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Digital age

Mapping the contours of the platform economy

Automation, digitisation and platforms: implications for work and employment

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Introduction

The mid-1990s saw the emergence of a number of not-for profit as well as for profit platforms such as those promoting the second-hand market (for example eBay). Founded respectively in 2008 and 2009, Airbnb and Uber paved the way to the rapid growth of the platform economy. Nowadays the business model underlying the functioning of online platforms has expanded to many industries susceptible to technological transformation.

The main driver of this expansion is of technological nature, that is, the increasing pervasive global presence of computing and networking capacity. It is also believed that one of the drivers of this expansion was the financial and economic crisis, which has marked a shift from a professional or expert-based economic model to the peer-to peer (P2P) economy and has given momentum to the development of online platforms in a growing number of sectors (Olson and Kemp, 2015; Ranchordas, 2017). Other factors include the more reasonable costs (and potential for scalability) of the technology required for hosting such platforms, the more affordable options offered to consumers (compared to conventional practices in the market economy) and a general cultural shift in consumer behaviours and preferences, with a 'sharing mentality' taking hold especially among the younger generations (European Parliament, 2016). There is however evidence that also older generations are getting increasingly involved in this new economy (Nielsen, 2014).

Despite the many benefits and opportunities offered by the platform economy, its expansion also entails disruptions to the status quo, by creating new markets, displacing established businesses, while at the same time opening up new possibilities to both businesses and consumers. A 2015 study by Goldman Sachs flagged crowdfunding as 'potentially the most disruptive of all the new models of finance' (Goldman Sachs, 2015). More recently, ride-hailing platform Uber - which operates in 600 cities across 78 countries - has been rated by American Consumer News and Business Channel (CNBC) second on its list of 50 'disruptor' companies in the world in 2018 (CNBC, 2018; Bhuiyan, 2018). Here the term 'disruptor' is not used necessarily in negative terms but it refers to the innovation potential of platform companies.

The rapid growth of the platform economy also poses new regulatory challenges that policymakers are called to address - including taxation and employment status or treatment of those in platform work. The growth of the platform economy may require a more general approach to legislation and policies, from the reform of the organisation and financing of social welfare systems, to changes in other policy areas such as competition, copyright, and data protection. The wide range of implications of the expansion of online platforms explains the ever-increasing interest in this new phenomenon from the media, governments and researchers across various disciplines.

At EU level, the growing centrality of online platforms in the economy and society is acknowledged in the European Commission's *Digital Single Market Strategy* (European Commission, 2015). Several studies - including many commissioned by European institutions - have been conducted to assess the scale and wide-ranging implications of platforms' activities with a view to establishing the growth potential of the platform economy, the disruptions that it may cause and possible regulatory requirements. The use of different and at times overlapping terms, definitions, categorisation and measurements has, however, hampered these efforts and prevented from drawing a coherent and comprehensive picture.

Against this background, this paper seeks to map measurements, statistical tools and methodologies used to establish the scale and scope of this new technology-driven segment of the economy and to collect some empirical evidence of its impact and relevance. The starting point in this mapping is the definition and classification of platforms set out in Eurofound's conceptual framework on the digital age (Eurofound, 2018a).

Platforms can be defined as 'two-sided markets' (Rochet and Tirole, 2003) or 'multi-sided platforms' (Hagiu and Wright, 2015), referring to the specific aspect that there are at least two groups of users, whose interactions are being coordinated by platforms. The interaction between users can be on commercial or non-commercial basis. Eurofound defines platforms as 'digital networks that coordinate transactions in an algorithmic way' (Eurofound, 2018a; Eurofound, 2017a). Within this definition, the two distinctive elements of platforms are the network as a structured digital 'space' where goods or services can be offered or requested and a set of technology-enabled algorithms for matching supply and demand and coordinating transactions in an automated way. One fundamental feature of online platforms relates to the 'network effects', that is, platforms become more valuable as more users use them, which in turn favours market concentration, triggering a cycle of growth. At the same time, this makes it more difficult for new market entrants to get a hold in the new market.

The underlying assumption in this analysis is the same as in Eurofound's conceptual paper (Eurofound, 2018a); the introduction of digital technologies in an increasing number of sectors has the potential of transforming profoundly socio-economic structures as well as the nature of economic activity, work and employment. The effects can also go beyond, including public service provision.

This paper draws from a wide range of sources (surveys, journal articles, policy papers, media reports) in many different disciplines in consideration of the cross-cutting nature of the topic at hand. The focus is only on empirical studies providing estimates of the scale and size of the platform economy (in revenue terms, number of workers employed and active users in terms of clients and/or service provider, etc.) through surveys or other quantitative methods. Qualitative studies drawing solely from in-depth interviews, focus groups and similar methods are however out of the scope of this paper.

The paper is structured around four main chapters. It starts with the discussion on the variety of terms and definitions most commonly used to describe the platform economy, pointing to the definitional complexity and implications for the measurement of the platform economy. The second chapter reviews categorisations, classifications and taxonomies - as proposed in policy and academic papers - as these influence the measurements. The third chapter introduces the methodological approach used across the studies reviewed. This paper ends with some concluding remarks on the methods used across the identified studies. This concluding chapter is enriched by feedback provided by experts involved in research measuring the platform economy and key reflections on the measurement options available, the array of unresolved issues and the most promising methods on which to build on in future policy research.

Terminology in use and definitional complexity

There is no general consensus about which term or label is the most accurate to describe the platform economy (Codagnone et al, 2016b). Even 'platform' is a blurred and ill-defined term (Gillespie, 2010; Huws et al, 2017) in spite of its widespread use and, to date, there is no widely agreed definition (Martens, 2016).

