

DEVELOPER ECONOMICS

STATE OF THE DEVELOPER NATION Q2 2018

The latest trends from our Q2 2018
Survey of 20,500+ developers

<https://sdata.me/DE2Q18DE>



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ABOUT SLASHDATA™

SlashData™ is the leading analyst company in the developer economy, tracking global software developer trends based on more than 40,000 software developers annually in over 160 countries. Our surveys track the changing landscape of mobile, IoT, desktop, cloud, web, AR, VR, games, machine learning developers and data scientists.

Our mantra: We help the world understand developers - and developers understand the world.

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TABLE OF CONTENTS

About this report	6
Partners	7
Key Insights	8
1. Data science: the top skill to learn in 2019	9
2. Developers are interested in disrupting global economies but keep working on customising software	12
3. Programming language communities - an update	16
4. Evolving technology and new channels help more game developers make money	19
5. Developers are decision makers in companies of all sizes	23
6. Big data and real-time predictions: to how many are they relevant?	28
Methodology	34



ABOUT THIS REPORT

SlashData Developer Economics is the leading research programme on Mobile, Desktop, IoT, Cloud, Web, Game, Augmented and Virtual Reality and Machine Learning developers as well as data scientists, tracking the developer experience across platforms, revenues, apps, languages, tools, APIs, segments and regions.

The 15th Developer Economics global survey wave ran from May to June 2018 and reached more than 20,500 developers in 167 countries. This research report delves into key developer trends for 2018 and beyond.

The report focuses on six major themes - each with its own visualisations, showing how the data lends insight into the developer community.

1. Data science: the top skill to learn in 2019. In our first chapter we explore the skills that developers want to learn or improve in the next year. We compare developer interest in twelve different skill sets, spanning from data science and machine learning to business/marketing skills, to cloud native development, DevOps, and hardware-level coding.

2. Developers are interested in disrupting global economies but keep working on customising software. To gauge developer interest and better understand how advanced certain technologies are we asked developers what areas they were working on, learning about or interested in. Based on their answers we explore which technologies are being developed today and what skills and knowledge are being researched for tomorrow.

3. Programming language communities - an update. Programming languages are often the kernels of strong communities and the object of opinionated debate. In this chapter we provide updated estimates of the number of active software developers using each of the major programming language, across the globe and across all kinds of programmers.

4. Evolving technology and new channels help more game developers make money.

Game economics are changing, and streaming is becoming the dominant trend. Here we look at the evolution of business models in gaming in the past twelve months, and discuss the driving forces behind it.

5. Developers are decision makers in companies of all sizes. When it comes to choosing and buying technology, are developers powerless line employees, or are they influencers and decision makers? A year ago we first published data in our State of the Developer Nation report which showed that developers indeed have a lot of influence in technology purchases. It's time for an update.

6. Big data and real-time predictions: to how many are they relevant? Big data has been hyped for several years. In addition, a race has begun to design processors capable of crunching large sets of often unstructured data and to produce real-time predictions. The question is, to how many in the rapidly growing Data Science and Machine Learning (ML) community are large datasets and real time predictions relevant? We shed some light to the hype, based on hard data from 4,200 data scientists and ML developers.

We hope you'll enjoy this report and find the insights useful! If you have any questions or comments, or are looking for additional data, you can get in touch with Miljana Mitic, Digital Marketing Executive for SlashData at miljana@slashdata.co. You can download this free report at www.DeveloperEconomics.com/go

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THANK YOU

We'd like to thank everyone who helped us reach 20,500+ respondents for our survey, and create this report. Our Research Partners - Intel and Microsoft, and our Media Partners, who are too many to name here. A special thanks to Meetups which participated in our survey including: Beijing Python, CocoaHeads Shanghai, PyHUG Taiwan, Docker Athens, Greece JS and Athens Big Data Meetup.

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SlashData is proud to be supported by a global network of partners, from global tech companies to local meetups and specialised developer communities. Our partners help us ensure that all developer segments are adequately represented in our sample, so that true value is delivered to the global community.



KEY INSIGHTS

- Data science and machine learning will be the most highly sought after skills in the next year - 45% of developers want to gain expertise in these fields. Recent advances in deep learning, cloud computing and open source software are creating exciting opportunities.
- 33% of developers want to learn UI design, 25% cloud native development. Other common tech skills, such as learning a new programming language, rank lower. Developers seem to be seeking out complementary skills instead of self improvement in their field of expertise.
- DevOps has entered the mainstream. One eighth of the developer population is working on DevOps projects.
- There is lots of interest in robotics from developers but limited activity. 40% of developers expressed interest in robotics but only 9% of them were engaged in actual projects.
- JavaScript remains the most popular programming language: it has now crossed the symbolic line of ten million developers. Furthermore, the JavaScript community is growing fast. Three million developers have joined the JavaScript community in one year.
- Python has reached 7M active developers and is climbing up the ranks, closing in on Java in terms of popularity. Sixty two percent of machine learning developers and data scientists now use Python.
- Game developers are making more money. In the first half of 2017 only 29% of game developers were making more than \$100 a month jumping to 48% in the first half of 2018.
- Game developers are moving to the web. 38% of game developers were targeting the web in Q2 2017 which grew to 43% in Q2 2018 while focus on tablets, smartphones and native desktop waned.
- Individual developers seem to have less influence, not more, when as a group they are the majority in a company, or even a sizeable part of it. It seems that when developers are a relatively small group in a company, they get to take their own decisions on their tooling. If they are a large group, a hierarchical structure emerges within the development team and decisions are concentrated at the top.
- The smaller an organisation is, the more likely a developer within that organisation is to be involved in the purchasing process. However the percentage of developers without any influence does not go above 40% for any company size.
- It is only a small minority of data scientists that work on large volumes of data, and only 21% who generate real-time predictions. To add to the “small data” case, the majority of those generating real-time predictions (68%) produce no more than 10,000 real time predictions per month - and the numbers are similar for those generating batch predictions.
- It is in the much discussed areas of speech recognition, image classification and natural language processing (NLP) that 50%+ of data scientists are using small training datasets of no more than 20,000 records.

01

DATA SCIENCE: THE TOP SKILL TO LEARN IN 2019

For developers to remain marketable in a fast changing technology landscape, they need to continuously improve their skills and develop expertise in new areas. In the 15th edition of our Developer Economics survey, we asked developers what skills they wanted to learn or improve in the next year. Data skills appeared at the top of their wishlist, followed by UI design and cloud development skills.

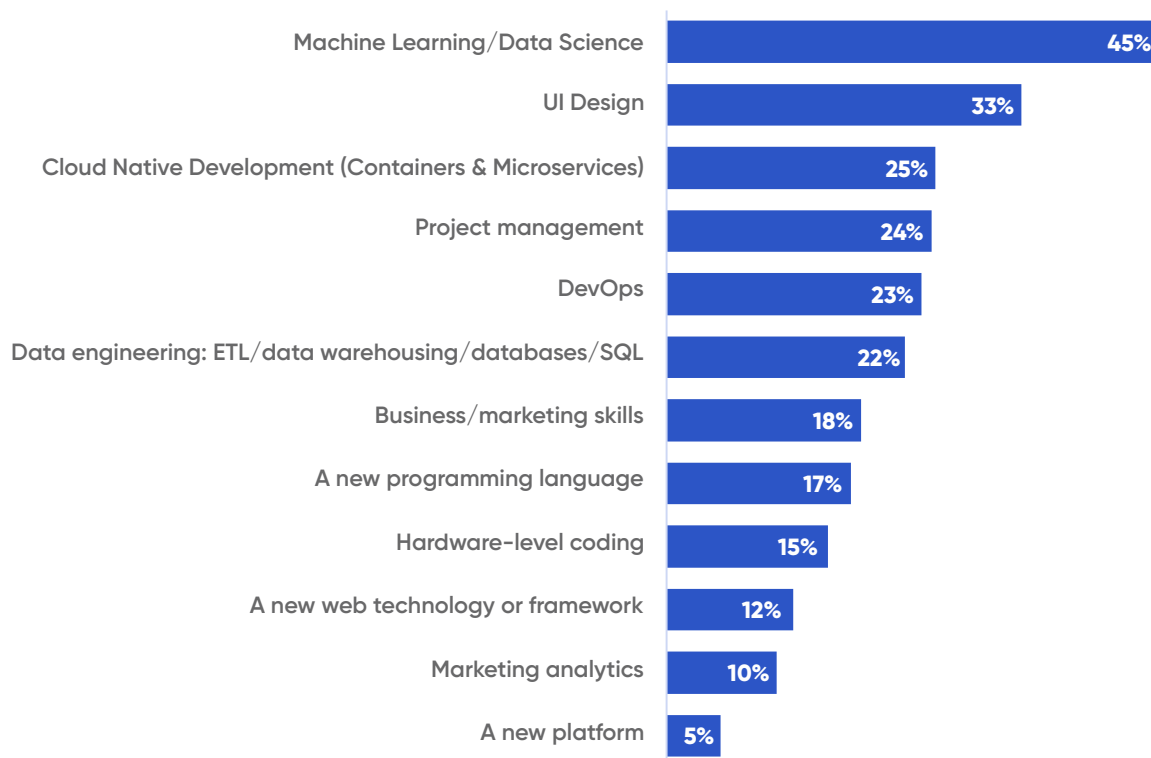


DATA, DESIGN AND CLOUD SKILLS THE MOST IMPORTANT FOR DEVELOPERS IN THE NEXT YEAR

Data science related skills will be the most highly sought after skills for developers in the next year. 45% of developers want to learn or improve their skills in Machine Learning / Data Science, 22% want to obtain data engineering skills (ETL, data warehousing etc.). Also somewhat relevant, 10% of developers want to gain experience in marketing analytics.

