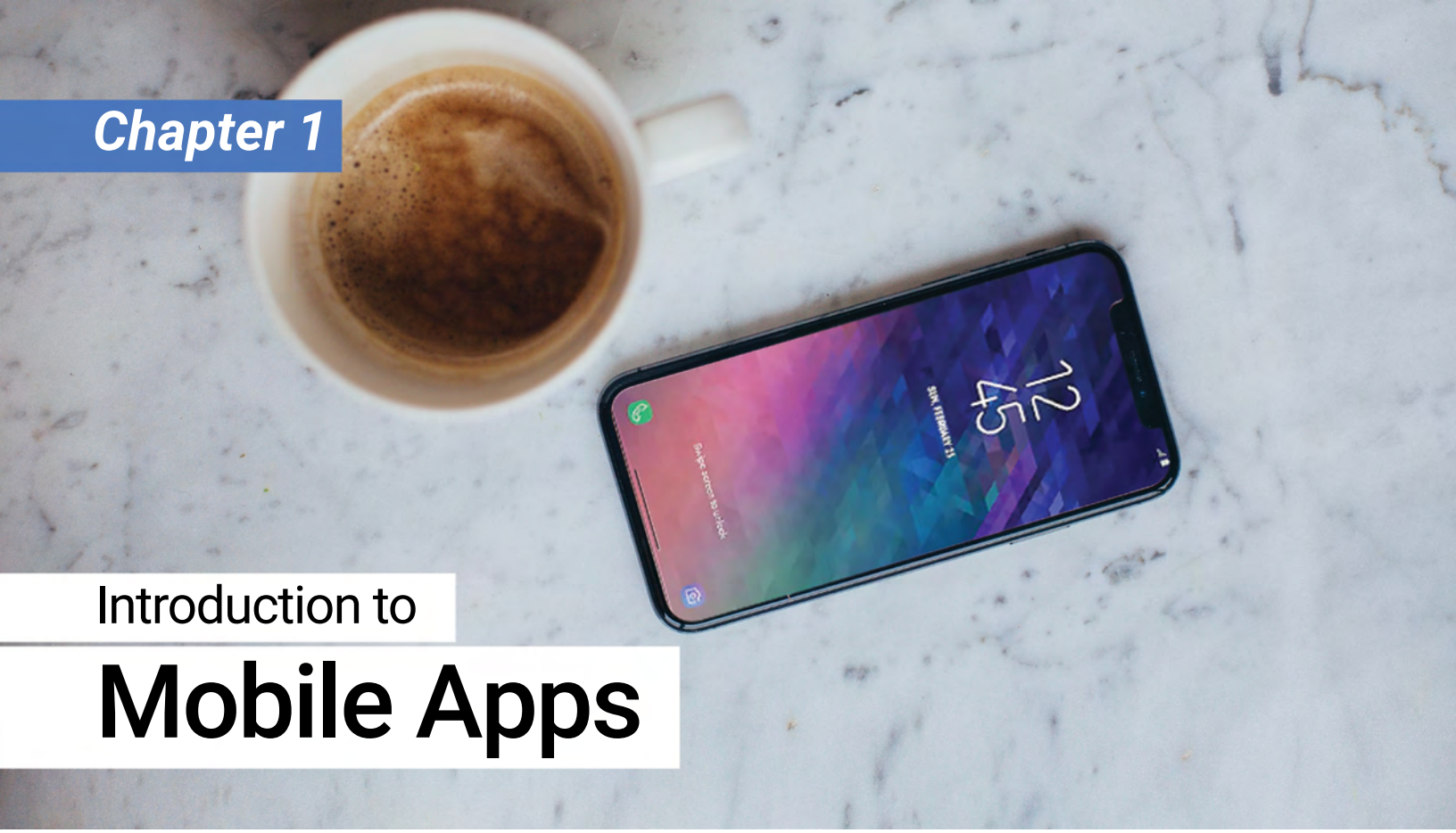
A Definitive Guide to

Enterprise Mobile Apps



Chapter 1

Introduction to Mobile Apps

The world has gone mobile! In both the consumer and business worlds, mobile apps have become a part of our everyday lives. With the constant rise in on-demand services, the majority of people spend their time in and out of various apps for thousands of reasons. The majority of the population has the world at their fingertips, businesses large and small are realizing that mobile is the future of enterprise.

Ninety-five percent of internet users are actively using mobile apps and according to worldbank.org mobile app subscriptions are at 7 billion and continue to grow. Mobile apps for enterprise are easy to use, tailor-made, interactive, accessible and increase brand visibility. They are also cost effective and provide flexibility that leads to higher efficiency. The rich user experience from effective response management leads to high customer satisfaction, more sales and revenue, and that's not all!

Defining a Mobile App

An enterprise mobile app is a computer application that collects and translates complex business requirements or challenges into an innovative technology solution. Mobile apps make it possible to deliver solutions right to users' fingertips – and onto their mobile devices.

Mobile apps can be used by employees to help with day-to-day work; providing a place to share and maintain data, or even submit requests to different departments such as human resources or the IT department. The goal for enterprise mobile apps is to serve business users faster and more effectively while ensuring personalized user experiences.

95%

of Internet users are actively using

Mobile Apps

Mobile Technology Trends

Mobile apps are preferred over mobile friendly websites, despite the possible advantages mobile-friendly websites have:

- Globally, the total number of mobile app downloads are expected to reach 352.9 billion by 2020. - Statista
- Mobile apps offer better engagement rates compared to mobile-responsive websites, some saw up to 300 percent higher conversion rates. - Tech Crunch
- Neuroscience researchers have discovered that delayed mobile loading times are more physiologically stressful than viewing horror films. - Ericsson
- Consumers are spending more than 85 percent of their time on their smartphones using native apps. - Business.com
- It is observed that 90 percent of consumer's time is spent on mobile apps. - Flurry Analytics
- The total number of smartphone users is estimated to be 6 billion and the worldwide consumer expenditure on mobile apps is predicted to reach $74 billion by 2020. - CNBC

Mobile Apps vs Mobile Friendly Websites

The demand for enterprise mobile apps is very high and some heated argument like "The Mobile Browser Is Dead, Long Live The App" are debated, There are many abilities mobile apps have to offer ahead of the mobile-friendly website and here are a few:

Serve Offline

Better Personalization

Notify and Connect 24/7

Tailored Branding Experience

Make Use of Mobile Features

Serve Offline

A mobile app backup syncs the data whenever an internet connection is available to ensure the user is provided with basic functionality information about the company even if there is no internet connection.

Better Personalization

With websites, users are forced to have all the data dumped irrespective of user interests. Unlike responsive websites, mobile apps enable users to choose their preference and cater only the content that is of interest. Mobile apps offer better engagement, tailored communication, and better personalization.

Notify and Connect 24/7

Click rates of emails are relatively low as most company emails are marked spam. Push notifications in mobile apps are categorized based on user interactions, preferences and interests. This results in higher user engagement. The critical component is that companies can send important notifications and connect with the user around the clock.