A plethora of journalists, economists, and academics have written about the difficulties of defining the new and continuously evolving economy, which revolves around online platforms. A host of terms are used in academic and policy research - such as 'sharing economy' (Schor, 2017), 'collaborative economy' and/or 'collaborative consumption' (Botsman and Rogers, 2010; De Groen and Maselli, 2016; European Commission, 2016d; European Commission, 2016g; Nesta, 2015; Vaughan and Daverio, 2016;), 'access economy' or 'access-based consumption' (Bardhi and Eckhardt, 2016), 'on-demand economy' (Frenken et al, 2015; De Groen et al, 2017), 'gig economy' (Friedman, 2014; Manyka et al, 2016; Balaram et al, 2017; CIPD, 2017; BEIS, 2018) , 'crowd work' (Huws et al, 2017; Serfling, 2018; Serfling, 2019) and others. All these terms have been used with different nuances and emphasis, but they also overlap (Rinne, 2017). Regardless of the specific label in use, the scholarly debate around definitions is somehow polarised with, on the one hand, the proponents of very broad and inclusive definitions that capture the different and disparate manifestations and practices of this new platform-based economy (see for example, Botsman and Rogers, 2010; Botsman, 2013; Schor, 2014; Stephany, 2015; Habibi et al, 2017) and, on the other hand, scholars in favour of narrower and more rigorous definitions to make this phenomenon more amenable to be operationalised and studied empirically (see for example Belk, 2014; Cockayne,2016; Eckhard and Bardhi, 2016; Frenken and Schor, 2017). This has resulted in different conceptualisations and operationalisations of the phenomenon. It is not just a question of labelling the phenomenon with one term or another; it is the breath of activities and scope of what these terms contain that poses a challenge for the measurement of the platform economy.

The confusion around the terminology and the definitions is mirrored in the public discourse. Many of these terms are recurrent in the media but for many the true meaning is elusive. The Pew Research Center (Smith, 2016a) has explored the understanding of some of these terms - sharing economy, gig economy, crowdfunding - in a survey of 4,787 American adults and found that most respondents were not familiar with many of these terms including the most popular 'sharing economy'. Similarly, a German survey conducted by the industry association Bitkom in 2017 among 503 companies with more than 20 employees found that 62% of top managers had never heard of the terms 'platform economy', 'platform markets' or 'digital platforms' (Bitkom, 2017). A UK survey found that awareness of the term 'gig economy' is fairly low even among gig economy workers (CIPD, 2017). Drawing from semi-structured interviews with expert stakeholders in eight EU countries, another study revealed that respondents used the terms 'platform economy', 'gig economy' and 'sharing economy' in different ways, and the connotations changed depending on the form and nature of work associated with one term or the other (European Parliament, 2017a).

The proliferation of terms and definitions is a challenge in itself because it makes it difficult to fully understand and assess the impact of this economic activity - enabled by digital technologies - on the labour market, economy and society. The definitional complexity hinders the development of reliable measurements (Codaglione et al, 2016b) and it has led to different estimations of the scale of the platform economy with implications for policymaking (European Parliament, 2017a). This concern is also raised by Huws et al (2018) in relation to measurements of platform work, arguing that 'the lack of clear definitions translates into a lack of indicators and hence an absence of statistics that can demonstrate the numbers, characteristics and geographical, occupational and sectoral distribution of this portion of the workforce' (p.117). Along the same lines, Kenney and Zysman (2016) suggest that the debate around terms and definitions is not

trivial - 'how we label this transformation matters because the labels influence how we study, use, and regulate these digital platforms' (pp.61-62).

Sharing economy

In 2013, the Economist announced 'the rise of the sharing economy' (The Economist, 2013). Since then, academic research on the so-called sharing economy has expanded considerably but the term continues to be controversial and to lack analytic coherence (Schor, 2014). For some scholars, sharing economy platforms represent an alternative to market capitalism by empowering consumers and creating communities (Benkler, 2006), while others are less positive about this new phenomenon and argue that it can be distilled in 'rational capitalism' (Ravenelle, 2017) or 'crowd-based capitalism' (Sundararajan, 2016). In a similar vein, Gobble (2017) argues that the sharing economy is not so much about 'sharing' as many online platforms are, to varying degree, profit-driven. From their end, many platforms operating in the platform economy have conveniently embraced the term 'sharing economy' (Schor and Attwood-Charles, 2017) for the positive and 'feel good' halo emanating from this term. According to Schor (2014), that of sharing economy is more a self-identification than a definition, while other scholars (for example Belk, 2007) argue that sharing by definition does not involve financial remuneration. As suggested by Codagnone and Martens (2016) the majority of commercial platforms that have assumed the mantle of the sharing economy are not 'truly sharing'. In favour of this point of view, many of the platform companies are highly capitalised and, in some cases, very profitable. According to Accenture (2016), 'the top 15 public platform companies already represent $2.6 trillion in market capitalisation worldwide' (p.38).

In an effort to reconcile different views, Sundararajan (2016) suggests placing the platform economy 'on a continuum between gift economies and market economies, with some cases at both ends of the spectrum, and many more in between' (p.17). The example given is from the hospitality sector with platforms ranging from gift economy forms such as Couchsurfing to the more hybrid forms such as Airbnb to pure market economy platform forms as OneFineStay.

Although the term of sharing economy continues to be controversial, some national statistical offices have started using it in their surveys. In Europe, the UK Office for National Statistics (ONS) defines the sharing economy as 'the sharing of under-utilised assets through completing peer-to-peer transactions that are only available through digital intermediation, allowing parties to benefit from usage outside of the primary use of that asset' (ONS, 2017a, p.3). As part of the development of a conceptual framework, the UK ONS (2017a) identified three main types of activities that would fall under what they term 'sharing economy' - namely, property rental and access, peer-to-peer services and collaborative finance. Based on the ONS definition of sharing economy, a decision tree was also developed to help with the identification of sharing economy businesses in the business register. The ONS however warns that any definition is subjective and likely to evolve alongside the understanding of how to measure sharing economy activities.