What skills do you want to learn or improve in the next year?

% of developers (n=17,270)



Recent advances in deep learning - including breakthroughs in Deep Reinforcement Learning (DRL) and Generative Adversarial Networks (GANs) - have brought us many interesting applications of machine learning / AI in areas like autonomous driving, computer vision, natural language processing and medical diagnostics. The analysis of very large datasets is now made possible and, more importantly, affordable to most due to the emergence of cloud computing, open-source data science frameworks and Machine Learning as a Service (MLaaS) platforms. As a result, the interest of the developer community in the field is growing steadily. The three most popular use cases in the past year have been image classification, customer behaviour analytics and natural language processing, targeted by at least 20% of machine learning developers and data scientists. However, the majority of them (26%) are still exploring their options and have not decided yet in which area to specialise.

As organisations continue to harness the power of big data, the demand for data scientists will keep increasing and their role will become more diverse and complex. Data scientists live in the intersection of coding, mathematics and business and, therefore, they need to possess a mixture of technical and soft skills as well as have domain specific knowledge. Analysing large volumes of data with advanced statistical and visualisation techniques often requires good mathematical background, especially in probability & statistics. It also requires ability to write code in at least one programming language like Python, which is currently by far the most popular language among data scientists. Those involved in building and training machine learning models need solid understanding of the underlying learning algorithms but will most probably use existing ML frameworks or libraries, such as TensorFlow or Apache Spark. Super star data scientists will be able to understand the business problems and use excellent communication skills to translate data analysis results into meaningful insights.

One in three developers would like to add UI design to their skillset. Traditionally, graphic / UI designers have been tasked with creating the user interface elements of projects. Although some of the developers will possibly transition to full-time UI design roles, there are also those who will acquire UI design skills to cover the design aspects of their projects without seeking the input of a designer. This is particularly true for web and mobile app developers who are the majority of those answering that they want to obtain UI skills. Developers looking to get involved in UI design will have to master typography (i.e. the art of arranging letters and characters to make text more readable and appealing), know how to use colours effectively and understand basic page layout rules.

Cloud native development is one the hottest topics of discussion in the software industry and a desired set of skills for 25% of developers. Simply said, cloud native is an approach to software development that fully capitalises on the strengths of cloud computing. It involves the architectural style of breaking an application into many smaller interconnected components, called microservices. Each microservice provides exactly one functionality of the application and runs in its own process, often a

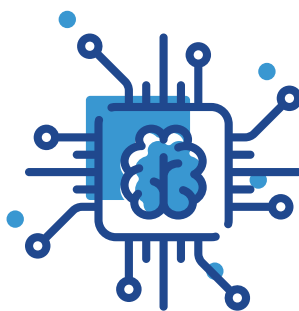
container solution. Containers have been increasingly adopted over the past few years and are now the most popular cloud compute abstraction, used by 32% of backend developers. The main benefit of the microservices architecture is that each service can be built, tested and deployed without affecting the other services, thus avoiding unexpected side effects every time a small change is made. Deployment of microservices to containers implies more efficient scaling, simply by starting additional containers for the specific services that are under heavy load.

Not all is great with cloud native though. As with every other technology there are disadvantages too. Containers are highly portable in that they can be easily deployed to different environments during development, testing and production. However, building distributed systems of containerised microservices introduces

challenges when it comes to system management, monitoring, load balancing and scaling. Although container orchestration platforms like Kubernetes come to the rescue offering automated management of containerised applications, it still takes highly skilled DevOps professionals to set up cloud native architectures and ensure efficient management of the infrastructure. Moreover, microservices are developed and

operated by small, agile teams that need to be managed effectively to achieve high quality software and short release cycles. As cloud native applications will continue flooding the world around us, the roles of DevOps and project manager will become more vital. Currently 24% of developers want to invest in project management skills and 23% want to get DevOps skills.

17% of developers want to learn a new programming language, 15% hardware-level coding, 12% a new web technology and 5% a new platform. These are tech skills that mostly enable developers to stay up to date within their own field of expertise. Interestingly, such skills don't seem to be a priority for developers as they mostly seek out adjacent skills like business / marketing skills (targeted by 18% of developers) and - most importantly - trending tech skills. Whatever their motive for learning new skills is, developers are among the earliest adopters of new technologies and the ones who will drive change and innovation with their ideas.



02

DEVELOPERS ARE INTERESTED IN DISRUPTING GLOBAL ECONOMIES BUT KEEP WORKING ON CUSTOMISING SOFTWARE

Developers have broad interests but understanding where their greatest passions lie provides the industry with insights into the next wave of innovation and where new opportunities will emerge. Where developers are focusing their attention not only has implications for the software industry but the entire global economy.



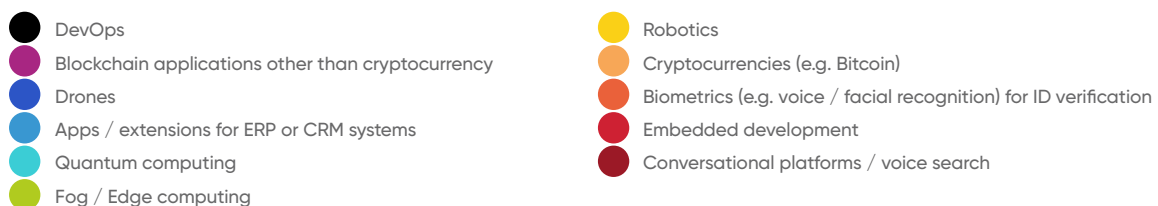
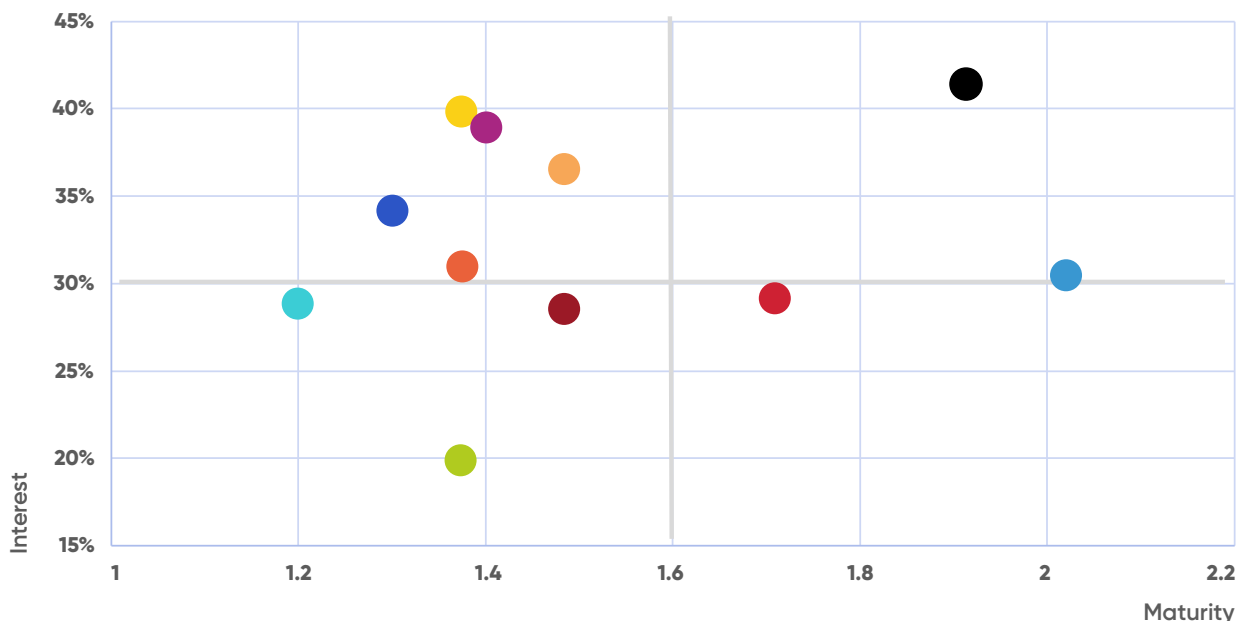
To gauge developers' interest and better understand how advanced certain technologies are we asked developers what areas they were working on, learning about or interested in. The resulting data provided an indication of what technologies are being developed today and what skills and knowledge are being researched for tomorrow. We plotted the results on a graph with the vertical axis representing the percentage of developers that were either working on, learning about or interested in a certain area. On the horizontal axis, we derived a weighted maturity score based on how respondents were involved in each technology. Survey respondents who indicated they were interested in an area received a weighing of 1, if they were learning about an area the weighing was 2 and if a respondent was working on a project in a certain area that response was weighted with a 3. The weighted average was used to determine the maturity score.