Tailored Branding Experience

Mobile apps let users freely reset the options of the mobile app at their discretion. Users can customize options such as selecting different types of icons and color schemes according to their branding. Also, any brand transitions are easier on mobile apps than on a mobile-friendly websites.

Make Use of Mobile Features

Users can use mobile device features (Camera, GPS, etc.), which increases the functionality of the mobile app. For example, say a client wants to submit reports or field agents want to update some bills. All they would need to do is take a photograph and upload it to the mobile app. In this way, mobile apps can be more interactive and generate enhanced experiences.

Compared to mobile-friendly websites, mobile apps have greater functionality, bring agility in presenting strengths of the company to their audience, and serve employees better. But, making the choice on when to go for a mobile-friendly website or mobile app is purely based on the business strategy. In the long run though, a mobile app will drive more success for your brand and business.

From Concept to Creation – The Complete Road Map to Mobile App Development

The process of creating a mobile app for your business can be confusing and complicated. Here is a flow that can help businesses to get a mobile app running.

Chapter 2

Transforming Enterprises with

Mobile Enablement

> ***"Global Mobile Workforce is projected to reach 1.75 billion and accounts for 42% of the global workforce."***
>
> ***- Strategy Analytics: Global Mobile Workforce Forecast***

The Rising Demand for Enterprise Mobile Apps

Customers and workforces are increasingly mobile, and the enterprise needs to adapt to this shift. Early movers in enterprise mobility have already seen positive ROI from their mobile initiatives. Businesses both large and small are wanting to get involved in what many already know – mobile is the future of the enterprise. As a matter of fact, 80% of online adults currently own a smart phone, and 75% of those users are accessing internet services on their phones.

Market demand for app development is higher now than it has ever been. Gartner predicts that "mobile phone sales is expected to reach 2.1 billion units by 2019, which will accelerate the demand for apps in the enterprise that meet the high performance and usability of consumer apps"

> ***"Demand for mobile apps in the enterprise is growing, but the urgency to scale up mobile app development doesn't yet appear to be a priority for most organizations. This must change, particularly given employees often have the autonomy to choose the devices, apps and even the processes to complete a task. This places an increasing amount of pressure on IT to develop a larger variety of mobile apps in shorter time frames."***
>
> ***- Adrian Leow, Principal Research Analyst, Gartner***

Why Don't More Companies Have Apps?

The number one reason companies aren't implementing enterprise mobile applications is because they don't have a mobile strategy in place. They aren't quite sure where to start in the process or even what it takes to develop a mobile app. Fortunately, there are companies out there willing to to help them develop a business app.

A few other common issues that prevent companies from developing or implementing a mobile app of their own are:

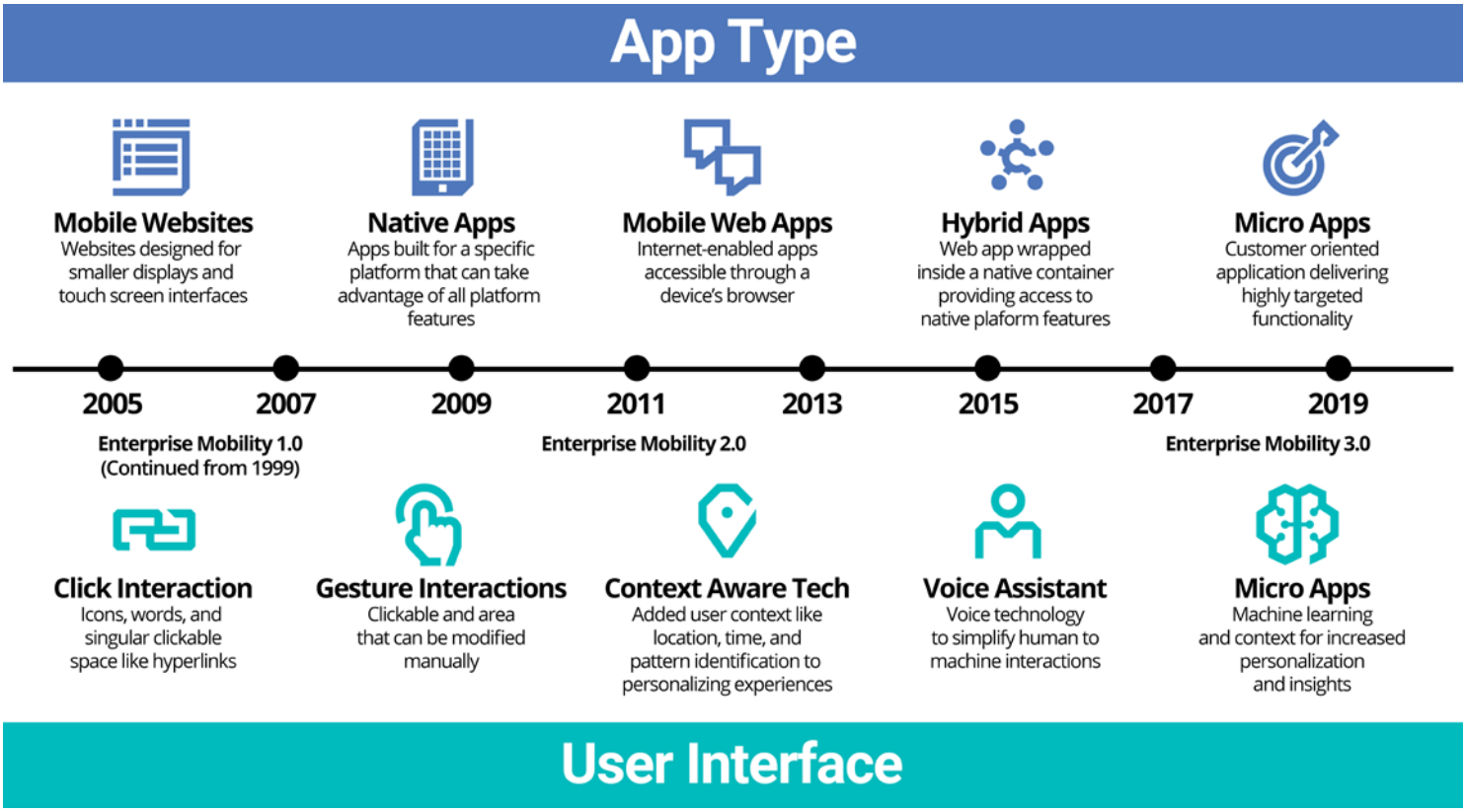
- Lack of resources
- Overtaxed IT department
- Difficulty integrating into existing systems
- Finding the right team
- Adoption of a new process
- Cost

BYOD and Enterprise Mobile Apps

BYOD (Bring Your Own Device) policies are starting to be much more prevalent in businesses throughout the world – in fact, approximately 55% of businesses have at least a loose policy regarding BYOD – and that number is continuously rising.

Despite the rising popularity of BYOD policies in the enterprise, it can cause quite a headache for those wanting to have a mobile app for their business. According to Seth Robinson, Director of Technology Analysis at CompTIA, the new norm is that each user will be utilizing three devices – typically, smart phone, tablet, and PC (or Mac). Having such a wide variety of technologies means that a company may struggle at times with implementing a mobile app that is compatible with the many devices their employees utilize.

