the primary customer engagement medium, mobile apps become a business-critical touchpoint and source of differentiation — not a commodity. Teams should bring in-house the design, development, testing, and analytics expertise needed to power a permanent mobile IDEA team for each app that touches customers or business partners (see Figure 7 and see Figure 8). Expect each IDEA team to require four to eight part- and full-time individuals, depending on the size and complexity of the app, the data it integrates with, and the technology strategy used to develop and maintain it (i.e., native code, HTML5, or cross-platform).
- **Use caution when hiring external agencies to do native app development.** Using external agencies as strategic partners to build native apps offers an attractive alternative to in-house development if you can't find or hire the talent you need. You have to be ready to use them as an extension of your internal team — and pay a premium. Finding an external partner is not difficult, especially for native app development. It is the safest and most profitable work for digital agencies and mobile specialists when working on a time-and-materials basis. They get to implement that same functionality multiple times with minimal tooling and infrastructure costs. They also don't have to maintain multiple code bases in parallel over the long term (although they will be happy to do so for you — adding new features to each code base and charging as they go). Push external providers to articulate why a native approach per platform is a long-term win-win for you, not just a safe bet for them.
- **Build maintainability in from the start.** eBusiness professionals should budget for an ongoing commitment to app maintenance and choose technologies that make apps maintainable. Done right, apps will be quick and easy to test (with automation); new features and data will be simple to add, thanks to common mobile infrastructure services and SDKs; and you'll be able to dynamically update content without requiring resubmission to an app store by using elements like integrated WebViews.⁷ Teams should plan for a minimum of four to six updates a year, per platform, along with spot patches to fix defects or support platform updates or new hero devices.
- **Plan for the integration challenges.** Useful apps integrate historical context from systems of record, such as customer databases, CRM systems, and supply chain management applications, as well as extended context from the real world and third parties.⁸ But building secure

application programming interfaces (APIs) and web services to closely guarded data takes time. Engage your business technology (BT) peers early to communicate your information needs, and use mock-ups of data and services or batch extracts from live data to support front-end mobile app teams during design and development. Push your BT organization to field and support common services for identity management, mobile app management, mobile analytics, offline data synchronization, and common services that provide customer data.

- Practice Lean Thinking, and minimize “time to feedback.”** Some of the most successful mobile teams we see go beyond just adopting a product management approach and use a minimum viable product (MVP) approach, where they identify a narrow slice through an app and then rapidly implement and deploy it. For these teams, a week of feedback from real-world use is better than receiving hundreds of pages of requirements or spending weeks on the analysis phase of a project. To follow their example, start with a single persona or customer journey and work outward — one release at a time. This Lean approach works best when teams have the ability to measure the results of their efforts through analytics and session tracking; pay close attention to app store reviews; and regularly benchmark apps against similar ones from competitors.

