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The App Economy in Europe

A review of the mobile app market and its contribution to the European Economy

August 2022

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Executive Summary

1. The introduction of **smartphones has reshaped the way Europeans interact in almost all areas of personal and professional life**. Apps[1] have become an essential part of the way phones, but also connected televisions, game consoles, virtual reality headsets, or PCs, provide digital services. Moreover, apps play a central role in the growing Internet of Things (IoT), connecting users to devices. Focusing on the mobile channel**, this report analyzes the benefits of mobile apps, and quantifies the contribution of the mobile app sector to the European economy**[2]. Also the impact of the Covid-19 crisis on the app economy is studied. The health crisis notably raised awareness of how **mobile apps have become an essential part of life**. The report furthermore discusses the active European landscape of small and medium-sized enterprises (SMEs) in the app development sector.

2. Our research demonstrates that app stores have a positive impact on the mobile app ecosystem[3]:

   - App stores enable disintermediation between buyers and developers which is one way through which app stores reduce transaction costs for app developers and their users.

   - App stores reduce entry barriers for developers and therefore increase the level of competition.

   - App stores increase consumer trust and security by creating a trustworthy platform for users and developers.

3. **The direct revenues of the app economy in the European Union[4] amounted to €95.7 billion in 2021** – these are revenues for mobile app developers. In comparison, box office revenues in the EU and the UK stood at €3 billion in the same year[5], and revenues for the provision of sporting and recreation services were estimated at €168 billion in 2019[6].

4. Including direct and indirect contributions, the app economy generated **€210 billion in revenue throughout all sectors of the EU's economy**. The breakdown of this sum is as follows:

   - Direct contributions are estimated at €95.7 billion with the following categories:

     i. Advertising revenue: €19.2 billion

     ii. Paid downloads, subscriptions, and in-app purchases: €6.5 billion. Mobile games represented 63% of this revenue.

     iii. Contract work: €66.4 billion

     iv. Mobile commerce: €3.6 billion is attributable to the app sector

   - Indirect contributions: €114 billion in indirect contributions due to additional business and household consumption triggered by app development.

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[1] Apps refer to the software applications that run on smartphones.
[2] The contribution of the mobile app sector is quantified for the European Union and the UK separately.
[3] App stores refer to all app platforms including Google Play store, Apple App Store, Amazon app store, etc.
[4] Throughout this document, figures are cited for EU27.
[5] International Union of Cinemas, Cinema-Going in Europe in 2021 - Recovering European Cinemas see 42 percent Box Office Growth in 2021, February 2022.
[6] Source: Eurostat, National accounts aggregates by industry (up to NACE A*64). € 168 billion in EU27 and the UK included.

The app economy represented 0.7% of the European Union's GDP in 2021.

5. In the United Kingdom, the direct revenues of the app economy in 2021 amounted to €38.4 billion.

6. Including direct and indirect contributions, the app economy generated **€86.5 billion in revenue throughout all sectors of the UK's economy**:

    - Direct contributions are estimated at €**38.4** billion with the following categories:

        i.   Advertising revenue: €13.8 billion

        ii. Paid downloads, subscriptions, and in-app purchases: €2.1 billion. Mobile games represented 55% of this revenue.

        iii. Contract work: €21.3 billion

        iv. Mobile commerce: €1.2 billion is attributable to the app sector

        v.   Indirect contributions: €48 billion in indirect contributions due to additional business and household consumption triggered by app development.

    In terms of value-added, the app economy represented 1.5% of the UK's GDP in 2021.

7. The total number of jobs generated throughout all sectors of the EU's economy by the app sector in 2021 is estimated at 1.4 million, and 400 000 in the UK. Jobs are calculated using our "Input-Output" framework (total revenue for the sector combined with national accounts data). These figures include direct jobs (software developers, mobile app specialists), indirect jobs (suppliers to the app developers), and induced jobs (jobs created by the spending of the directly and indirectly employed workers).

8. **Europe is generally considered to benefit from highly skilled app developers and is home to a rich ecosystem of SMEs** in the app development sector. These include pure players and agencies that work for the outsourcing market. The UK has the most app development firms in absolute terms, but smaller countries such as Bulgaria, Poland, Romania, Estonia, Lithuania, and Croatia show a relative specialization in app development with two to five times more SMEs in the sector per unit GDP than the UK.

9. **Nearshoring contributes to the success of app development SMEs in Europe**. Notably, app development firms in above-mentioned relatively specialized countries often work for clients in for example Northern and Western Europe, leveraging their high-skilled, cost-competitive developers. Cost difference between these countries and developers in Northern or Western Europe can reach a factor of two to three. In addition, nearshoring benefits from low risk due to proximity (language, culture, time-zone). Indeed, **the remote delivery model works very well in the app development sector,** resulting in intra-European trade, benefits for both clients and developer firms, and more opportunities for SMEs and startups throughout Europe.

10. **Apps have permeated business models in several ways**. Many **firms integrated apps into the way they provide services to their clients**. For example, European airline and railways companies facilitate the booking and travel process with mobile apps. Moreover, specific features of mobile phones (geo-localization, accelerometer, camera, touch screen) have enabled the development of new services.

11. Furthermore, **pure players, companies that have built their activities only on apps, have confirmed their importance in the ecosystem**. Well-known examples are ride-hailing apps, which use geo-localization, and mobile games. Europe counts innovative mobile game developers and specialized firms such as Citymapper or Greenly, which are **transforming consumer behavior.**

12. Citymapper calculates, in real-time, the routes of urban transport for users, by combining several modes of transport, suggesting alternative transport means to users[7]. Greenly is another app that changes user behavior. The app informs users on the greenhouse gas emissions generated by their mode of consumption, obtained through their banking transactions.

13. In interviews conducted for this study, several app developers stated that **future innovation in apps will not come from hardware developments but from the software side**.

14. **The mobile app sector has been resilient during the Covid-19 pandemic.** Growth of the app sector decoupled from the evolution of GDP in the EU and the UK. While real GDP in the EU decreased in 2020 by 7.8%, and by 11.5% in the UK, the mobile app sector has seen an acceleration in its growth trajectory in 2020: In the EU, real growth of consumer spending on apps was 30% in 2020, and in Great Britain 29%. Comparison of pre-Covid-19 market estimates and 2021 growth of app store revenue suggests that the long-term growth trajectory is unaffected.

15. This resilience is related to the fact that the use of apps such as mobile games was not impaired by physical distancing requirements. Furthermore, mobile **apps have provided innovative solutions to deal with the crisis.** They contributed to the continuity of public services, social and business activities during lockdown periods. Teleworking apps allowed desk-type jobs in mainly the service sector mainly to pursue activities. In the health sector, Covid-19 tracking-, vaccination- and testing-apps became the most downloaded medical apps in Europe in 2021. Apps for teleconsultation facilitated the provision of health services. Finally, the use of food delivery apps, such as Uber Eats or Deliveroo, increased dramatically during periods with strong physical distancing requirements, allowing restaurants to continue to operate.

16. **The pandemic has accelerated the digital transition in many sectors. Trends initiated during the Covid-19 pandemic are set to become permanent, as the crisis has shaped new ways of life.** For example, the increased use of telemedicine changed the publics' view on this practice: for example, in France between 2019 and 2020, the proportion of patients that had a positive opinion on telemedicine grew from 60% to 73%, and that of health professionals from 70% to 84%[8]. Along the same lines, teleworking was first used to adapt to the crisis, but its massive adoption during lockdowns has changed Europeans' perception on work and workplace organization.

17. App developers shared how they think **their solutions will continue to permeate more areas of our lives.** Areas where the use of mobile apps will further increase in Europe are hybrid events, education, and healthcare (online health records, connected medical devices, etc.). In addition, 5G networks now enable higher connection density which allows the use of many connected

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[7] These include public transport networks, taxi and self-service rental networks (scooters and bikes).
[8] Odoxa pour l'Agence du Numérique en Santé, Baromètre Vague 1 et 3

devices in the Internet of Things (IoT). The higher speed and lower latency of 5G will allow developers to create richer user experiences, further increasing apps usage. **The value created by mobile apps in the European economy is expected to grow significantly in the years to come. Accelerated by the Covid-19 crisis, the digital way and the use of mobile apps have become more and more widespread. Apps will continue to introduce major innovations that will shape the future of European consumers and firms.**

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1 Mobile app platforms and the "economy of platforms"

1.1 Mobile app markets are typified by a specific market structure

1.1.1 A presentation of app platforms

18. Mobile apps and app stores were originally introduced by Apple with the launch of the first iPhone in 2007. Since then, the phenomenal growth observed in this market has been fueled by the entry of several innovative competitors in mobile devices and app store markets. Competitors in the mobile device market include HTC, Huawei, LG and Samsung. The main competitor of Apple's app store is Google Play[9].

19. **Moreover, the range of app platform actors is wider than Apple Store and Google Play. Different types of platforms co-exist.** Native app stores belong to the major mobile OS developers, most notably iOS, Android and Windows. Third-party app stores involve manufacturer-specific app stores, including Samsung, LG, Motorola and Lenovo, but also carrier-specific app stores, such as Vodafone, T-mobile and TIM store.

20. Depending on the service provided by the app, apps not only run on smartphones, but may also run on other types of devices, such as connected televisions, game consoles, virtual reality headsets, or PCs. **This report focuses on the mobile channel**.

21. Developments in mobile devices and app store markets significantly increase the capabilities of mobile devices and the utility they provide to users.

> *"From a battle of devices to a war of ecosystems"[10]*
>
> **S. Elop, former Executive Vice President of Microsoft's Devices and Services**

22. **Hence, in the mobile communication industry, the role of apps and app platforms is key.** According to the former CEO of Nokia, this market is turning from "a battle of devices to a war of ecosystems". Indeed, based on the theory of network externalities[11], the development of app ecosystems and apps has been crucial to the business strategy of leading mobile operating system providers. Network externalities imply that attracting developers in an app ecosystem will lead to a large number of available apps, which will attract a large number of users and underpin device sales[12].
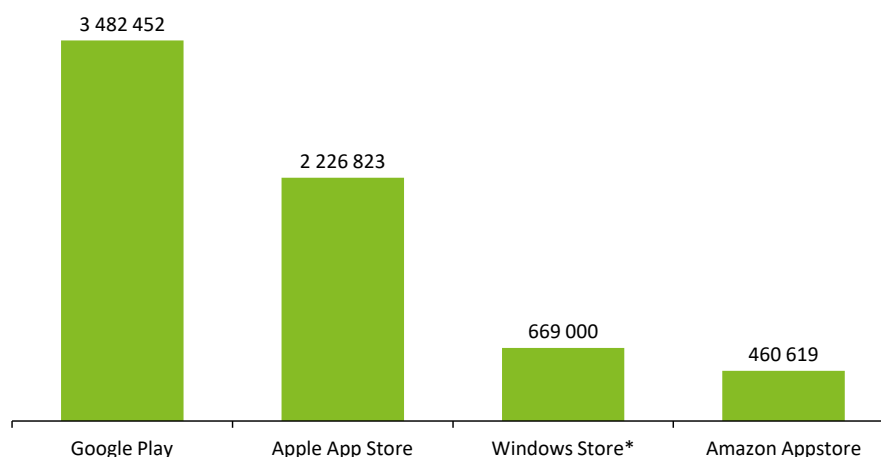
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[9] Néstor Duch-Brown (2017).
[10] Stephen Elop, former Executive Vice President of Microsoft's Devices and Services and former CEO of Nokia Corporation, speech at D9, June 1, 2011.
[11] Hyrynsalmi, Suominen and Mäntymäki (2016), Katz, Shapiro (1985).
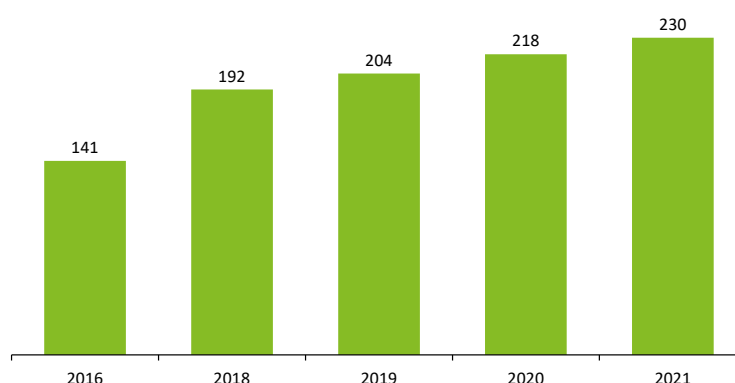[12] Holzer, Ondrus (2011).

23. As of Q1 2021, about 3 482 452 apps were available on Google Play, and 2 226 823 on the Apple App Store (Figure 1). **App stores host a large number of apps, and the number of apps downloaded from app stores is increasing significantly** (Figure 2).

Figure 1.   Number of apps available in leading app stores as of 1st quarter 2021, worldwide

Figure 2.   Number of mobile app downloads worldwide from 2016 to 2021 (billions)

24. The use of smartphones is also linked to the interest of consumers in apps and the utility they derive from this market. The number of smartphone users worldwide has increased from 2.5 to 3.6 billion between 2016-2020 and is expected to reach 4.6 billion in 2024 (Figure 3). This represents a Compound Annual Growth Rate (CAGR) of 6.1 % over the period 2019-2024[13].

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[13] Global Mobile Market Report (Free version, 2021), Newzoo.

Figure 3.   **Number of smartphone users worldwide from 2016 to 2024 (billions)**
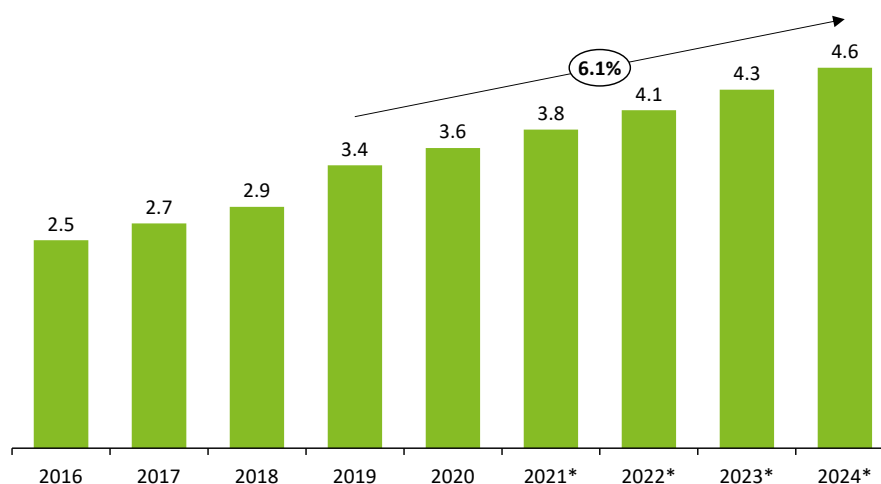
Source: Global Mobile Market Report (Free version, 2021), Newzoo . * are forecasts

25. This increase in smartphone usage has been accompanied by an increase in consumer spending on mobile apps from USD 57.7 billion in 2016 to USD 170 billion in 2021 (Figure 4). This represents a CAGR of 24.1%. Moreover, worldwide mobile app consumer spending is expected to grow on Apple App Store (from USD 72 billion in 2020 to USD 185 billion in 2025) and on Google Play Store (from USD 39 billion to USD 85 billion) (Figure 5).

Figure 4.   **Worldwide consumer expenditure on mobile apps from 2016 to 2021 (billion U.S. dollars)**
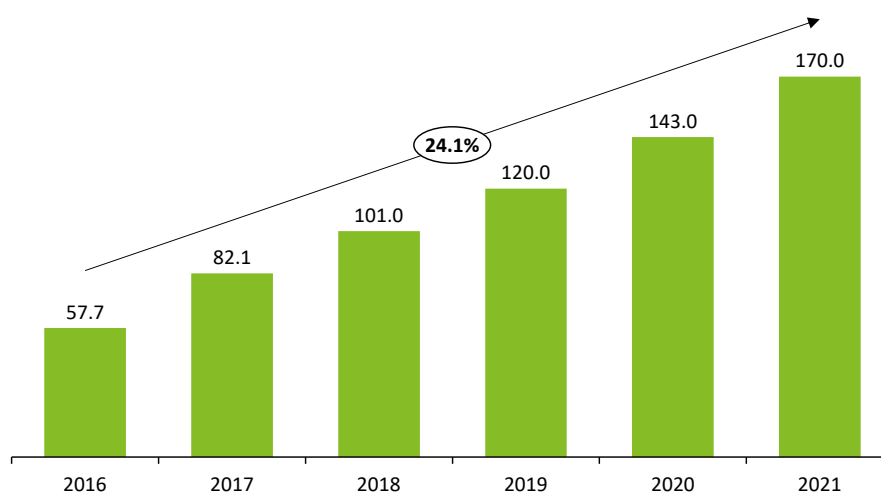
Source: App Annie Intelligence (January 2022)

Figure 5.   Mobile app consumer spending worldwide from 2020 to 2025, by store (billion U.S. dollars)
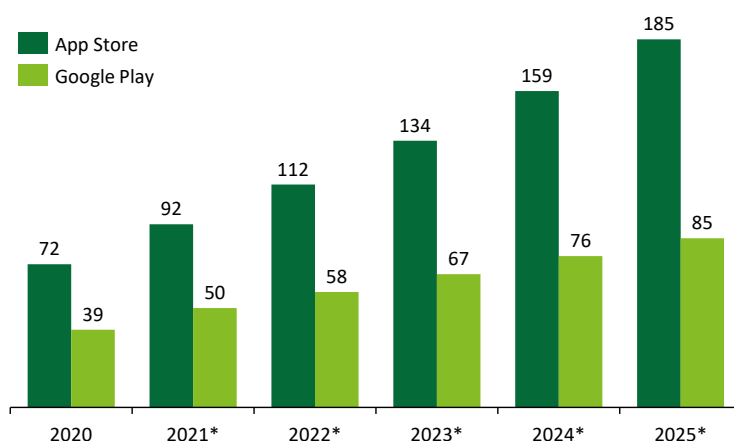
Source: Sensor Tower (February 2021)* are forecasts

1.1.2   App stores are "multi-sided markets"

26. In the information and communication technology (ICT) sector, app stores have a central position in the provision of digital services by connecting app buyers and sellers. Economic literature uses the concept of "multi-sided market" to define this type of market. Two-sided markets are characterized by the presence of (cross-side) network effects: the utility which users on one side of the market derive from their participation in the platform depends on the number of participants on the other side of the market.

27. The mobile app market is a *"multi-sided market"*, bringing together app developers on one side of the market and mobile phone (smartphone) users on the other side[14]. This specific market structure benefits both users and developers:

- **For mobile app developers:** app stores represent an efficient distribution channel. More generally speaking, the rise of the internet has reduced distribution costs and has made it easier to serve niche markets, also coined as reaching the "long tail" of the market. App stores further reduce these costs by making it easier for developers to access a wide potential market with limited marketing and advertising expenditure.

- **For mobile app users:** thanks to platforms, end users have a one-stop-shop with access to a host of apps. A multitude of websites would make searching and choosing apps more time-consuming for users. The cost-reduction in reaching end-users yields greater competition and reduced prices.

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[14] Hyrynsalmi, Suominen & Mäntymäki (2016), Rochet, Tirole (2003), Armstrong (2006).

Figure 6.   **Illustration of the mobile app market**
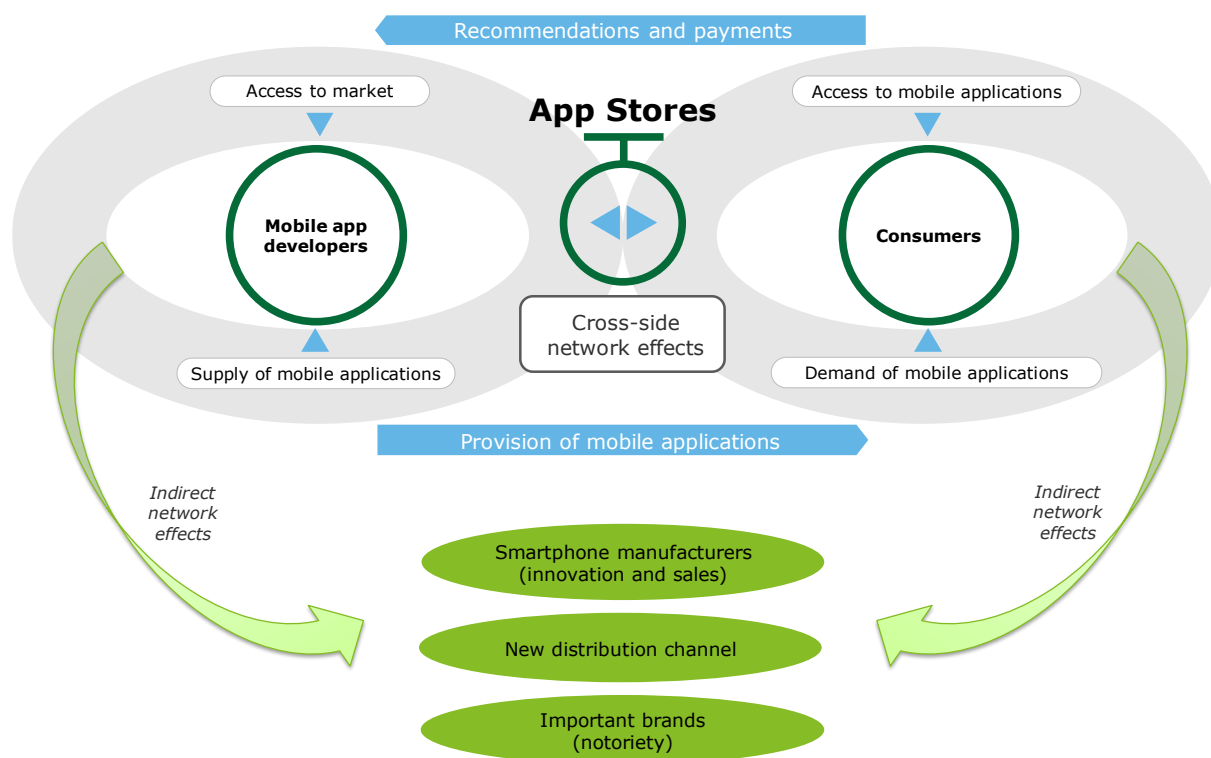
Source: Deloitte Economic Advisory

1.2   The positive effects of app stores

28.   Economists studied specificities of the mobile app market[15] and analyzed benefits introduced both on the supply side and the demand side. The positive effects of app stores for developers and users are presented in the following sections.

1.2.1   App platforms generate benefits for app developers

App platforms benefit developers by being the main intermediary between apps and users

29.   App platforms are accessible to all users. Users mainly install apps via an app platform. Even though users have the possibility to download an app directly from the developers' website or by jailbreaking their phone, it requires technical knowledge and might be risky.[16]

App stores create trust capital for developers

30.   **App stores create a relationship of trust between users and developers, stimulating the demand for app development.** Indeed, the success of developers depends on creating and maintaining trust of users, and app stores are a cornerstone in establishing trust between users and developers. App stores draw up contracts with each developer and verify all new app updates before they are released. This is beneficial to users due to the approval process behind the submission of each app. Consumer recognition for Apple or Google reflects the trust they place in their respective app stores[17].

App stores reduce transaction costs for developers

31.   The economic literature suggests that **app stores reduce transaction costs[18] for developers.** App stores provide a variety of ready-to-use services for developers such as:

- ubiquity in user interface/user experience features,

- a secure platform to promote their products,

- storage systems for hosting apps and managing downloads,

- a billing service,

- a payment management system (micropayments) which makes it easy for mobile app developers to recover sales revenue.

32.   Each developer avoids having to create and manage these services when using a centralized platform. **Marketing and operational costs are therefore lower**.

33.   **App stores provide their services to app developers through a standardized contract**. The harmonized legal framework effectively reduces information asymmetry between the different developers. This has the effect of **reducing transaction costs by reducing negotiation costs** (i.e.,

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[15] Heitkoetter et al. (2012), Holzer et al. (2011), Parker and Van Alsyne (2000), Rochet and Tirole (2006).
[16] Kramer, J and Zierke, O (2019).
[17] Cuadrado et al. (2012), Hyrynsalmi et al. (2014), Yun et al. (2017), Lee et al. (2014), Roma et al. (2012).
[18] Transaction costs were defined by the economist Ronald Coase "*When one wants to carry out a market transaction, it is necessary to discover who it is that one wishes to deal with, to give them certain necessary information and set the conditions of the contract, to conduct negotiations that result in a bargain, to draw up the contract, to put in place control structures to make sure that the terms of the contract are being observed by both parties, etc.*".

this framework prevents a proliferation of contracts)[19]. In addition, standardized contracts also assure that larger developers do not negotiate better terms than smaller developers.