Evolution of Enterprise Mobile Apps



Source: Mapping The Future Guide, Accenture

Enterprise Mobility Driving Digital Transformation

Digital transformation solutions are redefining the overall business operations, interactions, and service delivery process. Digital transformation is more a strategy than just technology. Understanding digital transformation requires deep insights on the reasons that necessitate its rise.

Despite all efforts, enterprises are failing to achieve total digital transformation. This is because companies are forgetting that digital transformation is a strategy not just a technology adoption. Enterprises need to have clearly defined objectives and scope while planning for transformation. To conduct this planning, the Chief Digital Officer role has emerged. Enterprise mobility has been the front runner of digital transformation and mobile apps evolved as the key facilitators of enterprise mobility.

Consumer digital trends driving transformation are:

- 75 percent of internet usage is driven by smartphones
- 2.46 billion are social media users
- As of December, 2018, the total number of internet users globally amount to 4.1 billion.
- By 2020, mobile apps revenue worldwide is projected to generate 188.9 billion U.S. dollars via app stores and in-app advertising
- By 2022, global digital commerce sales are expected to reach $6 trillion
- M-Commerce sales are predicted to make up 44.7 percent of total U.S. ecommerce sales in 2019

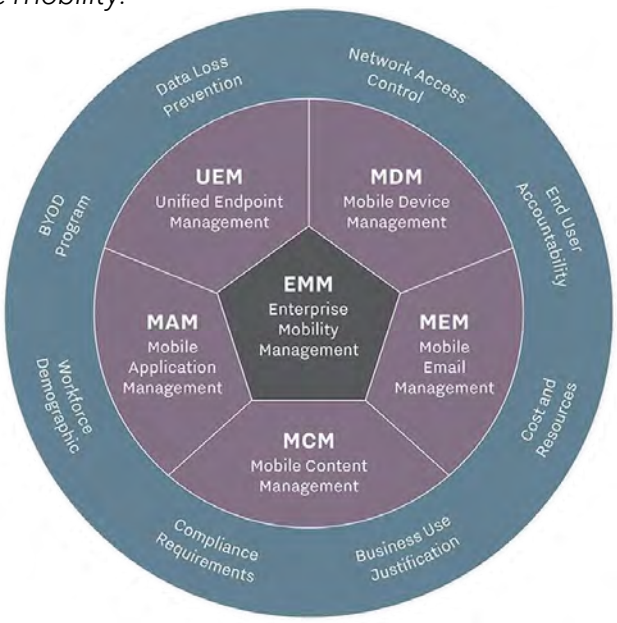
The trends clearly illustrate the rise of digital platform usage by consumers, change in the consumer behavior, and the need for businesses to re-strategize their efforts to suit the current market trends. So, to win the digital audience preferences and promote their services and products rigorously companies are putting efforts like mobile apps, responsive websites, social media channels, etc. at the forefront of their digital strategy.

Defining Enterprise Mobility

As stated by vmware, *"Enterprise mobility (also known as business mobility) is the growing trend of businesses to offer remote working options, allow the use of personal laptops and mobile devices for business purposes and make use of cloud technology for data access. Enterprise mobility management (EMM) refers to the people and plans behind enterprise mobility."*

How Enterprise Mobility Enablement Makes the Difference

Enterprise Mobility Enablement is an Integration Platform as a Service (IPaaS). It enables integration between different platforms along with being a workflow engine. This engine has a combination of action managers, event processors, rules, and APIs that are developed to combine multiple platforms together. This creates a real-time view of your entire enterprise's platforms in one concise location.

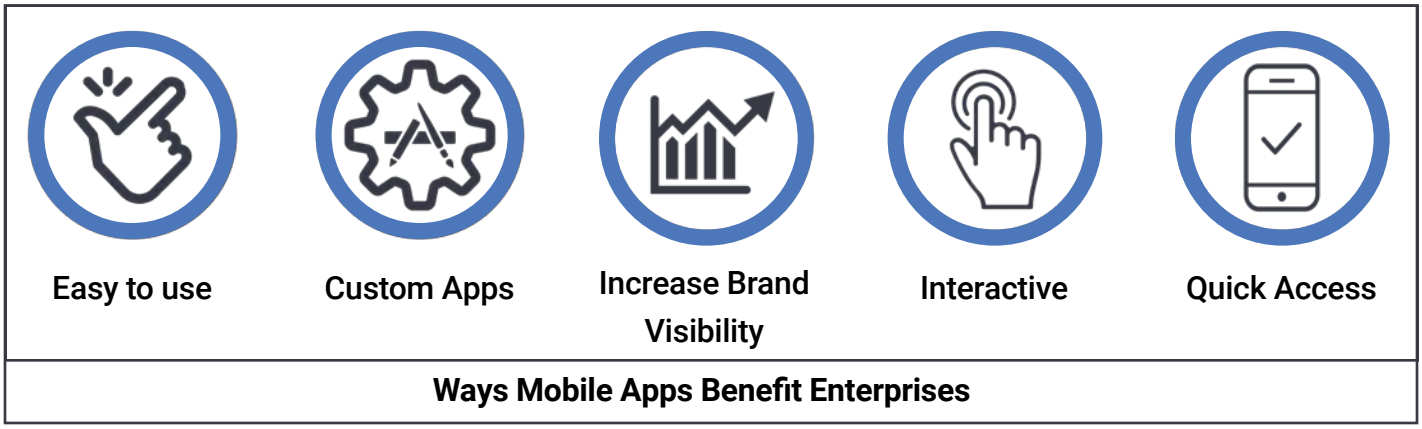


Elements of Enterprise Mobility Management

How Businesses Get Smart with Enterprise Mobility

Ways Mobile Enablement Impacts Business Channels of an Enterprise

- Easy for users to access information
- Quick access to data
- Gain data and support anywhere and offline
- Enhance organization-employee communication with personalized experiences
- 24/7 answers to employee/customer questions
- Helps target highly specific groups
- Compliments your company's website
- Engages customers by being where your customers live: mobile
- Supplies information to users at the right time on their desired device
- Tailored branding based on user choices
- Go-To marketing tool
- AR experiences
- Intelligent recommendations
- Proactive responses
- Opportunity to integrate with Virtual Assistants



Ways Mobile Apps Benefit Enterprises

The Challenges

According to multiple studies, integrating mobility into their business is a significant challenge for the enterprise. Despite this challenge, the demand for it continues to grow. In this article, we discuss some ways that organizations are able to accomplish their mobility goals.

Technology has grown more complex as time goes on. Programs are becoming more advanced, equipped with proprietary code and security features. Paired with that, remote, cloud-based software is also on the rise. This can result in difficult-to-use applications with no compatibility between one another, causing data to be fragmented and creating more effort for the end user.