Also in France, 'sharing economy' is the prevalent term. It was used in a broad survey exploring sharing economy habits (type of transactions, frequency, spending, etc.), which was carried out in October 2014 by market research firm TNS Sofres on behalf of the French Directorate General for Enterprises (Direction Général des Entreprises, DGE). As noted in a subsequent analysis of the data, a drawback of this survey was the lack of a clear definition of 'sharing economy' (DGE, 2016). This may have impacted on the estimates on declared total spending and income from all sharing economy transactions. In a follow-up analysis of the survey data (supplemented by other data sources), the sharing economy was defined as 'a community of individuals lending, renting, donating, sharing, swapping and buying (and selling) goods or services' (DGE, 2016, p.4).

Overseas, Statistics Canada also use the term of sharing economy to describe 'an activity facilitated by digital platforms where people rent their skills (such as, driving or computer skills) and make their resources (such as properties or cars) available for money' (Statistics Canada,

2017, p.1). The use of this term by Statistics Canada has been subject to criticisms on the basis that the risk is to distort public discourse and move it away from the negative implications of on-demand service platforms or low-cost lodging sites (Israel, 2017).
Beyond the scholarly and policy debate around the use of this highly contested term, the question remains 'what types of activities does the term actually encompass?'. Academic studies looking into the broader implications of this new economy have settled on more or less broad definitions of sharing economy, depending on the specific research purpose. Market research promoting the sharing economy concept to different audiences tend to define the phenomenon in very broad terms, to encompass peer-to-peer and business-to-peer platforms as well as market and non-market initiatives (see for example Owyang et al, 2014).

To better define the sharing economy construct and distinguish it from different, albeit related, economic forms, Frenken and colleagues (2015) developed a conceptual framework, whereby the notion of 'idle capacity' is at the core of the sharing economy definition. According to the authors, the sharing economy is characterised by peer-to-peer interaction, temporary access and physical goods, and it is distinct from other platform-based practices, namely on-demand personal services (on-demand economy), peers selling goods to each other (second hand market) and renting goods from a company via business-to-consumers platforms (product-service economy) (Frenken and Schor, 2017). A similar restrictive definition of sharing economy is used in market research on the size of this new economy; for example, ING international survey of almost 15,000 consumers across 15 countries[1] confines the phenomenon to capital or goods platforms and describes the sharing economy 'as utilising goods (such as a car, house or lawnmower) that would otherwise be idle or unused' (ING International, 2015).

Collaborative economy

At EU level, EU institutions have extensively used the term 'collaborative economy' and/or 'sharing economy' in their policy documents (European Economic and Social Committee, 2014; Committee of the Regions, 2015; European Commission, 2015a, 2015b, 2016b; 2016c; European Parliament, 2015, 2017a, 2017b; Netherlands EU Presidency, 2016). The European Commission has been using these terms interchangeably although more recently the recurring term is 'collaborative economy' (European Commission, 2016b; 2016c). In the 2016 Communication *A European agenda for the collaborative economy*, the European Commission provides a definition of the collaborative economy, which includes both for profit and not-for profit platforms:

> *the term 'collaborative economy' refers to business models where activities are facilitated by collaborative platforms that create an open marketplace for the temporary usage of goods or services often provided by private individuals. The collaborative economy involves three categories of actors: (i) service providers who share assets, resources, time and/or skills — these can be private individuals offering services on an occasional basis ('peers') or service providers acting in their professional capacity ("professional services providers"); (ii) users of these; and (iii) intermediaries that connect — via an online platform — providers with users and that facilitate transactions between them ('collaborative platforms'). Collaborative economy transactions generally*

[1] Australia, Austria, Belgium, Czech Republic, France, Germany, Italy, Luxembourg, the Netherlands, Poland, Romania, Spain, Turkey, United Kingdom, and US.

> *do not involve a change of ownership and can be carried out for profit or not-for-profit.*
>
> European Commission, 2016b, p.3

The above definition can easily embrace a wide and disparate range of activities and covers the growing number of platforms that have entered sectors such as transport and accommodation activities. This definition is sufficiently open to reflect the evolving nature of the platform economy dominated by young companies, some of which growing very fast and many others becoming inactive and disappearing quickly.

It also explicitly refers to platform activities not involving a change of ownership, thus suggesting a demarcation between common online selling or e-commerce websites and online platforms, which can be either commercially or non-commercially driven. This definition of collaborative economy however excludes social media and networking platforms. Referring to this definition, Drahokoupil and Fabo (2016a) argue that 'such a broad definition gives us very little to work with in terms of understanding the impact of this new economy on society' (pp.1-2).

In another study carried out by PwC for the European Commission (DG Grow) exploring the growth of the collaborative economy in the EU, the term collaborative economy covers both consumer and business activities. In the study the term designates organisations using 'online platforms to connect distributed groups of individuals and enterprises and enable them to share access to their assets, resources, time and skills on a scale that was not possible before' (Vaughan and Daverio, 2016, p.32). Within this definition, the study distinguishes a range of economic activities or sectors, namely peer-to-peer accommodation, peer-to-peer transportation, on-demand household and professional services and collaborative finance. It should be noted that PwC uses the term of 'sharing economy' in their own survey-based studies exploring the platform economy (Hawksworth and Vaughan, 2014; PwC, 2018).