Figure 7 A Mobile IDEA Team Structure For Native App Development

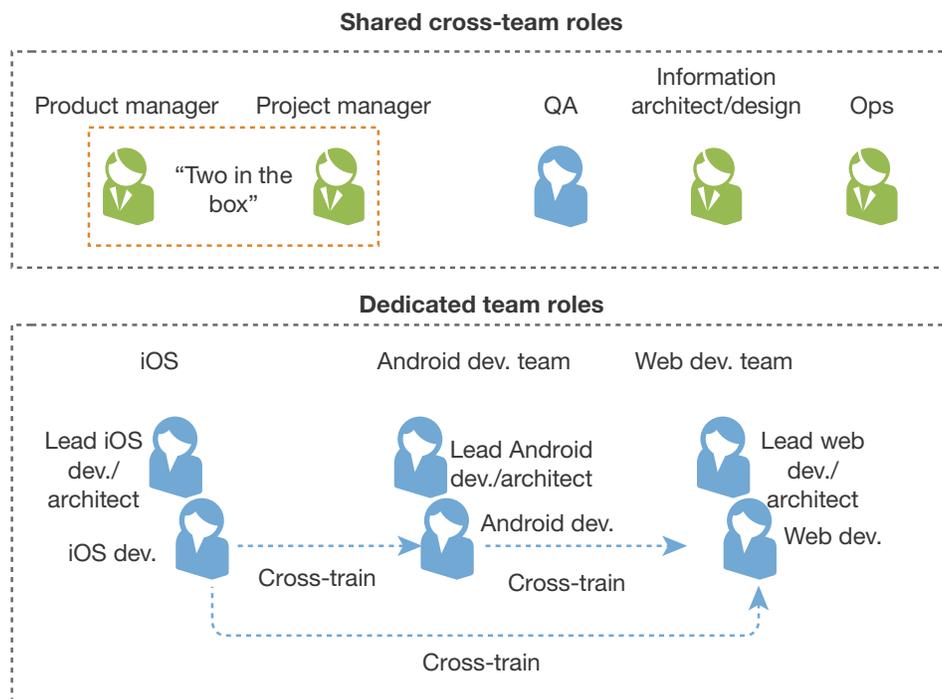
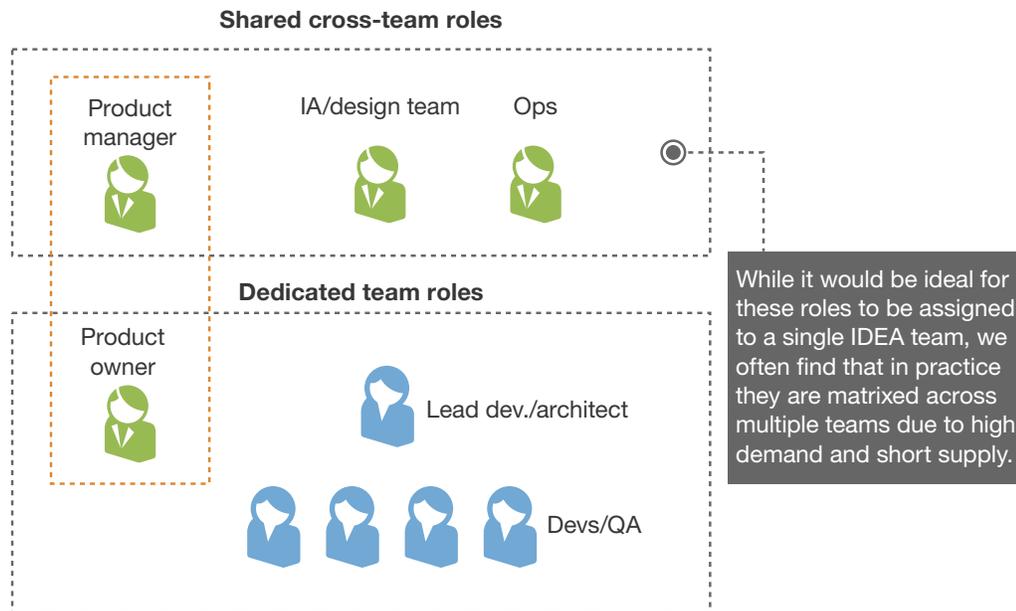


Figure 8 A Mobile IDEA Team Structure For Hybrid, Middleware, Or Mobile Web Development



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Look Beyond Your Tech Management Organization To Staff IDEA Teams

Building a top-flight IDEA team is easier said than done, as good mobile developers have a skill set that's more varied than what you're likely to find on the IT side of your firm's tech management organization.⁹ If existing in-house developers aren't used to Agile development techniques, continuous delivery, and using feedback from analytics to inform their actions, they will struggle mightily to meet your needs. Look for front-end designers, developers, and quality assurance (QA) professionals among your experienced web app developers as well as recent computer science graduates who have cut their teeth on current mobile platforms. Here are some of the more important traits to look for:

- **Fluency in mobile platform programming languages and frameworks.** Each of the major mobile app platforms — Android, iOS, and Windows — requires a different programming language.¹⁰ If you are building hybrid and mobile web apps, you need a strong command of yet another set of frameworks and programming languages.¹¹ We find that most native developers are stronger on either iOS or Android, as it's hard to stay current across both platforms. It's easier for hybrid and web developers to support cross-platform efforts, as they don't have to shift between different programming frameworks. Mobile platforms evolve quickly — for

example, Apple just introduced Swift, a completely new language, in its latest platform release — so it's more important to look for project delivery and design experience rather than a specific framework or language. That said, align developers with native experience with native projects when possible, while expanding your search for hybrid developers to include web developers with experience in responsive web design.

- **Knowledge of event-driven architectures.** Most enterprise developers are accustomed to building applications that use reliable, wired, broadband networks to send and fetch information and services from servers. Mobile applications, however, send and retrieve information and services over cellular networks that sometimes drop connections or minimize throughput to accommodate congestion or limited signal strength. To succeed, developers need to build mobile apps with a very different architecture than they use for traditional enterprise applications.¹² Ask prospective candidates about their experience with implementing asynchronous architectures and programming models that use stateless, nonblocking message-passing techniques.¹³
- **An understanding of the value of in-app analytics.** Enterprise developers generally don't understand the value of instrumenting applications in production; that's typically been the responsibility of their operations peers. But one consequence of the increased velocity of mobile app development is that there's just no time for exhaustive upfront testing or requirements gathering. Good mobile development teams compensate by watching their apps execute in real time and then quickly interpreting and acting on the data that they've collected.
- **Intrinsic motivation.** We've written extensively in the past about the differences between extrinsically and intrinsically motivated (Type I) developers.¹⁴ Type I developers are willing to figure things out on their own when they hit roadblocks or experiment with a new mobile framework on their own time to assess their value. It's natural for Type I developers to use online resources to get answers to their questions — a useful trait when reference manuals tend to be obsolete almost as soon as they're written and JavaScript libraries go in and out of vogue in a matter of months.
- **Good rapport with business sponsors and customers.** The rapid pace of mobile app development means that mobile developers can't hide from you back in the IT shop; it creates too much friction, and the teams just aren't that large to start with. Look for developers who are prepared to report directly to the business and engage with you (and even customers) face to face. Make sure you avoid designers and developers with fragile egos when it comes to their art. They must be able to stand up to blistering one-star reviews of their work in public app stores and be able to accept "constructive" feedback without sulking.