34. App stores provide ready to use interfaces for integrating advertisements into apps, thereby reducing research and transaction costs for developers[20]. Advertising departments of app stores are used by developers who wish to display advertisements on their app. This service combines several tasks – such as technology management and payments – together into one interface, reduces marketing effort and transaction costs for app developers. Without this service, developers would be forced to find an agency themselves, contract with them and manage payments.

35. A whole range of tasks required to market a mobile app is thus managed by app stores. All these services contribute to reducing time to market for developers[21].

App stores facilitate entrance to markets

36. App stores **facilitate developers' – and especially small business developers' – entrance into markets**[22]**.** The platforms effectively enable fast and inexpensive access to smartphone users around the world. Low barriers to entry mean that even the smallest businesses have access to 3.5 billion smartphone users globally[23]. Facilitating market entrance of small innovative companies increases the sustainability of this dynamic ecosystem.

App stores reduce apps' production costs

37. **Mobile platforms benefit from economies of scale and efficiency gains**. App stores can spread costs across a large customer base, thereby lowering costs for all listed developers[24].

38. Moreover, app platform's developer membership, in addition to giving developers the possibility to distribute their apps worldwide, provides access to high-quality programming tools[25] such as tools to realize in-app purchases and subscriptions and, in the case of Apple's app store, ARKit and Core ML which provide augmented reality and machine learning services. This reduces the need for developers to invest in software programming tools and, therefore, **brings down the cost of developing mobile apps**.

App stores enable developers to choose their payment modalities

39. **App stores offer developers freedom in their business models**. Developers are free to choose how their apps are remunerated. Today there are seven leading business models: distribution channel, paid download, in-app purchase, subscription, in-app advertising, freemium and paidmium[26]. They are explained in Table 1[27].

40. Apps do not necessarily have a single business model: they have the possibility to **generate revenues *via* several channels**, offering options to the user. These business models are called

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[19] Amit and Zott (2001).

[20] ITU (2016).

[21] Cuadrado et al. (2012).

[22] Roma et al. (2012), Pon (2015), OECD (2013), Ershov (2018).

[23] https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

[24] Rob Frieden (2017).

[25] Cuadrado et al. (2012).

[26] A Freeemium app is downloaded for free on app stores, but users do not have access to all the features: they are encouraged to pay or subscribe for advanced features. Paidmium apps are apps for which users pay the downloads and can also make purchases in the app.

[27] Tang (2016).

hybrid monetization. The number of apps using hybrid monetization has increased by more than 50% between 2017 and 2018[28].

41. The paidmium model is an example of a hybrid business model, in which users have access to differentiated services depending on the app-features they choose. Users first pay to access common features and are offered the possibility to pay for additional features.

42. Other forms of hybrid monetization exist beyond the paidmium model. A growing number of developers[20] are finding that **ads can co-exist with other sources of revenue, such as in-app purchases or subscriptions**. Some apps, for example, offer a free version on which they display advertisements. The consumer can choose to pay for a free-of-ads premium version. **The revenue stream is determined by the user's willingness to pay.**

43. **Hybrid monetization is frequent in mobile games**. Most players are not willing to pay for games, so advertising has become the most popular way of monetizing these apps. However, to capture revenues from users that are willing to pay, many games also include in-app purchase items. Another possibility for developers is to display in-app purchase announcements: this is a way to convert some players into paying users[29].

44. Reader-apps allow users to read various digital content within apps: videos, music, documents, books, including digital content purchased outside the app. For instance, Youtube, Netflix, Spotify, Kindle, and Audible are reader-apps. **Reader-apps often use hybrid monetization**: users have the choice between a free version, with ads and/or limited features, and a paid version. For example, Spotify is either free with ads after every 6 songs, or users can subscribe and pay for a premium version without ads on which they also benefit from exclusive features[30].

Multi-homing is an available option for all app developers

45. **The presence of several coexisting app stores allows multi-homing for developers.** When Multi-homing a developer publishes its product on several platforms. Even though multi-homing is not used by all developers, exclusive contracts between an app and an app store are very rare[31]. Multi-homing is an option available to all developers and give them access to each user.

46. **Multi-homing is very common for the most attractive apps[32]**. The largest app developers and companies – such as banks or airline companies – that wish to interact with their clients usually contract with several app stores to publish their apps. Moreover, when an app initially published on one app store meets great success, it is often developed for the other app stores[33].

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[28] https://admob.google.com/home/resources/monetize-mobile-game-with-ads/
[29] https://static.googleusercontent.com/media/www.google.com/en//admob/pdf/admob-mobirix.pdf
[30] Including offline listening, higher quality audio streams, unlimited playlists
[31] Sami Hyrynsalmi, Arho Suominen & Matti Mäntymäki (2016)
[32] Bresnahan, Timothy F. et al. (2014)
[33] Lévêque, François (2016)

Table 1.   Different business models available to mobile app developers

Business model	How it works	Examples of mobile apps
Single business models		
Distribution channel (Sale of goods and services)	Goods purchased in the mobile app are sent directly to users. Apps make the shopping experience frictionless and enable provision of new services.	Amazon eBay Uber/Lyft grubHub
Paid downloads (Paid)	Payment is made at the moment the app is downloaded (with access to all the app features).	Grand Theft Auto – San Andreas FaceTune Terraria
In-app purchase	Apps are offered free of charge. Users can pay for additional services or add-ons in the app (this business model is found mainly on gaming applications.)	CandyCrush Clash of Clans Brawl Stars
Subscription	The user must pay a monthly subscription to be able to use the app.	Netflix Coyotte
In-app Advertising	Installing and using the app is free. It displays advertising banners or video clips when it is used.	Rolly Vortex Helix Jump Waze
Freemium **(derivative of in-app purchase)**	The app is downloaded for free on app stores, but users do not have access to all the features. They are encouraged to pay or subscribe for advanced features.	Monster Strike TomTom Shazam
Hybrid business models		
Paidmium **(derivative of in-app purchase)**	Users must pay to download the app. They can also make purchases in the app (add-ons, etc.).	Minecraft - Pocket Edition Minecraft - Story Mode Ghost Blows Out the Light 3D
Other hybrid business models	Revenues are generated via a mix of business models, depending on the users' choice. Reader apps and games often use hybrid business models.	Spotify and Youtube: combination of in-app advertising and subscription[34] Duolinguo: combination of in-app advertising, in-app purchase and subscriptions[35] Candy Crush: combination of in-app advertising and in-app purchase[36]

Source: Deloitte analysis

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[34] Users either have access to a free version with ads or they can subscribe for an ad-free version with more features

[35] Users have access to a free version with ads, on which they can buy additional services. Users can also subscribe to an ad-free version with unlimited services.

[36] Users can play for free, with ads being displayed. Players can also make some in-app purchase.

1.2.2 Economic theory highlights various benefits introduced by app platforms for consumers

App stores reduce transaction and research costs

47. **Platforms reduce the cost and time spent by users to search for an application[37]**. The possibility for users to quickly discover new services and apps is a significant advantage offered by platforms. Using an app store is straightforward as users do not need any technical knowledge to install and use available apps.

48. **App stores offer users a single platform where they can download any app compatible with their smartphone's operating system**. This phenomenon of *"one-stop shopping"* reduces research and transaction costs. App stores offer users a single and secure interface for all their purchases on the platform.

49. **To facilitate the discovery of new apps, app platforms offer an editor-curated section to promote new high-quality apps.** The spotlight helps increase sales for the featured products. In addition, these editor's picks have spillover effects and stimulate sales of apps from the same developer and of the same app on other platforms[38]. In addition, there is a weak spillover effect for the same type of apps (similar functionality but different developer).

App stores promote a variety of innovative, high quality mobile apps

50. **App stores produce strong network effects conducive to the development of a rich and dynamic ecosystem of developers and apps[39].** The distinguishing feature of cross-side network effects relies on the fact that the utility of an agent on one side of the market depends on the number of participants on the other side of the market.

51. **The large number of apps available on app stores pushes developers to constantly innovate to attract new users[40].** As the pace of innovation and new developments is high, developers must be able to offer apps that meet new user expectations[41].

52. **Platforms have made innovative services available to users. Without platforms, several services would not exist.** Uber, Tinder, TooGoodToGo and other apps that use geolocation would not exist without the development of mobile app platforms. These services require a geolocation system to operate and need to instantly reach a critical mass of users. App stores, with 3 billion users, offer developers means to create these new services.

53. **The fact that app stores enable app ratings has a positive impact on consumers.** The economic literature about the reputation effect demonstrates that there is a correlation between the viability of apps and their scores on app stores[42]. This system has the advantage of rewarding apps that better meet the expectations of end users and intensifies competition among developers. An app rated as "excellent" by its users is more likely to survive on the market than an app with a low rating.

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[37] Ershov (2018), Cachon et al. (2008).
[38] Zhan et al. (2017).
[39] Cuadrado et al. (2012).
[40] Cuadrado et al. (2012).
[41] McIlroy et al. (2016).
[42] Lee et al. (2014).

App stores also have a positive impact through the way apps are ranked

54. **Promoting high-quality apps is in the interest of app stores**. Major app stores include quality and performance metrics in their ranking algorithm. Experience has shown that people use high-quality apps more and uninstall them less[43]. Promoting apps based on their quality and value to users is in the interest of app platforms. In fact, app stores are partially remunerated by sharing the revenue generated by app developers through their platform.

55. Kramer and Zierke (2019) analyzed the impact of app stores' ranking mechanism using a game-theoretic model[44]. In their model, app stores can rank apps according to their quality (a quality-based ranking) or according to their financial contribution (sponsored ranking). The study reveals that **quality-based ranking has a high impact on app quality and consumer surplus if app stores accurately assess app quality**[45]. Indeed, under a quality-based ranking, app developers will be more likely to invest in app quality to appear higher in the search results. This result is conditioned by the ability of app stores to accurately assess the quality of apps. The result underlines the importance of the review process of apps, the search algorithm, and the editorial choice.

App stores benefit users in terms of security

56. The consistent approval process behind the submission of each app benefits users. The apps downloaded by users thus present higher functionalities and present less risks to their device. The brand recognition the public has for the Apple or Google app stores reflects the trust that users place in their respective app stores[46]. For example, the Apple store's review process included since the early days a manual review of apps and put emphasis on protecting the total user experience, such as making sure users do not accidently perform in-app purchases and are informed about the use of data. The two major app platforms conduct today an approval process that consists of an automatic, algorithmic part and possibly a manual part[47]. A manual review is conducted for certain types of apps, such as in the case of apps for children[48].

57. **Moreover, app stores also moderate reviews and inappropriate content**. This is an important role as consumers are confident that negative reviews will not be deleted by the app developer, while preventing inappropriate content from being published.

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[43] Ahn, A. (2017).

[44] Kramer, J and Zierke, O (2019).

[45] The conclusions are based on certain hypothesis on the behaviors of the consumer, developer and app platform: in the model, the app store and the developer maximize profit and the consumer prefers to use high-quality apps.

[46] Cuadrado et al. (2012), Hyrynsalmi et al. (2014), Yun et al. (2017), Lee et al. (2014), Roma et al. (2012).

[47] Up till 2015, the Google Play review process of apps was entirely automatic.

[48] https://www.cnbc.com/2019/06/21/how-apples-app-review-process-for-the-app-store-works.html

https://yalantis.com/blog/apple-app-store-and-google-play-store/ https://www.androidpolice.com/2020/03/16/google-play-store-app-reviews-will-take-7-days-or-longer/.

1.3 App stores have an impact beyond the platforms' direct users

1.3.1 App stores generate indirect network effects

58. **App stores have a positive impact on smartphone manufacturers.** By increasing the number and the quality of apps available to users, the utility of the smartphone increases for users. This higher utility, in turn, increases smartphone sales[49].

59. Mobile app performance increases rapidly with the addition of new features[50]. Smartphone manufacturers, therefore, follow this trend by investing in research and development to offer their customers more efficient smartphones. **Mobile apps thus encourage smartphone manufacturers to innovate**[51].

60. Indeed, as highlighted in Figure 7**,** platform developers, content providers, third-party app developers and software developers provide content and services directly linked to the mobile devices market. **Innovations of smartphone manufacturers – triggered by mobile app performance – require electronic manufacturing services, original equipment manufacturers and original design manufacturers, as well as suppliers of raw materials and components such as metals, plastics and chips**.

61. The strong relationship between the mobile industry, app stores and apps, has been a cornerstone of the business strategy of leading mobile operating system providers when developing their own ecosystems. This strategy is based on the theory of network externalities[52]**. The multitude of quality apps will attract users, which will drive device sales, and leads to a virtuous circle**[53].

62. Although a significant percentage of mobile apps do not generate revenue directly, **they provide an additional distribution channel and can give existing services a broader customer base**. For example, when the mobile eBay app was launched in 2009, more than $600 million in sales were made through the mobile application[54]. More recently, start-ups have created business models based on consumer-to-consumer sales via mobile apps. OfferUp, which was founded in 2011, is now the largest peer-to-peer commerce marketplace[55]. The mobile market has expanded to allow new innovative business models that are mainly based on sales and activity via apps.

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[49] Holzer et al. (2011).
[50] According to a study by SensorTower, the size of mobile apps has continued to increase in recent years. Over the period 2013-2017, the size of the 10 most used applications on iPhones (Facebook, Uber, Gmail, Snapchat, Spotify, Messenger, Google Maps, YouTube, Instagram and Netflix) increased by 1,000% https://sensortower.com/blog/ios-app-size-growth.
[51] Cuadrado et al. (2012).
[52] Sami Hyrynsalmi, Arho Suominen and Matti Mäntymäki (2016), Katz, M.L., Shapiro, C., (1985).
[53] Holzer, A., Ondrus, J., (2011).
[54] eBay Inc. Annual Report 2009. http://files.shareholder.com/downloads/ebay/923940436x0x361552/b45137ee-aa41-4c2c-94ca-d72d5b0844be/eBay_77655_BANNERLESS.pdf.
[55] Friedmann, Z., Meet Two Young Entrepreneurs Who Raised $221 Million To Disrupt Craigslist, Forbes, 2017.

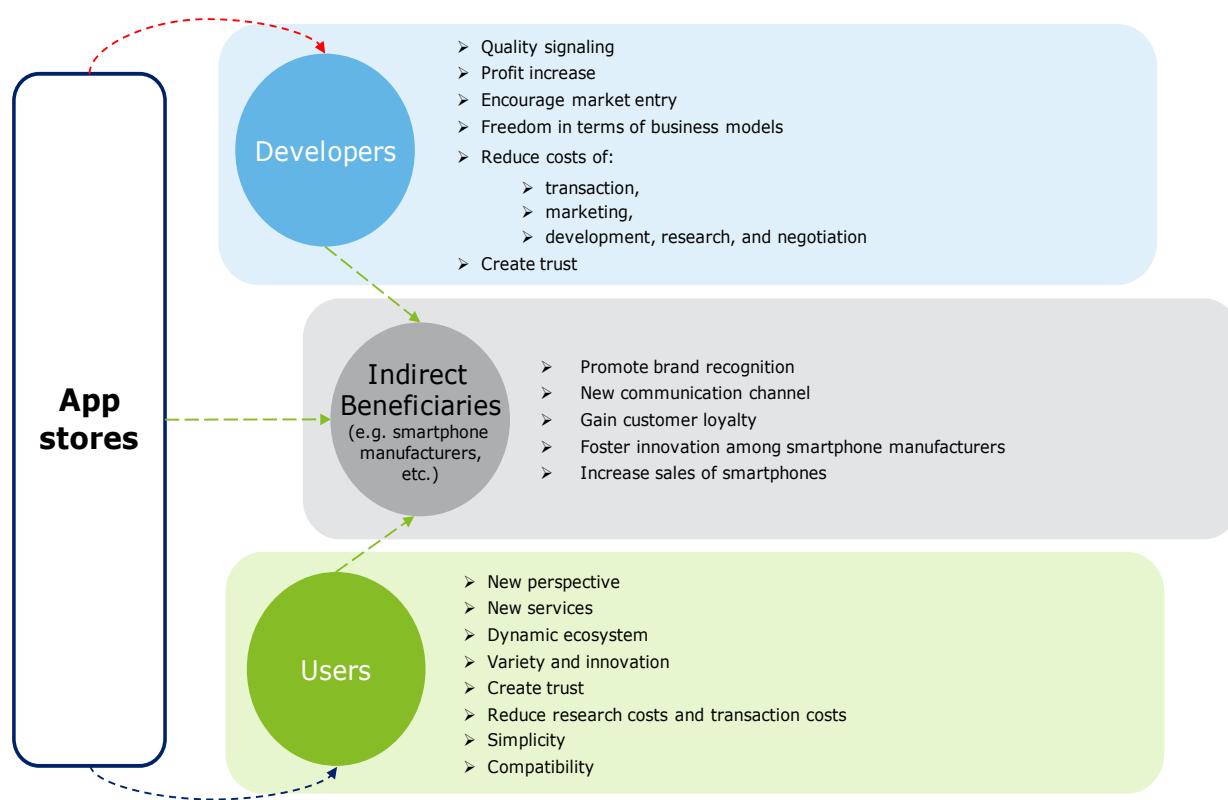**Figure 7.** **Main suppliers of mobile phone groups**
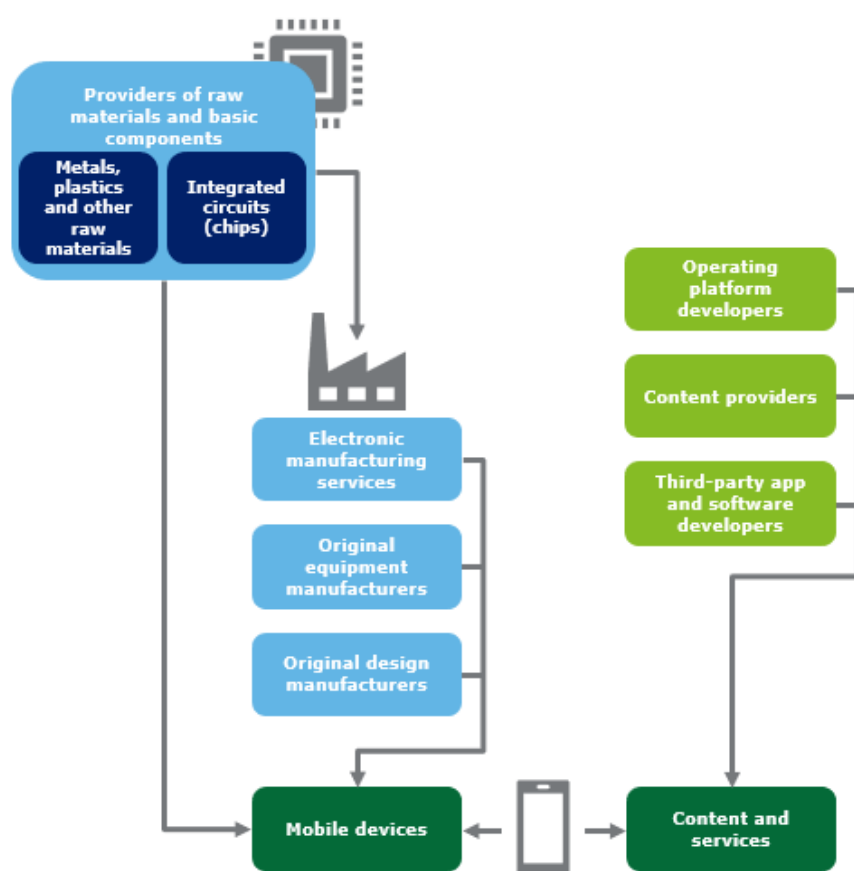
1.3.2 The platforms have been proactive in addressing several challenges such as personal information or payment

63. Mobile platforms manage users' and developers' personal information. They also manage financial transactions like payment for apps, in-app purchases, or payment of revenue to developers. The fact that sensitive information is increasingly digitized and stored on the cloud naturally raises concerns about inappropriate use or exposure to unauthorized entities. To prevent this risk, **app stores invest heavily in cyber security**[56].

64. Moreover, the centralization of personal data on online platforms could pose a problem for the pricing of applications. Since platforms have access to the complete purchase history or users, they could have a precise idea about users' willingness to pay and therefore offer services at the highest possible price. This fear is unfounded to the extent that **app stores do not set the prices of apps, this decision being the sole prerogative of developers**[57]. Since developers do not have access to other consumer app purchases, they cannot leverage that information for pricing decisions.

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[56] "Cybersecurity has been a part of Apple's DNA for a long time, and embedded into all of its products" Steve Morgan, Founder and Editor-in-Chief of Cybersecurity Ventures (Cybersecurity Q1 2018: Trends and takeaways https://investingnews.com/daily/tech-investing/cybersecurity-investing/cybersecurity-update-q1-2018-review/.
[57] OECD (2013).

Figure 8.   **Benefits generated by app stores**

App stores

Developers
- ➢ Quality signaling
- ➢ Profit increase
- ➢ Encourage market entry
- ➢ Freedom in terms of business models
- ➢ Reduce costs of:
  - ➢ transaction,
  - ➢ marketing,
  - ➢ development, research, and negotiation
- ➢ Create trust

Indirect Beneficiaries
(e.g. smartphone manufacturers, etc.)
- ➢ Promote brand recognition
- ➢ New communication channel
- ➢ Gain customer loyalty
- ➢ Foster innovation among smartphone manufacturers
- ➢ Increase sales of smartphones

Users
- ➢ New perspective
- ➢ New services
- ➢ Dynamic ecosystem
- ➢ Variety and innovation
- ➢ Create trust
- ➢ Reduce research costs and transaction costs
- ➢ Simplicity
- ➢ Compatibility

Source: Deloitte analysis

2 The economic weight of the mobile app market in the European Union and in the UK

65. This section quantifies the mobile app market in the EU and in the UK. We start with user statistics that characterize the increasingly important role of the app-ecosystem in daily life (section 2.1). Section 2.2 discusses how the app-ecosystem enhances consumer well-being and contributes to growth. Figures on revenue and jobs generated by the app economy are presented in the following two sections (2.3 and 2.4), and section 0 discusses the rich landscape of SMEs in the sector throughout Europe. Finally, we discuss the impact of the Covid-19 crisis on the app sector (0).

2.1   Presentation of the mobile app market in the European Union and the UK

2.1.1   Increasing adoption of the app-ecosystem the European Union and in the UK

66. In 2020, the European Union counted around 542 million mobile-cellular telephone subscriptions[58], corresponding to a mobile penetration rate of 121%[59]. The same year, the UK counted 79 million mobile-cellular telephone subscriptions corresponding to a mobile penetration rate of 118%[60].   In Europe, smartphone adoption increased by 2.6% in 2020, reaching 78% of mobile phone connections[61]. This figure is expected by the GSMA (GSM Association) to reach 83% by 2025[62].

67. With increasing smartphone adoption, a new category of internet users emerged across Europe: the mobile-only population. This category is characterized by people having only a mobile subscription and no fixed broadband subscription. Mobile-only users represent 21% of the EU's population and 14% of the UK's population in 2020[63].

68. On average in 2018, Europeans spent 185 minutes per day on their mobile phone, and 46% of them spent more than 3 hours per day[64]. 88% of the time spent on a mobile is dedicated to the use of mobile apps[65].

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[58]International Telecommunication Union (ITU) Statistics (accessed:01/18/2022). Indicator definition from ICT: "Mobile-cellular telephone subscriptions refers to the number of subscriptions to a public mobile-telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile-cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services."
[59] EU27 population was 447.8 million in 2020 (source: World Bank, accessed :01/18/2022).
[60] UK population was 67.2 million in 2020 (source: World Bank, accessed :01/18/2022).
[61] GSMA Intelligence (2021), *The Mobile Economy 2021.*
[62] Ibid.
[63] Estimate based on ITU data. Cf. Appendix 4.1.
[64] Interactive Advertising Bureau, 2017.
[65] Comscore, 2018.

2.1.2 Business models of the app economy

69. App development takes place at a diverse selection of companies[66]. Some, such as mobile game companies, develop and maintain their own apps and distribute them via the app platforms. Their revenues are obtained directly from consumer payments for the app and/or sale of ad-space. A closely related business model is used by mixed companies that propose services that run both on desktop and on mobile (for example Deezer and Spotify).

70. Large companies that use mobile apps to support their business or which provide mobile services to their customers, might have in-house developers. This is for example the case for Danske Bank[67]. The more common arrangement however is to outsource app development and maintenance. Many software companies in Europe thrive on this business model, developing apps for enterprises. An important category are apps that serve as distribution channels for consumer goods (M-commerce).