When we separate the chart into four quadrants the data points tend to gravitate to three quadrants. Two areas that are focused on optimising the utility of software, DevOps and ERP and CRM extensions, are in the top right quadrant with above the median level of interest and high maturity. Developers were interested in these technologies and many are currently working in these areas. Technologies that had the potential to disrupt global economies, Robotics, Blockchain, Cryptocurrencies, Drones, and Biometrics were in the top left quadrant generating more interest but still immature as many developers were more interested in them than actually working on projects. Areas that are more focused on improving the performance of computing and communications systems, fog/edge computing and quantum computing fell in the bottom left quadrant with less interest and maturity.

Interest vs. Maturity

DevOps generates lots of interest and is mainstream

(n=16,772)



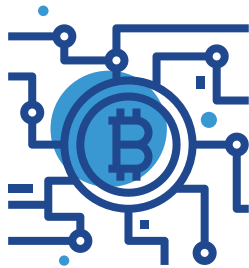
OPTIMISING AND CUSTOMISING ENTERPRISE OPERATIONS

The software development process has evolved over the last decade and inflexible apps have less value for users. To drive the next level of productivity, users need customised and regularly updated software. This is driving demand for customised extensions and a streamlined process for delivering new features and apps.

The DevOps movement or a strategic shift to a more iterative development process that incorporates development and operations is enabling rapid development of software and features required to meet the needs of today's users. These are the areas where developers are most interested. Forty-one percent of developers surveyed were working in, learning about or interested in this area. The DevOps movement is

also gaining momentum as 30% of developers engaged in the area were actually working on it which means that one eighth of the developer population is working on DevOps. While many developers are engaged in DevOps practices, the adoption of these practices across entire operations is still a relative rarity.

While less in vogue than DevOps, developers are also improving user productivity through the development of extensions of enterprise systems like CRM and ERP. Fewer developers are engaged in this area than DevOps, 30% vs. 41%, but the ones that are, are more likely to be working on actual projects instead of just interested in the area. Coincidentally, the percentages are reversed 41% vs. 30%.



DEVELOPERS ARE POISED TO DISRUPT GLOBAL ECONOMIES

The two fundamental ingredients to global economic growth, capital and labour are slated for technological disruption. Blockchain and cryptocurrencies will disrupt capital markets while smarter robots and drones will disrupt labour markets as machines replace humans. It is tough to ignore the hype and trepidation that surrounds these areas but even though developers are very interested in these technologies they are still learning and exploring.

The second most popular emerging area for developers behind DevOps was robotics. Forty percent of developers were working in, learning about or interested in this area. While there is significant interest, robots will not be putting us all out of work just yet as only nine percent of developers interested in this area are engaged in projects. The fragmentation of languages and operating systems in the robotics field is hampering growth and mainstream opportunities for developers. For developers interested in the space, they must have a diverse set of skills and understand multiple programming languages to navigate the fragmented ecosystem. An emerging extension of the robotics space, drones, has also captured the interest of developers but even fewer developers interested in this area are actually working on projects.

As robots and drones are poised to disrupt the labour markets, blockchain and cryptocurrencies are positioned to disrupt trade and capital

Biometrics, including voice and face recognition, is another related area that developers are interested in (31%). While blockchains can verify and record transactions, biometrics can authenticate users to ensure the right individuals are initiating the transaction. These technologies are very sophisticated and require skills in machine learning.

Without doubt, the social impact of these technologies will be profound. Societal push back will be more of a barrier to adoption than the evolution of the technologies themselves.

OPTIMISING COMPUTE POWER & BANDWIDTH

As the world looks to data to help solve more of its problems, the demand for bandwidth and compute power will continue to grow.

Technologies like fog or edge computing that locate processing resources closer to data collection points are reducing the demand on bandwidth. Quantum computing has the potential to enable us to solve problems that have never been possible.

These technologies promise significant efficiencies but attract limited interest from developers. Optimising bandwidth usage seems to be less glamorous than robots or cryptocurrency. Fog and edge computing is also relatively immature with only nine percent of developers interested in the technology working on projects.

Interest in Quantum computing is high due to its promise to revolutionise computing. The extreme complexity of the technology and the sensitivity of the core computing elements, qubits, relegating the technology to research labs. Researchers have trouble just explaining how quantum computing works. Consequently, the number of developers actually working in the area is very low. Companies like IBM have started providing developers access to their quantum computer to tinker with. Just to get started in the space, developers will need expertise in quantum mechanics, maths, and computer science.

LESS EXCITING, FURTHER ALONG TECHNOLOGIES

We also included conversational platforms and embedded development in our query of developer interest. Developers expressed an average level of interest in these areas and the level of maturity was also average.

Conversational platforms have grown rapidly over the past few years but developer interest may be waning as the hype subsides. Embedded development is nothing new but the

limited excitement of developers may be due to the disappointing growth of the IoT sector. Embedded development is also much more technical and less glamorous.

As is usually the case, excitement and interest around technology waxes and wanes as expectations are built up and disappointment ensues. We would expect the technology areas we include in our analysis to be no different.

03

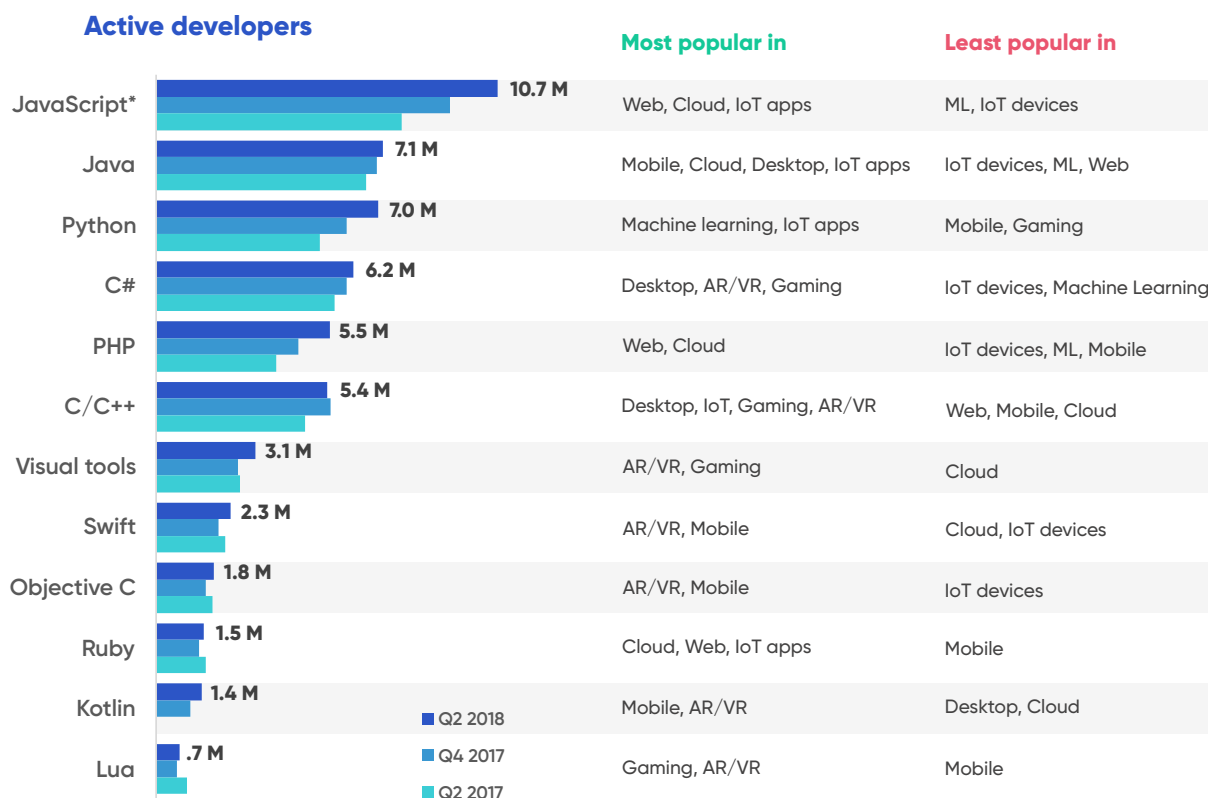
PROGRAMMING LANGUAGE COMMUNITIES - AN UPDATE

Ah, programming languages! They're the beloved subject of debate for many developers, and the kernels of some of the strongest developer communities. The choice of programming language matters deeply to developers because they want to keep their skills up to date and marketable. It matters to toolmakers too, who want to make sure they provide the most useful SDKs.