“Our cross-functional teams put themselves in the customer's shoes to really understand their mobile needs. For one client, this meant crawling around in attics and basements with HVAC salespeople and installers, as well as talking directly to end customers about

the experience of buying an HVAC system. For other projects, our developers have gone into automotive repair shops, wireless retail stores, and tire stores to find mobile moments where we could create mobile apps to help transform the business.” (Dave Wolf, managing director, digital and mobile solutions, KPMG)

- **Experience with Agile techniques.** Good IDEA teams are good Agile teams, as the effective application of Agile techniques is the only practical way to achieve the delivery velocity that business sponsors and consumers expect. Look for developers who have experience with Agile practices like test-driven development, continuous integrations, and Kanban-style demand-pull techniques.¹⁵
- **A broad range of skills.** They might be rare, but cross-skilled developers do exist. When it comes to mobile app development, it’s especially helpful to find designers with some development skills or developers who have experience with both client-side and back-end development. Make sure that overly formal job classifications don’t get in the way of hiring this rare beast — if you can manage to pry one away from the design agency or digital boutique down the street.

“We had a lot of efficiency because I was the designer and developer, so I could attack both types of issues simultaneously during a three-week period.” (Danilo Campos, iOS developer and UI/UX designer, Hipmunk)

- **A mastery mindset.** When looking for IDEA team talent, don’t expect to find all the traits you need in a single individual (but if you do — pay them)! Be prepared to compromise and invest in further technical and process training as needed. The most important factor in hiring is the candidate’s flexibility and ability to survive and thrive in a fast-changing environment where they will have minimal ability to control operating systems, platforms, or device form factors. Look for individuals who operate in “mastery mode,” constantly learning the latest tips and techniques while honing their craft.

RECOMMENDATIONS

GET OUT OF YOUR COMFORT ZONE: OWN THE TECHNOLOGY CONVERSATION

You need to understand mobile app technology whether you are building in-house or working with a third party. If you don’t, you won’t make the right long-term decisions on process, frameworks, personnel, organization, or strategic partners. eBusiness and channel strategy professionals: You should:

- **Get comfy with acronyms.** App developers need to reduce the “tech speak,” but you also need to learn that you develop with Objective-C for iOS apps, Java for Android apps, and C# for Windows Phone/RT apps — and that Cordova isn’t just a city in Spain, it’s a popular open source hybrid framework. Knowing the development language basics will earn credibility and respect with developers.

- **Spend time with your developers.** Treat your mobile developers more like artists and less like faceless cogs in the corporate machine. They are creative, young, highly social and have a high metabolism. Bring pizza and drinks into the next retrospective or scrum. Understand them. Learn their culture. Learn to speak their language. Understanding the collaborative culture of a high-performance development team is as important as understanding the technology. Doing so will help you make the right personnel decisions, tap into their network of developers, and retain the best.
 - **Hire developers who have grown up placing mobile first.** Each major technology shift divides developers into two camps: those who must transition to the new way of building, and those who grew up as “natives.” Many mainframe developers struggled to adapt to client/server; client/server developers struggled to adapt to web apps. Instead of hoping that your existing Java and .NET developers can make the leap, take the opportunity to hire some newer developers who have cut their teeth on mobile apps and modern web-scale architectures. Look at recent computer science graduates as a good place to start.
 - **Build one IDEA team at a time.** Start your internal hiring with the goal of building out a single self-contained IDEA team and align it with an important business-to-consumer (B2C) app. Once that team has spun up and defined the specifics of what works inside your company, take one or two (at most) team members and use them as the core of the second IDEA team. Then add a third and fourth team as you scale up your capacity and add additional mobile apps.
 - **Be strategic when it comes to vendor selection.** Make smart decisions when you hire third parties or license technology solutions because they will be with you for a few years. Almost every enterprise leverages external expertise, as third parties can offer a lot of value: They learn faster by doing more projects for more companies in shorter periods of time. But be smart and choose vendors that can grow with you while not locking you in. Anecdotally, many of our clients have spent two to three years moving away from platform choices that seemed right at the time but have not served their ongoing needs — or been too expensive.
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SUPPLEMENTAL MATERIAL