> *"(Our product studio) works with innovation and business teams that want to open new lines of mobile products and digitalize their products to create an IoT layer."[68]*
>
> *G. Dombri, CEO of mobile product studio Tapptitude*

71. Six different sources of revenue are generated via apps. The analysis of the app economy's weight in the European economy quantifies each of them:

   a. Developers can generate revenue by charging for the download of their app.

   b. Developers can opt for **in-app purchases**. In this case, developers provide their app for free to increase the user base.

   c. Developers can also be compensated by offering a subscription for the use of their application. This is the case with several newspaper or periodical apps, such as the Economist (UK), Gazeta Wyborcza in Poland, and Sme.sk in Slovenia, for which consumers pay a subscription fee to access articles.

   d. Developers can be paid by **displaying advertisements in their app**. This payment method is possible for both free and paid apps.

   e. Developers can be paid as subcontractors for the development of apps that support the clients' business. Examples are apps that provide mobile banking services and apps that are a distribution channel for consumer goods (M-commerce).

   f. Many retailers use **a mobile app to open a new distribution channel for consumer goods**. For example, the Amazon app allows orders to be placed directly without using a PC. To access a large clientele, retailers provide their app for free in app stores. Revenues generated through this channel are grouped under the name of mobile commerce or M-commerce.

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[66] Thelle M.H. et al (2017).
[67] Keenan C., "No gimmicks for Danske Bank's agile app team. Danske Bank's journey to becoming a truly digital business now includes its own in-house app development team.", Sync NI, 2018.
[68] Interview with Deloitte, February 2022.

Table 2. **Revenue sources via apps**

Revenue for developers					Revenue for retailers
Revenue generated on app stores			Sale of ad-space	Contract work	Online sales platforms
Paid download	In-app purchases	Subscriptions	Mobile ads	App development for clients	Distribution channel
a	b	c	d	e	f
Revenue generated by the sale of apps on app stores	In-app purchases *(including Freemium and Paidmium)*	Revenue generated by subscriptions	Revenue generated by mobile advertising	Revenue generated through contract work	Mobile commerce[69]

Source: Deloitte analysis

72. The revenue generated through sources *a*-to-*e*, – i.e., on app stores, through the sale of in-app ad-space and through subcontracting – is revenue for developers. M-commerce revenue is different in nature. Indeed, developers are remunerated for the development of the app; however, the sales-revenue accrues to retailers. M-commerce apps facilitate the sale of goods and services that are generally also available via alternative distribution channels.

73. The first four revenue sources (a-d) can also be combined (hybrid monetization). For example, games can be monetized through a combination of in-app ads and in-app purchases. In the EU, 63% of the App market revenue was generated on the "Games" segment in 2021[70]. In the UK, this ratio was a little smaller (55%)[71]. In 2021, three European mobile game companies generated more than €1 billion in revenues, app store revenues and advertising combined (Table 3).

Table 3. **Top European mobile game developers**

Company	Number of games available on app platforms	Total downloads (million)	Revenue in 2021 (million Euros)
King	52	2 800	2275[72]
Supercell	13	1 800	1 890[73]
Playrix	6	995	1 730[74]

Source: Statista, Venture Beat, 2021

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[69] Mobile-commerce includes all commercial transactions carried out on mobile devices, both via web apps and via native apps. The transactions are possibly carried out on the move, but also at home.
[70] SensorTower Enterprise, accessed: 01/25/2022).
[71] SensorTower Enterprise, accessed: 01/25/2022).
[72] King annual revenue 2021 | Statista.
[73] Supercell makes $852M on $2.24 billion in 2021 revenue | VentureBeat.
[74] Playrix annual IAP revenue 2021, Statista.

2.2 The app-ecosystem stimulates growth and increases consumer well-being

74. The new products and services offered by apps increase consumer choice and consequently, their well-being. Indeed, the rapid adoption of smartphones and apps demonstrates the preference of many consumers for apps over alternative channels. In addition, growth is stimulated by the creation of new products which offer new ways to generate revenue. Finally, growth is stimulated by the increase in efficiency due to the use of mobile apps. Each of these aspects is detailed below.

2.2.1 The app-ecosystem increases efficiency in firms

75. Apps provide a fluid device-user interaction and offer personalized services. These characteristics offered by the app ecosystem have the potential to improve efficiency of many types of professional tasks like e-mails, expense reports, conference calls, etc. The economic role and impact of mobile internet use and apps can be regarded as distinct from fixed internet connection[75]. The influence on firms of mobile and apps has been little studied. However, a few studies indicate a positive relationship between the smart mobile office and firm productivity.

76. Mobile devices and applications coupled with workplace flexibility have been shown to enhance labor productivity. The use of mobile communication technologies in firms is associated with a significant increase in labor productivity with an increasing penetration rate of mobile devices amongst employees[76]. Moreover, a causal relationship is revealed, meaning the data studied support the idea that mobile use causes the increase in labor productivity[77]. Also, increased productivity due to the use of mobile devices would be higher when employees are granted autonomy in the context of trust-based workplace arrangements[78].

2.2.2 The app-ecosystem has a positive impact on consumer well-being

Consumer preference for apps

77. Smartphone- and app-use displayed impressive growth in recent years. In the EU, consumers spent 21% more on apps in 2021 than in 2020, and in the UK 23% more. Growth of app-spending thus decelerated compared to 2020 (33% increase in both the EU and the UK), but was in line with average pre-Covid-19 growth rates over the period 2017-2019 (26% in the EU and 24% in the UK)[79].

78. The total number of downloads of apps decreased in 2021 by 6% in the EU, and by 8% in the UK (Figure 9). This can be interpreted as a normalization of the particularly high consumption of apps in 2020. Indeed, in 2020, app downloads increased by 17% in the EU and by 16% in the UK, compared to 5% average growth over the period 2017-2019 in the EU and 7% in the UK[80].

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[75] Draca et al (2018).
[76] Viete S. and Erdsiek D. (2020), Bertschek, I. and Niebel, T. (2016).
[77] Bertschek, I. and Niebel, T. (2016).
[78] Viete S. and Erdsiek D. (2020).
[79] SensorTower. Average growth rates are compound average growth rates (CAGR).
[80] SensorTower.

79. In 2019, European smartphone owners downloaded on average 31 new apps[81]. 76% of people spend more than an hour per day on their mobile phone and 88% of time spent on a phone is spent in apps[82].

Figure 9. **Number of apps downloaded in the EU and in the UK, 2017-2021 (billions)**

Source: SensorTower
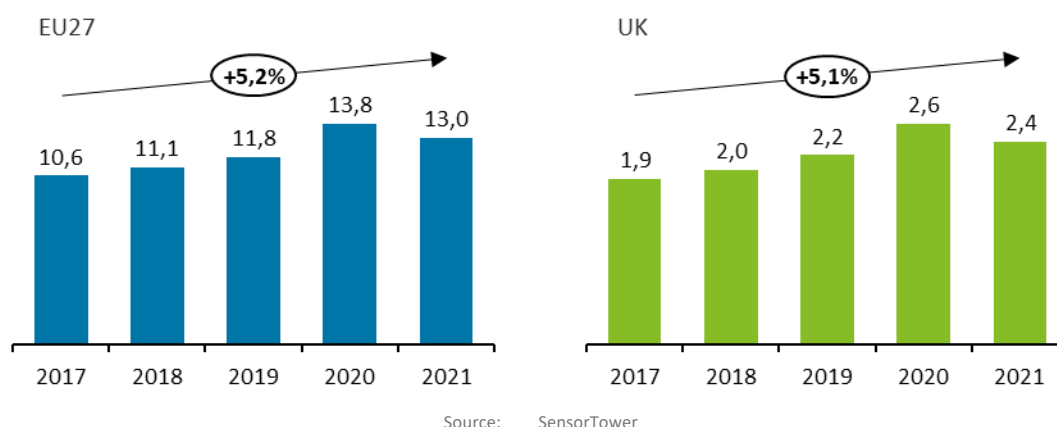
Mobile-only population

80. Another development showing an increase of consumer well-being due to the app-ecosystem is linked to the growth of the "mobile-only" population. This choice has become attractive thanks to the generalization of high-speed and very high-speed mobile data networks and affordability of smartphones. Access to information and services via mobile sites and apps are important for this category of population.

81. Based on ITU databases, 21% of the EU population is mobile-only, representing a total of about 78.4 million people (cf. appendix 4.1 for the methodology). In the UK, the mobile-only population represents 14% or 7.6 million people).

82. Choosing to only access the internet via a mobile device is possible because of the high-quality user experience offered by mobile websites and apps. The growth in size of the mobile only population shows that when having the possibility, many users opt for mobile-only. This choice allows them to save costs on a fixed internet subscription, optimize their budget and increase consumer welfare.

2.2.3 The app ecosystem creates new services

83. A mobile device has many functionalities which make interaction intuitive and fast: geo-localization, a camera, a microphone, a tactile screen, and movement detection. In addition, a smartphone is a device that can be taken anywhere: 91% of smartphone owners report they never leave home without their phone[83]. With mobile devices, new user experiences have emerged: augmented reality used in games or services, games based on the movement of the smartphone itself, ride-hailing services, dating apps that use geo-localization, online marketplaces for used items, health apps, etc.

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[81] These are unique installations. Source: GSMA.
[82] Comscore, 2018.
[83] Ward, A., (2016).

84. In the future, apps are likely to offer more and more new types of services as they will adopt technologies such as virtual reality (VR), connection of smart objects (internet of things IoT), and the analysis by artificial intelligence algorithms of user data collected through apps combined with other data sources. Below, we discuss several categories of apps that use the specific features of mobile devices.

Games

85. Many games, such as casual and hyper-casual games[84], only exist on smartphones. In 2021, it was estimated that there were 100.8 million game app users in the EU[85] (23% of the population), and 25.8 million in the UK (38% of the population)[86]. Games account for 10% of user time spent in apps[87].

86. Mobile games offer new experiences to users. The players' experience is often built around the tactile screen. For instance, the Swedish game Candy Crush Saga is based on tactile screen specificity: the game is played by swiping candies in any direction.

87. Innovation is also important for app games. A more recent development in the game industry is the introduction of augmented reality (AR) technology. Apps using AR create an interactive user experience, overlaying digital objects with the real-world environment, thus creating composite views that augment the real world. The most common use of AR is a digital image being viewed through the smartphone's camera. Artificial environments are created, and users can interact with them by moving the phone, swiping, and clicking. AR apps do this by accessing the smartphone's camera, motion sensor and geo-localization.

88. For example, the ARrrrgh app, developed by Warping Media AB (Sweden), uses the tactile screen, geo-tracking system, and camera to offer players an AR experience in a classic hide and seek game that transforms players into modern-day pirates. Players look for digital-generated treasures hidden in the real world through their phone's camera.

Ride-haling services

89. Ride-Hailing applications offer a new type of service thanks to the geo-location of the user. Ride-hailing apps connect clients and drivers through an app, and the geo-tracking system finds a car close to the client. Both the client's waiting time and the distance the driver must drive to pick up clients are reduced, increasing efficiency for both passengers and drivers.

90. Ride-Hailing apps have been present in the EU for about 10 years, with the introduction of Uber in Paris in 2011. Uber remains the most used app in the EU, but many similar companies were successfully created all around Europe, offering ride-hailing services to millions of users.

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[84] Casual games are games targeted at a wide audience. Hyper-casual games are very easy-to-learn games that usually monetize with in-app ads.

[85] Estimates from Statista, *Digital Market Outlook, Mobile Games, EU-27* (most recent update: Nov 2021).

[86] Estimates from Statista, *Digital Market Outlook, Mobile Games, UK* (most recent update: Nov 2021).

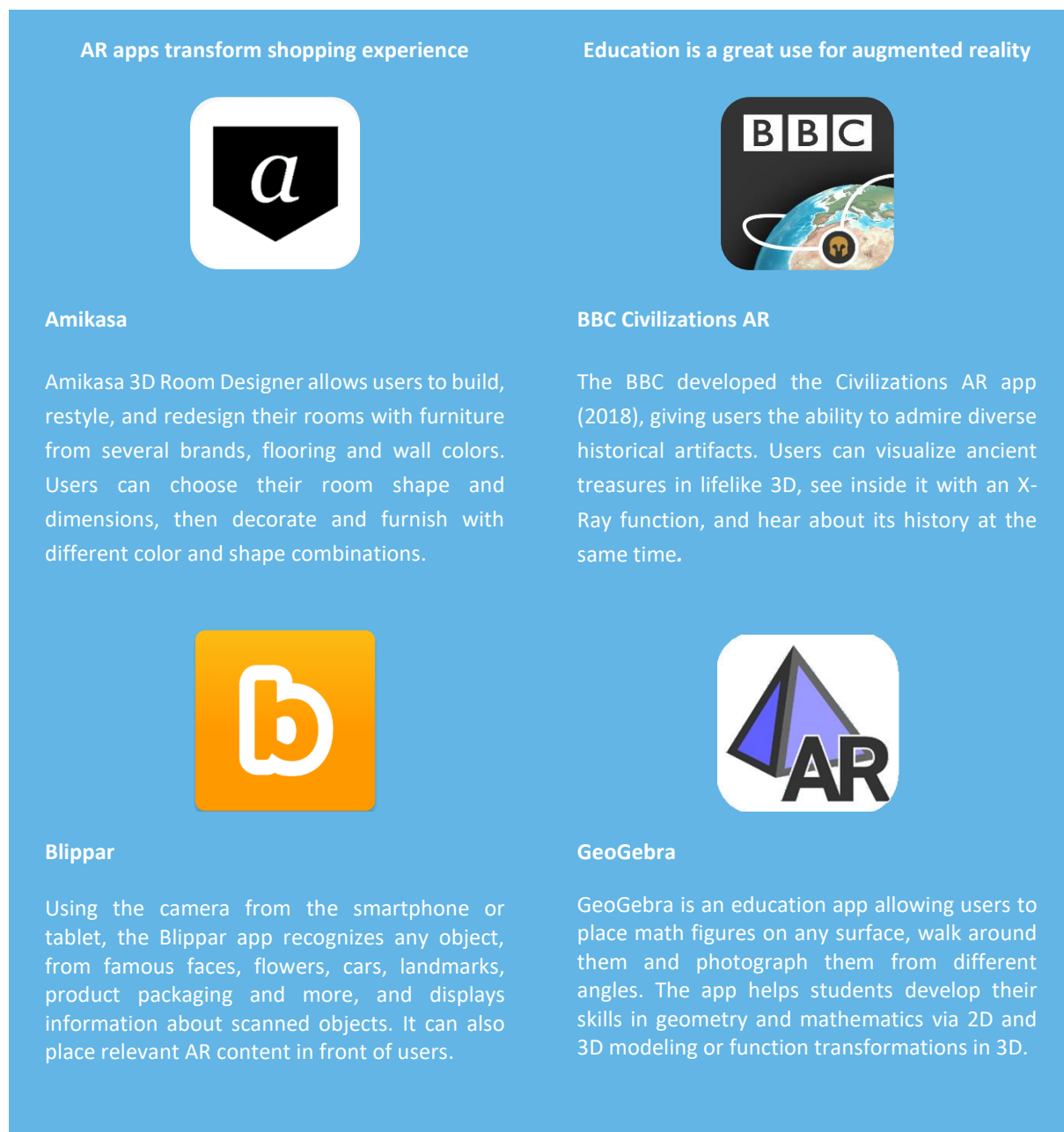[87] AppAnnie, Worldwide Data, 2019.

Dating apps

91. Dating apps offer customers new types of dating services. For dating applications, geolocation is a crucial feature as the app matches users geographically close to each other. Happn relies on this feature: the app allows users to see all other users they cross paths with while on the move. Whenever registered users walk by each other, the app shows them their respective profiles and a map of where they crossed.

92. Tinder is another example of new experience introduced by apps. It relies on the tactile screen: users slide other user's picture to the right or left on the screen if they like or dislike the profile.

Other types of apps that offer new services

93. Apple's ARKit and Google's ARCore developer tool were released in 2016, allowing AR experiences to be included in more apps and allowing AR to go beyond game apps. AR features are now implemented in many app categories: lifestyle, shopping, learning, culture. This new technology is widely adopted by European developers (cf. Figure 10).

94. Health apps also offer a new type of service and are widely adopted. Health information, such as duration of sleep or total number of steps can be recorded using motion and location sensors, sometimes in conjunction with a connected device. The possibility to connect smartphones with other (medical) devices allows the phone to record extensive data on users' health.

Figure 10. Presentation of 4 European non-gaming apps using AR

AR apps transform shopping experience

Amikasa

Amikasa 3D Room Designer allows users to build, restyle, and redesign their rooms with furniture from several brands, flooring and wall colors. Users can choose their room shape and dimensions, then decorate and furnish with different color and shape combinations.

Blippar

Using the camera from the smartphone or tablet, the Blippar app recognizes any object, from famous faces, flowers, cars, landmarks, product packaging and more, and displays information about scanned objects. It can also place relevant AR content in front of users.

Education is a great use for augmented reality

BBC Civilizations AR

The BBC developed the Civilizations AR app (2018), giving users the ability to admire diverse historical artifacts. Users can visualize ancient treasures in lifelike 3D, see inside it with an X-Ray function, and hear about its history at the same time.

GeoGebra

GeoGebra is an education app allowing users to place math figures on any surface, walk around them and photograph them from different angles. The app helps students develop their skills in geometry and mathematics via 2D and 3D modeling or function transformations in 3D.

2.3   The value created by the app economy in Europe

2.3.1   The app economy creates value in Europe *via* several channels

95.   The study of the economic value of the app economy in the European Union is divided into three parts:

-   Direct economic impact: this includes the total direct revenue earned by companies in the sector. This direct impact is calculated by evaluating the revenues generated through downloads, in-app purchases, subscriptions, in-app advertisement, and contract work. Most of these revenues are generated via the app platforms.

-   Impact due to spillover effects: an important spillover effect of the app ecosystem is the rise of M-commerce. The revenues generated by sales through mobile sites go to retailers, wholesalers, and producers[88]. In addition to the choice of consumers to purchase standard products like clothing and even tickets via mobile apps, M-commerce also brought new types of services. The revenues associated with the new types of services are considered as economic activity created by the app-sector.

-   Indirect impact: because the different sectors of the economy are interdependent, the app economy generates wealth beyond the companies in the app industry. These indirect impacts include both impacts on other productive sectors and impacts on households. These indirect impacts are quantified according to the methodology presented in section 2.3.4.

2.3.2   Direct economic impact of the mobile app market in Europe

Revenue generated directly on app platforms

96.   In 2021, app platforms generated a total revenue of €6.5 billion in the European Union, of which 63% stems from mobile games[89].The same year, app platforms generated a total revenue of around €2.1 billion in Great Britain, of which 55% came from mobile games[90]. These revenues are generated by paid downloads, in-app purchases, and subscriptions. In 2021, the EU accounted for 8.4% of global app platform revenue, while Great Britain accounted for 2.7%[91]. App platform revenues from EU users increased by 17% and from Great Britain users by 19% in 2021[92]. If growth continues at the same rate in 2022, revenue generated via app stores could reach €10.1 billion in the EU and Great Britain in 2022.

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[88] The developers are remunerated for the development and maintenance of the app.
[89] Source: SensorTower,accessed January2021. EU Appstore revenue is $ 7729 billion. Average 2021 exchange rate: € 0.8458 = 1 $, https://www.exchangerates.org.uk/USD-EUR-spot-exchange-rates-history-2021.html.
[90] SensorTower, accessed January 2021.
[91] SensorTower, accessed January 2021. In 2021, global app platform revenue was USD 92 billion (EUR 78 billion).
[92] The growth rate is calculated in euros. Average 2020 exchange rate: 1$ = 0,8755 $, World Bank, LCU per US$, period average.

Revenue generated by in-app advertising

97. Many apps are free to download and use. In this case, developers generally gain revenues from selling in-app ad-space. In 2021, mobile ad revenues represented roughly €19.2 billion[93] in the EU, and 13.8 billion in the UK[94].

Revenue generated through contract work

98. Many apps are developed by software companies for third party clients to meet specific needs. These can be B2B or B2C apps[95]. B2C apps provide value for the client by delivering mobile services to the final consumers, thereby for example increasing their competitiveness. Common examples are banks that provide apps for mobile banking or retail apps. B2B apps, by enabling mobility, can stimulate productivity, enhance well-being at the workplace and increase efficiency in B2B relations and transactions. Apps are used for business tasks such as e-mail, online collaboration, inventory management, automation of the purchase process and many more. These practices are already widely adopted: in 2019, the share of revenue from web sales in the EU was mainly realized via enterprises' own websites or apps[96].

99. Companies are increasingly interested in having their custom apps: the share of developers' revenue coming from the development of custom apps for businesses increased from 23% in 2014 to 32% in 2016[97]. We can expect an increase in the demand for mobile apps, since young business owners are the ones developing most mobile apps: 55% of small business owned by millennials have a mobile app, while only 13% of small business owned by baby-boomers have one.

100. The development of these apps is sometimes done in-house in the case of large firms but is generally subcontracted to specialized app-development firms.

101. These apps do not generate revenue via the app store. Developers are directly remunerated for the development of the app by their client. The value for the client is in the services these custom apps provide, either for internal processes or for its clients (businesses or final consumers).

102. We estimate the revenue generated in 2021 through contract work at €66.4 billion for the EU and €21.3 billion for the UK[98]. This estimate is based on data obtained by Gigaom in 2013, extrapolated to today, assuming equal growth rates of contract work as of app platform revenue[99].

The direct revenue generated by the app economy via app platforms, in-app ads, and contract work, represented for the EU in 2021 €92.1 billion, and for the UK 37.2 billion.

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[93] In 2021, digital advertising revenue in EU member countries (excl. Croatia, Cyprus Lithuania, and Malta) was USD 49.6 bn (source Statista Digital Market Outlook, October 2021). The share of mobile in digital advertising spending in Europe was 46% (source: Statista, oct. 2021). The estimate in euros was obtained as follow: 46% x 49.5* 0.8458.

[94] In 2021, digital advertising revenue in the UK was USD 27.2 bn (source Statista, oct. 2021). The share of mobile in digital advertising spending in the UK was 60% in 2020 (source: Statista – PwC; IAB UK). The estimate in euros was obtained as follows: 60% x (27.2*0.8458).

[95] B2B stands for business to business, B2C for business to consumers.

[96] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=E-commerce_statistics.

[97] ContractIQ, 2017.

[98] €94 billion for the EU and the UK combined. We considered that 76% of this revenue is generated in the EU and that 24% is generated in the UK (corresponding to the share in the revenue generated on app stores in 2021).

[99] Gigaom Research, 2014. More recent estimates of this share of the market were not available at this date.

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2.3.3 Revenue due to the spillover effect on the retail sector: M-commerce

103. The app-ecosystem also has a spillover effect on commerce and retail. Mobile apps open a new channel for generating revenues for retailers: M-commerce. The use of mobile apps for commerce is becoming more and more common: in 2020, 47% of the major webshops in the EU have a mobile app[100].

Revenue generated by M-commerce

104. M-commerce denotes the realization of commercial transactions by way of mobile phones. These transactions are conducted via native apps[101] or mobile web apps.

105. Unlike games or running apps, the user does not directly pay for the app, or for the services provided by the app. The consumer uses the app to purchase goods or services sold by third parties. The use of these apps does not directly generate revenue for their developers but opens new distribution channels for retailers.

106. The goods and services purchased via mobile apps encompass many types of final consumer products: air and train-travel tickets, clothes, furniture, health and beauty products, tickets for events, electronic equipment, etc.[102] The value of M-commerce in EU27 is estimated at € 499 billion in 2021 and at € 84 billion in the UK[103].

107. Moreover, reader-apps[104] generate mobile-commerce revenue, as the app allows consumption of external digital content (for example books or music) in the app. Subscriptions or purchases can pass outside of the app platform. For instance, people buying digital or audio books can read them respectively on the Kindle and Audible mobile apps.

108. Mobile apps enable their users to change their consumption habits. Purchases formerly made via traditional distribution channels (shops, hypermarkets, commercial websites etc.) can be easily made on a digital device. However, because many (if not most) of the expenses made by consumers through mobile apps would have happened through another distribution channel, we do not attribute all the M-commerce revenues to the app sector.

Methodology to estimate the contribution of M-commerce to the European economy

109. M-commerce can have a positive effect on the growth of the European economy via two channels:

- An overall positive effect on the retailing business is due to M-commerce's characteristic of ubiquitous access, creating an important advantage of shopping via mobile apps over desktop e-commerce[105]. In addition, M-commerce presents other specificities such as the ability to personalize services by using geo-localization. However, while the overall effect of e-

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[100] 2021 European e-commerce report, Ecommerce Europe, Centre for Market Insights, Amsterdam University of Applied Sciences, 2021.
[101] Native apps are apps that are developed for a specific platform or device. Because of this, the app can use hardware and software specific to the device.
[102] Eurostat publishes extensive data on e-commerce in the Europe. We hypothesize that the list of consumer products acquired via mobile phone is similar to the range of products acquired via any internet site. https://ec.europa.eu/eurostat/statistics-explained/index.php/E-commerce_statistics_for_individuals.
[103] This estimate is based on Eurostat data and data by Criteo. Details can be found in appendix 4.2.
[104] Defined in paragraph 28.
[105] Rajan Y. et al (2016).

commerce on the EU economy has been estimated, there is, to date, no study on the effect of M-commerce on economic growth. This possible effect is not considered in this study.