JavaScript, Python & PHP are growing the fastest

Number of active software developers, globally, in millions, (Q2 2018 n=13,652)



(*) JavaScript includes CoffeeScript, TypeScript

(*) The 'least popular' column only includes sectors for which we have data on the language in question.

Understanding how widely used a programming language is can be hard. The indices available from players like Tiobe, Redmonk, Stack Overflow's yearly survey, or Github's Octoverse are great, but mostly offer only relative comparisons between languages, providing no sense of the absolute size of each community. They may also be biased geographically, or skewed towards certain fields of software development, or open source developers.

The estimates we present here look at active software developers using each programming language, across the globe and across all kinds of programmers. They are based on two pieces of data. First, our independent estimate of the global number of software developers, which we published for the first time in 2017. Second, our large-scale, low-bias surveys which reach more than 20,000 developers every six months.

In the survey, we consistently ask developers about their use of programming languages across nine areas of development¹, giving us rich and reliable information about who uses each language and in which context.

JavaScript remains the most popular programming language: it has now crossed the symbolic line of ten million developers. Furthermore, the JavaScript community is growing fast. Three million developers have joined the JavaScript community in one year - more than the entire population of Swift, Ruby, or Kotlin developers, among others. New developers see it as an attractive entry-level language, but also existing developers are adding it to their skillset.

Two other languages distinguish themselves by their fast growth: Python and PHP. Both have added over 1.5M developers between Q2 2017 and Q2 2018.

1. We have programming language information for each of the following fields: web, cloud, mobile, desktop, IoT applications, IoT device-side code, game development, AR/VR, and machine learning & data science. In this report, we look at broadly used languages, present in 6 or more of these areas, counting developers who use each language in at least one area. Developers don't have to prioritise a programming language for it to count; it may be that they only use a language occasionally.

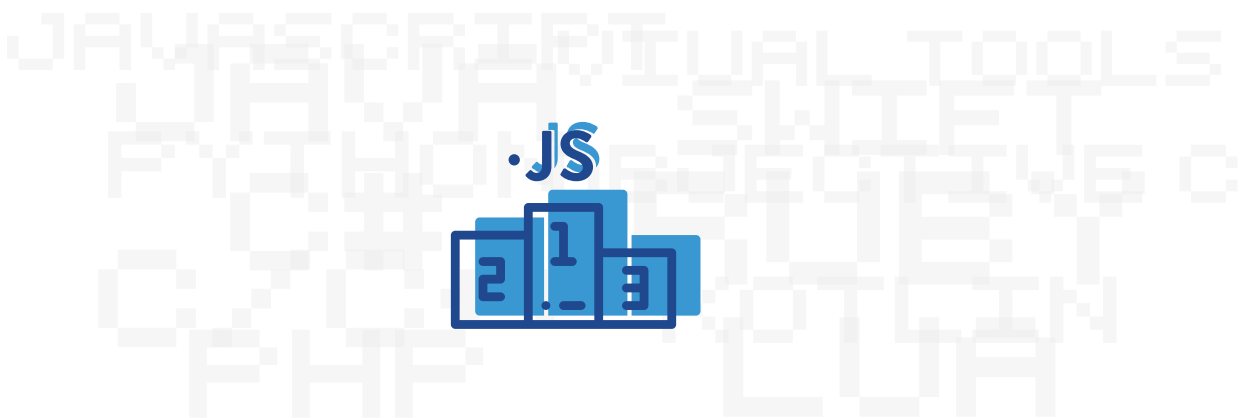
Python has reached 7M active developers and is climbing up the ranks, closing in on Java in terms of popularity. The rise of machine learning is a clear factor in its popularity. A whopping 62% of machine learning developers and data scientists now use Python (compared to 20% of them using R).

PHP is now the second most popular language for web and backend development and the fifth most popular language overall, with 5.5M developers. Despite having (arguably) a somewhat bad reputation, the fact that PHP is easy to learn and widely deployed still propels it forward as a major language for the modern Internet.

Java (7.1M active developers), C# (6.2M), and C/C++ (5.4M) are fairly close together in terms of community size and generally growing along with the global developer population. Java is very popular in the mobile ecosystem and its offshoots (Android), but not for IoT devices. C# is a core part of the Microsoft ecosystem. Throughout our research, we see consistent correlation between the use of C# and the use of Microsoft developer products. It's no surprise to see desktop and AR/VR (Hololens) as areas where C# is popular. C/C++ is a core language for game engines and in IoT, where performance and low-level access matter (AR/VR exists on the boundary between games and IoT). The rise of AR/VR and IoT boosts C/C++ usage.

More niche languages don't seem to be adding many developers, if any. Swift and Objective C are important languages to the Apple community, but are stable in terms of the number of developers that use them. Ruby and Lua are not growing their communities quickly either.

Older and popular programming languages have vocal critics, while new, exciting languages often have enthusiastic supporters. This data would suggest that it's not easy for new languages to grow beyond their niche and become the next big thing. What does this mean for the future of these languages and others like Go or Scala? We will certainly keep tracking this evolution and plan to keep you informed.



04

EVOLVING TECHNOLOGY & NEW CHANNELS HELP MORE GAME DEVELOPERS MAKE MONEY

The Fortnite phenomenon has captured the attention of the gaming community and exemplifies many of the changes that have occurred over the past 18 months in the industry. Gaming has become much more social, and watching expert gamers execute perfect moves can be just as much fun as playing them. This creates a new channel for developers to promote their games and new ways to generate revenues. Fortnite first gained popularity when rock star streamer Ninja and rapper Drake streamed their game-play on Twitch. This shift is influencing revenue models and opportunities for developers. The trend is also helping to shift development to the web.



GAME ECONOMICS ARE CHANGING WITH STREAMING

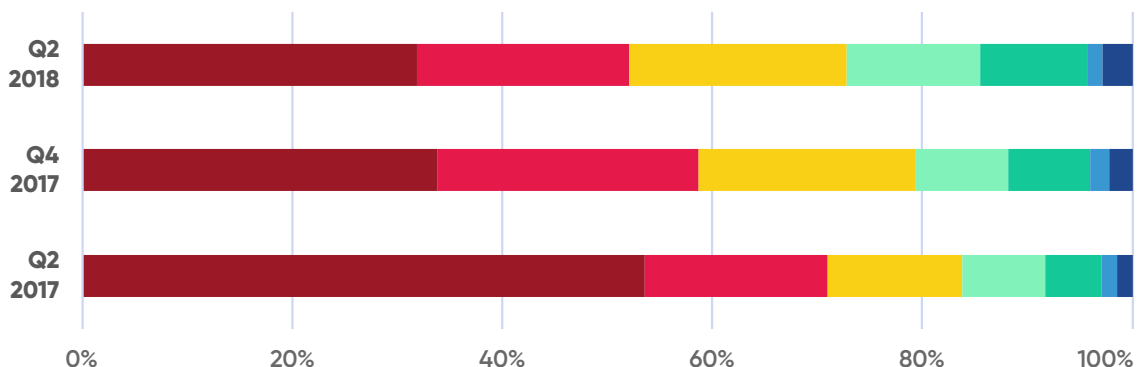
Before gaming consoles hit the market in the 80's, gamers had to visit the arcade and wait for a machine to be available for their turn to play. This created a sense of community and players watched more games than they played, especially if their supply of coins was low. The emergence of streaming is bringing this experience back and watching games has become its own form of entertainment.

One of the reasons Fortnite has become so popular is because it is so watchable. Streaming is creating a new channel for developers to promote their games and generate revenues. Gamers can actually watch experts play a game before trying it themselves. The trend is also bringing new capital into the space. Streamers can make big money attracting subscribers to follow them on their channels and sponsors are paying to promote to these audiences. Ninja, the most successful streamer, is reported to make \$500,000 a month from his streams. While this revenue does not go directly to developers it does bring a new source of capital into the ecosystem, introducing new opportunities.

This new revenue source is helping spread more money across the industry. In the first half of 2017 only 29% of game developers were making more than \$100 a month. In the first half of 2018 that jumped to 48%. While many factors may be influencing revenue growth, streaming is providing a new way to engage with video games, passively, providing opportunities to innovate new business models.

Game developers generate more revenues

% of game developers (Q2 2017 n=1,611, Q4 2017 n=1,299, Q2 2018 n=1084)



Average monthly revenues



One dominant trend in game developer business models is that developers are focusing on a fewer number of them, and the more popular ones such as advertising and in-app purchases are getting significantly less popular. Presumably this is due to developers focusing only on revenue sources that are producing for their apps. However, the use of a few less popular approaches is growing. This can be traced back to a growing communal and collaborative environment in the gaming space. Symbiotic relationships are emerging among streamers, developers and gamers that are beginning to change the economics of the industry.