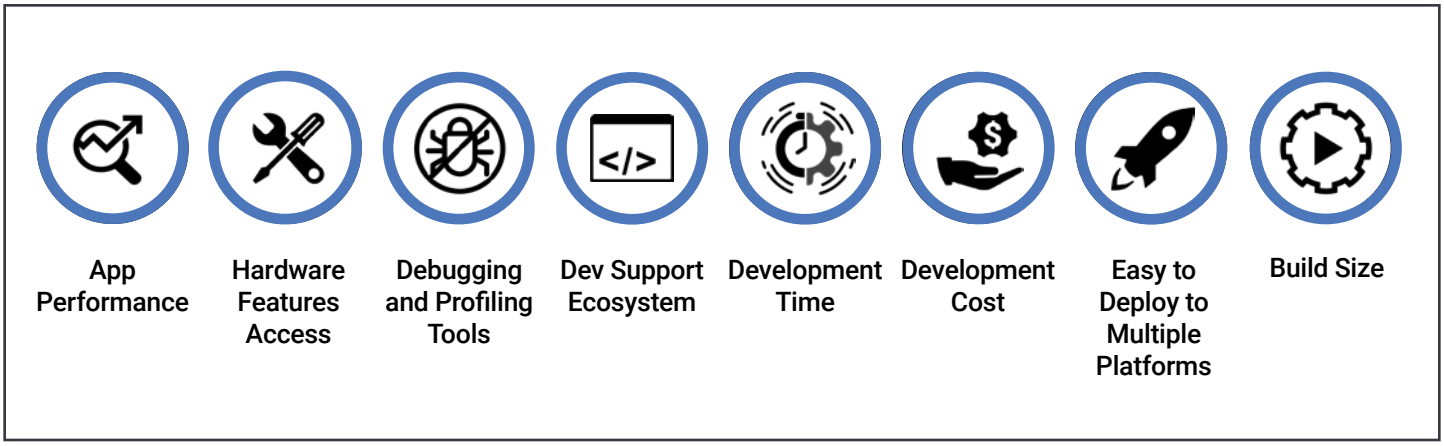
As more and more of the enterprise is moving to the cloud, trying to connect the many aspects of business is getting more difficult. Things like the growing popularity of the Internet of Things and Big Data aren't making that transition any easier, as they require an entirely different level of technology than other standard applications most businesses are accustomed to.

Among these expectations, there is a rising demand for businesses to develop mobile apps that are compatible with a plethora of different devices. Despite these challenges, if implemented properly, a mobility structure can bring substantial value to an organization.

Parameters to Consider in App Development

Mobile apps are bridging the gap between the enterprise and customers. Once you start deliberating how to develop your mobile application, you will come across terms like native app, hybrid app, and cross-platform. Deciding on the right mobile app design can be tough and being clear on what you want from your mobile app makes all the difference.

Prior to proceeding with mobile development, enterprises have to list out some important concerns including:

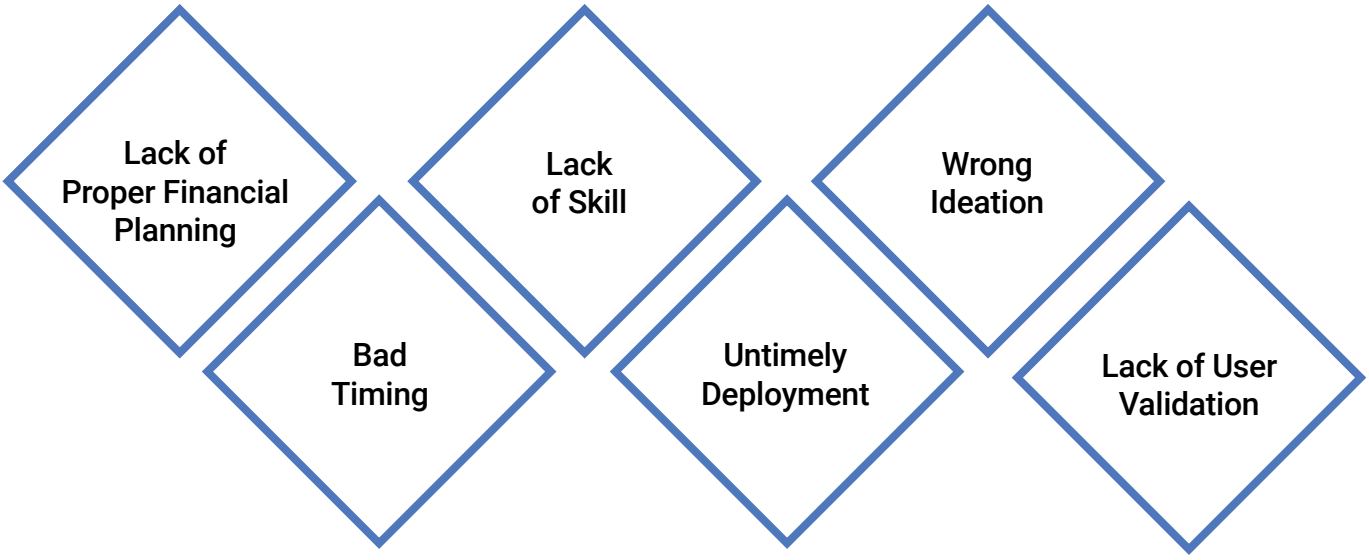


Apart from these aspects, the following are questions enterprises should understand prior to the development process:

- What problem is the app trying to solve, and is mobile the best solution?
- What is unique about this app that cannot be achieved through existing or similar apps?
- Have the desired end-user needs and preferences been identified and validated?
- Are the target mobile platform and services aligned with the business and enterprise strategy?
- What development methodology will be followed (Agile, Waterfall, or Hybrid)?
- How long does it take average users to set up the app on their mobile devices?
- Users want issues to be resolved at once. Do you have enough support teams or status of support mechanisms to fix user issues?

To get the app performing better continuous integration of better functionalities is required. To optimize the app, get feedback from the end users on a regular basis.

Reasons for Failure of Enterprise Mobile Apps



Case Study: Integration of Enterprise Mobile App with ServiceNow™

ServiceNow™ is one of the biggest and fastest growing platforms for companies to maintain their IT processes. When it was proposed to develop a mobile application with ServiceNow™ integration, the V-Soft Labs team realized that there was an untapped market for ServiceNow™ mobile apps.

The management of IT resources and processes is the backbone of any business today. ServiceNow™ is an extremely powerful tool for managing incidents, requests for field services, and for HR. Coupled with the flexibility it has to provide tools needed for your company, it is infinitely more useful when it is directly accessible from your smartphone.

Benefits of a Mobile App with ServiceNow™ Integration

Combining ServiceNow™ and mobile app development to bring a unique plug-and-play solution that easily integrates with any client's ServiceNow™ backend. Functionalities like reporting/viewing of incidents, and ordering from a service catalogue will work directly out of the box. The advantages of this solution:

Quick Delivery	As we have already created the backend and basic framework for the app, a simple working version can be produced in minimal time.
Custom Branding	The client is able to have their own splash screen, icons, and color scheme according to their branding (with the option to have a white label mobile app).
Offline Capability	Most operations can be done without a working internet connection.
Extendable	One can add additional modules to the existing solution. They can also put in simple static content and make it their own complete mobile app.
Multi-platform	Available on both Android and iOS, covering more than 95 percent of users.