-   Apps and the app-ecosystem gave birth to new types of products such as ride-hailing apps that use geo-localization. **We consider only the revenues of these new types of products as specifically generated by the app-sector**.

Contribution via mobile sales of new types of products

110. To estimate the contribution of M-commerce to the growth of GDP, the sales of new types of products via mobile channels are quantified.

111. The app-ecosystem gave rise to new types of services (cf. section 2.2.3) such as ride-hailing apps, dating platforms, gaming apps and several other apps that use the functionalities of mobile devices but do not generate much revenue (yet). In this category, we consider only ride-hailing app revenues[106]. Table 4 presents the results of this approach.

112. Europeans widely adopted ride-hailing services: the 6 main applications cumulated almost 117 million users in 2021[107]. Over the same period, ride-hailing apps generated a revenue of about €4.8 billion in Europe[108].

Table 4.   **Revenues of main ride-hailing apps in Europe (2021)**

App	Location	Users (M)	Revenues (M€)
Uber	US	75,8	3100
Gett	Israel	3,51	143
Bolt	Estonia	11,7	478
Cabify	Spain	2,34	96
Free Now	UK	23,4	957
Ola	India	0,2	10
TOTAL		117	4784

Source: Uber, Business of Apps

In 2021, sales via mobile apps (M-commerce) in the European Union represented € 499 billion in direct revenues for retailers and producers and € 84 billion in the UK. We consider that the revenue generated by new types of products is attributable to the app-ecosystem. This represents 0.8% of M-commerce revenues or €4.8 billion in the EU and in the UK combined.

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[106] Dating apps and mobile games revenues are app store revenues (subscriptions, in-app payments, paid apps).
[107] Number of users were calculated based on the total users in Europe according to Statista (https://www.statista.com/forecasts/891452/number-of-users-in-the-online-ride-hailing-market-in-europe), assuming that the number of users for each app were proportional to their market share in Europe. The source of market shares: Business of Apps. (https://www.businessofapps.com/data/taxi-app-market/). However, as opposed to Business of Apps, we assumed that the 6 main apps occupied 100% of the market, i.e., that Uber has 64.8% rather than 60% of the market.
[108] Total revenue of mobile apps was obtained based on market shares and on Uber's annual revenue in 2021 for Mobility Services in the EMEA region (Quarterly revenue multiplied by 4 in Uber Technologies, Inc. - Uber Announces Results for Third Quarter 2021). The source of market shares: Business of Apps.

2.3.4 Indirect economic impact of the mobile app market in Europe

113. In 2021, the total indirect contribution of the mobile app economy in the European Union represents € 111.5 bn (Table 5). This includes revenue generated through supplier relationships (€ 67.2 bn) and revenue resulting from the spending by people employed in core app economy jobs and its suppliers (€ 44.3 bn).

114. In the UK, the total indirect contribution of the mobile app economy in 2021 represents €47.2 bn (Table 5). Revenue generated through supplier relationships reached € 19.6 bn, and revenue resulting from the spending by people employed in core app economy jobs and its suppliers represented € 27.6 bn.

Table 5. Breakdown of the impact of the mobile apps beyond app developers

Impact	Revenue generated in the EU economy	Revenue generated in the UK economy
Impact on the productive sectors, generated by intermediate consumption by app developers (indirect impact)	€67.2bn	€19.6 bn
Impact of households, resulting from consumer spending by people employed in mobile app development companies and their suppliers (induced impact)	€44.3 bn	€27.6 bn
Total indirect contribution	€ 111.5 bn	€47.2 bn

Source: Deloitte analysis

Methodology

115. Indirect impacts are estimated using an Input-Output model. The model enables us to assess the additional value introduced by the app economy in the other sectors of the EU and the UK economy (beyond the sector where the direct revenue is generated). We consider the total value (in terms of revenue) of the app economy and estimate the spillovers on the rest of the economy.

Figure 11.   **Direct and indirect economic impact of the app-ecosystem**
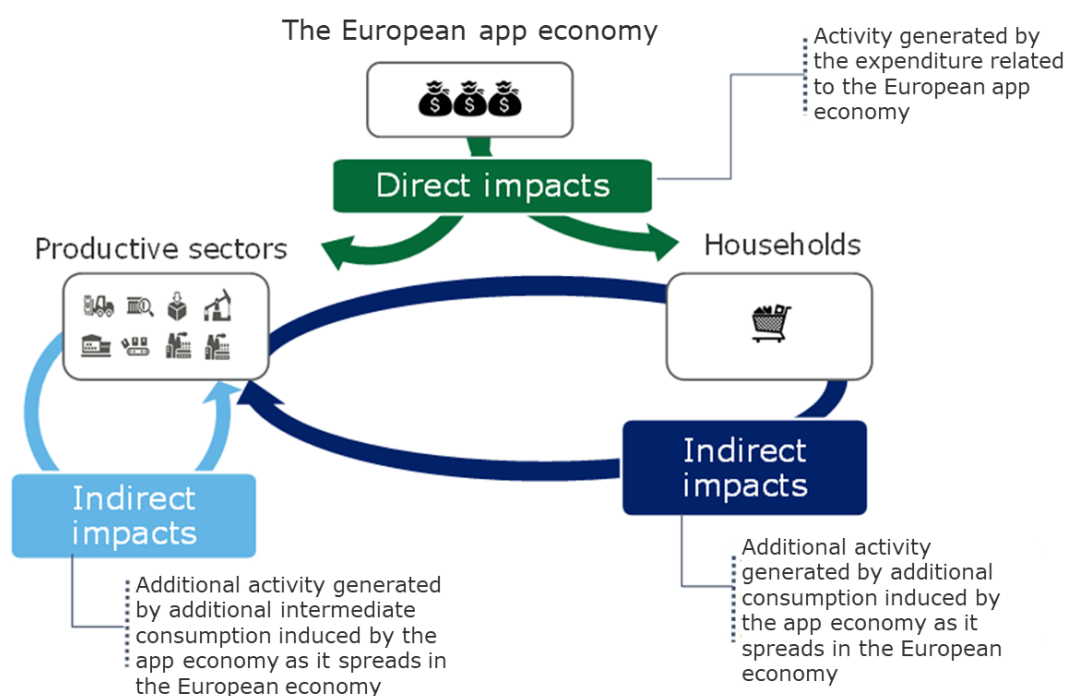
Source: Deloitte

116. The Input-Output model is a powerful tool to assess the impact of an industry or an investment project on other sectors of the economy. The general idea is to measure how a sector is integrated into the economy and how the companies in that sector interact within the supply chain. Our model is based on the most recent (2017) Eurostat input-output tables for EU28 and the 2018 OECD input-output table for the UK.

2.3.5 Total economic impact of the mobile app market in the Europe

117. The total impact of the app economy in the European Union is estimated at €210 billion in 2021. Table 6 summarizes the economic impact of the mobile app market in the EU.

Table 6.   Impact of the app economy in the EU (2021)

	Details	Revenue
Direct contribution	• €6.5 *bn in revenue generated on app stores* • €19.2 *bn from in-app advertising* • €66.4 *bn from contract work* • €3.6 *bn net contribution from sales made on mobile apps*[109]	€95.7 bn
Indirect impact	• €68.9 *bn from impacts on the productive sector* • €45.4 *bn from impact on households*	€114.4 bn
Total economic impact		€210.1 bn

Source: Deloitte analysis

118. The total impact of the app economy in the UK is estimated at €87 billion in 2021. Table 7 summarizes the economic impact of the mobile app market in the EU.

Table 7.   Impact of the app economy in the UK (2021)

	Details	Revenue
Direct contribution	• €2.1 *bn in revenue generated on app stores* • €13.8 *bn from in-app advertising* • €21.3 *bn from contract work* • €1.2 *bn net contribution from sales made on mobile apps*[110]	€38.4 bn
Indirect impact	• €20.0 *bn from impacts on the productive sector* • €28.2 *bn from impact on households*	€48.2 bn
Total economic impact		€86.5 bn

Source: Deloitte analysis

The total economic impact of the mobile app market in 2021, including in-app ads and the net contribution of online sales generated on mobile apps, represents € 210 billion in revenue, throughout all sectors of the EU economy and € 86.5 billion in the UK economy.

This is equivalent to 0.7 % of the EU gross domestic product in 2021, and to 1.5 % of the UK GDP.

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[109] The total revenue from mobile app sales for the EU and the UK equal to 4.8 billion was distributed between the UK and the EU by assuming both regions' shares are equal to their shares of revenue generated on app stores: €6.5 bn/ (€6.5 bn +€2.2 bn) = 76%.
[110] The total revenue from mobile app sales for the EU and the UK equal to 4.8 billion was distributed between the UK and the EU by assuming both regions' shares are equal to their shares of revenue generated on app stores: €2.2 bn/ (€6.5 bn +€2.2 bn) = 24%.

2.4 The app economy and job creation in Europe

2.4.1 The diversity of jobs created by the app economy

119. App development companies range in size, from entrepreneurs working from home in teams of a few people, to large software and media companies, marketing groups, etc.

120. The types of jobs generated by the app economy are similarly diverse. Core app economy jobs include technical jobs: programmers whose work requires knowledge of mobile applications, security engineers keeping mobile apps safe from being hacked, and help-desk staff who support the use of mobile apps. In addition, employment is created as support to core app economy jobs: marketing, sales, human resources, etc.

2.4.2 Total number of jobs generated

121. We estimate the total number of jobs generated throughout all sectors of the economy in 2021 at 1.36 million in the EU, and 396 thousand in the UK. These estimates are based on the total revenue for the app sector determined previously, combined with national accounts data[111]. These figures include direct jobs (software developers, mobile app specialists), indirect jobs (suppliers to the app developers) and induced jobs (jobs created by the spending of the direct and indirect jobs).

    - Direct jobs:

        • Mobile app specialists: these are IT-positions occupied by qualified employees, including mobile app development, maintenance, and support.

        • Support roles within companies employing mobile app developers: jobs consisting of management teams, human resources, marketing, sales, etc.

    - **Indirect jobs:** jobs created by the procurement relationships of app development firms, including positions in security, catering and cleaning services, and office utility supply.

    - **Induced jobs:** jobs supported by the spending of wages from direct and indirect jobs. People directly or indirectly employed by the app sector gain wages which are spent on taxes, savings and consumption. Based on an estimate of the share of wages consumed, the number of induced jobs is deduced.

122. The number of direct jobs in the EU is based on Eurostat data on sectoral output and employment, from which we deduce that 5.8 people are employed for every € 1 million output in the Programming and Software sector in 2021[112]. From the estimated € 95.7 billion direct revenues for the app sector, follows that app development supports around 560 000 direct app economy jobs. Furthermore, supplier relationships and consumption induced by the wages of direct and indirect jobs support an additional 836 000 jobs, resulting in a total of 1.40 million jobs supported by demand for app development (cf. Table 8)[113].

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[111] Eurostat data for the EU, OECD data for the UK.

[112] NACE sector J62-63, "Computer programming, consultancy, and information service activities". For the year 2017, 6.2 people are employed for every € 1 million output. This number was corrected for cumulated inflation between 2017 and 2021, equal to 5.96% (source World Bank, FP.CPI.TOTL.ZG).

[113] The number of indirect and induced jobs supported by the app-economy has been estimated using the input-output model presented in 2.3.4.

123. In the UK, app development supports around 222 000 direct app economy jobs, and an additional 182 000 indirect jobs, resulting in a total of around 404 000 jobs[114].

Table 8. **Jobs generated by the app economy in Europe (2019)**

	Details	Thousands of people employed in the EU	Thousands of people employed in the UK
Direct jobs	*IT positions and support roles within app-development companies.*	560	222
Indirect jobs	*Jobs at the companies supplying app companies*	485	131
Induced jobs	*Jobs supported by the spending of those directly and indirectly employed by the app economy.*	351	50
Total number of supported jobs		1 397	404

Source: Deloitte analysis

124. To put our estimate of employment in the app sector into perspective, a study by the Progressive Policy Institute (PPI) provides a similar estimate. In 2019, they obtain – via an altogether different methodology that consists of counting job ads with relevant keywords – an estimate of the number of direct jobs in the EU's and in the UK's app economy of 672 000[115]. This figure is 28% higher than our own figure for 2019 (524 000), and 14% lower than our figure for 2021 (782 000, EU+UK). Table 9 summarizes PPI's results for 2016 up till 2019.

Table 9. **Estimates of the number of jobs created by the app economy in the EU and in the UK, 2016-2021, PPI**

	January 2016	January 2017	April 2018	July 2019
Direct jobs (thousands)	520	600	650	672
YoY growth		15.4%	8.3%	3.4%

Source: The Apps Economy in Europe: leading Countries and Cities, PPI, 2017 and update 2019

125. Considering that the two methodologies are very different and independent, the results give credibility to the range defined by the estimates. The reason for our more conservative estimate of the number of direct jobs in 2019 might be found in the prudent methodology used to identify all revenue sources.

---

[114] The estimate of direct jobs in the UK is based on sectoral and employment data for the year 2020 from the OECD: For every €1 million output in the "IT and other information services", 6.04 people are employed in 2018. This number was corrected for cumulated inflation between 2018 and 2021, equal to 5.21% (source World Bank, FP.CPI.TOTL.ZG). The number of indirect and induced jobs is based on the 2018 UK input-output table, OECD.

[115] The Progressive Policy Institute estimates that the European App Economy totals 2.1 million jobs in July 2019, encompassing direct, indirect and induced jobs, for 30 countries, including Norway and Switzerland. These results are based on the identification of online job postings which contain "iOS" or "Android" or "Blackberry" or "Windows Phone" or "Windows Mobile" or "app". The number obtained is calibrated against national accounts data. Based on the employment multipliers specified in their paper, and by only retaining EU28 countries as geographical scope, we obtain the figure of 672 000 direct jobs.

126. The app intensity – defined as app economy jobs as a percentage of all jobs – in the EU is 0.7%[116]. In the UK, the app intensity is 1.5%[117]. In 2019, according to the PPI, four European countries presented an app intensity of 1.5% or higher: Denmark, Finland, The Netherlands, and Sweden.

> *The number of jobs supported in 2021 by the EU app economy is 1.4 million, and in the UK close to 400 000, direct, indirect and induced jobs combined.*

---

[116] Sources: Eurostat (total employment, LFSI_EMP_A, last update: 02/02/2022), and own analysis (app economy jobs): 1 360 000 / 191 442 000 = 0.7%, where 191 442 000 is the estimate of total employment in 2021 in the EU, based on total employment in 2020 (186 972 000), corrected with the Share of employed people 20-64 in the total population of 2020 (71.1%), and of Q2 2021 (72.8%). https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Employment_-_quarterly_statistics

[117] Sources: OECD, Labour input by activity (total employment in 2020 = 32 523 252): 396000/32 523 252=1.2%.

2.5 SMEs in the app economy

127. Many small and medium-sized enterprises (SMEs) work in the app development sector in Europe[118]. These include pure players, and agencies that work for the outsourcing market. Mobile app development outsourcing is a significant market in the EU and the UK, accounting for two thirds of total mobile app revenue according to our estimates. Nearshoring, the practice of outsourcing app development to nearby countries, contributes to the development of SMEs in the region[119]. SMEs' activity in the mobile app sector is expected to increase in the future, in line with the expected strong growth of the software sector, of 57% between 2021 and 2026, compared to 24% between 2016 and 2021[120].

Europe is a strong player in mobile app development

128. App development SMEs in Europe are part of a dynamic ecosystem, built on strong universities and highly skilled developers.

129. The EU member countries and the UK combined represent 37% of the top 50 of countries with the best developers (online coding challenges hosted by HackerRank, Figure 12)[121]. Moreover, 4 of the top 10 best ranked universities in Computer Science & Information Systems are in the EU and the UK[122].

130. Europe is indeed generally considered to benefit from highly qualified developers. High skills are essential for mobile app development, encompassing both technical and soft skills. On this matter, F. Ronchi, president and CEO of Synesthesia, stated about the European educational environment: "*More people get trained in software development in Europe and the quality of education is increasing*"[123]. Along the same lines, when asked why European games are successful, Kristian Nordahl, Senior Vice President of Operations at Kiloo, answered: "*Education in the arts and in software development are critical*"[124]*.*

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[118] The definition of SMEs varies from country to country. In this report, we adopt the OECD definition: "*SMEs employ fewer than 250 people. SMEs are further subdivided into micro enterprises (fewer than 10 employees), small enterprises (10 to 49 employees), medium-sized enterprises (50 to 249 employees). Large enterprises employ 250 or more people*."

[119] Nearshoring is. the practice of outsourcing app development to countries within the region.

[120] https://www.statista.com/forecasts/963584/software-revenue-in-europe; https://www.statista.com/outlook/tmo/software/europe.

[121] Trikha Ritika, *Which Country Would Win in the Programming Olympics?*, HackerRank Blog, 2016. https://blog.hackerrank.com/which-country-would-win-in-the-programming-olympics/ consulted February 2022. The classification is based on online coding challenges posted by HackerRank.

[122] QS Top Universities, 2021 Ranking https://www.topuniversities.com/university-rankings/university-subject-rankings/2021/computer-science-information-systems.

[123] Interview with Deloitte, April 2020.

[124] Interview with Deloitte, April 2020.

Figure 12. **Top 50 of countries with the best developers, based on online coding challenges, 2016**

Rank	Country	Score Index	Rank	Country	Score Index
1	China	100,0	26	Netherlands	78,9
2	Russia	99,9	27	Chile	78,4
3	Poland	98,0	28	United States	78,0
4	Switzerland	97,9	29	United Kingdom	77,7
5	Hungary	93,9	30	Turkey	77,5
6	Japan	92,1	31	India	76,0
7	Taiwan	91,2	32	Ireland	75,9
8	France	91,2	33	Mexico	75,7
9	Czech Republic	90,7	34	Denmark	75,6
10	Italy	90,2	35	Israel	74,8
11	Ukraine	88,7	36	Norway	74,6
12	Bulgarie	87,2	37	Portgal	74,2
13	Singapore	87,1	38	Brazil	73,4
14	Germany	84,3	39	Argentina	72,1
15	Finland	84,3	40	Indonesia	71,8
16	Belgium	84,1	41	New Zealand	71,6
17	Hong Kong	83,6	42	Egypt	69,3
18	Spain	83,4	43	South Africa	68,3
19	Autralia	83,2	44	Bangladesh	67,8
20	Romania	81,9	45	Colombia	66,0
21	Canada	81,7	46	Philippines	63,8
22	South Korea	81,7	47	Malaysia	61,8
23	Vietnam	81,1	48	Nigeria	61,3
24	Greece	80,8	49	Sri Lanka	60,4
25	Sweden	79,9	50	Pakistan	57,4

Source: HackerRank, 2016

131. Also, G. Dombri, CEO of the Romanian mobile product studio Tapptitude, remarks that "a lot of women are entering this market"[125].

> *"Europe has a vibrant app economy. We have some of the best universities here with strong academic foundations in engineering and computer science. When it comes to software engineering and design in particular, the talent in Europe is outstanding, and the ability to source and attract such talent from all around the continent is truly unique"[126].*
> **K. Morsy, CEO of Algoriddim, maker of the music app "djay"**

132. Excellence in soft and hard skills sparks innovation in the app development sector in Europe, which in turn stimulates the emergence of startups and the development of SMEs in the app development sector.

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[125] Interview with Deloitte, February 2022.
[126] Interview with Deloitte, February 2022.

The EU and UK are home to a rich ecosystem of SMEs in the mobile development sector

133. SMEs are very active in the mobile app development sector in Europe. The platform Clutch lists 4224 mobile app development firms in the EU and the UK (2022)[127]. Most of these companies are SMEs: 34% are micro firms with 2 to 9 employees, 46% are small firms with 10 to 49 employees, 15% are medium-sized firms with 50 to 249 employees, and 9% are large firms of more than 250 employees (Figure 13)[128].

Figure 13.   **Number of firms in mobile app development by size in the EU and in the UK, by region, 2022.**
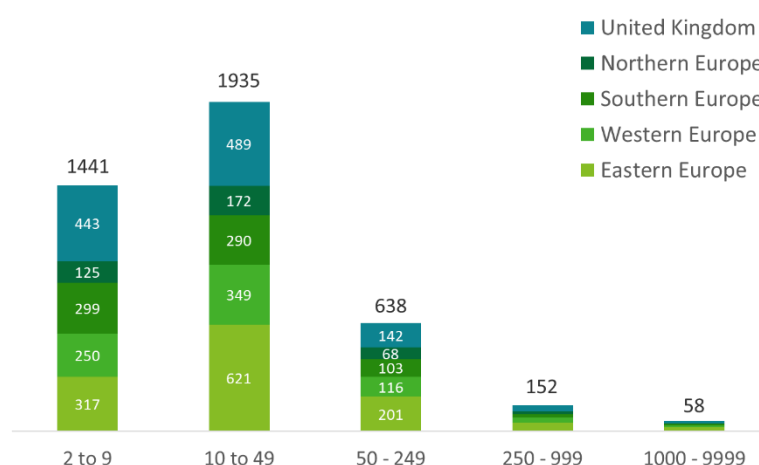
Source: Clutch.co, Deloitte analysis

134. The country with the most app development firms in Europe is the UK (1121 firms or 27% of European firms), followed by Poland (644 firms or 14% of European firms)[129]. Eastern Europe has a strong position with 1209 firms (29% of European firms). In Western Europe, 754 firms were identified which represent 18% of European firms. Southern and Northern Europe represent respectively 17% and 9%.

135. Countries with a smaller share of GDP in the EU and the UK, such as Bulgaria, Poland, Romania, Estonia, Lithuania, and Croatia, have two to five times more app development firms per unit GDP than the UK, demonstrating a relative specialization (Figure 14)[130].

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[127] Clutch is a rating and review platform that provides information on the top companies ranked and referenced by their market presence, reviews on previous work experience, and proven ability to deliver. Being ranked by Clutch is a testament of the company's quality of service. Worldwide, more than 150 000 agencies are listed on Clutch.co. We only included firms with 2 employees or more, excluding individual consultants.

[128] Clutch also lists 1-person companies (freelancers). We did not include these in the reported data, because only 61 freelancers are listed in the mobile app development category, in the EU and UK combined. We conclude that most freelancers are not listed on Clutch.

[129] Clutch.co

[130] Number of firms was related to GDP in each country to show the specialization of each country/region in app development.

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Figure 14. **Number of mobile app development firms relative to GDP in the EU & UK, per trillion euros**
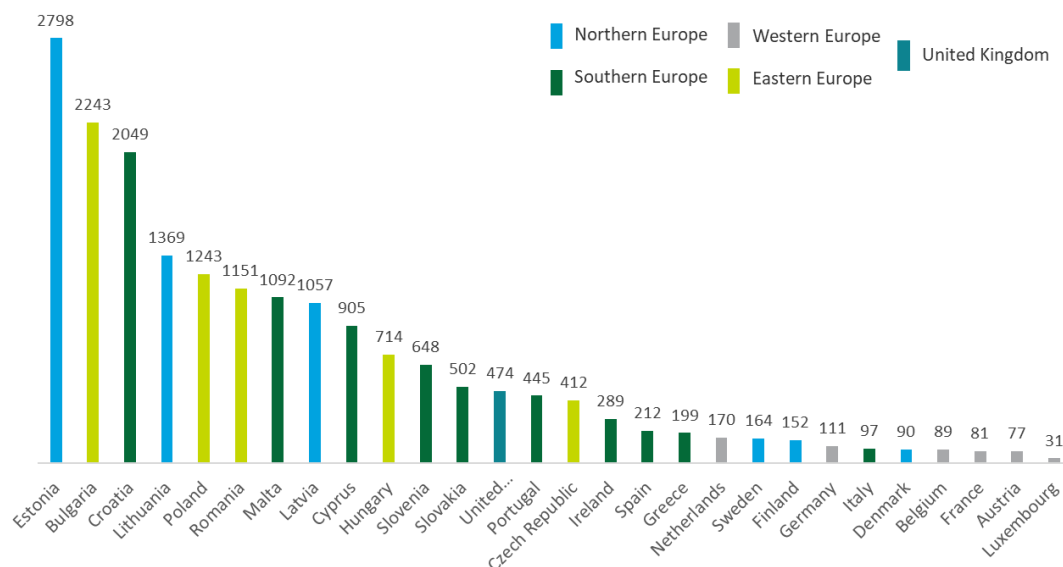
Intraregional trade in app development services

136. SMEs throughout Europe have achieved significant success by creating a nearshoring market, taking advantage of highly qualified local talent, and, for some countries, a cheaper workforce. Compared to offshoring to countries far from the head office (ex. South East Asia), nearshoring combines cost competitiveness, and is low risk because of proximity (language, culture, time-zone, physical distance)[131]. According to Swiss firms that use nearshoring, this model has the advantage of providing high-quality products and being cost-efficient. Interaction with developers is also considered to be easier[132]. For developers, nearshoring gives access to a large market.