The challenge of developing a game and attracting users has proven too expensive for small developers so they are focusing on leveraging ecosystems and platforms that enable them to help each other instead of relying on launching their own game. Our data shows a small but steady increase in the

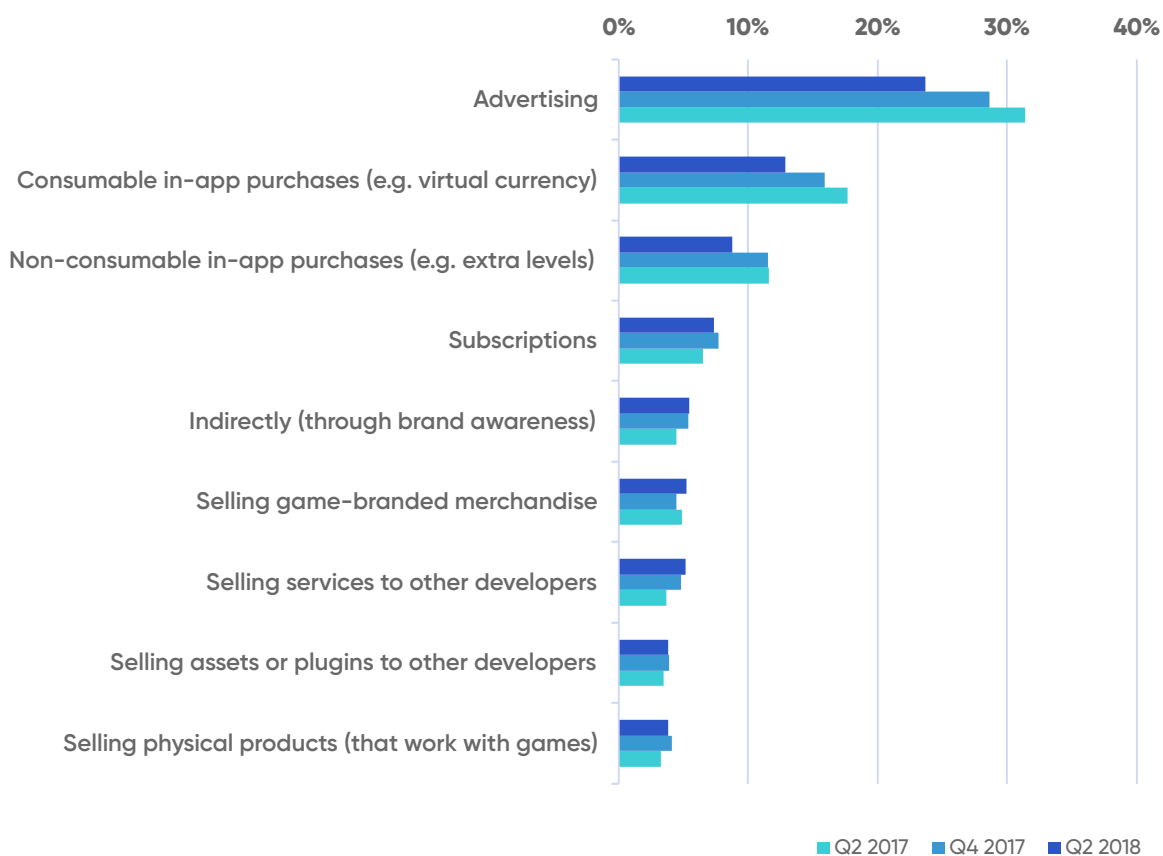
number of developers making money through selling services, assets and plugins to other developers. The communal effect fueled by streaming is also leading to increases in subscription games such as World of Warcraft which keep players engaged in the community. Developers are also making money through subscriptions to their own live streams of their development process.

As the rock stars of streaming create a new entertainment experience, development and streaming platforms are innovating new ways to provide opportunities. Twitch has launched extensions which enable viewers to engage with the game stream through web overlay extensions developed by third parties. Developers can create stats views or side games and split profits with the streamers who are attracting the audience. Unity content store is providing a channel for developers to deliver plugins to other developers, another channel for delivering game software. As games are passively consumed, it also provides more opportunity to sell merchandise. We are seeing an uptick in developers generating revenues this way.

Cryptocurrencies are another trend that is helping spread the wealth across the industry by enabling developers, streamers and gamers to make micropayments to influence behaviours. Gamers can tip streamers when they are entertained and developers can pay streamers to promote their games, all through cryptocurrencies. Bits, the cryptocurrency within the Twitch platform which allows viewers to tip streamers, generated \$12 million in the service's first 10 months.

Developers move away from popular business models

% of game developers (n=2,527)



GAME DEVELOPERS ARE MOVING TO THE WEB

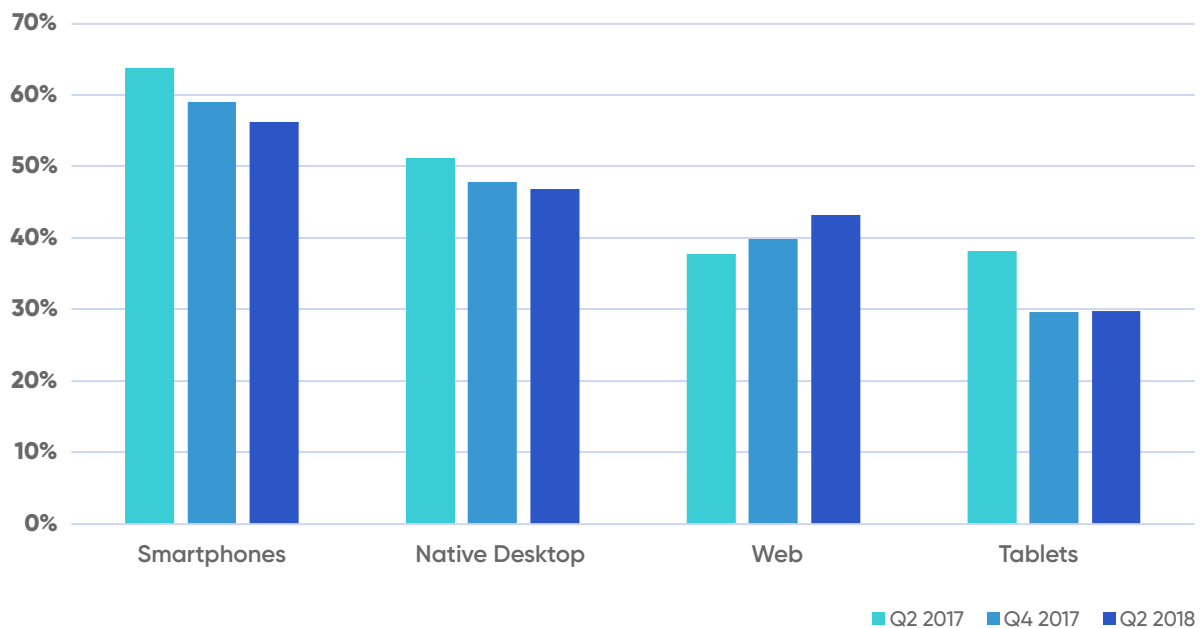
As developers promote and distribute games outside of app stores through streams, they are also moving to the web. This fact and the constantly improving performance of JavaScript is reducing the percentage of developers focusing on mobile, desktop and tablets.

As gamers congregate in communities around streamers, developers can reach these prospects without having to go through an app store. Moreover, smaller developer teams don't have to build for each platform and can have more control of their app and engagement with their audience via the web. New Twitch extensions are also web based, providing a new product category for web developers.

The improving performance enabled by JavaScript JIT compiling engines and frameworks such as React are enabling web developers to create superior game performance over what was possible in the past. With greater performance and distribution options, it is not surprising that the web is becoming more popular with game developers.

Game developers are moving to the web

% of game developers (n=6,228)



As the opportunity to make money becomes more democratised, the chance for real innovation grows. When more resources are spread around the industry, fledgling ideas have the economic viability early on and stand a better chance to get out of the starting gate.