Chapter 3

Choosing The Right Mobile App

Development Process, Platform, & Method

The Mobile App Primer

Here is an overview of the key components to be aware of when it comes to a mobile application and the development required for successful execution.

There are different Operating Systems (OS) for mobile devices: Android (87.7 percent market share) and iOS (12.1 percent) are the most popular ones currently (together they make up 99.8 percent of the market). Others are Windows Mobile, Blackberry OS, etc. (only .02 percent of market share).

Each OS needs the application program to be in a particular format so that it can be run on the device. For Android code is written in Java, and for iOS code is written in Objective-C or Swift. Writing apps in the native language of the OS is called Native App Development

When you see an app that is available for both Android and iOS, it means the developers had to package it separately for each platform and complete corresponding development.

Which Mobile Platform to Choose

Everyone knows about iOS and Android OS. They are the two big names in the mobile industry. But do you want to develop apps for Windows, BlackBerry, or any other mobile operating systems?

Android OS

The most widely used OS, Android is the powerhouse of mobile devices. It boasts the simplest application process to place your apps into their proprietary app store, the Google Play Store, and is used among hundreds of different device types. Companies should at least make an effort to have an Android-capable app somewhere in their business plan. Be sure to note that there is a $25 one-time fee to be able to publish apps to the Google Play Store.

iOS

Despite Android's popularity, Apple's iOS is the most well-known operating system for mobile devices. It is viewed as dynamic, hip, and progressive. Unfortunately, Apple's App Store has much more stringent guidelines and a longer queue for your app to be accepted for download. There is also a mandatory annual fee for all developer accounts to be able to publish an app, so if you are planning on doing it in-house, budget for the Developer Fee. At the time of this publication, it is ranging from $99-299 depending on your developer level.

Othe OS Options

Smaller OS options depend on your audience. It may be prudent for you to invest in more development around other, smaller operating systems. Most people are familiar with Windows OS, but there are also BlackBerry OS, BADA, and Firefox OS. Each one has its own market depending on location across the globe and what type of app you are creating. Research what your competitors are making apps for and follow suit.

Mobile App Development Methods

The decision of how you want to have your app developed can range from how long it will take to come to fruition to if you want to utilize internal staff, outsource. Here are a few things to take into consideration as you decide which path you want to travel down.

- **Developing In-House**

  Whether you have a bench of app developers in-house or are looking to hire them, developing your app in-house has quite a few benefits. You and your developers will be much more familiar with the project itself and will know your values, style, and offerings better than any outside vendor. This means the app will be developed how you want it. You will be able to develop a unique-to-you customized system with an exact fit for your company.

  Another benefit of this method is that your company will have full ownership and rights to the app, its code, and the features that make it tick. You will be able to quickly report any changes needed to your developers and they will be able to collaborate with employees to create a resolution.

  Unfortunately, in-house development does have its downsides. It will bring you a high overhead cost and can be very time-consuming for the team responsible for developing it. Maintenance costs will also rack up whenever it is time to upgrade or modify existing features.

- **Outsourcing**

  Outsourcing can often be considered a "bad word" in business, but it shouldn't be. Outsourcing simply means to have another business – take care of certain needs of your business. Outsourcing can be very cost-effective and reliable, as the one you are giving the job to is well-versed in the task you are providing to them.

  Outsourcing the development of your app to an experienced vendor can be the most effective use of time and money. There are many different agencies that have the capability to develop a stellar app for your business from onshore, nearshore, offshore, or hybrid options. Each has its own benefits and unique offerings.

  One thing that does surprise most is the price tag of developing an app by a professional. Experienced app developers have a very wide range of costs associated with creating your app. Depending on the calibre of the business you have chosen to partner with and the type of app you need to develop, you can expect a bill in the five- to six-figure range.

- **Using a Template or DIY App Service**

  Using a template for an app may be one of the cheapest ways to get your app completed, however, it comes at a cost of the quality or unique capabilities of the app. There is definitely a benefit of not needing to know any coding languages, but you may not be able to get the app to work exactly how you want due to limited features. Many of the app building websites out there boast that it's free to develop your app, but you will be required to pay a monthly premium to keep it on app stores.

  If your app is meant for retail, restaurants, or events, it may not be a bad option to look into. However, if you require backend integrations into your proprietary software with a need for real-time information to be processed, you will likely need a completely custom app designed.

Understanding Mobile App Development Processes

As a mobile app developer you'll want to reach as many people possible within your target audience. This requires the same development efforts multiple times for each platform, and for the same product. To avoid the costs involved in these repetitive efforts, Cross-Platform App Development (sometimes called Hybrid App Development), would be the right solution. This works on the principle of "write-once-run-everywhere". There are two kinds of cross-platform app development practices:

- **Web-Hybrid App Development**

  All operating systems have some way of displaying web content, called a web view. Writing the application using HTML/CSS/JavaScript will enable the application to be compatible with any mobile OS. These apps will have a native container, which will give them more access to device hardware than a web-app running on a web browser. Some example frameworks are Cordova and Ionic.

- **Native-Hybrid App Development**

  Most parts of the app are written in a common language, which gets converted into a native form to eventually run on each OS. Since it is converted into an executable format supported natively by the OS, it runs much smoother and the performance is better. Some examples are, Xamarin and React Native.

Deciding on the Right Mobile App Development

So, given at least three ways to develop your application, how do you decide what to start with? To assist you in this decision-making process, here is the list of comparisons between native, web-hybrid, and native-hybrid mobile application developments:

	Native App	Hybrid App	Web App	Progressive Web App (Shell App)	Micro App	Instant App
Description	Apps built for specific operating systems (e.g. iOS)	Apps built using a combination of web and native technology that is distributed via a native app store	Apps built with web technologies such as HTML5 tools	Use latest browser technologies to meld the accessibility of web with the presence of mobile	Intelligent and aware single-purpose apps on top of existing enterprise systems	Users can launch parts/ components of apps without having to download the app
Trend	Dominant for mobile app development (54% of organizations surveyed)		Growth in apps that are planned are mostly web apps	By 2020, PWAs will have replaced 50% of general-purpose, consumer-facing apps	Sapho is a leading micro app platform and now available in MSFT Teams, SAP, Oracle	Available on more than 500M devices globally since launching in May 2017
Key Players	Swift					
Advantages	+ Leverage native platform capabilities + Best performance + Highest security + Best UX	+ Lower than native + Faster to build + Access to hardware/ software capabilities through plugins	+ OS agnostic + Lower cost than native	+ Benefits of native (e.g. app icon, push notifications) and hybrid apps + Lower cost than native	+ Quick to download and develop + Focused functionality (instead of bloated app) + Lower cost than native	+ Leverage native capabilities without needing to download an app + Lower cost than native
Drawbacks	- Dev skills required for all performs - High development costs	- Compatibility challenges with OS updates	- Dependent on internet connection - Not able to leverage all native capabilities	- Currently not supported on Apple iOS devices	- Limited functionality - Limited audience because highly platform specific	- Apps are limited in score - Available only for Android