As part of the effort of understanding the role and impact of online platforms, the European Commission also conducted in 2016 two Eurobarometer surveys. The Flash Eurobarometer survey used the term 'collaborative economy' and 'collaborative platforms' defined for the interviewees as 'internet-based tools that enable transactions between people providing and using a service. They can be used for a wide range of services, from renting accommodation and car sharing to small household jobs' (European Commission, 2016e, p.2). The special Eurobarometer survey referred instead to online platforms as 'search engines, online social networks and online marketplaces' (European Commission, 2016f, p.2).

A more restrictive connotation of the term collaborative economy is used in a review prepared for DG Grow exploring the direct and indirect impact of the collaborative economy on the labour market (De Groen and Maselli, 2016). As the labour aspects of online platforms are investigated in this research, the focus is exclusively on labour platforms, thus excluding capital or asset-sharing platforms that are generally considered part and parcel of the collaborative economy.

Albeit acknowledging the more customary use of the term collaborative or sharing economy in EU policy documents, a 2017 exploratory study commissioned by DG Just settles on the notion of 'peer-to-peer markets facilitated by online platforms' to refer to selling or buying goods, sharing or renting goods, sharing or renting accommodation and hiring people to do odd jobs (European Commission, 2017).

Collaborative consumption

According to a 2016 study conducted by Nesta for DG Grow (European Commission, 2016g), the EC definition of collaborative economy - as set out in the 2016 EC Communication - is a reminiscence of a term popularised by Botsman and Rogers (2010) and known as 'collaborative consumption'. The latter term denotes systems that reinvent 'traditional market behaviours -

renting, lending, swapping, sharing, bartering, gifting - in ways and on a scale not possible before the internet' and makes a differentiation into three broad categories: 'product service systems' (access to products or services without need for owning the assets), 'redistribution markets' (re-allocation of goods from where they are no longer needed to someone/somewhere they are needed), and 'collaborative lifestyles' (exchange of intangible assets like skills and time) (Rading Heyman, 2017). The core principles underpinning the definition of 'collaborative consumption' include critical mass, untapped values of underutilised resources ('idling capacity'), belief in the commons, and trust in strangers.

Table 1: Three distinct systems within collaborative consumption

Terms	Description	Examples
Product service systems	These refer to professionalised services for underutilised assets. At the other end of the spectrum of traditional, physical product sales. Users pay for the product's temporary use.	Zipcar, Netflix, BMW's Drive Now
Redistribution markets	Used or previously owned products are reallocated to where they are needed. This includes the private selling and buying of things through online platforms.	eBay, threadUp
Collaborative lifestyles	Exchanging or trading assets and resources like products, time, space, skills, food, money, etc. from and/or with peers.	Uber, Helpling, TaskRabbit

Source: Botsman and Rogers, 2010

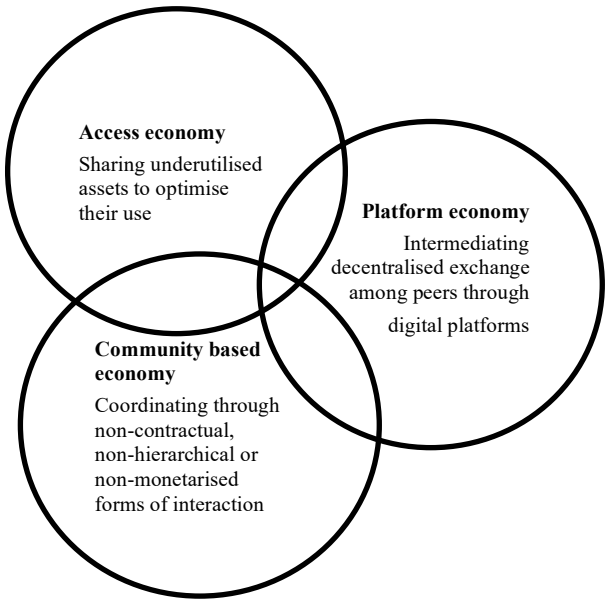
Belk (2014) argues against Botsman and Rogers' definition of collaborative consumption, which is too broad, mixing marketplace exchange, gift giving, and sharing. For Belk (2014) collaborative consumption is about 'the acquisition and distribution of a resource for a fee or other compensation' (p.1597), thus excluding activities where there is no compensation involved. Yet another definition of collaborative consumption is offered by Hamari and colleagues (2015) in their survey-based study on motivations: 'an economic model based on sharing, swapping, bartering, trading or renting access to products within a community as opposed to personal ownership' (p.2053).

Platform economy

The term 'platform economy' has recently gained currency in the public and policy discourse and among scholars for its more neutral connotations (Schor, 2017; Farrell and Greig, 2016; Kenney and Zysman, 2016; European Parliament, 2017a, 2017b; EU-OSHA, 2017; Fabo et al, 2017; Schmidt, 2017; Eurofound, 2018b). The 2017 European Parliament's opinion on the *European agenda for the collaborative economy* called for the use of a more coherent terminology and proposed the term 'platform economy' as an 'objective description' of this new developing

economy (European Parliament, 2017b). In a recent study commissioned by the European Parliament, interviewed stakeholders considered that the more generic term 'platform economy' better encompasses the span of activities involved (European Parliament, 2017a).
In a similar vein, Drahokoupil and Fabo (2016a) argue against the use of misleading and normatively biased terms such as 'collaborative economy' and favour the more neutral 'platform economy' as the best fit to describe this digitally-driven phenomenon. One of the assumptions is that the platform economy is an extension of the market economy (powered by the use of the technology). For Schor (2017) the term 'platform economy' designates 'for profit companies that use platforms and apps, crowdsource ratings and reputational data, and use digital technology to organise exchanges' (p.267). Drawing from a broad review of the literature on definitions, Acquier and colleagues (2017) propose a conceptual framework whereby the platform economy is referred to as the 'intermediation of decentralised exchanges among peers through digital platforms' (p.4) and is one of the three organising cores of the broader sharing economy.