05

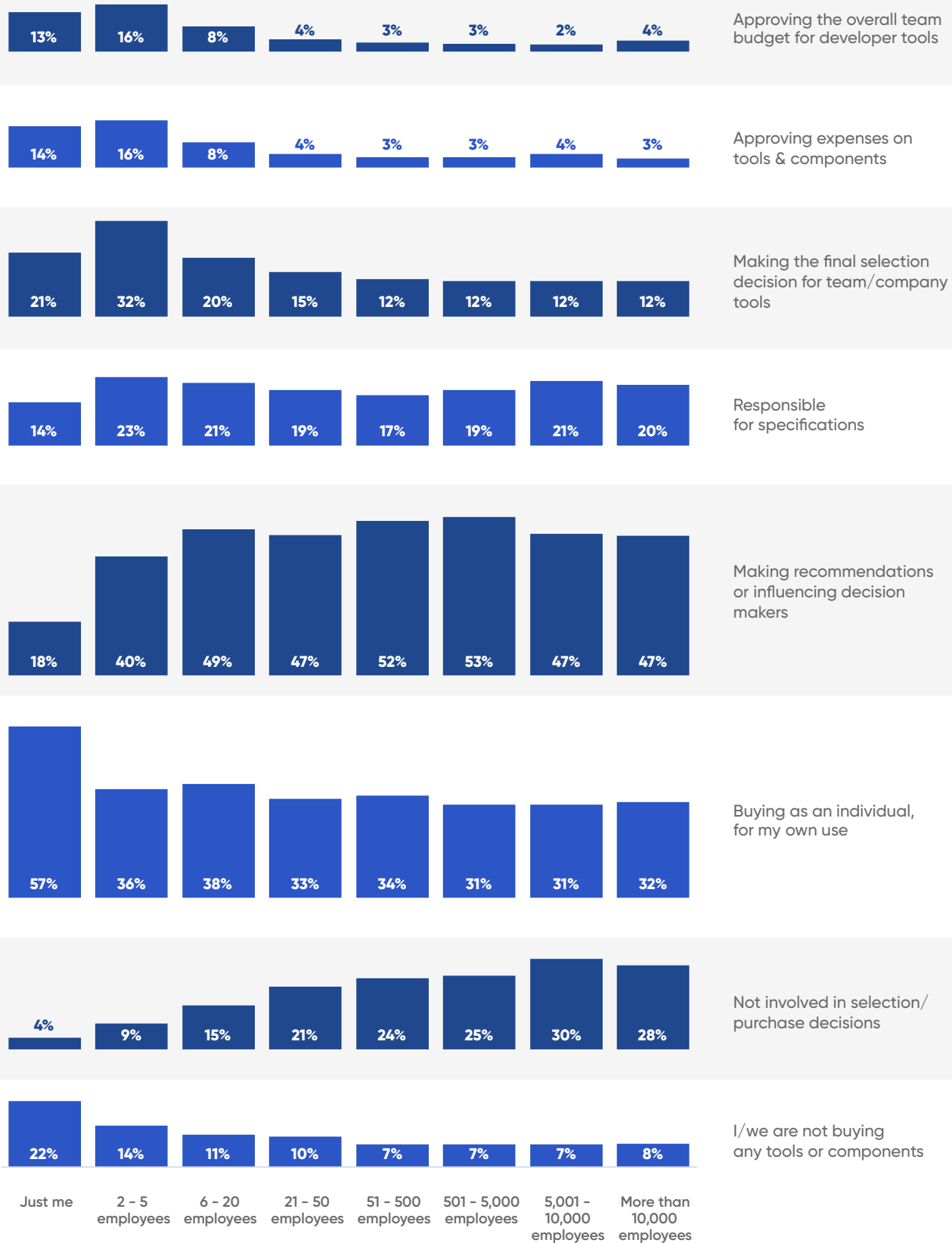
DEVELOPERS ARE DECISION MAKERS... IN COMPANIES OF ALL SIZES!

When it comes to choosing and buying technology, are developers powerless line employees at the whim of the purchasing department, or are they influencers and decision makers, at the centre of the buying process? Thirty years ago, the former was surely true in most organisations. However, things have changed. A year ago we first published data in our State of the Developer Nation report that shows that developers indeed have a lot of influence in technology purchases; that indeed they have buying potential and can act as a wedge point to start selling into an organisation. It's time for an update.



Influence of professional developers, by company size

% of developers (n=13,976)



In 2018, 71% of professional developers² have at least some influence when it comes to buying tools and software components. The remainder are either not buying tools at all (11%) or are not involved in selection or purchase decisions (18%). 45% of developers are influencers, i.e. in a position to make recommendations; almost 1 in 5 write specifications; 17% get to make the final decision.

This said, context matters when it comes to the amount of influence that developers have. In our report a year ago (Q2 2017) we focused on the role of developers in the organisation: are they front-line programmers or do they have management responsibility? In this edition we'll highlight developer influence across companies of different sizes and depending on how many developers work at an organisation. As we'll see, developers have influence in companies of all sizes; most of the differences occur at the smallest and the largest organisations.

First of all, in almost every developer organisation (89% of them), third party tools are used and there is a willingness to pay for them. For organisations that have more than 50 employees or more than 10 developers, only 7% don't buy tools or components. Only the smallest companies are less eager to spend money on tooling. There is no evidence that organisations with very large developer teams would be more inclined to develop everything in-house.

Notably, regardless of organisational size, the number of developers who buy tools individually never drops below 29%. First, this means they have at least some decision power and at least a small budget to spend. In aggregate, this by itself is an important market. Second, this increases their influence in their organisations and allows them to act as a 'wedge point'. They can introduce tools in an organisation for personal use or at small scale, and then have a proof point to demonstrate the tool's value to others, based on actual experience and results. As such, they can evangelise tools in larger organisations. Targeting individual developers therefore becomes a viable strategy for enterprise sales.

In single-person companies and organisations with a single developer, the developer buys more tools for their own use; there is no need for them to be an influencer (whom would they influence?) or go through a formal selection procedure.

By extension, the smaller the organisation, the more likely the developer is to be involved in the purchasing process. However, the percentage of developers without any influence does not go above 40% for any company size. Similarly, developers in small organisations are more likely to make final decisions or approve budgets and expenses. The decision power of developers stabilises on 12% for companies larger than 50 people and doesn't drop further with size.

2. By developers we consider programmers and software developers; data scientists and machine learning developers; system, solution, or software architects; and technology or engineering team leads. Developers have to be professionally involved in at least one sector of the software economy. System admins, DevOps specialists, testers, designers, and managers are not considered, unless they also act in one of the roles above.



Individual developers seem to have less influence, not more, when as a group they are the majority in a company, or even a sizeable part of it.

As developers get less outright decision power with growing company size, they take on a role as key influencers of those decisions. Only in large companies of over 5,000 employees does their influence wane somewhat. Whereas in companies with up to 5,000 employees 53% of developers make recommendations, in larger companies only 47% do so. Again, this is still almost half of all developers - the time that purchase decisions were taken exclusively by purchase departments or executives is gone.

It is not the case that developers retain more influence if the company is heavily developer focused, i.e. if the number of developers (rather than all employees) is very high. In fact, in companies with over 1,000 developers, we see the same drop in influence and involvement that we see in companies with over 5,000 employees.

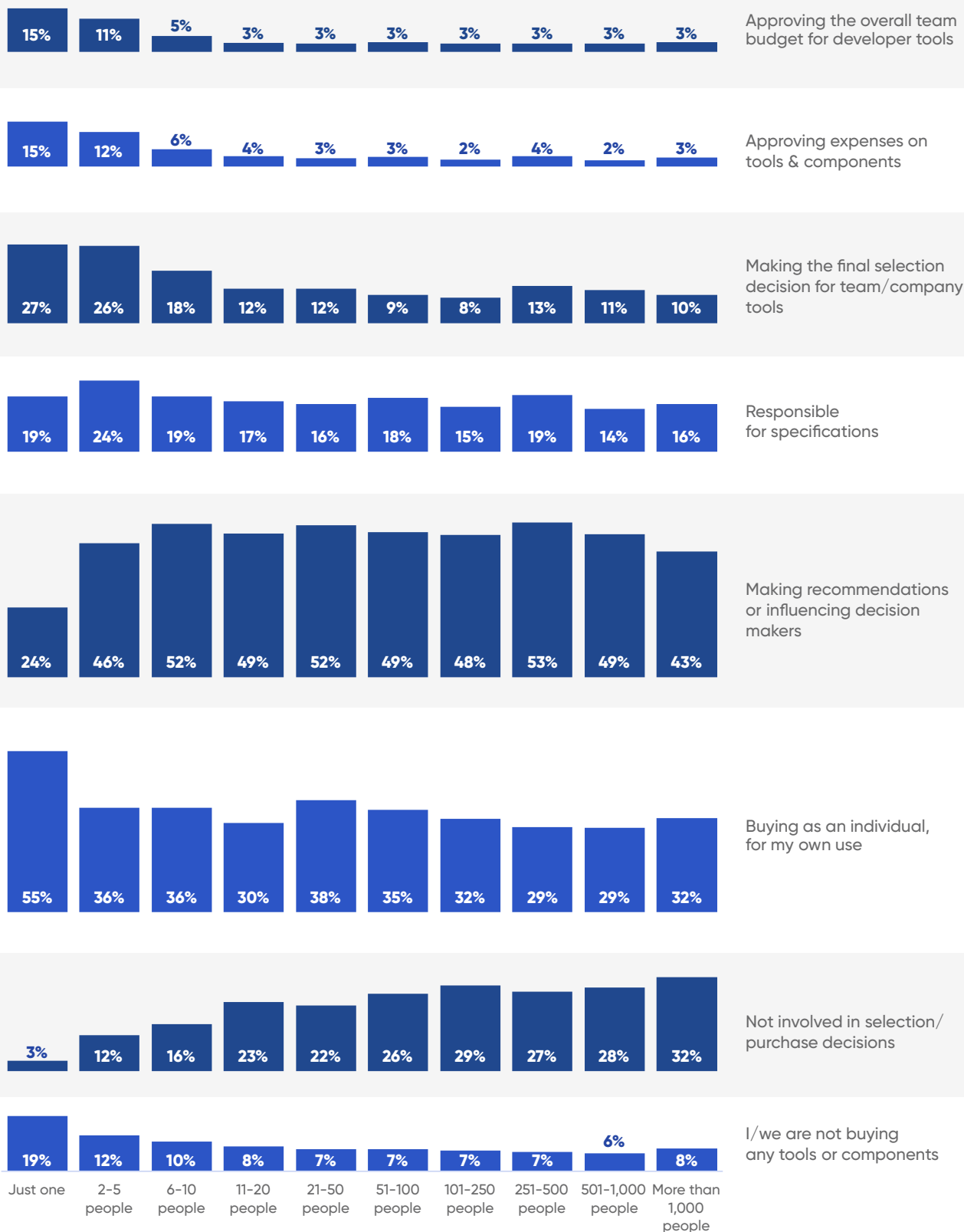
What's more, individual developers seem to have less influence, not more, when as a group they are the majority in a company, or even a sizeable part of it. Let's focus for a moment on organisations with more than 10 developers,