Survey Methodology

Forrester's Q2 2014 Global Mobile Executive Online Survey received 414 complete or partial responses from professionals from our ongoing Marketing & Strategy Research Panel. The panel consists of volunteers who join on the basis of interest in and familiarity with specific marketing and strategy topics. For quality assurance, panelists are required to provide contact information and answer basic questions about their firms' revenue and budgets. Forrester fielded the survey in

April and May 2014. Respondent incentives included a summary of the survey results. Exact sample sizes are provided in this report on a question-by-question basis. Panels are not guaranteed to be representative of the population. Unless otherwise noted, statistical data is intended to be used for descriptive and not inferential purposes.

ENDNOTES

- ¹ Source: “USAA To Offer Bank Deposits By Mobile Phone,” PaymentsSource, August 10, 2009 (<http://www.paymentsource.com/news/usaa-offer-bank-deposits-mobile-phone-2693201-1.html>).
- ² Source: Elizabeth Holmes, “Designer Rebecca Minkoff’s New Stores Have Touch Screens for an Online Shopping Experience,” The Wall Street Journal, November 11, 2014 (<http://www.wsj.com/articles/designer-rebecca-minkoffs-new-stores-have-touch-screens-for-an-online-shopping-experience-1415748733>).
- ³ For more information on mobile IDEA teams, see the October 16, 2014, “[CIOs: Organize For Mobile Success](#)” report.
- ⁴ While high pay is important, it’s not everything to developers. Instead, focus on above-market-average pay, and work to create a culture that attracts high performers. For more information on how to tap into your development teams as a source for growth, see the November 3, 2010, “[Best Practices: Building High-Performance Application Development Teams](#)” report.
- ⁵ Forrester has recently profiled 19 companies that help businesses design, develop, and deploy enterprise mobile apps. For more information about these companies, see the February 15, 2013, “[The Forrester Wave™: Enterprise Mobility Services, Q1 2013](#)” report.
- ⁶ Technical debt is created when development teams solve a problem in an expedient way to get a system “out the door.” These expedient solutions often have long-term consequences that require code to be refactored, replaced, or adjusted just to keep the same features and qualities of service as an application scales. When technical debt is not addressed, it can pile up over time, resulting in a system that is hard to maintain, add new features to, or breaks as more customers try to use it. Source: Martin Fowler, “[TechnicalDebt](#),” MartinFowler.com, October 1, 2003 (<http://martinfowler.com/bliki/TechnicalDebt.html>).
- ⁷ A WebView is a component of both iOS and Android development frameworks that displays web page content. Think of it as a browser without any surrounding “chrome.” Developers frequently use WebViews as a way to embed web content in native apps while making the content look like it is stylistically part of the app. Source: “[Building Web Apps in WebView](#),” Developer.android.com (<http://developer.android.com/guide/webapps/webview.html>).
- ⁸ For a deeper treatment of these integration challenges, see the February 27, 2014, “[Systems Of Automation Will Enrich Customer Engagement](#)” report.
- ⁹ Your current development shop is most likely populated by Java, .NET, or even a few COBOL developers. These developers may be able to pick up Objective-C or Android’s Java programming frameworks over the course of a few months, but that’s the easy part of the transition. The cultural changes demanded by Agile

development, DevOps, and continuous delivery are a significant change from traditional development practices, and it can take a year or more for traditional developers to adjust (even if they are willing to make the leap).

- ¹⁰ When building native mobile apps, developers will program in Objective-C for iOS apps, Java for Android apps, and C# for Windows Phone/RT apps.
- ¹¹ Hybrid and mobile web developers should understand responsive web design (RWD) principles and have a working knowledge of JavaScript frameworks; examples to look for include Angular, Bootstrap, Ember, Foundation, Ionic, jQuery, Meteor, Node, Sencha Touch, Skeleton, and Zepto.
- ¹² For more on some of the significant architectural differences that mobile app development creates, see the January 28, 2015, “[The Future Of Mobile Application Development](#)” report.
- ¹³ For a useful primer of the types of changes and technologies your firm should be looking for, see the November 24, 2014, “[Mobile Needs A Four-Tier Engagement Platform](#)” report.
- ¹⁴ For more information about intrinsically motivated “Type I” developers and their importance, see the November 3, 2010, “[Best Practices: Building High-Performance Application Development Teams](#)” report and see the September 27, 2011, “[Hiring Creative Developers](#)” report.
- ¹⁵ For more information about how Kanban works and why its demand-pull techniques matter for high-velocity development, see the March 25, 2011, “[Why Kanban Matters](#)” report.

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