137. An analysis of a sample of the top-13 medium-sized (50-249 employees) firms in the app-sector in the EU and in the UK revealed that all these firms export their services[133]. Table 10 gives a description of the firm sample. An analysis of their clients allows us to make the following observations:

   - The UK firms in the sample usually export outside of Europe, mainly to the US.

   - Most of the firms selling to other EU member countries (nearshoring) are based in Poland.

   - Polish, Romanian, and Croatian companies have many clients in the UK. Cost comparative advantage and proximity explains this situation.

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[131] Knaflewski J., "What's the best country to outsource app development, and 5 reasons why it's Poland?", IT Generator, Poland. https://www.itgenerator.com/nearshore-software-development/.
[132] Nearshoring-info, "Nearshore App Development and Reasons Why People Use It", 2019.
[133] These conclusions are based on public data: firms' websites and reviews on Clutch.
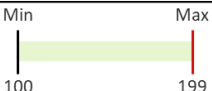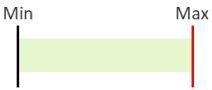
Table 10.   Characteristics of the sample of top 13 mobile app development firms in Europe

The top 13 medium-sized (50-249 employees) firms that dedicate 60-70% of their activities to mobile development in the European Union and in the UK, based on the ranking of firms on the Clutch platform, are located in the UK (6) and in Poland (5) (see table below)[134]. Smaller countries such as Romania and Croatia are also present in this list (with 1 firm).

The clientele of Polish firms in this list is mainly composed of MidCap companies (USD 10 million-USD 1 billion), while the app development firms in the UK have more LargeCap clients (> USD 1 billion). UK developers charge their services twice as much as those in Poland, Romania, and Croatia. The sectors with the highest demand for mobile app developers in the sample are the financial service sector (10 firms work for this sector) and the healthcare sector (9 firms).

Country	# of firms	Average hourly rate (USD)	Types of client
UK	6	Min 100 — Max 199	1. LargeCap (>$1B) 2. MidCap ($10M-$1B) 3. SmallCap (>$10M)
Poland	5		1. MidCap ($10M-$1B) 2. LargeCap 3. SmallCap (>$10M)
Romania	1	Min 50 — Max 99	1. SmallCap (>$10M) 2. MidCap ($10M-$1B) 3. LargeCap (>$1B)
Croatia	1		1. MidCap ($10M-$1B) 2. SmallCap (>$10M)

Source: Clutch, Deloitte Analysis and firms' websites

138. G. Dombri, CEO of mobile product studio Tapptitude describes, from the developers' point of view, how the remote delivery model appeared in Europe over time in the app sector: "*Initially development firms worked locally. Then foreign development teams were integrated into the delivery model, and since this worked very well, the next step was to also pursue clients abroad.*"

139. Tapptitude is a product studio with headquarters in Transylvania, Romania, focused on products for "people who do not sit at a desk", and for connected devices. The studio is a good example of the nearshoring business model. Most of Tapptitude's revenue comes from the US, the UK, and from other European countries. They have very little revenue from local clients. Remote delivery is their core model. They also have experienced product stragegy teams in New York, London and Amsterdam, which allows them to work closely with clients on product strategy and delivery.

"This is a sector where the remote delivery model works very well. It is easy [in the mobile app sector] to deliver high-value services all over the world"[135].

G. Dombri, CEO of mobile product studio Tapptitude

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[134] Clutch.co provides a worldwide list of the top mobile application development firms. The firms located in the EU and in the UK were selected in this list, which resulted in a sample of 13 firms.
[135] Interview with Deloitte, February 2022.

140. Countries such as Poland, Romania and Bulgaria are cost competitive. SMEs in these countries employ local highly skilled developers to provide high-quality services at lower rates: the hourly rate for developing an IOS or Android app is on average € 30, about half the average rate in Western Europe (€ 64)[136]. According to G. Dombri, the cost difference between Romania and Scandinavian countries, for the same level of quality, can be a factor two to three.

141. This nearshoring trend has a positive impact on the development of the mobile app economy. Clients benefit from strong expertise and cost effectiveness when outsourcing their mobile app development projects. For app development SMEs, nearshoring provides access to a larger market, which means more opportunities for growth.

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[136] ContractIQ – mobile app development report 2017.

2.6   Impact of the Covid-19 pandemic on the app economy

142. The EU and the UK experienced a period of economic recession in 2020 due to the global Covid-19 pandemic. In the EU, real GDP decreased in 2020 by 7.8%, and in the UK by 11.5% (Figure 15, Figure 16). In contrast, the mobile app sector has seen an acceleration of its growth trajectory.

Figure 15.   **GDP and App Store revenue in the EU, 2015-2021, constant 2010 billion euros**
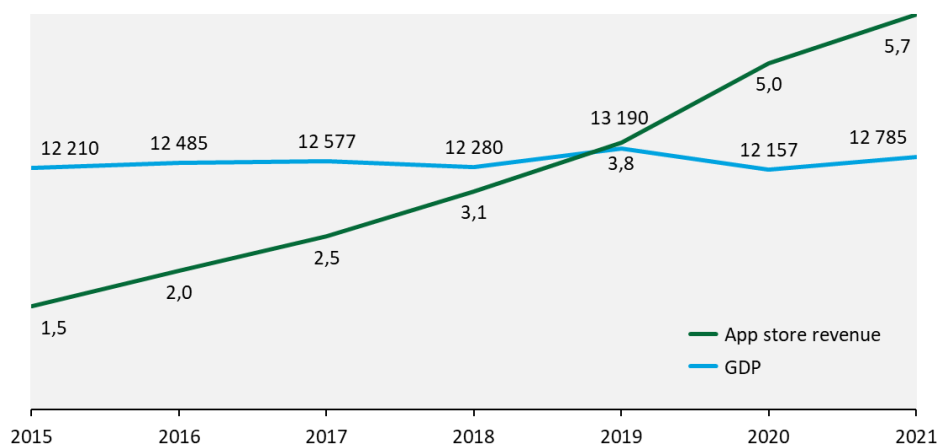
Source: World Bank (GDP), SensorTower (App Store Revenue), OECD (2021 GDP and inflation projections)

Figure 16.   **GDP and App Store revenue in the UK, 2015-2021, constant 2010 billion euros**
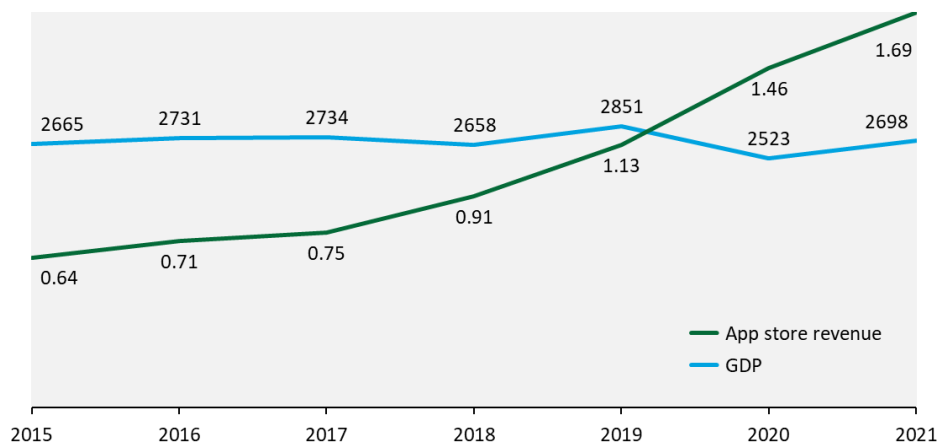
Source: World Bank (GDP), SensorTower (App Store Revenue), OECD (2021 GDP and inflation projections)

143. At the beginning of the pandemic, it was already expected that the crisis' impact on the app economy would be limited. At the end of March 2020, Codin'Game conducted a worldwide survey of 2700 developers on the impact of the Covid-19 pandemic. At the time of the survey, 87% of the respondents were still full-time employed. Temporary company closures impacted only 1.3% of the developers in the survey[137]. In April 2020, SensorTower projected worldwide app platform revenues to increase by 20%, taking into account the effects of the crisis[138]. This estimate was one percentage point lower than their initial projection prior to the crisis.

144. Actual growth of app platform revenue even surpassed projections. Worldwide, app platform revenue increased by 28% in real terms in 2020[139]. In the EU, real growth of app store revenue was 30% in 2020, and in Great Britain 29%[140].

145. This situation is explained by the fact that the use of many apps, such as games, is not impaired by lockdown measures and physical distancing requirements. Moreover, apps provide innovative solutions to respond to the crisis. In an interview in April 2020, the Italian app developer Synesthesia noted that many actors in industries affected by the crisis turned to developers to find solutions: "*We saw a rise in the interest in mobile app development during the emergency*"[141].

146. Average growth over 2019-2021 was above 20% worldwide and for Europe, which is in line with initial market projections. In conclusion we can consider that the development of the mobile app economy was accelerated by the crisis, but that the long-term trend is not impacted.

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[137] Codin'Game (2020).
[138] Nelson R., "5-Year Market Forecast: App Spending Will Double to $171 Billion by 2024 Despite COVID-19", April 2020. https://sensortower.com/blog/sensor-tower-app-market-forecast-2024. Projected growth is in nominal terms.
[139] SensorTower for app platform revenue ; inflation figures from the World Bank. Nominal growth of app platform revenue was 30% in 2020.
[140] SensorTower for app platform revenue. Inflation figures from the World Bank.
[141] Interview with Deloitte, April 2020.

3 Mobile apps will shape the economy of tomorrow

147. Section 3 analyses innovative apps and the future of the European app economy. In the first two sections, we describe how apps have permeated business models: many firms incorporate apps into the way they used to provide services to their clients (3.1). In addition, pure players emerged, which are firms that have built their activity on apps (3.2). In section 0 we look at the future of the app economy, including an analysis of the future of the sector through the lens of developers, and the impact the global Covid-19 pandemic had on the app sector (0).

3.1 Success stories of firms that integrated apps into their business model

148. As smartphone penetration increases, presence on mobile phones has become increasingly important for many companies. Companies whose core-business is not related to the app-economy are adapting to the digital mobile trend by introducing apps to propose their services and goods to consumers. They also use mobile apps as internal business tools. This trend is observed in all branches.

149. When companies launched an app, users' adoption was often broad and quick. For example, when the Lithuanian marketplace Vinted introduced its app in 2012, one day after the release, 30% of its traffic, which corresponds to the volume of visits, came from the app[142]. The DB navigator app of the German railway company Deutsche Bahn, which allows to book contactless tickets and receive information about travels, saw a 50% year-on-year increase in active users in mid-2019, after implementing new features[143].

3.1.1 Medical sector

150. The use of mobile devices by health care professionals (HCPs) has transformed many aspects of clinical practice in Europe. Mobile devices have become commonplace in health care facilities, leading to rapid growth in the development of medical apps. **Numerous apps are now available to assist HCPs with essential tasks**, such as information and time management, electronic prescribing, access to medical textbooks and drug reference guides, patient management and monitoring, clinical decision-making, and medical education and training[144].

VIDAL Mobile

151. Vidal was founded in France in 1911, and its first book, a dictionary of pharmaceutical specialty, was published in 1914. For almost a century, the company's revenues were generated by book sales[145]. Vidal launched its mobile app "VIDAL Mobile" in 2010 (for iPhone) and in 2011 (for Android, Blackberry)[146].

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[142] Vinted offers a platform for CtC apparel sales. Source : http://lemonlabs.co/vinted/.
[143] Deutsche Bahn, 2019 Interim Results Press Call.
[144] Mobile Devices and Apps for Health Care Professionals: Uses and Benefits, C. Lee Ventola, 2014.
[145] The firm also developed a CD-ROM in 1989 and websites in 1999.
[146] http://www.vidalfrance.com/societe/histoire/.

152. The app is restricted to healthcare professionals: they need to authenticate when they first use the app. The app helps health professionals with the diagnoses of a disease based on symptoms and gives them easy access to information on pharmaceutical drugs.

153. In 2019, the app was used by more than 100 000 health care professionals and hospitals across Europe and generated a revenue of almost $300 000 through subscriptions.

Figure 17.   **VIDAL Mobile's app interface**
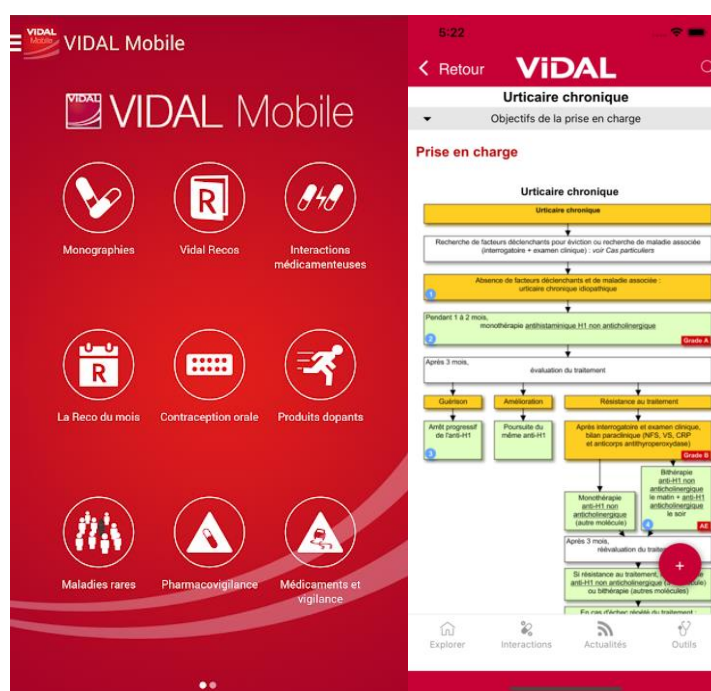
Source: Apple Store

154. **Mobile phone characteristics[147] and app convenience explain why apps are adopted even in traditional sectors such as medicine.** Health practitioners can always have their phones at hand, contrary to books. Also, searching for treatment and dosage is easier and quicker with an app. The app contributes to improving patient care efficiency.

3.1.2   Airline and Railway companies

155. Most European railway companies were created in the first half of the 19th century. Transport is the second item in European household expenditures[148]. In 2018, rail passenger transport in the EU was estimated at 472 billion passenger-kilometers, a 10% growth from 2013. During the same year, 1.1 billion Europeans traveled by air[149].

156. In a world where mobility plays a crucial role in people's lives, **most railway and airline companies respond to travelers' needs by providing basic features in their mobile app**. These apps make the booking and travelling process easier: users can book flights and trains anywhere and at any time. Apps also enable users to easily obtain up-to-date information on delays or gates, to

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[147] Small handheld device.
[148]https://ec.europa.eu/eurostat/statistics-explained/index.php/Household_consumption_by_purpose#Evolution_of_shares_over_time.
[149] https://ec.europa.eu/eurostat/statistics-explained/index.php/Air_transport_statistics.

exchange or cancel tickets, etc. and thanks to mobile passes, travelers can have their boarding pass at hand.

157. If most transport companies nowadays propose a mobile app, some apps, such as Lufthansa and Oui.SNCF, stand out by adopting new technologies to offer new user experiences.

Lufthansa: integration of new technologies

158. Lufthansa (the German national airline company) launched its mobile app in 2012. In February 2020, it counted a total of 20 million downloads and 350 000 monthly active users. New features are continuously added, with the goal of "Rethinking air travel".

159. The Lufthansa app goes beyond traditional services offered by airline apps, such as booking tickets, mobile boarding passes and instantaneous updates. The app's success is explained by technological innovations, offering travelers a differentiated and convenient experience.

160. Lufthansa was one of the first airline companies to propose a passport and credit card scan option on its mobile app, in 2015. Customers booking flights on the Lufthansa app can scan their payment cards and passport with their smartphone's camera: the relevant information is automatically extracted. Using the scan option reduces the average mobile check-in time from about two minutes to twenty seconds[150].

Figure 18.   Lufthansa's mobile app Apple Watch interface
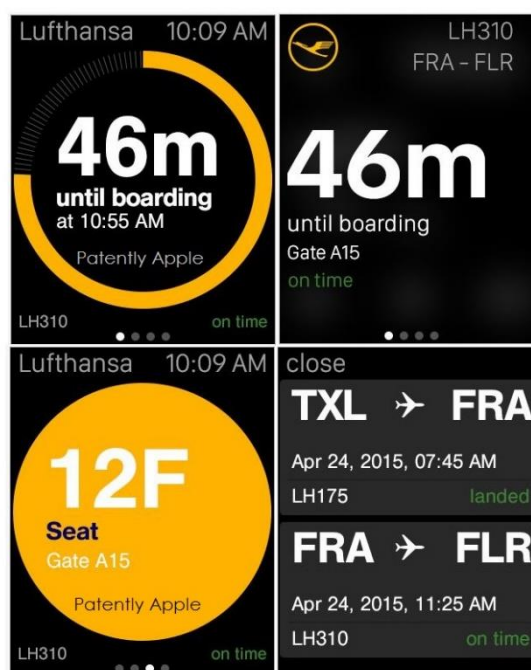
Source: Patentlyapple

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[150] This figure is obtained from another app with similar functionalities. https://www.businesstraveller.com/news/2016/02/23/easyjet-app-upgraded-for-credit-card-scanning/.

161. **Services permitted by the internet of things (IoT) were integrated early on**. Since 2015, users can synchronize the mobile app with their smartwatches. This option allows users to keep an eye on all the important information about their Lufthansa flight at all times.

162. In 2019, the Lufthansa app has added a new option which allows to directly access flight information by voice command, without opening the app. This function is based on the Siri Shortcut technology launched by Apple in 2018, which allows to deliver information from apps to Siri. Thanks to a short voice command, such as "Hey Siri, my flight", users get all the flight information from the intelligent assistant: the time needed to get to the airport, the boarding gate, etc.

Oui.sncf: simplifying the travel process

163. The app proposed by the French railway company SNCF is a great example of how to meet consumers' expectations with innovative options. SNCF launched its mobile app in 2009. The Oui.sncf app has been downloaded more than 18 million times and has more than 1.5 million monthly active users. It is frequently ranked as the number one travel app in France. **In 2018, the firm announced that more sales had been achieved through the app than through its website**[64].

Figure 19.   **Oui.sncf's app interface**
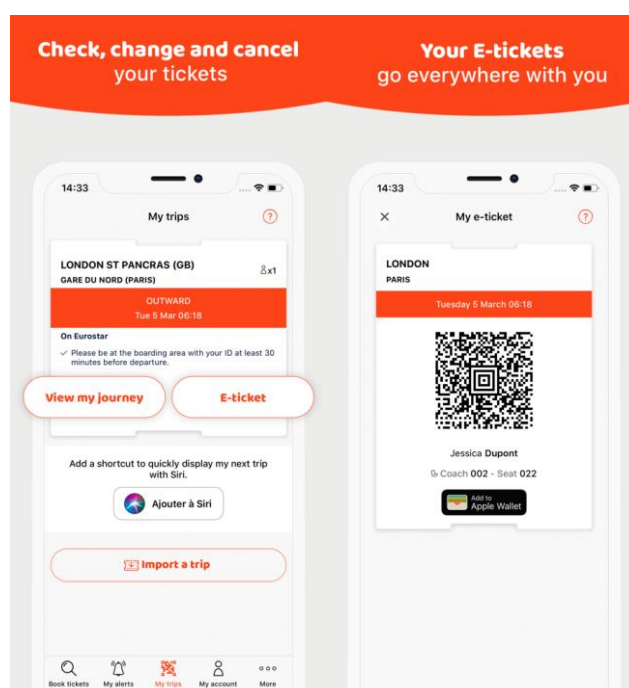
Source: Apple Store

164. **The app makes the whole travel process simpler**. When users perform a search, their recent trip searches are shown, and thanks to Artificial Intelligence (AI) the app proposes trips that are more likely to be booked. Also, the Low Price Alert[151] option has been very successful since its launch in 2017. App users can enter the destination and the travel date of their interest, and they will receive a notification on their mobile phone when the price is low. In 2018, this option has led to

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[151] Alerte Petits Prix. This option is also available via SNCF website: an e-mail will be sent when a given trip is available. However, when using this option through the app, users can book their train as soon as it is available.

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more than 2.4 million notifications. The app thus proposes a new booking process: users can book tickets everywhere, at any time, with an intelligent platform. In addition, the tickets are available as QR code.

3.1.3 Shopping

165. With M-commerce revenues reaching an estimated €394 billion in Europe in 2019, mobile apps became an integral part of retailers' business model[152]. Traditional brands acknowledged that apps are tools for increasing sales. While many retailers offer a basic app as an additional distribution channel, **other retailers offer users a renewed shopping experience.**

Ikea Place: AR technology supporting shoppers' purchasing decision

166. Ikea is a Swedish company founded in 1943 that designs and sells ready-to-assemble furniture, kitchen appliances, and home accessories. Realizing that consumers were ditching showrooms for online shopping, the company decided to develop three **apps enhancing the shopping experience**: an in-store app that helps to collect barcodes, an Ikea catalog app, and an augmented reality app to preview furniture in the customer's room.

167. This last app, Ikea Place, was launched in 2017 and has been downloaded 3.7 million times since. Ikea Place had more than 370,000 monthly active users worldwide on iPhones in February 2018[153]. **This app demonstrates AR's potential to create valuable user experiences by solving practical problems**.

Figure 20. **Ikea Place's interface**
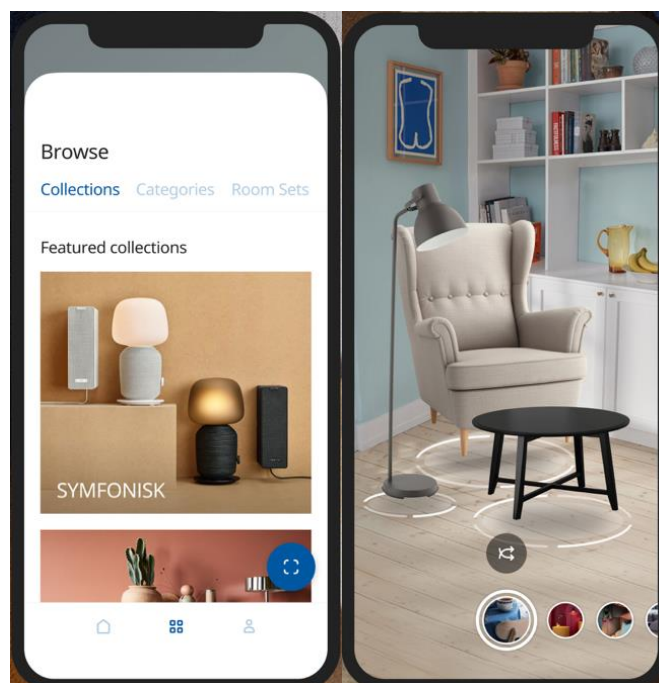
Source: Apple Store

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[152] Cf. section 2.3.3.
[153] According to App Annie.

168. **IKEA Place lets shoppers virtually place true-to-scale 3D models in their own home**[154]. Consumers can use the augmented-reality feature to visualize the furniture in their house before buying. The last version of the app also features Visual Search, allowing users to take a photo of any piece of furniture they fancy, then find similar or identical Ikea products through the app.

Asos: Visual Search technology to help shoppers choose

169. Asos was created in 2000 in the United Kingdom as an online clothing retailer. However, with the increasing mobile-phone penetration rate and m-commerce spending, the firm soon understood the importance of developing a mobile app. Today, 70% of Asos' traffic and 58% of purchases happen on mobile[155].

170. The company developed its built in-house app, which was released in 2011 in the UK and in 2014 worldwide. The app has more than 50 million downloads in total and 5 million monthly active users in 2019.