Despite all of this, the result of this would depend purely on the kind of app being developed. A web-hybrid development could be considered if your requirement is any of the below:

- Less complicated functionality
- Less features accessing hardware
- A quick POC (proof of concept)
- Limited budget

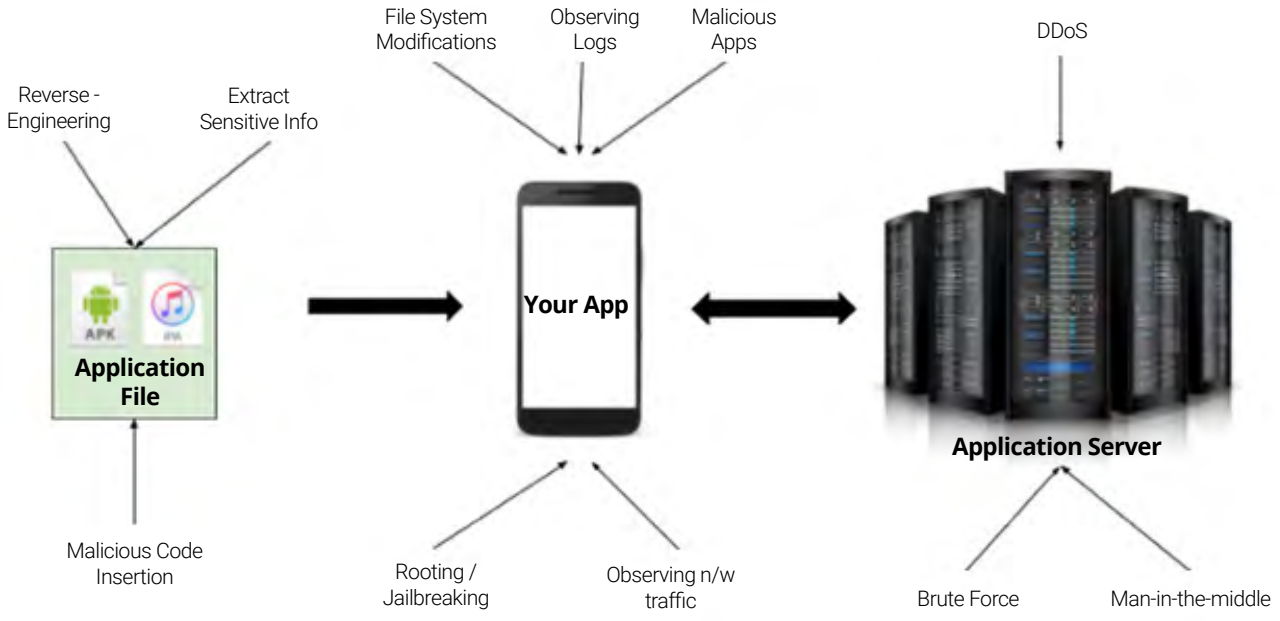
If your requirement doesn't fall within the above, then native or native-hybrid development would be a better option.

Chapter 4

Enterprise Mobile App Security:

Issues and Measurements

The world is now at the pinnacle of the smartphone revolution, where each and every service you need can be accessed with the smartphone in your pocket – be it banking, shopping, healthcare, education, and more. As these app-based services become more prevalent and widely used, the number of people looking to exploit and abuse you and your business is also growing. So what are the different ways in which mobile apps can get hacked?



Key aspects of Mobile Security: 1. Security Management 2. Enforcement of Device Compliance 3. Software Management 4. Hardware Management

Types of Attacks on Enterprise Mobile Apps

Application Binary-Level Attacks

Unlike web apps, mobile apps are able to be exposed to binary-level attacks, as this application must be made public. The attacker is capable of downloading the app, compromising the source code, and exploiting it. Ways of doing so are:

- **Reverse-engineering**

  Some hackers use dedicated tools to reverse-engineer the app's source code. This can reveal a company's core business logic, which can be used by competitors to steal ideas and tactics.

- **Extracting sensitive information**

  Some tools are available which can extract string constants from the binary. This can call out critical information such as an administrator's login credentials or a sensitive URL.

- **Inserting malicious code and redistributing your app**

  Some hackers will hack directly into the binary file of the app, then insert their own malicious code. They will then distribute the app through unofficial channels. Doing so enables them to do things like 'phish' a user's details, redirect users to their website/products unwittingly, or show things that can harm your company's reputation and credibility.

Mobile Device-Level Attacks

A device-level attack is when a vulnerable device is exploited to gain access to a network. The attack can be performed on any connected device(s).

- **Malicious apps that steal data**

  Hackers distribute their own apps disguised as games, utilities, etc. which will, behind the scenes, observe user's actions and inputs. Thus they'll be able to steal details such as, what other apps are installed, all of the user's keyboard inputs, all network activity, etc.

- **Installing your app on rooted/jail-broken devices**

  Hackers modify the OS installed on their phone and then run your app. With this, they are able to observe the internal activity of your app like what data you are storing, and what network calls are being made. With all this data available, they have more knowledge about how your product or service is working, and can abuse them.

- **Modifying app data**

  Hackers will look at the file system and see how the app is storing files and data locally. Sometimes modifying the data files can make the app behave differently to suit the hacker's intents. For example, by modifying a file, the hacker might be able to appear logged in to the application, without any credentials.

- **Observing logs**

  Sometimes the developers of the app put logs to debug the application and forget to remove them before releasing to production. Anyone can simply observe these logs and get insight into the working of the apps.

- **Observing unencrypted network traffic**

  If the app's communication with server is not encrypted correctly, all the communication can be read in plain language by an observer. This includes the credentials passed to the server, sensitive information returned by the server, etc.

Server-Level Attacks

By hacking the mobile application as described in the previous two levels, the hacker could have gained knowledge about how the app is interacting with the web service, and can try to exploit the web service.

- **Man-in-the-middle attacks**

  The hacker understands the API calls made by the app, and uses authentication sent by the app to pose as a legitimate user. The unsuspecting server might provide confidential data to the hacker.

- **DDoS attacks**

  By knowing the API end points used by the app, the hacker could use automated tools to push heavy traffic to those end points, causing the server to go down. In effect, your product or service would become unusable to intended consumers.

How to Keep Your Enterprise Mobile App Safe

To make sure your app holds out against these attacks and to provide the best security to your products and users, businesses need to have certain standards and best practices, which are followed as soon as you write the first line of code. The standard measures include never putting any sensitive information in the code, disabling all logs on production builds, cleaning up all user inputs before processing them, adding crash reporting and analytics to detect any unusual app behaviour, etc.

- **Never Store Credentials on the Device**

  Never store any sensitive information like username and password on the device, even in the app's private space. Instead, use OAuth or other token-based authentication to make requests on behalf of the user. Also refresh and expire user sessions after a pre-set amount of time, to prevent any compromised authentication info being misused.

- **Use App's Private Space, and Use Encryption for Storing User Data**

  In all operating systems, there is a dedicated space for each app to store its data, which is not accessible to regular users. To prevent even a user with root access from reading this data, encrypt all data in this region. Never use a public data region like an SD Card.