excluding small businesses run by developers themselves. In such organisations, if developers constitute less than 15% of employees, 52% of them are in a position to make recommendations and 12% are final decision makers. When the development team is over half of the company, only 46% exert influence and only 8% are decision makers. It seems that when developers are a relatively small group in a company, they get to take their own decisions on their tooling. If they are a large group, a hierarchical structure emerges within the development team and decisions are concentrated at the top.

In conclusion, developer experience matters - a lot! The world of developer tooling has indeed fundamentally shifted in the past few decades. It is no longer the purchasing department you need to woo, but the developer who will use your tools on the floor, and their direct team manager. As a research company entirely focused on developers, we will keep following this evolution closely.

Influence of professional developers, by number of employees involved in development

% of developers (n=13,976)



06

BIG DATA AND REAL-TIME PREDICTIONS: TO HOW MANY ARE THEY RELEVANT?

Big data, i.e. large-volume datasets produced in high frequency (often thousands or millions of records per second), has been hyped for several years. Currently past its disillusionment phase, big data is beyond doubt of pivotal importance to large organisations, and especially to the giants like Google, Twitter and their peers. A question, however, remains: To how many in the rapidly growing data science, AI and Machine Learning (ML) community is big data relevant? How many ML developers and data scientists are working on large datasets?



To add to the big data hype, and as an aftermath of the Deep Learning (DL) breakthroughs, a race begun to design processors capable of crunching large sets of often unstructured data - including text, audio or images - to train ML algorithms and to produce real-time predictions. Such processes are key to image classification and natural language processing (NLP) applications, including voice assistants, face recognition, and self-driving cars. Again the question is - to how many are these relevant? How many are in need of generating real time predictions, or at least a fair number of batch predictions?

To answer the above questions, we asked 4,200+ ML developers and data scientists in our latest Developer Economics survey about the datasets they use to train ML models, and the predictions they produce based on those. We excluded from our sample those who indicated that they only deploy algorithms that others have built, build frameworks, or develop AI functionality that does not involve machine learning.

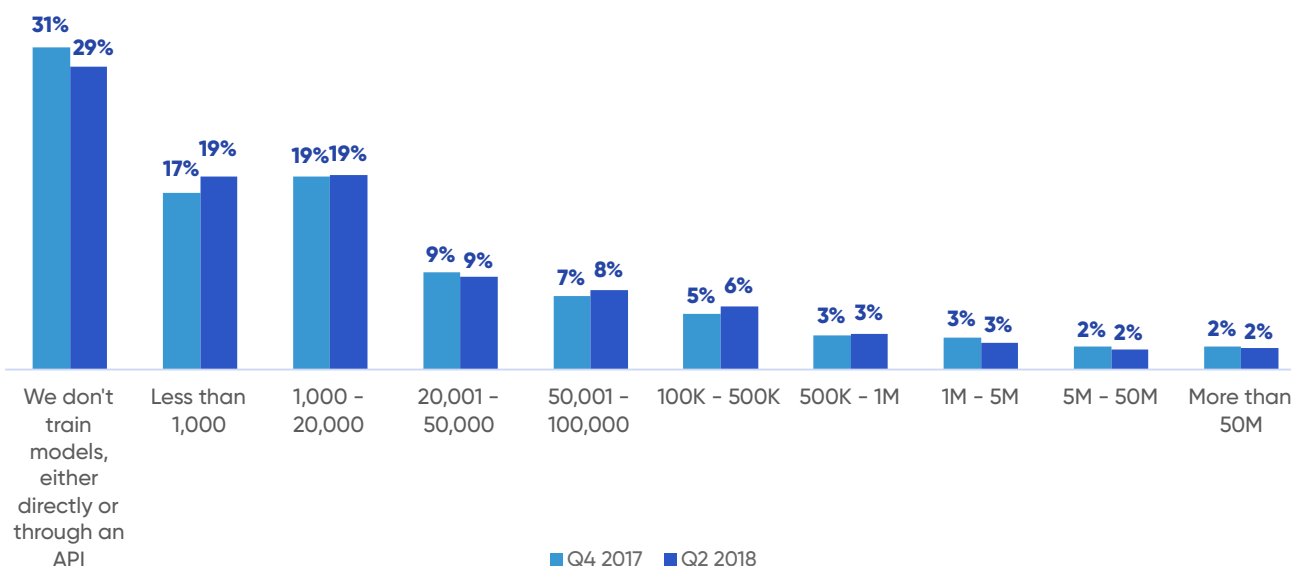
THE BIG PICTURE IS NOT WHAT YOU MIGHT EXPECT

The majority (58%) of ML developers and data scientists don't use models to generate predictions, whether real time or batch, while 29% say they don't train models at all - and that's after excluding those only deploying models or building frameworks. Data scientists not training models are in most cases working on data engineering tasks, using data for descriptive and exploratory reasons, or simply consuming pre-trained models. Those who train models but are not generating predictions focus on describing population segments or

behaviours, or on identifying patterns. The need to identify patterns, behaviours and profiles has been one of the main uses of clustering and classification models (among others) for several decades, and an area where "black box" models (as all neural networks are) were not favoured as they provided no insight. Our data suggests that the part of the population that limits itself to this type of analysis, and has therefore little interest in sophisticated models of high prediction power, remains of considerable size.

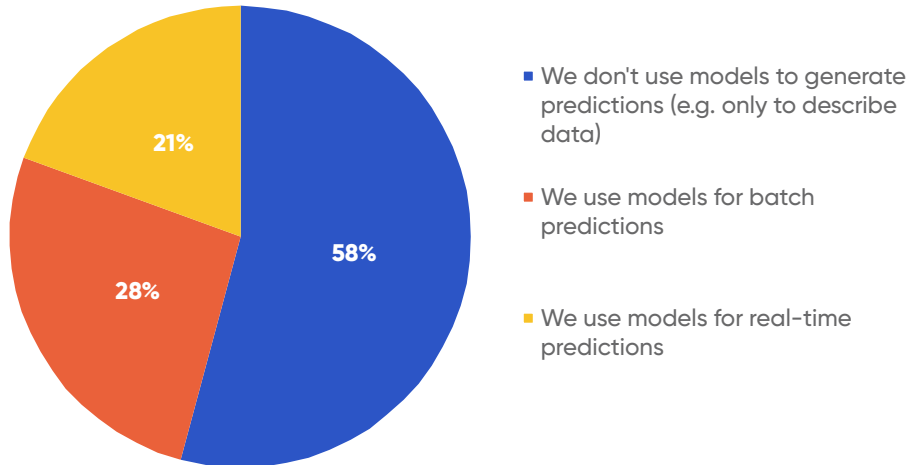
On average, how many rows do your training datasets have?

% of data scientists and ML developers (Q4 2017 n=3,630 Q2 2018 n=3,679)



Do you or your team use models to generate predictions?

% of data scientists and ML developers (Q2 2018 n=4,239)



In addition to those who don't train models, another 38% work on datasets no bigger than 20,000 records, and only 2% crunch more than 50M records. Comparing against the same data from our Q4 2017 survey it's obvious that this is not just a glitch in our data, but a rather stable state of affairs - particularly with regards to moderate and large data volumes (above 1M records). It is only a small minority of data scientists who work on large volumes of data, and only 21% who generate real-time predictions. To add to the "small data" case, the majority of those generating real-time predictions (68%) produce no more than 10,000 real time predictions per month - and the numbers are similar for those generating batch predictions.