Figure 21.   **Asos' Visual Search option**
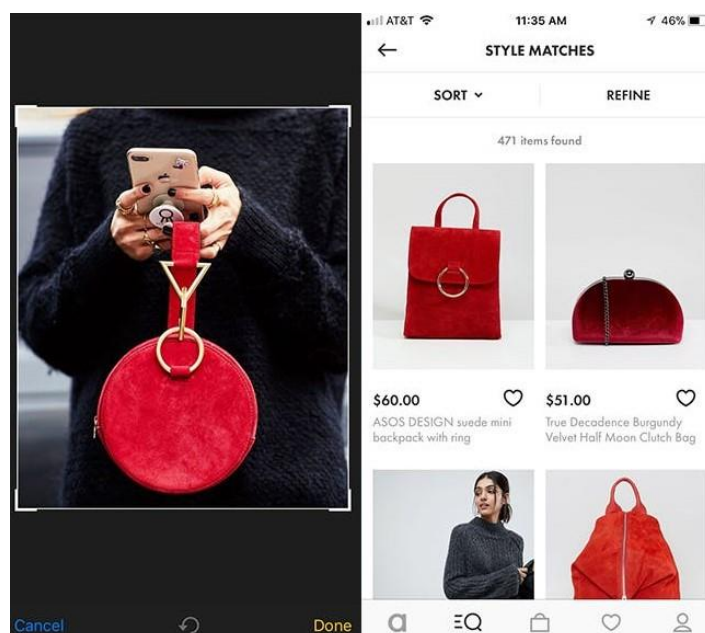
Source: Businessinsider

171. The firm's willingness is to "build experiences that capitalize on mobile"[156]. In line with that idea, the app proposes, since 2017[157], a **Visual Search tool: the Style Match option**. This option is valuable for users since shoppers can take an in-app photo of a product they like, and, thanks to both **data learning and intelligent digital image processing technologies**, the app pulls similar items from a pool of 85,000 product images. This option responds to an issue that users are facing when doing online shopping: they face a dense and hard-to-digest range of products. This tool will help narrowing down the product range and **getting customers straight to the products they are looking for**.

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[154] App description in Apple Store.
[155] https://digiday.com/marketing/asos-gets-50-percent-customers-buy-mobile/.
[156] Rich Jones, Asos's head of product.
[157] 2017 for the UK and 2018 Worldwide.

3.2 Pure Players

172. The novelty and the intrinsic features of the smartphone allow anyone with a good idea to propose a unique service and experience by launching an app. When the App Store was created in 2008, there were 5 000 apps launched the first year. Five years later, there were more than 730 000 apps available in both stores. In this section some examples of pure players are discussed in popular categories: health and lifestyle, travel, and games.

3.2.1 Health and lifestyle

173. Health[158] and lifestyle[159] mobile apps aim to make their users' lives easier. These categories of apps are growing fast. Lifestyle apps have a penetration rate of 65%[160] among Android users, and mobile health apps are expected to increase steadily with wearable device adoption. Smartphone features facilitate the recording of health data. Moreover, the camera of mobile devices allows for an interaction between app functionalities, the user, and its environment, which provides a basis for innovative services.

Yuka

174. **Yuka gives users the possibility to scan food and cosmetic products and analyzes their impact on health**. The French app was launched in January 2017, after Yuka's developers won the 2016 Food Hackathon, a startup competition, allowing them to benefit from a year of support in their development.

Figure 22.　　**Yuka's interface**

Source:　　Yuka, 2020

175. In November 2020, Yuka counted 20 million users[161]. In total, five million products are scanned every day, which means that on average, 55 products are scanned per second.

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[158] Health apps are only for users, while m-health solutions improve the collaboration between patients and healthcare professionals.
[159] Some of the lifestyle apps include: Fitness apps, Food & Drink apps, Dating apps, Music apps, Fashions apps, news, etc.
[160] https://www.statista.com/statistics/200855/favourite-smartphone-app-categories-by-share-of-smartphone-users/
[161] Yuka's 2020 Press Kit, 13/11/2020, https://yuka.io/wp-content/uploads/presskit/Yuka-dossier-de-presse.pdf

176. The app has 3 main features:

- It evaluates the quality of food according to nutritional quality and the presence of food additives.

- Since June 2018, Yuka also checks the quality of cosmetics according to the presence of allergens, carcinogenic compounds, endocrine disruptors or irritant products.

- For mediocre or bad products that a user has scanned, Yuka independently recommends more healthy alternatives.

Figure 23. **Yuka's recommendations of alternative products**
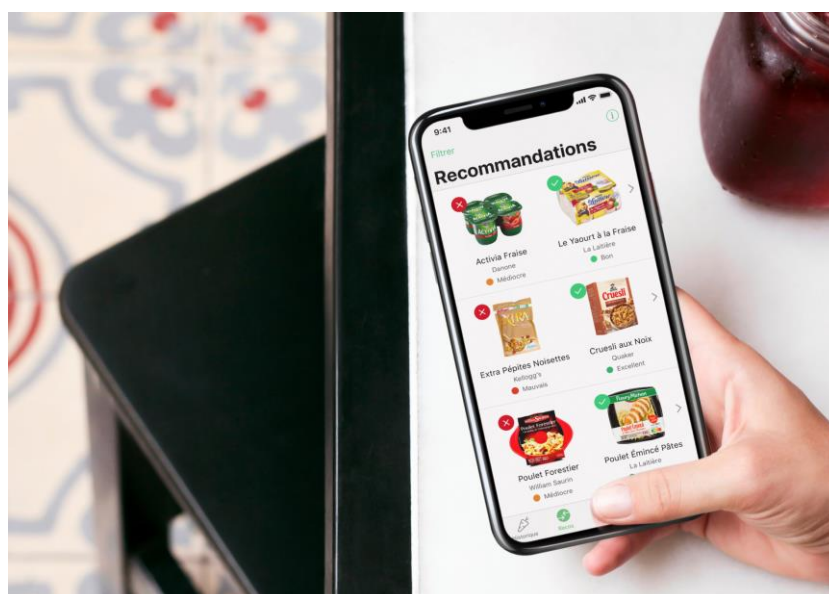
Source: Yuka, 2020

177. Yuka's success is dependent on the product database. Currently, it contains 1.5 million food and cosmetic references. About 2 000 new products are added to the database daily[162].

178. Yuka has an impact on consumer behaviors and on companies:

- 92% of users do not buy the scanned products when it is rated red on the app[163];

- 21 food and cosmetic companies said that Yuka has impacted the composition of their own products[164].

Too Good To Go

179. Too Good to Go was created to enable everyone to fight against food waste at their own level. Food sellers can offer unsold items that would otherwise be wasted. Consumers can obtain food at a reduced price. The app was launched in 2016 in France and is now available in 11 European countries. In 2021, it had 31 million users and allowed to "save" 60 million meals worldwide.

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[162] Yuka's 2020 Press Kit, 13/11/2020, https://yuka.io/wp-content/uploads/presskit/Yuka-dossier-de-presse.pdf
[163] Op cit.
[164] These companies include Nestlé France, Monoprix, Garancia, Unilever, Caudalie, Leclerc, Fleury Michon and Intermarché.

180. More than 60 000 food businesses are registered on the app, such as bakeries, supermarkets, restaurants, and hotels[165]. Many food leaders joined the platform to propose their unsold items[166].

Figure 24. **Too Good To Go's interface**
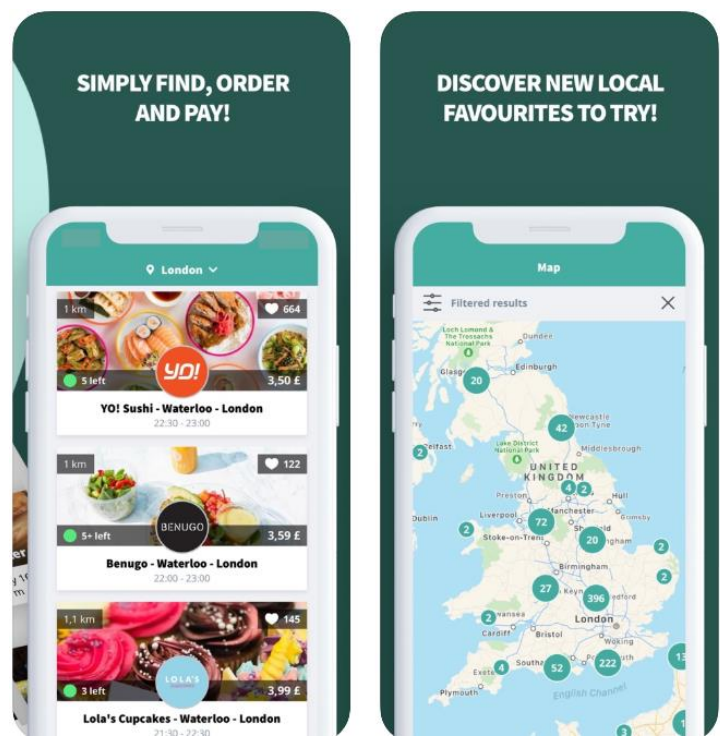
181. The strategy of the app can be qualified as a Win-Win-Win[167] strategy. Too Good To Go's success is based on matching the needs of consumers, producers and the planet. **Both producers and consumers take part in an environmental effort by using the app. The app's success is linked to its environmental commitment**, aligned with current mindset change. When developing Too Good To Go, Lucie Basch, the Too Good To Go founder, understood that **apps can be activists**.

Figure 25. **Too Good To Go's environmental commitment**

*Each meal saves the planet from 2.5Kg of CO2.
Calculation source: The EPA - United States Environmental Protection Agency.

Source: Too Good To Go, 2020

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[165]Ibid.

[166] Examples include Casino (FR), Carrefour (FR), Auchan (FR), Edeka (GR), Spar (NZ) and Starbucks (US).

[167] Business, consumers and planet benefit reducing food waste

3.2.2 Travel

Citymapper

182. Citymapper is an example of the innovative solutions in the field of travel and route calculations that are enabled by the geo-localization feature of mobile devices.

Figure 26.   Services offered by Citymapper
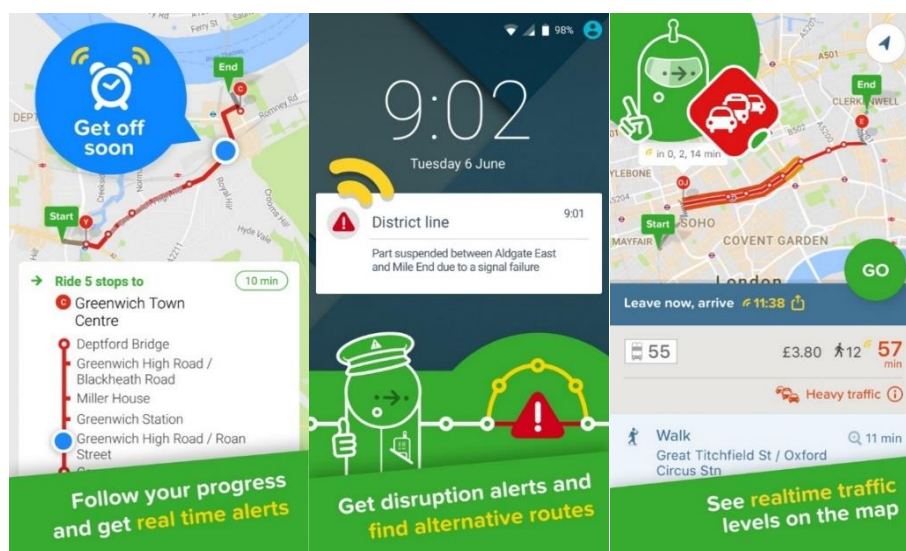
Source: Citymapper

183. Citymapper is a mobile app for urban route calculations. The start-up was created in London in 2011. The app calculates, in real time, the routes of urban transport users, by combining several modes of transport. It considers both public transport networks, taxi, and private hire, such as self-service rental networks, from scooters to bicycles[168].

184. **As of 2021, Citymapper was active in more than 80 cities worldwide** including Amsterdam, Berlin, London, Madrid, and New York, Paris, Rome, Tokyo and Vienna, and headquarters are based in London[169].

185. **The app offers many innovative features**. Citymapper indicates to the user where to board the train i to be close to the exit when leaving the train and suggests the best entrance to get quickly to the platform. Citymapper also has a live service alert concerning disruptions and offers alternative routes taking them into account. It also indicates availability of bikes and docks at nearby locations.

186. Its success led the app to innovate beyond the app ecosystem. Citymapper has created a "Citymapper Pass", a subscription to all transport modes available in London. This new pass integrates ticketing and payment and allows the user to avoid queues. Citymapper aims to extend this pass to other cities. Hence, with a single subscription, users are able to travel easily everywhere.

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[168] In London, Citymapper includes Bus, Santander, beryl, JUMP, Mobike, Tube, Train, Turo, Zipcar Flex, Virtuo, Getaround, Ola, Kapten, Uber, Black Cab, FREE NOW, Ferry, Tram and on foot.
[169] Citymapper's official website.

3.2.3 Games

187. Of all the mobile apps available on the app platforms, the most popular category is gaming. Nearly 25% of all mobile apps fall into this category[170].

188. **Mobile has helped broaden the age range of gamers**: most time spent in mobile games is by people over 25, who do not identify themselves as gamers[171]. Europe groups many successful mobile game developer companies.

Supercell: Clash of Clans

189. Supercell is a Finish mobile game development company founded in 2010. The company has released five mobile games which are freemium fast-paced games[172]. Supercell's games have been downloaded 1.8 billion times and in 2019, the company's revenues topped €1.4 billion[173].

190. The firm's strategy relies on developing long-lasting games. More than 8 years after it was launched, Clash of Clans still has 36 million monthly active users in 2020. The firm managed to keep players using their app: the app never had less than 19 million monthly active users. This success is explained by app store and smartphone specificities:

- Games are **community-based**: players join teams and fight against other teams. The app platforms offer visibility to the game and allow players to battle against million players worldwide.

- **Adaption to user behavior:** most smartphone apps are opened for less than 3 minutes. Clash of Clans and Clash Royal apps are adapted to this behavior. To upgrade levels, **players must play several times during the day, for small intervals**.

Playgendary and Voodoo

191. Even though mobile games are very popular, app usage analysis reveals that users often download an app and use it for a very short period of time: the user retention rate of mobile applications worldwide was 32%[174] in 2019.

192. With this in mind, some game developers choose a strategy to keep users playing their games: develop multiple small games. Once players are bored with one game, they can download another game of the company.

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[170] Statista, Most popular Apple App Store categories by share of available apps, 2019
[171] App Annie, State of Mobile: 2019 and beyond, 2019
[172] Hay Day, Clash of Clans, Boom Beach, Clash Royale, and Brawl Stars
[173] Statista, 2020
[174] Percentage of users that returned to an application 11 times and more.

Figure 27. **Voodoo's and Playgendary's top Games by number of downloads**

Voodoo's Top Games

| *Helix Jump* 550M *downloads* | *Crowd City* 190M *downloads* | *Color Road* 103M *downloads* | *Paper.io* 253M *downloads* |

Hole.io 184M downloads | **Rolly Vortex** 61M downloads | **Balls VS blocks** 170M downloads | **Fire Balls 3D** 89M downloads

Playgendary's Top Games

Kick the Buddy 51M downloads | **Polysphere** 53M downloads | **Tank stars** 31M downloads | **Partymasters** 16M downloads
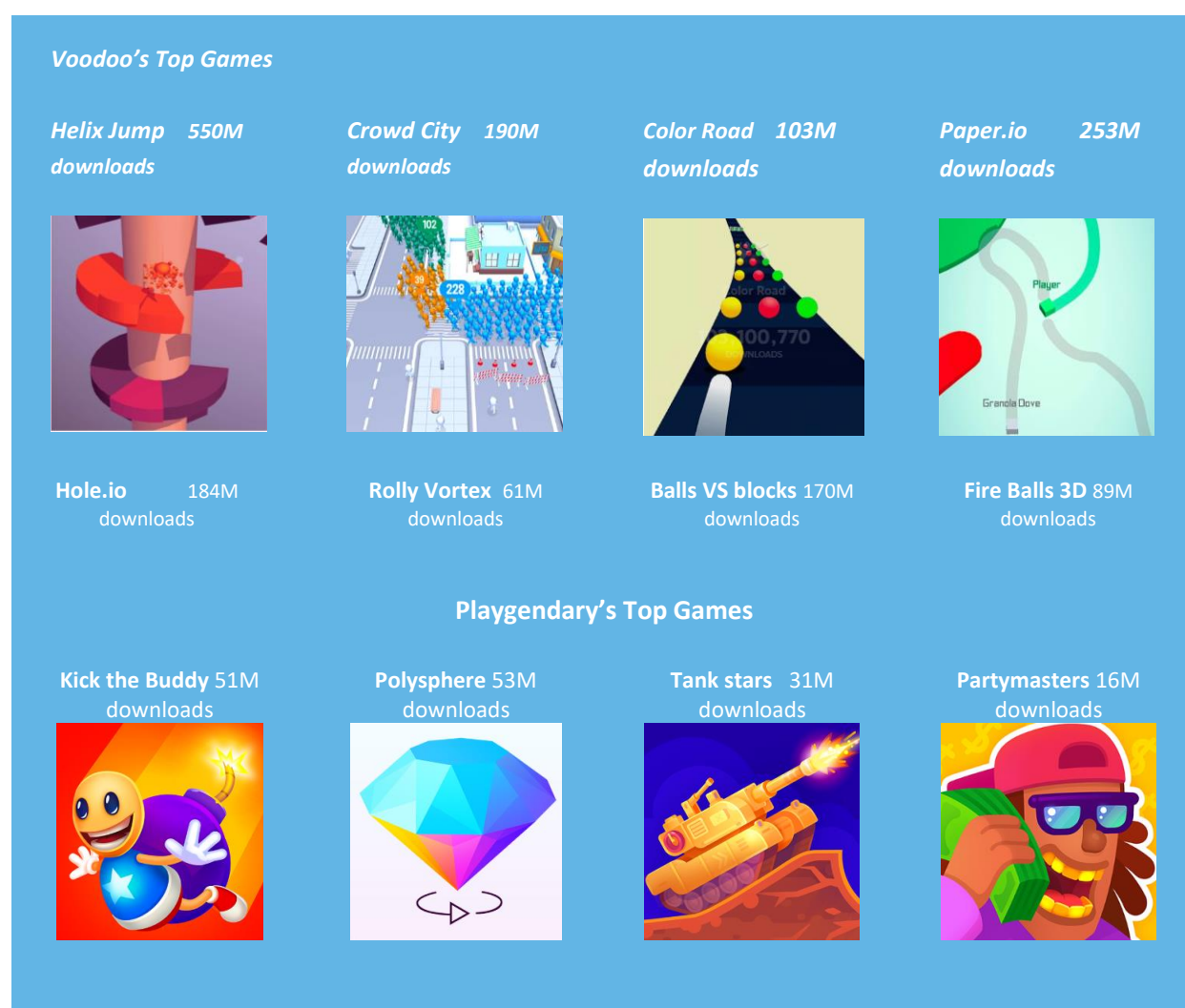
Source: SensorTower

193. Playgendary, founded in Germany in 2016 and Voodoo, founded in France in 2013[175], have both based their strategy on developing multiple hyper-casual games[176]. Voodoo has more than 90 mobile games available on the major app platforms, of which 12 were released in the last three months. Playgendary has a total of 69 apps available. The firms' success relies on developing games that attracts many users, even if is only for a short period of time. Both developers constantly have games in the top 10 games.

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[175] In 2019, Playgendary had a total of 1.2 billion downloads, and $59 million revenues while Voodoo had 2.9 billion downloads and $7.5 million in revenue. Voodoo and Playgendary respectively have 1 billion and 500 million individual players worldwide.
[176] Hyper-casual games are games that have simple tap-to-play mechanics and offer instant gameplay. They don't take much of users' time and can be played while multitasking.

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3.3 Seizing mobile apps' potential: technologies and companies of tomorrow

3.3.1 Apps of the future

IoT and connected devices

194. The internet of things[177] (IoT) refers to a vast network of connected devices that share and exploit many different types of data. **Mobile apps play a fundamental role in the IoT: they constitute the interface enabling users to interact with physical connected devices.** Gartner[178] predicts that, globally, there will be more than 50 billion connected devices by 2030[179] (Figure 28).

Figure 28.   Change in the number of connected devices globally in millions (estimates)
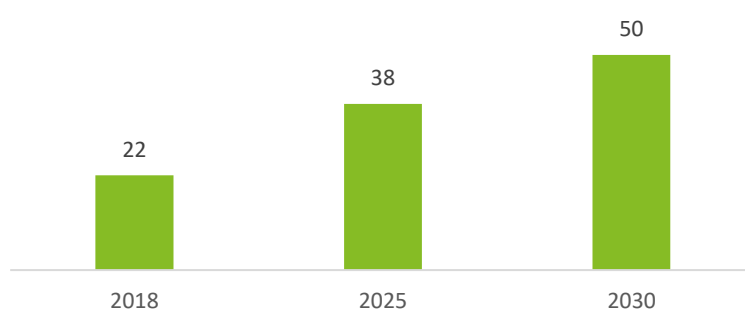
Source: Statista

195. More and more homes will be connected throughout Europe: in 2019, there were 20 million smart homes. This number is expected to exceed 80 million by 2023[180], or 23% of European households. Hence, smart homes will be a strong driver of the future development of connected devices.

196. A connected home has a network that interconnects multiple devices and sensors. Services range from communications and entertainment to healthcare, security, and home automation. Users are connected in real-time with their home, and mobile apps enable them to control and monitor their homes.

197. Connected devices inside smart homes can be regrouped into 5 categories: control and connectivity, smart appliances, security, media and entertainment, comfort and lightning and energy management. Table 11 describes the different categories and evaluates their growth in 2023 in terms of number of households equipped with the different connected devices.

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[177] 63.   This term includes a wide range of devices connected via mobile apps ranging from household appliances, to cars, and even buildings forming a concept widely referred to as smart cities.
[178] Gartner is the world's leading IT research and consultancy firm. Gartner regularly publishes sector analysis of the IT market. Gartner advises more than 12,000 companies all over the world. The company employs more than 8,000 people in 85 countries and in 2016 Gartner generated $2.4 billion in revenue.
[179] https://www.statista.com/statistics/802690/worldwide-connected-devices-by-access-technology/
[180] Berg Insight (2019)

Table 11. European households (in million) equipped with connected devices, by categories of connected devices

Category	Description	2018	2023
Control and Connectivity	The segment includes smart speakers, central control and communication units, programmable control buttons, and smart plugs for the control of non-smart devices.	21	57
		Growth: 173%	
smart appliances	This includes connected versions of all kinds of household appliances, provided they are connected to the internet.	9	27
		Growth: 198%	
Security	The Security segment includes surveillance products as well as equipment for risk monitoring	11	31
		Growth: 185%	
Home entertainment	The Home Entertainment segment comprises the sale of products and services for multi-room entertainment as well as connected remote controls and streaming devices.	16	41
		Growth: 157%	
Comfort and Lighting	The Smart Home segment Comfort and Lighting includes devices for the improvement of the living atmosphere.	14	40
		Growth: 185%	
Energy management[181]	The Energy Management segment covers the sale of products and services for the control and reduction of energy consumption.	12	41
		Growth: 237%	

Source: Smart Home Report (2019), Statista

Enterprise mobile applications and Enterprise mobility management

198. Enterprise mobility management (EMM) apps enable ubiquitous access to tools and processes for workers. The rise of EMM goes hand in hand with the allover rise of the use of smartphones. The modern workforce becomes more and more mobile, and firms thus increasingly use mobile devices: **60% of employees use apps for work-related activities[182]**.

199. Moreover, enterprise mobile apps are designed to improve business and employee efficiency. For example, mobile access to emails has been shown to increase labor productivity[183]. Employees perform work-related tasks on mobile devices during transport time, which increases the total time employees spend working[184].

200. EMM is a growing industry. Many companies plan to adapt by offering new/additional mobile apps: 87% of companies plan to expand their app portfolio[185]. Revenues are expected to grow from $6.9 billion in 2017 to $16.3 billion in 2021[186].

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[181] This category is still mainly linked with smart cities, but consumers are progressively proposed devices and apps allowing them to track, control and monitor their gas/electricity consumption.
[182] Digital Strategy consulting, (2014)
[183] Bertschek, I. and Niebel, T. (2016)
[184] iPass, 2011
[185] Apprian (2016)
[186] 451 Research report, 2017

3.3.2 Innovation and apps of the future

201. In April 2020, interviews with several app developers were conducted on their view on innovation in the app sector. As sector specialists, they shed a light on why and how they innovate, and on the types of innovations to be expected in the future.

Innovation in the app sector

> *"Innovation is something that should be valued, that we should embrace and appreciate in Europe."*
> **F. Ronchi, president and CEO of Synesthesia[187]**

202. Even though apps already are an "integral part of our life" (F. Ronchi), Stanislas Dewavrin, co-founder and CEO of Oh BiBi, explains why many innovations are still to come: "*Aspects of our lives that have not been revolutionized yet are the next frontier, anything that has been done the same way for a century is about to change. Consider the way you're exercising your democratic rights for example: do you think the next generation will feel comfortable doing it this way? They're used to a level of communication and interactivity with leaders that has yet to be invented*".