Figure 1: Three organising cores of the sharing economy definition



Source: Acquier et al, 2017.

Not unlike other terms, that of 'platform economy' is used inconsistently and at times as a synonym of 'platform work' (DG IPOL, 2017; European Commission, 2018a); this latter term typically refers only to labour or work platforms typically excluding capital platforms, sales platforms and various non-commercial platforms. Eurofound defines platform work as 'a form of employment that uses an online platform to enable organisations or individuals to access other organisations or individuals to solve problems or to provide services in exchange for payment' (Eurofound, 2018b, p.9). Platform work may be delivered either online or locally (in person).
For Eurofound, the broader phenomenon termed as 'platform economy' goes beyond labour platforms and is inclusive of a broad range of platform activities in different sectors[2]. Also the EU

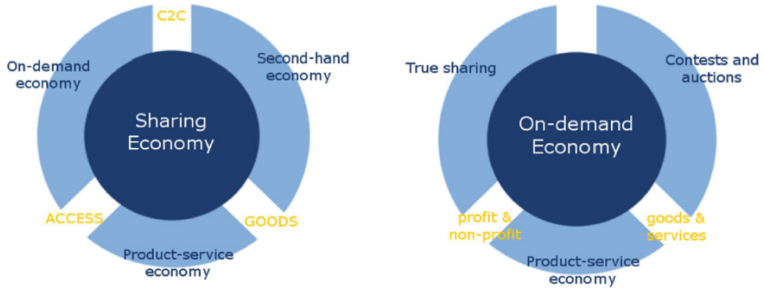
[2] See platform economy sectors classification in Eurofound's online platform economy repository available at https://www.eurofound.europa.eu/data/platform-economy/typology

agency for health and safety at work (EU-OSHA) has a broad understanding of the platform economy, which is considered 'as a part of the broader digital economy, characterised by the role played by online platforms in various parts of the economic "value chain"' (2017, p.10). It is also understood that this has an impact on the provision of labour, which raises important regulatory concerns (EU-OSHA, 2017).

On-demand economy

The term 'on-demand economy' is recurrent in discussions on the labour implications of work mediated through platforms. In public debates the on-demand economy is generally discussed as an outcome of digitalisation. Eurofound (2018d) makes use of the term 'work on demand' to refer to 'non-standard form of work', which is often associated with less favourable working conditions and lower level of social security than the standard forms. These forms of work can be found in both the offline and online economy. Frenken and colleagues (2015) argue that the on-demand economy is a distinct economic form from the sharing economy. While the sharing economy is understood as characterised by peer-to- peer intermediation, temporary access to goods, and greater efficiency in the use of physical assets, the on-demand economy refers to those platforms enabling individuals to deliver each other a service (for example TaskRabbit, Uber). Adapting from Frenken et al's conceptualisation, Maselli and colleagues (2016) reverse the perspective and place the on-demand economy as the overarching concept, which comprises three components: true sharing (temporary access to underutilised assets between consumers), auctions or contests (service provision via a contests or auctions), and product-service economy (business to consumer exchange). The notion of underutilised assets in the Frenken et al's initial conceptual framework (as reproduced on the left-hand side of Figure 2) is expanded to cover both goods and services as well as for profit and not-for profit platforms.

Figure 2: Conceptual framework: sharing versus on-demand economy



Source: Frenken et al, 2015 ; Maselli et al, 2016.

Equally broad is the definition of on-demand economy applied in a study prepared by policy research centre CEPS for the European Economic and Social Committee (EESC) on the impact of platforms on employment and industrial relations (De Groen et al, 2017). Here, the on-demand economy is defined as 'the new phenomenon of digital peer-to-peer intermediation that provides consumers temporary access to one another's goods and/or services without owning them' (p.9). This intermediation occurs via online platforms defined by the authors as digital providers of the peer-to-peer arrangements - usually existing in a form of website or software application for smart phones or tablets. The authors argue that the use of a broad definition reflects the wide-ranging implications of this new economy in terms of restructuring of labour relations, beyond the direct impact on people working for platforms. One argument is that traditional and established businesses and industries may at some stage propose different arrangements to their employees in the face of increasing competition from platforms and even move to the platform

business model and outsource some of their activities. Even broader is the definition of on-demand economy in a US survey conducted in 2015 by the TIME magazine, Burson-Marsteller and the Aspen Institute Future of Work Initiative measuring the extent of engagement across the whole population in a broad range of platform-based activities including selling or market platforms such as eBay and Etsy (Steinmetz, 2016).

Gig economy or gig work

The 'gig economy' is another controversial term and definitions vary widely. It ranges from very broad definitions including contingent work of fixed duration (that is, including the offline economy) (Staffing Industry Analysts, 2016) or covering ways of earning an income by either trading goods or services via online platforms (Gardiner, 2015; Jesnes et al, 2016) to narrower definitions designating limited-duration and assigned-based work facilitated by online platforms or apps. Within the latter narrower definition, there are many nuances, which have given rise to an array of other, albeit related, terms and definitions.

Particularly in the UK and US, the term 'gig economy' is generally used in a broad sense to refer to digital platforms mediating jobs performed online and delivered remotely as well as those mediating jobs or tasks delivered physically on location. For example, the survey carried out by the UK's Chartered Institute for Personnel and Development (CIPD) defines gig economy workers as those who perform activities such as 'performing tasks online, providing transport or locally delivering food or other goods' (CIPD, 2017, p.4). The survey also asked respondents whether they used online sharing platforms for buying and selling things (for example eBay, Etsy) or renting their property (for example, Airbnb, HomeAway), but these do not fall within the given definition of 'gig workers'.