- **Keep Your App and its Components up to Date**

  Everyday, hundreds of vulnerabilities are found in the mobile and web space and patches are released regularly. Developers should make sure they incorporate these patches in their applications and encourage their users to update their app regularly. This will ensure hackers who attempt these known vulnerabilities will be unsuccessful.

- **Use Obfuscation on Production Builds**

  To thwart efforts to reverse-engineer the app binary to extract core business logic and other sensitive information, use obfuscation — intentional obscuring of data — and minifying. This will not only make the reverse-engineered code hard to read, but will make the app binary more compact in size. Proguard is an example, available for Android.

- **Use HTTPS for all API Communication**

  HTTPS is a secure protocol for encrypted communication in an open network. When using HTTPS, a person who is observing the network activity will not be able to get any information about the requests, such as the URL, login/authentication information, or any of the data passed through the web service.

Over and above these, depending on the high-security requirements of the client, we also include the following features to prevent and contain any security issues:

- **Built-In Ability to Clear App Data Remotely**

  If we come to know that a device has been compromised or login credentials have been hacked, we will provide a remote web dashboard giving you the capability to easily change the login credentials or perform a data wipe of the device through an API or even a simple SMS.

- **Detect Rooted/Jail-broken Devices**

  The app should be built with the capability to detect whether or not it is running on a compromised device and can intentionally cease running.

- **Detect Tampered App Binary**

  The app can be built with the capability to check whether its binary has been modified by verifying its files' Checksum. Once detected, it will proactively cease operation to prevent further damage.

Chapter 5

Artificial Intelligence is Changing the Game for

Mobile Apps

> ***"Mobile Artificial Intelligence (AI) Market worth $17.83 billion by 2023"***
>
> ***- MarketsandMarkets***

Every business in nearly every industry is trying to figure out how to leverage Artificial Intelligence (AI) to meet their business goals. It is being incorporated in almost all products and services; right now the mobile applications industry is no exception. Most of the time we hear about AI being applied to a business's backend — like Predictive Intelligence, anomaly detection on video streams, credit card fraud, etc. But AI has very interesting applications inside a mobile app as well.

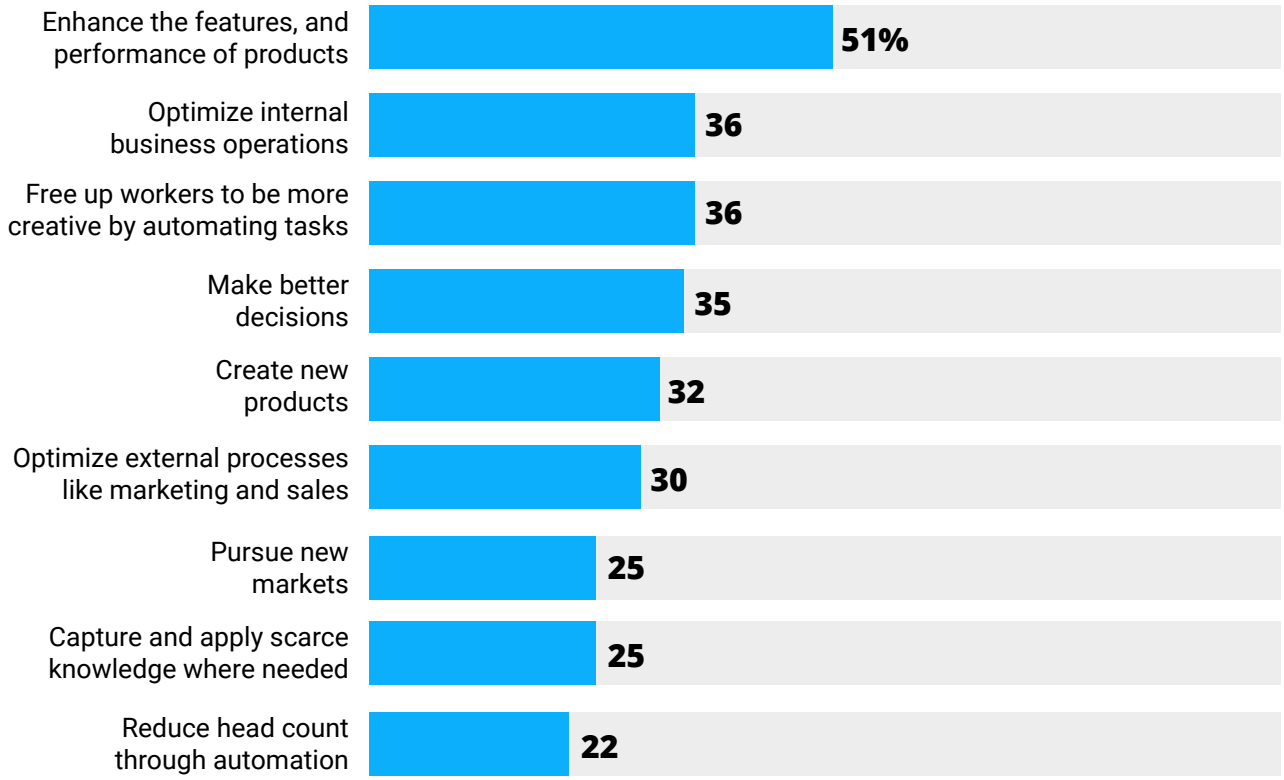
Reasons Industries Should Adopt AI

Artificial Intelligence comes with the ability to streamline various business functions and also equips businesses to deliver innovative solutions to solve various business challenges and deliver a better experience to users both internal and external. AI abilities are pushing businesses to make great gains in service to their customers by leveraging top technology and resources. Expanding the application of existing AI-enabled technologies (like chatbots) will help businesses meet the demands of their millennial clients and help provide immediate access to services while improving margins.

How AI is Impacting the Mobile App Industry

Here are some highlights of why industries are looking out for AI.