203. Over the past years, there have been many hardware innovations for smartphones. According to S.Dewavrin: "*Tech is already great. We have tons of bricks that allow us to create whatever we want*". Future innovations will come from software combined with the use of big data.

> *"Innovation is progress, it's a perpetual race towards unlocking competitive advantage in the segment".*
> **Stanislas Dewavrin, CEO of Oh BiBi[188]**

204. For app developers, "*Innovation is vital to remain competitive*", says F. Ronchi[189]. He adds that innovation is important both for developing new solutions for their customers, as well as for increasing the efficiency of the internal work process.

205. In the mobile game industry, innovation is strongly driven by user behavior. An important share of games are hyper-casual games: "*games that can get the attention from anyone out there and which let users play for a short period of time*" as Kristian Nordahl, Senior Vice President Operations at Kiloo, puts it. These games are adapted to the way users interact with a smartphone: the phone is used for short moments, up to 10 minutes, and users go back often to their phone[190]. K. Nordahl gave an insight into hyper-casual games' importance: "*of the top 10 games today, give and take but we will see half of those being hyper-casual games*". Users play these games for not more than a year and then pass on to other games. This dynamic drives innovation, as S. Dewavrin says: "*you can expect a lot of innovation [in mobile games] as the cycles are shorter and pressure to understand people in multiple situations is pretty high*"[191].

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[187] Interview with Deloitte, April 2020.
[188] Interview with Deloitte, April 2020.
[189] Ibid.
[190] Source: Statista
[191] Ibid.

The innovation process

206. App developers transform inventions, which are new technologies or processes, into innovations. Innovation happens when an invention is implemented in marketable products and adopted by consumers and enterprises. Inventions relevant for app developers are big data analysis techniques such as artificial intelligence and virtual and augmented reality. Developers use these inventions to propose innovative apps for consumers. A. Normand, founder of Greenly, illustrates this transformation of invention to innovation. The app's concept is to inform users on the greenhouse gas emissions generated by their consumption pattern, obtained via their bank transactions. For this, detailed databases on emissions for individual brands and products are used. In addition, as he explains, the app *"takes advantage of the consequences of the European Directive DSP2 which obliges banks to make banking information available to third party applications with the consent of users".*

207. Innovation in app development is a two-way process. On the one hand, new needs and expectations emanate from users: enterprises and consumers. On the other hand, developers are aware of inventions and societal evolutions of which non-specialist end-users might be less aware. As Synesthesia's developers state: "*We have two ways to do research: bottom-up and top-down*". Bottom-up research is more short-term and consists of "*collecting customer needs and then develop prototypes*" that can be proposed to their clients. The driving idea is to "*identify the gaps in the current technology*".

208. The top-down process concerns longer-term development of new solutions. In collaboration with startups and research groups at universities, technologies are selected "*that will bring value for example five 5 years from now*".

> *F. Ronchi gave an example of top-down innovation: "People in the future will want to know how Artificial Intelligence decisions are made, and to be part of the process. In the future, the non-transparent nature of AI technologies will be less acceptable for users. Developers need to be ready in time."* [192]

209. Developers acknowledge the importance of professional networks for the innovation process. For Synesthesia, this network is both academic and business oriented.

210. **Developers agree on the importance of training and education for app development, encompassing both hard and soft skills**. Also, in development companies, **a stimulating work environment is an important factor** for innovation. Freedom and intrinsic motivation are highly valued: "*what we have are highly-skilled, highly educated people who can think: they have the liberty to think.*", says K. Nordahl. "*My colleagues are passionate: they could be musicians or soccer players. They love [their job], and that affects the creation of the games*".

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[192] Interview with Deloitte, April 2020.

Future developments in apps

"Innovation will continue, there are fantastic things to do and many problems to solve."
P. Abel, Escapadou

211. **Interviewees agreed on the importance of connected devices for the mobile app sector**. In particular, app development for medical and health-related connected devices will further develop. If connected devices, such as connected watches, are already largely adopted by individuals, professional adoption in the health sector is less advanced. In Europe, "*Doctors are not equipped for remote monitoring with connected objects and applications*" observes A. Normand, who previously worked at Withings. In the future, mobile apps will be used to "*aggregate telemedicine data to identify at-risk patients in heart failure, diabetes, hypertension, etc.*"

212. F. Ronchi identifies **digital identity as an area which will further develop**. Many technologies are included in this topic: "*connection with public administrations, healthcare, digital payments, etc.*"

213. If mobility and micro-mobility are already important in the mobile app economy, Synesthesia developers predict that "**Mobility is a sector that will continue to grow**. We saw the explosion of electric scooters in cities and of ridesharing. These services, that are enabled by smartphones and apps, were quickly adopted by users. [….] This segment will continue its expansion."

214. Finally, developers argue that app platforms have a role to play in development of the mobile app sector. As P. Abel says, app platforms offer "*great opportunities, a fantastic medium*" that "*give people the opportunity to develop apps*." App platforms he says have the responsibility to help users find the right apps: "*For the last ten years, the question has been: how can the user find the right apps? This is a problem that Apple and Google have to address*". Some app categories struggle to be visible on app stores. A. Normand points out that "*neither Apple nor Android have an environment category on their platform.*" He defends that "*If a central topic of the next few years is the environment, and mobile applications have a major role to play in this, then it is important to have an environment category.*"

"The platforms have enabled a lot of innovation."
P. Abel, Escapadou

3.4 What the Covid-19 crisis reveals about the mobile app sector

215. The health crisis has raised awareness of the importance of apps in everyday life. Apps are used today both for market activities and public use (information and education for example). **Apps went from a nice-to-have product to a must-have product**: "*mobile apps are moving from complementary components to essential components.*" says F. Ronchi, CEO of Synesthesia[193].

216. App downloads for services such as business apps, food & drink apps, medical, and health & fitness apps, increased significantly in 2020. For example, business app downloads went from 186 million in 2019 to 476 million in 2020 (Figure 29). For these sectors, the use of apps has enabled the continuity of social and market activities during periods of strong physical distancing measures imposed by governments. Although it is too early to draw conclusions, some of these evolutions may prove to be permanent changes.

Figure 29. Downloads in millions for apps in four categories in the EU (2017-2021)

Source: SensorTower
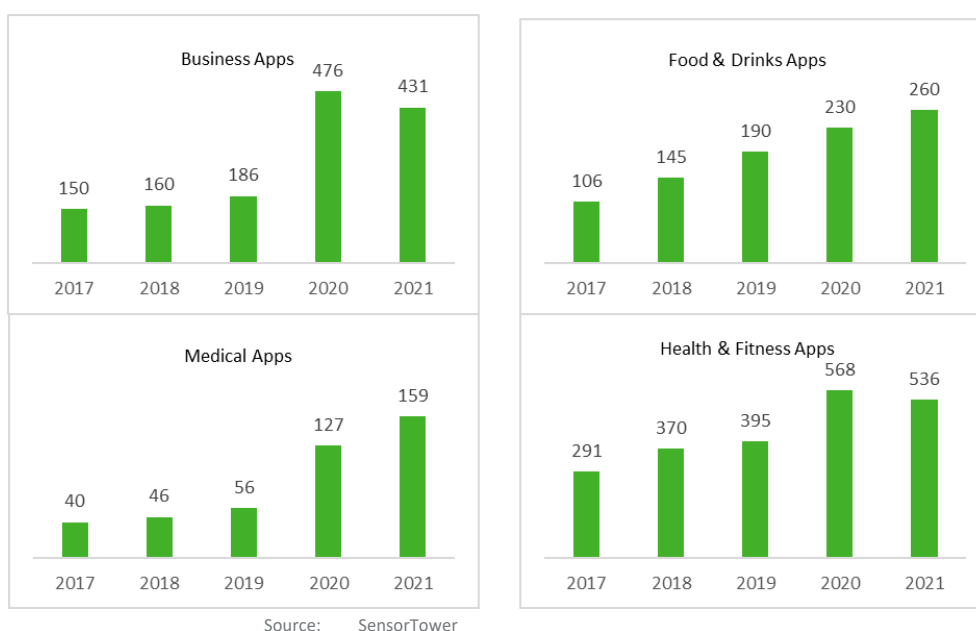
217. Since the beginning of the pandemic, many industries prepared for the possibility of a durable change in markets and mindsets: "*We have been contacted by many players among the most affected industries like tourism, education, event organizers… All these players are very concerned with how this crisis is going to change the market and mindset of people. Some of them think that this is going to permanently change some industries*", reports F. Ronchi in April 2020[194].

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[193] Deloitte Interview with F. Ronchi from Synesthesia, April 2020.
[194] Interview with F.Ronchi, CIO at Synesthesia, April 2020.

3.4.1   The app economy strengthens the resilience of existing sectors

218. During the Covid-19 crisis, mobile apps enabled business continuity for several sectors. Apps allow efficient teleworking, especially in the service sector (office jobs) which accounts for more than 70% of GDP in the EU. For the restaurant sector, the Covid-19 pandemic significantly affected consumers' relationship with food and eating. Food delivery apps allowed many restaurants to continue to operate and meet the new expectations form consumers.

Teleworking

219. Downloads of professional applications such as mail and teleconferencing apps increased by 94% in the first quarter of 2020, and by 55% in the second quarter. Throughout 2020 and 2021, during periods of strong distancing requirements in Europe, the use of professional applications has increased to a level almost three times higher than in 2019 (Figure 30)[195]. Hours spent on apps in the business category increased from 65 million in Q1 2019 to 137 million in Q4 2020 cumulatively in the UK, France, and Germany[196] (Figure 31). This trend illustrates that apps have played a crucial role in working and collaborating throughout the crisis.

220. Indeed, apps related to cloud technology, collaborative work, and scheduling tools have made teleworking highly efficient. Features such as videoconferencing, content sharing and interactive presentations have been developed to introduce more interactivity between workers.

Figure 30.   **Number of downloads of business apps per quarter in the EU and in the UK, Q1 2019 to Q4 2021 (in millions)**
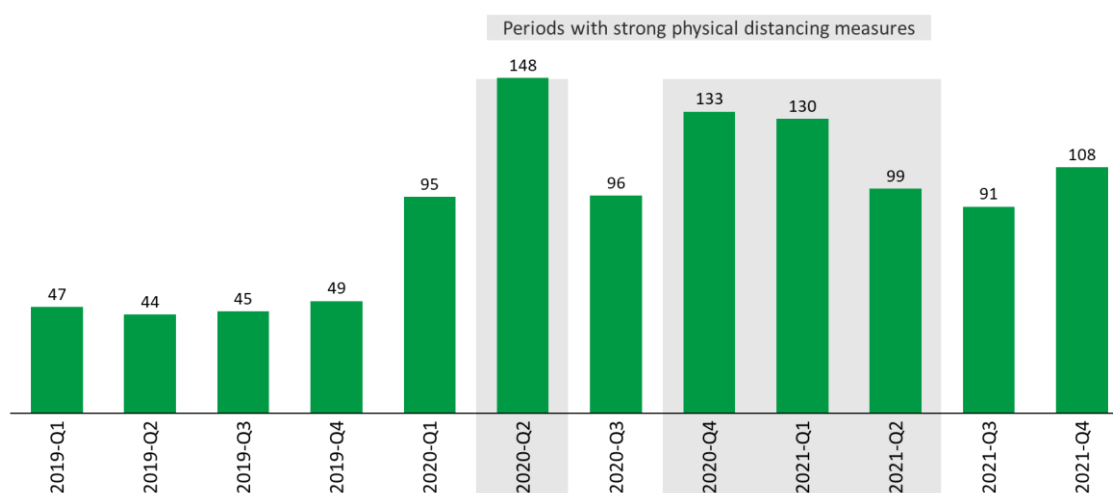
Source: SensorTower (downloads), Oxford Covid-19 Government Response Tracker (Covid-19 Stringency Index)

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[195] The "periods with strong distancing requirements" in Europe and in the UK were defined with the Covid-19 Stringency Index (Oxford Coronavirus Government Response Tracker). "The nine metrics used to calculate the Stringency Index are: school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirements; public information campaigns; restrictions on internal movements; and international travel controls."
[196] State of mobile 2021, App Annie

Figure 31.   **Hours per capita spent in business apps, Q1 2019-Q4 2020, UK, France and Germany (Android phones only)**

Hours per capita
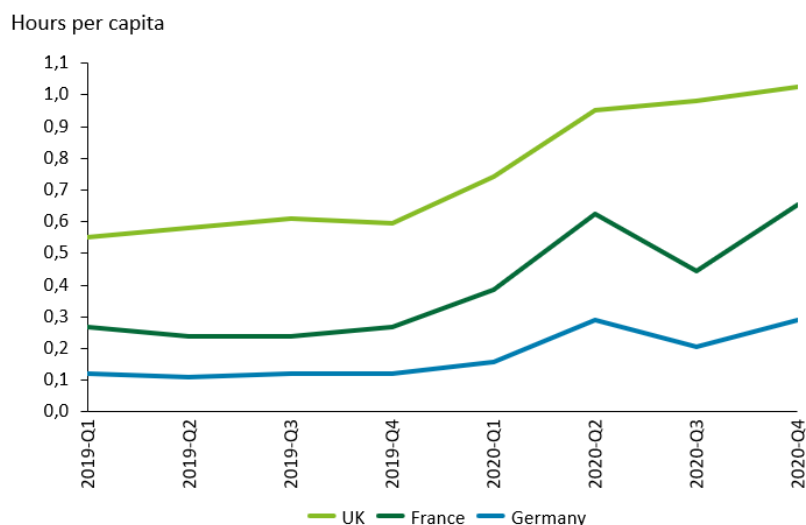
Source: App Annie, State of mobile 2021

Restaurant delivery through apps

221. Restaurant delivery services through apps provided a level of business continuity in the restaurant industry during the lockdown periods[197]. The success of online restaurant delivery is reflected in its use since the start of the Covid-19 pandemic. Consumer spending through restaurant delivery apps increased by 46% in 2020 and by 26% in 2021 in the EU and the UK combined, compared to average growth of 19.5% over 2017-2019 (CAGR) (Figure 32)[198].

Figure 32.   **Annual online food delivery revenue and revenue change, in the EU and in the UK, 2017 to 2021**

In million EUR
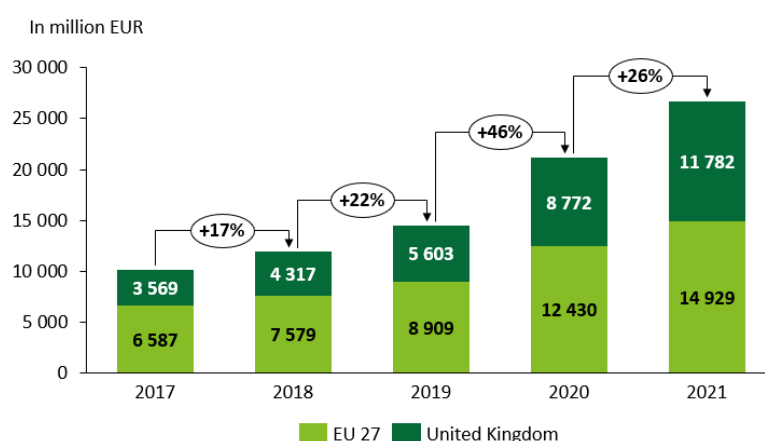
Source: Statista data for Online Food Delivery extracted on the 02/11/2022

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[197] The restaurant delivery market encompasses the delivery of meals carried out by delivery service platforms or by restaurants themselves.

[198] Statista data for Online Food Delivery, extracted on the 02/11/2022. "Consumer spending" corresponds to the gross merchandise value, which is defined as the total sales value for merchandise/food sold through the Online Food Delivery marketplace.

222. Worldwide, the use of food delivery apps increased significantly: the number of connections to food delivery apps doubled in 2020[199]. In France, the number of connections to food delivery apps (ex. Uber Eats, Deliveroo, Phenix) went from 23 million per week in January 2020 to 45 million per week in December[200].

223. Specifically during the periods of the crisis with strong governmental physical distancing measures, food delivery apps were even more used. For example, downloads of the Deliveroo app peaked during those periods, increasing for instance by 47% in one quarter between Q3 and Q4 2020 in the EU and UK (Figure 33).

Figure 33.   **Number of downloads of the Deliveroo app per quarter in the EU and in the UK, Q2 2019 – Q4 2021 (in millions)**

Source: SensorTower (downloads), Oxford Covid-19 Government Response Tracker (Covid-19 Stringency Index)

3.4.2   The Covid-19 crisis has accelerated the digital transition

224. The crisis has been an accelerator of the digital transition. In Europe, all countries have witnessed a surge in the use of apps, which allowed the continuity of public services, business, and social activities during lockdown periods. This increase in app utilization is set to become a permanent trend, as stated by F. Ronchi from Synesthesia:

225. "*A lot of trends we are seeing during [the sanitary crisis] are going to set permanent changes on how people work, study, teach, get distraction and entertain in the future. The digital way is going to be more and more wide-spread and accepted.*"[201]

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[199] Bregeon B., "Les applications mobiles ne connaissent pas la crise", 2021. https://www.digital-mobile-retail.com/category/apps/. The number of connections is counted on Android apps.
[200] Op. cit.
[201] Interview conducted with Synesthesia in April 2020.

226. The pandemic has disrupted activities in all sectors of the economy. Even traditional sectors such as education or events had to adapt to lockdown constraints. Digital tools and mobile apps were key in this adaptation, as shown in the following examples:

- **Education:** education was provided online or via digital tools in several countries during the crisis. Ed-tech, or the use of technology in education, proved to be a consistent alternative for children and youth to pursue their classes during lockdowns. The pandemic has proven its benefits and its use might further expand in the future.

"Apps are not teachers but rather facilitators. Educational apps can guide children and provide them autonomy in their learning process. For small children, using fingers on a tablet is a very intuitive way to interact with a machine."
P. Abel, Escapadou [202]

- **Online and hybrid events**: conferences, theatre shows, and concerts were held online during the crisis. Democratization of online events or hybrid events that mix physical and digital experiences is likely to continue in a post-Covid-19 world. Mobile apps are likely to play a crucial role in the hybridization of events. According to F. Ronchi "*For these kinds of events, we need software and mobile apps to let people interact just as if they were going physically to the event*"[203].

- **Micro retail and grocery delivery**: shopping at micro-retailers that sell locally made products, and ordering groceries on mobile apps, were two trends already seen before the sanitary crisis, but which accelerated significantly during lockdowns. Examples of grocery delivery apps include German Gorillas, created at the beginning of 2020 and French Cajoo. These two trends are expected to become "*a big deal in the future[204]."*

227. Teleworking and digital heath are two other major trends using digital apps and that are expected to continue to increase after the pandemic. Both are discussed in more detail below.

Teleworking

228. Since the outbreak of the pandemic, an increasing number of companies allows their employees to work from home. This has resulted in an acceleration of digital transformation in the business sector, and in parallel the general adoption of business apps. What was considered as an exception before the pandemic became the "new normal" for employees, especially in the services sector.

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[202] Interview with Deloitte in April 2020.
[203] Synesthesia, April 2020.
[204] Ibid.

Figure 34. **Correlation between the number of downloads of business apps and the Covid-19 Stringency Index, the EU and UK, Q1 2019 – Q4 2021**
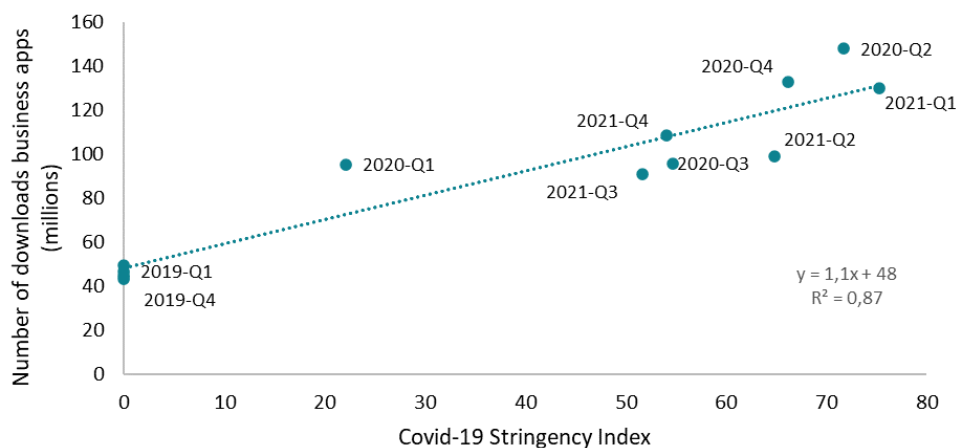
Source: SensorTower (downloads), Oxford Covid-19 Government Response Tracker (Covid-19 Stringency Index)

229. Business app downloads increased significantly since the start of the pandemic (Figure 30). Moreover, a strong correlation was observed between the stringency of governmental measures and the volume of business apps downloaded (Figure 34). The use of business apps has been crucial in the transition to teleworking during the crisis.

230. In 2019, the mail app Microsoft Outlook was the most downloaded app with 15 million downloads in the EU and the UK combined. In 2020, the top 3 most downloaded apps were teleconferencing apps, totaling nearly 130 million downloads[205] (Figure 35). The success of teleconferencing marks a new stage in the digital transition of work, where apps allow to communicate and to partially reproduce real working conditions.

Figure 35. **Top 10 of the downloaded business apps in 2019, 2020 and 2021 in the EU**

Video call & content sharing apps   Other business apps

2019		
Rank	Application	Downloads
1	Microsoft Outlook	15 041 299
2	Adobe Acrobat Reader	9 060 078
3	LikedIn: Network	7 949 944
4	Google Docs	6 943 019
5	HP Smart	5 632 156
6	Google Sheets	5 163 614
7	Cam Scanner	406 892
8	Microsoft Authentificator	3 710 840
9	Indeed Job Search	3 709 681
10	Adobe Scan: PDF Scanner	3 342 261

2020		
Rank	Application	Downloads
1	ZOOM Cloud Meetings	58 764 638
2	Microsoft Teams	39 817 967
3	Google Meet	29 647 085
4	Microsoft Outlook	16 484 625
5	Adobe Acrobat Reader	13 407 427
6	Google Docs	12 383 524
7	HP Smart	9 915 489
8	Webex Meetings	8 776 576
9	LinkedIn: Network	8 747 654
10	Google Sheets	7 570 982

2021		
Rank	Application	Downloads
1	Microsoft Teams	29 850 821
2	ZOOM Cloud Meetings	29 562 404
3	Google Meet	13 477 671
4	Microsoft Outlook	12 232 750
5	Adobe Acrobat Reader	11 904 018
6	Google Docs	9 243 345
7	HP Smart	9 003 317
8	Microsoft Authentificator	8 178 237
9	Microsoft Office	7 341 935
10	LinkedIn: Network	7 026 785

Source: Data from SensorTower, analysis by Deloitte

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[205] Sensor Tower data, 2021.

231. Teleworking was first used to adapt to the crisis, but its massive adoption during lockdowns might have permanently changed Europeans' perception on work and workplace organization.

Figure 36.   **Number of teleworking days in 5 European countries in 2021**

	France	Germany	Italy	Spain	UK
Total Teleworking (%)	34%	61%	56%	43%	50%
At least once a week (%)	29%	51%	50%	36%	42%
Mean (days)	0,9	0,4	0,5	1,3	0,4
Desired days of teleworking (days)	1,8	2,2	2,4	2,7	2
Gap (days)	0,9	1,8	1,9	1,4	1,6

Source: IFOP and Fondation Jean Jaurès

232. A survey on teleworking in five European countries in 2021 revealed that the desired number of teleworking days by employees is higher than the actual number of teleworked days, by on average 1.5 days. Indeed, the desired number of teleworking days varies between 1.8 (France) and 2.7 (Spain), while the average number of teleworked days varies between 0.4 and 1.3 (Figure 36).

233. The difference between desired and actual teleworking rates suggests that working conditions in Europe are evolving towards more flexibility. The digitization of work is likely to increase workers' welfare and also firm productivity in the future (cf. section 2.2.1).

e-Health

234. The pandemic has accelerated the adoption and use of mobile apps in healthcare. The increase in use was remarkable for medical apps and health and fitness apps.

- The use of medical apps surged in all European countries in 2020: in Great Britain downloads more than tripled (226%) and in the EU downloads doubled (104%). (Figure 37). In comparison, the average annual growth rate of downloads over the period 2017-2019 was 21% in the EU and in the UK combined[206].

- Health & fitness apps were already widely used before the crisis, with a 51% average growth rate of revenues in the EU and the UK over the period 2017-2019 (CAGR). Revenue growth was even higher in 2020, with a 72% increase (Figure 38)[207].