Also the UK governmental Department for Business, Energy and Industrial Strategy (BEIS) uses the term gig economy in their surveys (2018) but it describes it in more generic terms as 'the exchange of labour for money between individuals or companies via digital platforms that actively facilitate matching between providers and customers, on a short-term and payment by task basis' (p.4). This definition excludes agency work, matching services (for example LinkedIn), online retail (for example eBay) and accommodation services (for example Airbnb) and overall it closely aligns with Eurfound's definition of platform work.

Equally broad is the definition of gig economy in the UK survey by the Action and Research Centre (RSA), which is inclusive of labour-based platforms to find small tasks, sometimes completed immediately after request (on-demand) (Balaram et al, 2017, p.10). The definition covers both platform-mediated work performed online from anywhere and platform-mediated work carried out locally. In a US study, Harris and Krueger (2015) also refer to gig economy as involving the use of an internet-based app to match customers to workers who perform discrete personal tasks.

A different approach is followed by McKinsey Global Institute in their online panel survey measuring the independent workforce engaging in the gig economy in France, Germany, Spain, Sweden, the UK and US to (McKinsey Global Institute, 2016). The focus is much broader as the survey measures the scale of independent work mediated by digital platforms, allowing workers to sell goods or lease assets or provide labour services.

Crowd work(ing)

Eurofound's conceptual framework on the digital age points to the difference between the online provision of labour services via platforms sometimes labelled 'crowd work' and the physical delivery of labour services coordinated via online platforms referred to as 'gig economy' (Eurofound, 2018b). The term 'crowd work' typically refers to labour platforms outsourcing a job or a task to an undefined group of people through an open call via the internet (Howe, 2006; ILO,

2018). One specific form of crowd work is micro tasks whereby the tasks are subdivided into smaller units and paid a small amount - a typical example is Amazon Mechanical Turk (AMT) (ILO, 2018).

In a global study, Kuek et al (2015) make use of an alternative term, that is 'online outsourcing', which encompasses microwork whereby projects or tasks are broken down into micro tasks, and online freelancing requiring higher level of expertise than microwork (Kuek et al, 2015).

Hensel et al (2016) equates crowdsourcing with crowd work, which may be misleading as crowdsourcing is a broader term including voluntary participation of people (without necessarily a remuneration) in the production of open source products or content (as exemplified by Wikipedia). By contrast, crowd work is used exclusively for paid activities, which according to Bonin and Rinne (2017) are undertaken online. There are, however, broader definitions of crowd work as in a recent study - partly funded by the German Ministry for Labour and Social Affairs (Serfling, 2018; Serfling, 2019) - as part of the 'crowdworking monitor' research project (Serfling, 2018). This study defines crowd workers as 'natural persons who earn at least part of their income by completing paid temporary work assignments allocated through internet platforms or smartphone apps, which are implemented either online or offline' (p.7). This definition however excludes internal crowd working. Similarly, European research conducted by the University of Hertfordshire - in association with the Foundation for European Progressive Studies (FEPS) and UNI Europa - refers to crowd work as paid work via online platforms that can be performed locally or remotely via the internet (Huws et al, 2017). Also EU-OSHA (2015) uses the term crowd work to refer to 'paid work organised through online labour exchanges' (p.1), which covers a range of work practices involving high-skilled to routine micro tasks and that can be carried out online or offline on location.

Crowd work is also known as 'crowd employment', which had been used by Eurofound in the past to capture the click-work originally associated with the concept (Eurofound, 2015). As the phenomenon has changed over time and now encompasses many more types of tasks, Eurofound has discontinued the use of this term and adopted the more encompassing term 'platform work' (see definition on page 10 of this working paper).

Overview of terms and definitions used in empirical research

The table below lists the terms used in the empirical studies identified for this review as well as the definitions associated with each term. Each term can be defined more or less broadly.

Table 2: Examples of terms and definitions used in empirical research

Source	Term	Definition
Hawksworth and Vaughan, 2014 (PWC)	Sharing economy	'the sharing economy uses digital platforms to allow customers to have access to, rather than ownership of, tangible and intangible assets.'
Nielsen, 2014	Sharing economy	'share economy … in which people around the world are leveraging the unused capacity of things they already own or services they can provide by leveraging them for a profit.'
ING International, 2015	Sharing economy	'utilising goods (such as a car, house or lawnmower) that would otherwise be idle or unused.'

Source	Term	Definition
Olson and Kemp, 2015 (Piper Jaffray)	Sharing economy	'A sharing economy is a market whereby: • users are individuals, businesses, or machines • there is excess supply of an asset or skillset and sharing creates economic benefit • for both the sharer and the user • the internet provides means for communication and coordination of the sharing'
PWC, 2015	Sharing economy	'Sharing economies allow individuals and groups to make money from underused assets. In this way, physical assets are shared as services.'
DGE, 2016	Sharing economy	'A community of individuals lending, renting, donating, sharing, swapping and buying (and selling) goods or services.'
Jesnes et al, 2016	Sharing economy	It comprises work platforms, where one's labour is put at the disposal of others' and capital platforms, where under-utilised resources are put at the disposal of others
Statens Offentliga Utredningar (SOU), 2017	Sharing economy	Sharing economy in which individuals provide other individuals who are not their acquaintance, access to underutilised resources, property as well as services, against or without payment through digital platforms or analogue forums.
Statistics Canada, 2017	Sharing economy	'an activity facilitated by digital platforms where people rent their skills (such as, driving or computer skills) and make their resources (such as properties or cars) available for money.'
UK Office for National Statistics (ONS), 2017	Sharing economy	'sharing of under-utilised assets through completing peer-to-peer transactions that are only available through digital intermediation, allowing parties to benefit from usage outside of the primary use of that asset.'
Owyang et al, 2014 (Vision critical and crowd companies)	Collaborative economy	No specific definition provided.
Stokes et al, 2014 (Nesta)	Collaborative economy	'it involves using internet technologies to connect distributed groups of people make better use of goods, skills and other useful things.' Also defined as having five traits: 'enabled by internet technologies; connecting distributed networks of people and/or assets; making use of the idling capacity of tangible and intangible assets; meaningful interactions and trust; and embracing openness, inclusivity and the commons'.
Nesta, 2015	Collaborative economy	Idem as above (see Stokes et al, 2014).