Percentage of executives who cite the following as benefits of AI

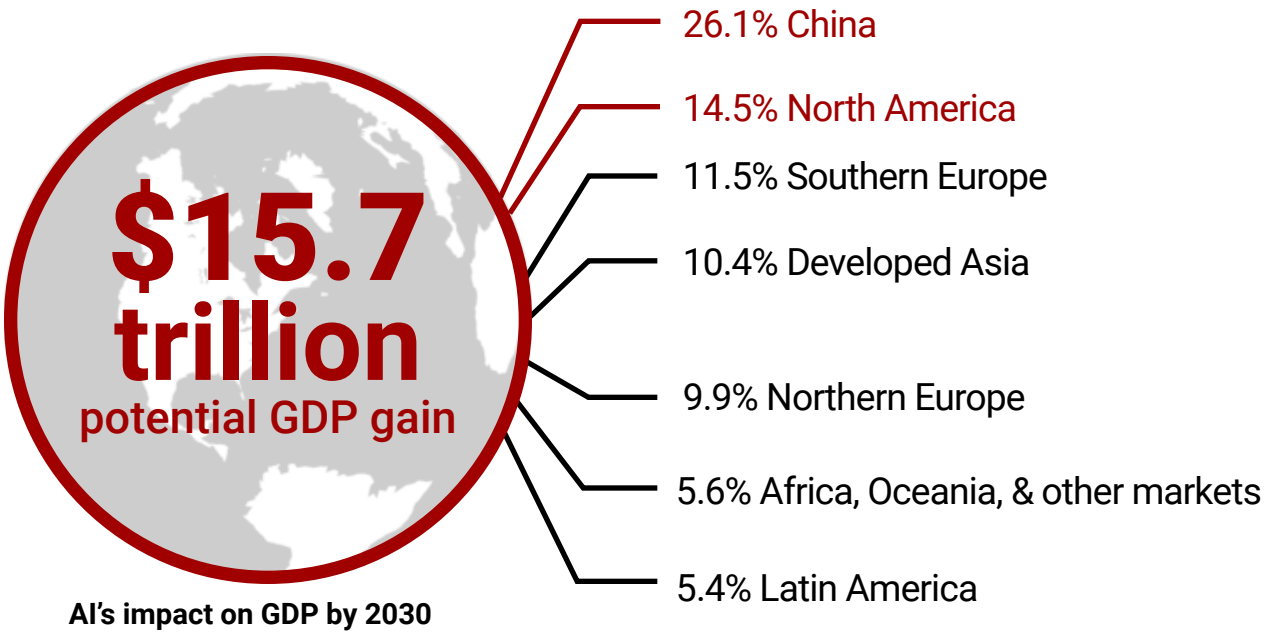


SOURCE DELOITTE 2017
FROM "ARTIFICIAL INTELLIGENCE FOR THE REAL WORLD,"
BY THOMAS H. DAVENPORT AND RAJEEV RONANKI, JANUARY - FEBRUARY 2018 **@ HBR.ORG**

The rise in smartphone usage has accelerated the demand for mobile apps. At the same time, people look for good user experience. Smart features have elevated the significance of mobile apps and in turn intensified the enterprise's scaling up capabilities, while ensuring superior user experience and engagement.

Moreover, the rise of smart technologies like IoT, smart wearables (like fitness trackers and smart watches) Augmented Reality (AR), Big Data, and Cloud Technology necessitated mobile apps to become smarter with Artificial Intelligence. These smart devices stream in huge torrents of a wide variety of data. Here, the challenge lies in demarcating huge chunks of data, understanding data patterns, tracing out relationships among this data and deriving meaningful insights. It's nearly impossible for data scientist to manually extract this data and produce meaningful insights without the help of Artificial Intelligence.

The AI enabled mobile apps act rationally in gathering, processing, and extracting deep analytics data. This intelligent information is the core of the decision-making process. This info helps businesses precisely predict consumer behaviour patterns and reframe strategies to meet demand and cater to future-proof solutions.



AI's impact on GDP by 2030

Source: PwC Global Artificial Intelligence Study

Practical applications of Machine Learning and Artificial Intelligence on mobile:

- **Product Recommendations**

  Based on the user preferences, content recommendations can be made to the users with a recommendation engine. These preferences can be plotted based on the current content consumption behaviour patterns or based on the ratings they might have given for some other content — think what Spotify is doing for music, YouTube is doing for videos, and Medium is doing for blogs.

- **Image Recognition and Tagging**

  If you are a phone-shutterbug, then you might have faced the situation where you have thousands of funny and lovely pictures but, at the moment you wish to share, you found it difficult to find the content. This is where image recognition using Machine Learning can benefit a lot. The mobile app can identify the content of the picture in terms of activity or entities and tag them accordingly — 'Trekking at the mountains', 'Birthday Party', 'Christmas in New York'. This makes it very easy for you to search for them without having to manually tag each and every picture you take.

  Another interesting application could be to provide more info about an entity in an image by scanning it and identifing species of the dog/plant or identifing the criticality of a medical condition such as a burn or skin disease.

- **Predict User Response**

  In this era of experiences-driven economy, users don't want content (ads, updates, promos) forcibly pushed on them. That's why most apps fail. AI-driven mobile apps use predictive intelligence to understand user behaviour and cater content or make recommendations accordingly. This is what YouTube does to make it easy for users to search for content.

Some of the fully AI-driven intelligent mobile apps are even going to the extent of reorganizing app menus in line with user behaviour.

Chat, email, and content writing apps can assist the user with plausible responses without having to type in the whole thing. For example, an instant messenger could suggest emojis to use depending on the content and context of messages and based on the user's preference of images. Gmail does something similar by suggesting quick replies. This can be a huge time saver.

- **Learn and Act to User Preferences**

  Apps can observe a user's behaviour within the app and auto-arrange new apps on the home screen or options inside an app according to usage. Basically, through deep learning practices, the app learns how it's being used from the interactions and customizes itself accordingly.

- **Optical Character Recognition**

  Using the camera finder, apps can scan handwritten or printed documents, and do many things with it. It could be used to tag and make the documents searchable; it could even be translated into other languages. Apps could let users scan bills and then prepare an income—expense report by reading the content of the bills. Or they could let users 'draw' or 'write' on the app and then convert that to digital content, making it more flexible for storage and retrieval.

The Rise of Intelligent Mobile Apps

With experience-as-a-service taking over the modern IT revolution, questions have been raised on the capabilities of mobile apps. Putting an end to all these discussions mobile apps adopted advanced AI capabilities and evolved as more intelligent mobile applications. Intelligent mobile apps can go beyond the traditional service solutions to serve business users faster and more effectively while ensuring personalized user experiences. The demand for smart mobile apps is further improved with innovations like:

IoT | **Smart Wearables** | **Augmented Reality** | **Big Data** | **Artificial Intelligence** | **Chatbots**

To meet the demand, intelligent mobile applications continue to adopt the advancements in the Artificial Intelligence capabilities to stay ready for their role in delivering future-ready solutions.

Chatbots Won't Replace Mobile Apps: AI is the Key

Are chatbots going to replace mobile apps? Not really, but this has been a heated discussion since the evolution of chatbots started. However, chatbots certainly complement some of mobile app's responsibilities like communication streaming. Though chatbots look more suited than apps in some cases, ***chatbots may not substitute mobile apps completely, but they may complement each other for a better user experience.*** Moreover, each has a different use case that targets a different set of business applications and contexts. This fact can be validated with the market research by Statista: "...globally the total number of mobile apps downloads are expected to be 352.9 billion by 2020".

For a field service application, chatbots can be very effective in fetching information and submitting reports easily. Usually, a company can have hundreds/dozens of field workers. On top of that, turnover is quite high in this domain compared to other departments. For the field services people to get to know the mobile app and it's functionalities, there is a learning curve involved. This is where the chatbot shines. You don't need any training, all you need to do is just open a chatbot and start asking questions to get answers. This is possible because 100% of smartphone users are familiar with using some messaging service, be it SMS or IM services like Whatsapp and Facebook Messenger.

The problem with chatbots is that you must be connected to the internet for them to work properly. If the field service workers are in an area with no internet connectivity, a chatbot can't help and is limited to local data stores. In this case, mobile apps would be the best solution. Mobile apps can have offline functionalities and download the most recent information into the local memory in order to display minimum help, even while offline.

Chapter 6

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