Figure 37.   Downloads of Medical apps by Country, 2017-2021, in millions

Source: SensorTower
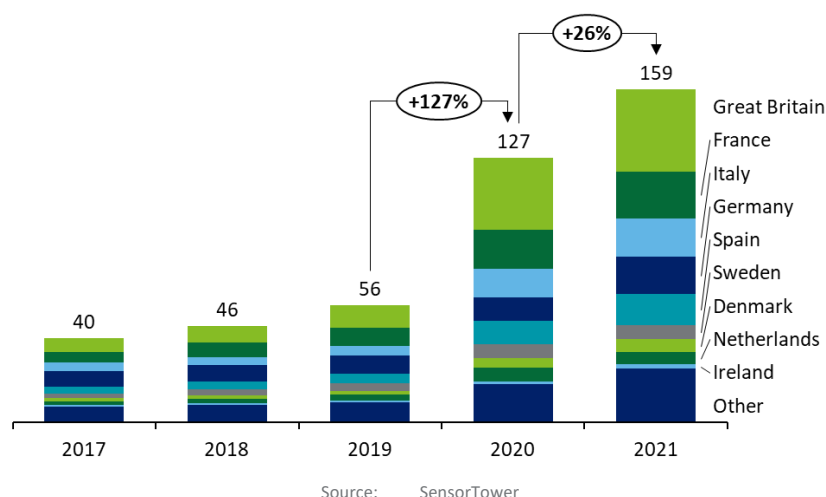
Figure 38.   Revenue of Health & Fitness Apps by Country, 2017-2021, in million USD

Source: SensorTower

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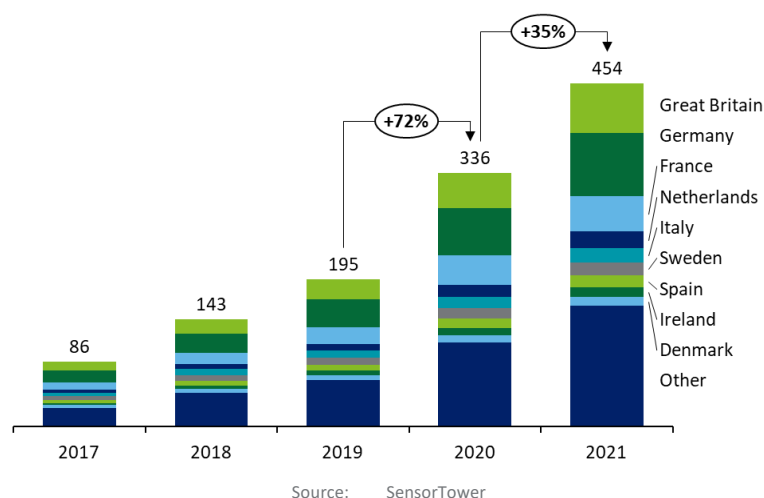
[206] Sensor Tower data for the period 2017-2021 on medical apps.
[207] Sensor Tower data for the period 2017-2021 for health & fitness apps.

235. eHealth apps have played an important role during the crisis. Governments and private organizations have created apps to fight the pandemic through contact tracing, symptom monitoring and information provision. Apps used different data collection technologies such as Bluetooth or GPS, to facilitate analysis of contacts and contaminations. Downloads of Covid-19 tracking apps, and vaccination and testing result apps, became the most downloaded medical apps in Europe in 2021[208] (Figure 39).

Figure 39.   Top 10 of the downloaded health apps in 2019, 2020 and 2021 in the EU & UK

Telemedicine   Covid19 Tracking Apps   Other medical apps

2019 Rank	Application	Downloads
1	Flo Period & Ovulation Tracker	6 443 020
2	Clue Period & Cycle Tracker	3 525 627
3	Doctolib	2 693 390
4	Pregnancy+ I tracker app, week by week in 3D	2 216 720
5	myGP	1 875 231
6	Pacer Pedometer & Step Tracker	1 637 966
7	Instant Heart Rate: HR Monitor	1 063 318
8	NHS App	1 046 388
9	Foodvisor – Nutrition & Diet	840 372
10	Patient Access	829 681

2020 Rank	Application	Downloads
1	NHS COVID-19	15 463 503
2	Immuni	7 129 708
3	Flo Period & Ovulation Tracker	6 779 257
4	TousAntiCovid	5 822 564
5	Doctolib	3 913 402
6	Radar COVID	3 640 367
7	Headspace: Mindful Meditation	3 212 863
8	NHS App	3 047 257
9	Clue Period & Cycle Tracker	2 904 114
10	Pregnancy+ I tracker app, week by week in 3D	2 625 627

2021 Rank	Application	Downloads
1	TousAntiCovid	14 135 875
2	NHS App	13 715 180
3	Doctolib	7 847 508
4	Flo Period & Ovulation Tracker	7 133 638
5	VerificaC19	6 075 359
6	NHS COVID-19	6 062 659
7	Immuni	5 578 557
8	Pregnancy+ I tracker app, week by week in 3D	2 897 116
9	Tarjeta Sanitaria	2 797 623
10	La Meva Salut	2 554 653

Source: Sensor Tower

236. In order to adapt to physical distancing recommendations, telemedicine was also widely adopted during the crisis (Figure 40). For example, downloads of the NHS App (used in the UK) almost tripled in 2020 and more than quadrupled in 2021[209] (Figure 39). The NHS App allows users to access health advice, use emergency services, register as organ donors, and choose whether the NHS can use personal data for research and planning[210]. The number of teleconsultations on the platform Doctolib in France multiplied by 100 in one month, to reach 100 000 per day at the end of March 2020[211]. Similarly, the demand for teleconsultations doubled for Swedish digital health provider KRY, and the demand for the Top Doctors platform increased 30 times in Italy, Spain, and the UK[212].

237. Downloads for other medical apps such as health monitoring and health reminder apps remained stable before and during the crisis[213] (Figure 39).

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[208] Sensor Tower
[209] Ibid.
[210] NHS Digital, Introducing the NHS App, accessed February 2022. https://digital.nhs.uk/services/nhs-app#introducing-the-nhs-app
[211] https://siecledigital.fr/2020/04/24/doctolib-les-chiffres-de-la-teleconsultation-sont-tombes/
[212] The rise of digital health technologies during the pandemic (europa.eu), European Parliament
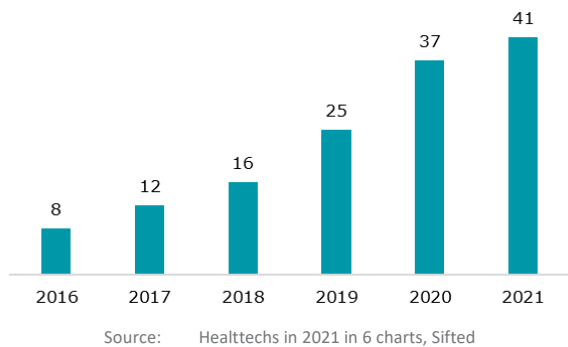[213] Ibid.

Figure 40.　　　**Map of European Teleconsultation Platforms in 2020**
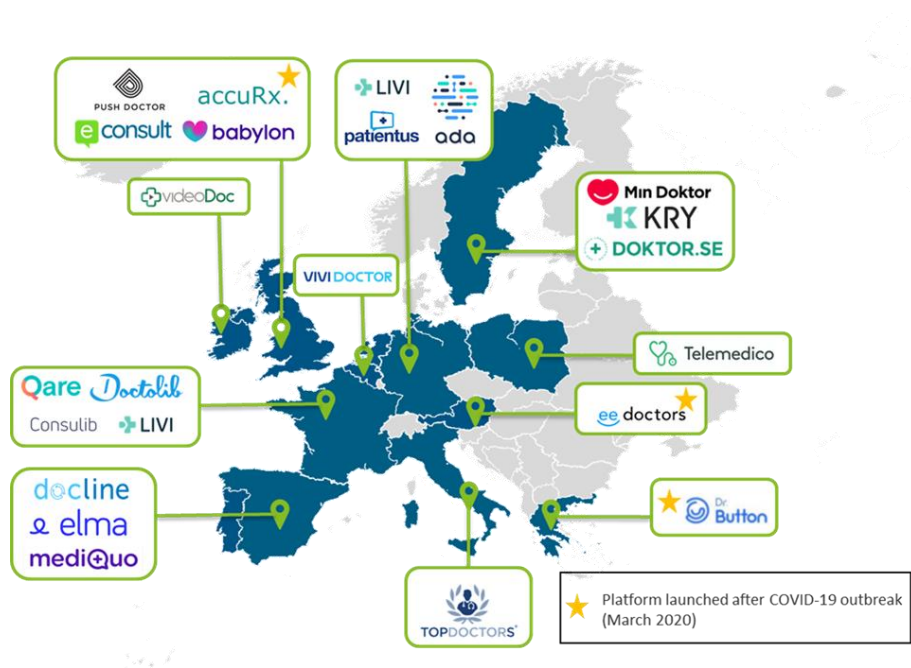
Source:　　　Source: HealthAdvances (2020), Deloitte 2022

238. As the crisis continued, the sector received more financing. In 2020, investment in Europe for digital health increased by $ 750 million[214]. Venture capital and private equity have invested massively in European health-techs, mainly in telemedicine, operations, software and insurtechs[215]. Large funding rounds included $ 150 million for the Swedish teleconsultation platform LIVI216 and $ 30 million for the German dermatology platform Formel Skin. By 2021, the combined value of European-based health-techs was estimated at $ 41 billion, reaching six times its 2016 value (Figure 41)[217].

Figure 41.　　　**Combined value of European health tech companies ($B)**

Source:　　　Healttechs in 2021 in 6 charts, Sifted

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[214] https://www.digitalhealth.net/2020/01/livi-raises-118m-to-fund-ambitious-expansion-plans/

[215] Insurtechs are firms that use technological innovations to expand and optimize the sector. Examples include Wefox in Germany and Alan in France.

[216] https://www.digitalhealth.net/2020/01/livi-raises-118m-to-fund-ambitious-expansion-plans/

https://www.eu-startups.com/2021/12/german-healthtech-startup-formel-skin-gets-e30-million-boost-to-make-dermatology-more-accessible/

[217] The healthtech trends of 2021, in six charts | Sifted

239. The crisis has improved consumer perception of telemedicine which for many was a new way of accessing health services. In France, only 7% of the population used teleconsultations before the first lockdown, compared to 22% after[218]. Between 2019 and 2020, the proportion of French patients with a positive opinion of telemedicine rose from 60% to 73%, and that of health professionals from 70% to 84%[219]. In the United Kingdom, appointments through the National Health Service (NHS) App increased by 111% in March 2020, with a rapid increase in adoption rates on patient portals[220].

240. The growing use of eHealth services during the crisis has contributed to the uniformization of regulatory frameworks across Europe, allowing countries with lower institutional readiness to catch up with more advanced countries[221]. The increased adoption of public reimbursement for teleconsultations during the crisis is an example of this. Progress in regulation shows that governments are eager to develop telemedicine and digital health at scale, setting the framework for after the crisis.

> *"The pandemic has helped pushing doctors and hospitals into more digital environments. Doctors started receiving their patients remotely, and when Ministries of Health started to reimburse remote visits, suddenly, everything was moving in the right direction very fast. What the Covid-19 crisis has done with telemedicine for doctors, it has also done with decentralized clinical trials for research stakeholders. And Andaman7 is helping with these new opportunities."*
>
> *V. Keunen, CEO of digital health platform Andaman7*

241. The rise in the number of mHealth research publications reveals a growing scientific interest in the field, and a willingness to further develop the sector[222]. Apps allow to optimize health procedures like monitoring of chronically ill patients or assisted cognitive rehabilitation. Moreover, data collected through mobile apps support clinical diagnosis and medical analysis. mHealth innovations will help shape the future of the health sector.

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[218] France Assos Santé, Les français et la e-santé, Juillet 2021
Diapositive 1 (france-assos-sante.org)
[219] Odoxa pour l'Agence du Numérique en Santé, Rapport Baromètre Vague 1 et 3
[220] Rachel Hutchings, The impact of Covid-19 on the use of digital technology in the NHS, August 2020.
https://www.nuffieldtrust.org.uk/files/2020-08/the-impact-of-covid-19-on-the-use-of-digital-technology-in-the-nhs-web-2.pdf
[221] G. Chittim, A. Pappas, J. Bomba, "The Changing Fortunes of Telemedicine in Europe – Past, Present and Future beyond Covid-19", Health Advances Blog, May 2020
[222] Cao J, Lim Y, Sengoku S, Guo X, Kodama K, Exploring the Shift in International Trends in Mobile Health Research From 2000 to 2020: Bibliometric Analysis, JMIR Mhealth Uhealth 2021;9(9):e31097.

Conclusion

242. **Mobile apps have introduced significant changes in the life of Europeans across consumer and enterprise frameworks**. These were especially accelerated in the context of the crisis. This report has quantified the app economy in the EU and UK and discussed the increase in the use of apps in all aspects of daily life, **a trend expected to further develop in the post-Covid-19 era.** The health crisis notably raised awareness of how mobile apps have become an essential part of life. The report furthermore discusses the active European landscape of small and medium-sized enterprises (SMEs) in the app development sector.

243. Our research demonstrates that app stores have a positive impact on the mobile app ecosystem[223]:

    - App stores enable disintermediation between buyers and developers which is one way through which app stores **reduce transaction costs** for app developers and their users.

    - App stores reduce entry barriers for developers and therefore increase the level of competition.

    - App stores increase consumer trust and security by creating a trustworthy platform for users and developers.

244. **The direct revenues of the app economy in the European Union amounted to €95.7 billion in 2021[224]** – these are revenues for mobile app developers. In comparison, box office revenues in the EU stood at €3 billion in the same year[225], and revenues for the provision of sporting and recreation services were estimated at €168 billion[226].

245. Including direct and indirect contributions, the app economy generated **€210 billion in revenue throughout all sectors of the EU's economy[227]**. The breakdown of this sum is as follows:

    - Direct contributions are estimated at € 95.7 billion with the following categories:

        i. Advertising revenue: € 19.2 billion

        ii. Paid downloads, subscriptions, and in-app purchases: € 6.5 billion. Mobile games represented 63% of this revenue.

        iii. Contract work: € 66.4 billion

        iv. Mobile commerce: € 3.6 billion is attributable to the app sector (out of a total of € 499 billion total revenue)

    - Indirect contributions: € 114 billion in indirect contributions due to additional business and household consumption triggered by app development.

    In terms of value-added, the app economy represented 0.7% of the European Union's GDP in 2021.

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[223] App stores refer to all app platforms including Google Play store, Apple App Store, Amazon app store, etc.
[224] See Appendix 4.2.
[225] Eurostat, Symmetric input-output table at basic prices. NACE R93, Sporting services and amusement and recreation services.
[226] Ibid.
[227] See Appendice 4.2.

246. In the United Kingdom, the direct revenues of the app economy in 2021 amounted to €38.4 billion.

247. Including direct and indirect contributions, the app economy generated €86.5 billion in revenue throughout all sectors of the UK's economy:

  - Direct contributions are estimated at €38.4 billion with the following categories:

    i.   Advertising revenue: €13.8 billion

    ii. Paid downloads, subscriptions, and in-app purchases: €2.1 billion. Mobile games represented 55% of this revenue.

    iii. Contract work: €21.3 billion.

    iv. Mobile commerce: €1.2 billion is attributable to the app sector.

    v.   Indirect contributions: €48 billion in indirect contributions due to additional business and household consumption triggered by app development.

  - In terms of value-added, the app economy represented 1.5% of the UK's GDP in 2021.

248. The total number of jobs generated throughout all sectors of the EU's economy by the app sector in 2021 is estimated at 1.4 million, and 400 000 in the UK.

249. **Europe is generally considered to benefit from highly skilled app developers and is home to a rich ecosystem of SMEs** in the app development sector. These include pure players and agencies that work for the outsourcing market. The UK has the most app development firms in absolute terms, but smaller countries such as Bulgaria, Poland, Romania, Estonia, Lithuania, and Croatia show a relative specialization in app development with two to five times more SMEs in the sector per unit GDP than the UK.

250. **Nearshoring contributes to the success of app development SMEs in Europe**. Notably, app development firms in above-mentioned relatively specialized countries often work for clients in for example Northern and Western Europe, leveraging their high-skilled, cost-competitive developers. Cost difference between these countries and developers in Northern or Western Europe can reach a factor of two to three. In addition, nearshoring benefits from low risk due to proximity (language, culture, time-zone). Indeed, **the remote delivery model works very well in the app development sector,** resulting in intra-European trade, benefits for both clients and developer firms, and more opportunities for SMEs and startups throughout Europe.

251. **Apps have permeated business models in several ways**. Many **firms integrated apps into the way they provide services to their clients**. For example, European airline and railways companies facilitate the booking and travel process with mobile apps. Moreover, specific features of mobile phones (geo-localization, accelerometer, camera, touch screen) have enabled the development of new services.

252. Furthermore, **pure players, companies that have built their activities only on apps, have confirmed their importance in the ecosystem**. Well-known examples are ride-hailing apps, which use geo-localization, and mobile games. Europe counts innovative mobile game developers and specialized firms such as Citymapper or Greenly, which are **transforming consumer behavior.**

253. In interviews conducted for this study, several app developers stated that future innovation in apps will not come from hardware developments but from the software side.

254. **The mobile app sector has been resilient during the Covid-19 pandemic.** Growth of the app sector decoupled from the evolution of GDP in the EU and the UK. While real GDP in the EU decreased in 2020 by 7.8%, and by 11.5% in the UK, the mobile app sector has seen an acceleration in its growth trajectory in 2020: In the EU, real growth of consumer spending on apps was 30% in 2020, and in Great Britain 29%. Comparison of pre-covid market estimates and 2021 growth of app store revenue suggests that the long-term growth trajectory is unaffected.

255. This resilience is related to the fact that the use of apps such as mobile games was not impaired by physical distancing requirements. Furthermore, mobile **apps have provided innovative solutions to deal with the crisis.** They contributed to the continuity of public services, social and business activities during lockdown periods. Teleworking apps allowed desk-type jobs in mainly the service sector mainly to pursue activities. In the health sector, covid-19 tracking-, vaccination- and testing-apps became the most downloaded medical apps in Europe in 2021. Apps for teleconsultation facilitated the provision of health services. Finally, the use of food delivery apps, such as Uber Eats or Deliveroo, increased dramatically during periods with strong physical distancing requirements, allowing restaurants to continue to operate.

256. **The pandemic has accelerated the digital transition in many sectors. Trends initiated during the Covid-19 pandemic are set to become permanent, as the crisis has shaped new ways of life.** For example, the increased use of telemedicine changed the publics' view on this practice: for example, in France between 2019 and 2020, the proportion of patients that had a positive opinion on telemedicine grew from 60% to 73%, and that of health professionals from 70% to 84%[228]. Along the same lines, teleworking was first used to adapt to the crisis, but its massive adoption during lockdowns has changed Europeans' perception on work and workplace organization.

257. App developers shared how they think **their solutions will continue to permeate more areas of our lives.** Areas where the use of mobile apps will further increase in Europe are hybrid events, education, and healthcare (online health records, connected medical devices, etc.). In addition, 5G networks now enable higher connection density which allows the use of many connected devices in the Internet of Things (IoT). **The value created by mobile apps in the European economy is expected to grow significantly in the years to come, and apps will continue to introduce innovations that will shape the future of European consumers and firms.**

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[228] Odoxa pour l'Agence du Numérique en Santé, Baromètre Vague 1 et 3

4 Appendices

4.1 Methodology to determine the size of the smartphone-only population

258. For each country in the European Union and for the UK, the size of the mobile-only population was estimated by taking the difference between the number of people having access to the internet via a mobile and via a fixed connection.

259. Data on the number of fixed broadband and mobile broadband subscriptions at the country level are provided by the ITU. We assumed that a mobile subscription provides a personal access to the internet (for one person) and a fixed subscription for the household. World Bank data on the size of households per country were used to estimate the number of people per country that have internet access via a fixed connection.

260. The penetration rate is calculated with respect to the population aged 10 to 80 years old, as we consider that this is the population likely to have a mobile phone[229].

261. Finally, we are interested at people who have only a mobile access to the internet and use a smartphone. At the European level, 75%[230] of mobile subscriptions concern smartphones. This final adjustment results in a smartphone-only population of 21% in the EU and 14% in the UK.

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[229] https://techcrunch.com/2016/05/19/the-average-age-for-a-child-getting-their-first-smartphone-is-now-10-3-years/
[230] Eurostat data

4.2   M-commerce revenue

262. Criteo reports that M-commerce represents 47% of e-commerce in the EMEA region in 2020[231]. By hypothesis, we assumed this share the same for 2021.

263. E-commerce revenue from consumers was obtained from Eurostat data gathered through the 2021 survey on 'ICT usage and e-commerce in enterprises'[232]. The data provides the share of turnover due to e-sales. Only 7% of total enterprise turnover in the EU stems from consumer e-spending (2020)[233]. These figures were combined with Eurostat's enterprise turnover data to obtain the value of e-commerce due to consumers. Total turnover in EU27 was € 13 394 billion in 2020, and in the UK, € 2527 billion in 2019 (Table 12).

264. An estimate for 2021 was obtained by assuming that enterprise turnover increased with the same growth rate as GDP. GDP projections for 2021 were used from the OECD (Table 12).

265. The value of total M-commerce revenue in 2021 was obtained by determining the consumer share of e-commerce equal to 3.3% = 47%*7% (Table 12).

Table 12.   Estimate of the value of M-commerce in the EU and in the UK in 2021

	2019	2020	2021	Source
Total output EU27 (billion euro, current)		13 394	15 154	Eurostat 2020 value (NAMA_10_GDP)
Total output UK (billion euro, current)	2 527	2 302	2 542	Eurostat 2019 value (NAMA_10_GDP)
Real growth EU27			5,2%	OECD
Real growth UK		-9,7%	6,9%	OECD
CPI EU27		1,05055	1,07583	OECD
CPI UK		1,00881	1,033041	OECD
Share E-commerce websites	7%	7%	7%	Eurostat, 2021 survey on 'ICT usage and e-commerce in enterprises'.
Share M-commerce	47%	47%	47%	Criteo
Value M-commerce (billion euro, current)		441	499	Calculated
Value M-commerce (billion euro, current)		76	84	Calculated

Source: Eurostat, OECD, Criteo

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[231]Criteo, november 2020 (App Commerce Booming in APAC | Criteo)
[232] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=E-commerce_statistics
[233] Note: The figure of 7% corresponds to the turnover from web sales. The turnover from EDI-type sales is not taken into account (source E-commerce statistics - Statistics Explained (europa.eu))
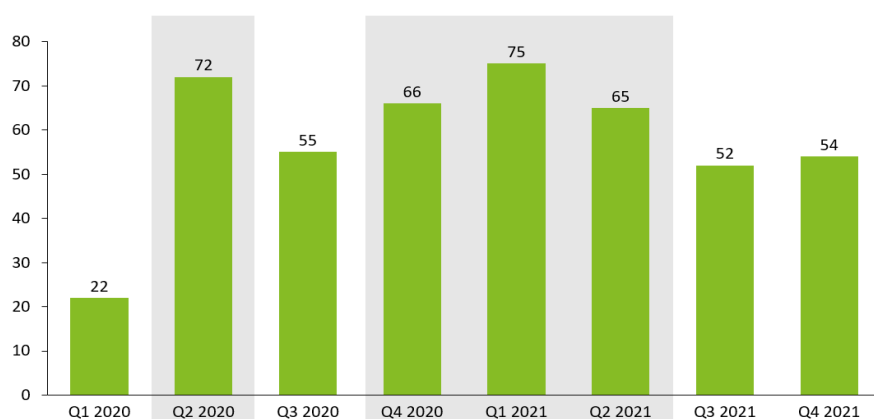
4.3   The Covid-19 Stringency Index

266. The Covid-19 stringency index is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest)[234]. If policies vary at the subnational level, the index shows the response level of the strictest subregion.

267. From the daily Stringency Index data, quarterly averages are calculated for each country of the area of interest (the EU + the UK). Then, these quarterly averages are weighted by the weight of the country in the GDP of the area to obtain an aggregate index for the EU and the UK.

268. The results highlighted 2 periods of high stringency measures. The first one occurred during the second quarter of 2020 and coincides with the outbreak of the virus in Europe. The second one lasted during three quarters, from Q4-2020 to Q2-2021.

Figure 42.   Quarterly average weighted Covid-19 stringency index by GDP EU+UK

Source: GDP data World Bank, Covid-19 stringency index https://ourworldindata.org/grapher/covid-stringency-index?tab=chart

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[234] Covid-19 Stringency Index (ourworldindata.org)

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