Source	Term	Definition
Vaughan and Daverio, 2016 (research commissioned by European Commission's DG Grow to PWC)	Collaborative economy	'collaborative economy organisations use online platforms to connect distributed groups of individuals and enterprises and enable them to share access to their assets, resources, time and skills on a scale that was not possible before'.
European Commission, 2016e (Flash Eurobarometer 438)	Collaborative economy	'collaborative platforms are Internet-based tools that enable transactions between people providing and using a service. They can be used for a wide range of services, from renting accommodation and car sharing to small household jobs. These platforms are part of the wider phenomenon of the so-called 'collaborative economy', which has the potential to provide opportunities for Europe to create growth, jobs and benefits for consumers'.
European Commission, 2016g (research commissioned by European Commission's DG Grow to Nesta)	Collaborative economy	'enabled by internet technologies, connecting distributed networks of people and/or assets, making use of the idling capacity of tangible and intangible assets, encouraging meaningful interactions and trust, and embracing openness, inclusivity and the commons.'
De Groen and Maselli, 2016 (research commissioned by the European Commission to CEPS)	Collaborative economy	Research only considers 'online collaborative platforms in which labour is an important component and remuneration takes place in hard currencies'.
European Commission, 2018b (research commissioned by European Commission's DG Grow to Technopolis, Trinomics, and VVA Consulting)	Collaborative economy	'Business models meeting all criteria simultaneously: • Business transactions take place between three parties – the service provider, the online platform and the customer; • Service providers offer access to their goods, services or resources on a temporary basis; • The goods, services or resources offered by the service provider are otherwise unused; • The goods, services and resources are offered with or without compensation (i.e. for profit or non-profit/sharing)'
European Commission, 2017 (research commissioned by European Commission's DG Just to VVA, Milieu and GFK)	Peer-to-peer online platform market	'(Re) Selling or Buying of Goods - like eBay; Sharing or Renting of Goods – like Peerby; Sharing or Renting Accommodation – like Airbnb; Sharing or Hiring rides – like BlaBlaCar or Uber; and e) Hiring people to do Odd Jobs – like Yoopies.'

Source	Term	Definition
Farrell and Greig, 2016 (JPMorgan Chase & Co. Institute)	Platform economy	'platform economy as economic activities involving an online intermediary that provides a platform by which independent workers or sellers can sell a discrete service or good to customers. Labor platforms, such as Uber or TaskRabbit, connect customers with freelance or contingent workers who perform discrete projects or assignments. Capital platforms, such as eBay or Airbnb, connect customers with individuals who rent assets or sell goods peer-to-peer.'
Evans and Gawer, 2016	Platform economy	No specific definition provided. Definitions were given for each platform type investigated (that is, transaction, innovation, integrated, and investment platforms).
Fabo et al, 2017	Platform economy	No specific definition provided. 'Platforms can be classified in three main types: transportation platforms, which can be further divided into platforms that either focus on the transportation of people or goods; platforms trading online services (e.g. design, IT services); and platforms trading offline, local services (e.g. delivery or housework).'
Pesole et al, 2018 (JRC's COLLEEM survey)	Digital labour platforms	'Digital labour platforms are defined as digital networks that coordinate labour service transactions in an algorithmic way.'
De Groen et al, 2017 (research commissioned by the EESC to CEPS)	On-demand economy	'the new phenomenon of digital peer-to-peer intermediation that provides consumers temporary access to one another's goods and/or services without owning them'
Burston-Marsteller, the Aspen Institute and TIME, 2015	On-demand economy	'… offering ride sharing, accommodations, food delivery, or other such platform-enabled services.'
Harris and Krueger, 2015	Gig economy	'The online gig economy involves the use of an internet-based app to match customers to workers who perform discrete personal tasks, such as driving a passenger from point A to point B, or delivering a meal to a customer's house. Note that this definition excludes intermediaries that facilitate the sale of goods and impersonal services to customers, such as TeacherPayTeachers.com, a Web site where teachers sell lesson plans and other non-personal services to other teachers, and Etsy.com, a Web site where individuals sell handmade or vintage goods. It also excludes