You might think that the low popularity of large datasets is due to the substantial number of learners flooding the data science and machine learning community, and that the practice of

professionals is an entirely different story. Not quite. Professionals are, of course, more into training models (23% of them saying they are not as opposed to 36% of amateurs), and do tend to work on the larger datasets. Still, only 8% of them use datasets of more than 5 million records, and only 4% use datasets bigger than 50 million records. It's therefore not a matter of amateurs experimenting with small datasets, but rather a practice common across all data scientists, professionals included.

The above picture may be more than just an indication of lack of interest in larger datasets. It points, in fact, to what data scientists have told us in the past to be their key challenge: lack of suitable data. It remains to be seen whether the emerging initiatives of publicly available data and blockchain technologies will have any effect on tipping the scales towards bigger - if not big - data.



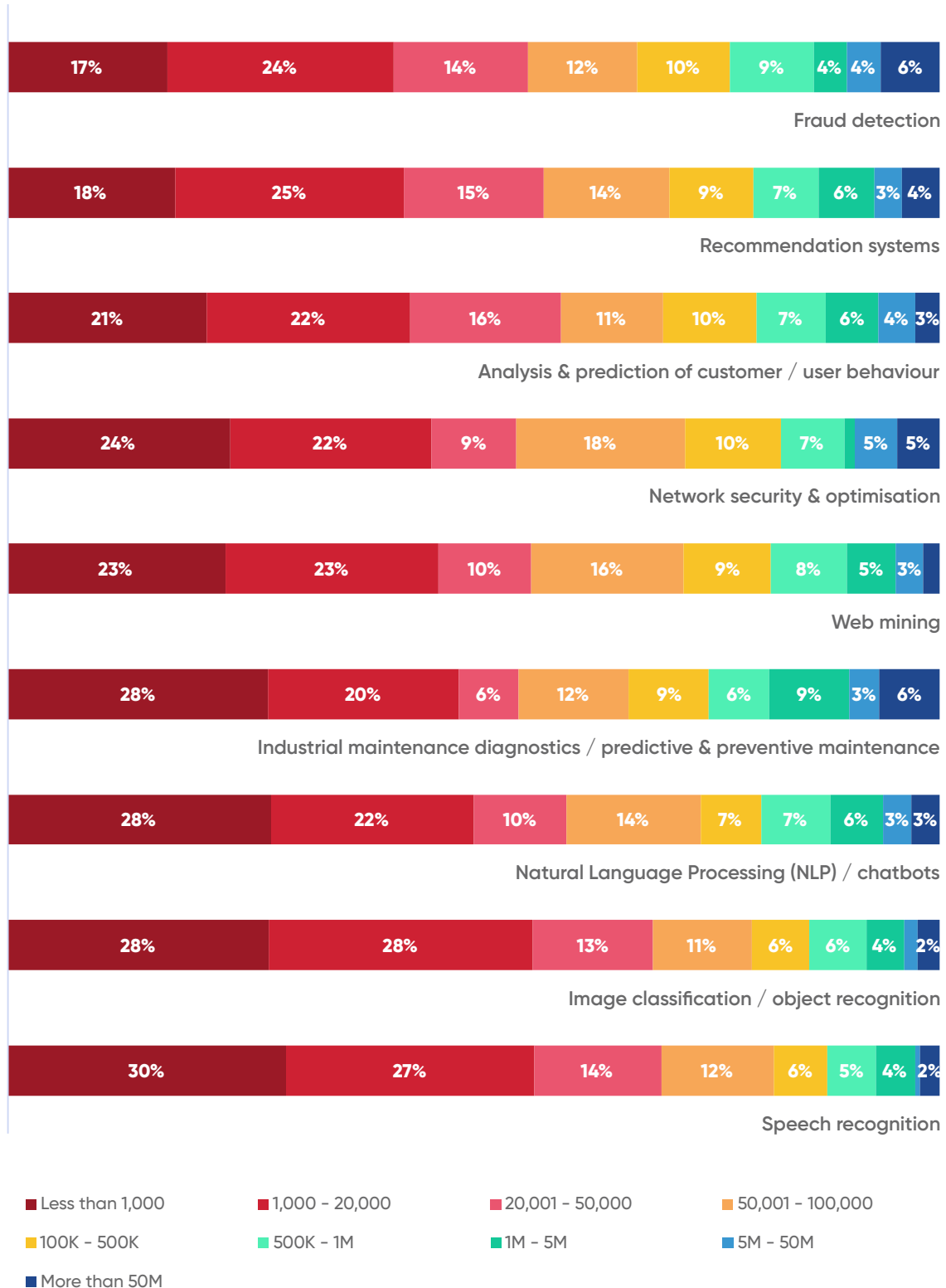
IT'S ABOUT QUALITY, NOT QUANTITY

Working on small datasets may be no mean feat, though. “Short” datasets may be hiding other challenges, such as unstructured text and video. In speech recognition projects, for example, data is gold: Obtaining clean and annotated data to train speech recognition algorithms is difficult (as data is in many cases proprietary), especially in languages other than English. Voice platform vendors can leverage the large volumes of relevant data they have accumulated, but smaller companies or startups hoping to enter this arena find themselves at a disadvantage. As a result, and although a large training set is highly desirable in deep learning modeling, the majority (57%) of developers and data scientists

who work on speech recognition use datasets of up to 20,000 records, while only 12% get their hands on datasets of more than 500,000 rows. The case of image classification is similar, with 56% of data scientists using training sets of no more than 20,000 images. Publicly available datasets, such as TED talks, MNIST, WordNet, and ImageNet among others, and initiatives such as Mozilla’s Common Voice and Google’s Speech Commands and Open Images Datasets are certainly moves in the right direction, but do not seem to appeal to the majority of data scientists working on speech recognition and image classification.

Size of training datasets used per Data Science / Machine Learning application area

% of data scientists and ML developers active in each area (n = 2,330)



At the other end of the spectrum we find application areas where data is produced in abundance from transactional systems, networks, the web, beacons, or devices. Fraud detection, customer/user behavioural analysis, and recommendation systems, all based on transactional data, have the lowest percentage of data scientists working on small (up to 20,000 rows) datasets. In industrial maintenance and prognosis, which is mostly based on data collected from systems and beacons, we find the highest percentage of data scientists working on datasets of 1M records or above (18%). Even in these areas, though, it's still more than 40% of data scientists who work on small sets. Although access to data may be an issue here as well (as for example at the onset of a recommendation system where limited customer behavioural data is available), in many cases it is just a matter of small scale projects - such as companies profiling a limited clientele, or running analysis of survey data.

Despite the noise around big data and real time predictions, the majority of the data science and machine learning community is working on small datasets, and generates limited number of predictions. This is something that MLaaS providers should take into account when designing their pricing policies around training set sizes and number of predictions generated. The number of attributes (columns) in a dataset is also important, but based on our data the large majority again limits itself to not-so-wide data (up to 100 attributes). For the majority, the burning issue seems to be accessing good quality data. This is a key area where the main ecosystem players should focus on.



METHODOLOGY

Developer Economics 15th edition reached an impressive 20,500+ respondents from 167 countries around the world. As such, the Developer Economics series continues to be the most global independent research on mobile, desktop, IoT, cloud, web, game, AR/VR and machine learning developers and data scientists combined ever conducted. The report is based on a large-scale online developer survey designed, produced and carried out by SlashData over a period of seven weeks between May and June 2018.

Respondents to the online survey came from 167 countries, including major app, machine learning and IoT development hotspots such as the US, China, India, Israel, UK and Russia and stretching all the way to Kenya, Brazil and Jordan. The geographic reach of this survey is truly reflective of the global scale of the developer economy. The online survey was translated into eight languages in addition to English (simplified Chinese, traditional Chinese, Spanish, Portuguese, Vietnamese, Russian, Japanese, Korean) and promoted by 70 leading community and media partners within the software development industry.

To eliminate the effect of regional sampling biases, we weighted the regional distribution across eight regions by a factor that was determined by the regional distribution and growth trends identified in our Developer Economy research. Each of the separate branches: mobile, desktop, IoT, cloud, web, games, augmented and virtual reality, and data science and machine learning were weighted independently and then combined.

To minimise other important sampling biases across our outreach channels, we weighted the responses to derive a representative distribution for platforms, segments and types of IoT project. Using ensemble modeling methods, we derived a weighted distribution based on data from independent, representative channels, excluding the channels of our research partners to eliminate sampling bias due to respondents recruited via these channels. Again, this was performed separately for each of mobile, IoT, desktop, cloud, web, games, augmented and virtual reality, and data science and machine learning.

For more information on our methodology please visit <https://www.slashdata.co/methodology>



Developer Economics is more than just a survey!

“...the survey ended up being educative to me. It made me curious about some new technologies I wasn't aware of...”

Become a part of our developer community

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