Source	Term	Definition
		Airbnb, a Web site where people can rent apartments, houses, and other accommodations.'
Staffing Industry Analysts (SIA), 2015	Gig economy	'the gig economy includes any contingent work of a fixed duration such as temporary work and independent contracting.' 'The main categories of workers comprising the current US Contingent/Gig Workforce … are Temporary Workers Assigned through a Staffi ng Agency; Human Cloud Workers managed through an online platform; Independent Contractors/Self Employed Workers; Temporary Employees Sourced Directly; and Statement of Work (SOW) Consultants Employed by a Consulting Firm.'
McKinsey Global Institute, 2016	Gig economy	Digital platforms for independent work, comprising platforms for people to sell goods or lease assets or provide labour service.
Kässi and Lehdonvirta, 2016[3]	(online) Gig economy	'… includes platforms for online freelancing, microwork, and similar activities, but excludes platforms for local gigs, such as Uber and Deliveroo.'
CIPD, 2017	Gig economy	Trading time and skills through online platforms (websites or apps), providing a service to a third party as a form of paid employment.
Balaram et al, 2017	Gig economy	'the trend of using online platforms to find small jobs, sometimes completed immediately after request (essentially, on-demand).'
BEIS, 2018	Gig economy	'involving exchange of labour for money between individuals or companies via digital platforms that actively facilitate matching between providers and customers, on a short-term and payment by task basis.'
Huws et al, 2017	Crowd work	'having ever sold own labour via an online platform'.
Serfling, 2018, 2019	Crowd work	'the completion of paid, short-term tasks conveyed via internet platforms or smartphone apps.'
Kuek et al, 2015	Online outsourcing	'contracting of third-party workers and providers (often overseas) to supply services or perform tasks via internet-based marketplaces or platforms. These technology-mediated channels allow clients to outsource their paid work to a large, distributed, global labour pool of remote workers, to enable

[3] See Kässi and Lehdonvirta (2018) for the updated version of this publication.

Source	Term	Definition
		performance, coordination, quality control, delivery, and payment of such services online.' 'This definition also encompasses two major segments: • microwork, where projects and tasks are broken down into microtasks that can be completed in seconds or minutes. • online freelancing, where clients contract professional services to distributed third-party workers.'

Note: terms and definitions used in policy documents, theoretical and discussion papers are not included in the above listing.

Source: Author's own compilation.

Platform categorisation, typologies and taxonomies

Estimates on the scale and impact of the platform economy are very different across studies depending not only on the definitions used but also the variety of platform activities covered and the way they are grouped or categorised. Platform categorisation can be either broad or very specific. The differentiation of platforms can be made according to different criteria, for example, platform activity, revenue model, type of provider, market orientation, type of commodity traded, nature of the transaction and others. The review of platform categorisations and classifications presented here is not exhaustive and offers only a partial representation of how platforms work. Online platforms are complex eco-systems with business models that change very rapidly. There are a lot of nuances that categorisations and classifications may fail to capture.

When classifying platforms and drawing typologies/taxonomies, one issue is the unclear - or at best fluid - boundaries between platform activities and what is to be considered a platform. For example, the public consultation launched by the European Commission in 2015 provided a taxonomy of online platforms covering a disparate range of activities and diverse business models. The inclusion of online intermediaries and service providers (for example Netflix) was somewhat contested by respondents in the public consultation for making the definition of 'online platforms' too broad and potentially complicating already complex regulatory frameworks (European Commission, 2016a).

Table 3: Taxonomy of online platforms used in EC public consultation

Type of online platform	Revenue model	Example
Search engines and specialised search tools	Advertisement	Google, Bing, Kelkoo, Twenga, Google Local, TripAdvisor, Yelp
Location-based business directories or maps	Advertisement	Google or Bing maps
News aggregators	Advertisement	Google News
Online market places	Transaction fees	Amazon, eBay, Allegro, Booking.com
Music/video sharing platforms	Subscription, advertisement	Deezer, Spotify, Netflix, Canalplay, Apple TV, YouTube
Payment systems	Transaction fees	Paypal, Apple Pay
Social networks	Advertisement, subscription	Facebook, LinkedIn, Twitter
App Stores	Transaction fees	Google Play, Apple app store
Collaborative economy platforms	Transaction fees	Airbnb, Uber, Taskrabbit, BlaBlaCar

Source: European Commission's public consultation on platforms, 2015-2016.

The above categorisation also includes companies – for example, Google, Apple, Facebook, and Amazon - that operate both matching platforms and so-called innovation platforms serving as a foundation for the development of complementary technologies, products or services.

This type of platform is called 'integrated platform' in the categorisation proposed by the Centre for Global Enterprise (Evans and Gawer, 2016). Besides the integrated platforms, Evans and Gawer's categorisation separates online platforms into other three groups: transaction platforms, innovation platforms and investment platforms. Transaction platforms refer to a technology, product or service acting as an intermediary, which facilitates exchange or transactions between

different users, buyers, or suppliers (for example Airbnb, Uber, eBay, etc.); innovation platforms (Microsoft, Oracle, Intel, SAP and Salesforce) serve as a foundation on top of which other companies develop complementary technologies; and finally, investment platforms are not platforms *per se* but consist of companies that have developed a platform portfolio strategy and act as a holding company, active platform investor or both (for example, Priceline Group and IAC Interactive in the US, Softbank in Japan, Naspers in South Africa, and Rocket Internet in Germany).

A recent study prepared for DG Just (European Commission, 2017) looking into consumer issues arising from the growth of peer-to-peer platforms differentiates platforms on the basis of the revenue model used to cover their costs and generate profits. These revenue models range from advertising, paid subscriptions, renting hosting space, charging an entry fee, or transaction fees, or combinations of the above. These diverse revenue models are collapsed into three main types according to whether the platforms:

- provide only hosting offers without becoming involved in the peer-to-peer transaction;
- actively administer the matching of demand and supply, thus influencing the peer-to-peer transactions without however controlling it;
- set one or more of the contractual terms of the peer-to-peer transaction, conduct payment transactions and assume (partial) responsibility for the performance of the transaction.

The above distinction gives an indication of the level of control the platforms exert over the transactions they mediate. Within peer-to-peer online platforms, the study only focuses on platform activities in specific areas, notably selling or buying goods, sharing and renting of goods, sharing or renting accommodation, sharing or hiring a ride, hiring other people to do odd jobs.

Another platform categorisation is proposed by Martin (2016), which emphasises the different products or services traded online and covers mainly (but not exclusively) peer-to-peer platforms. Martin (2016) separates platforms into four categories corresponding to so-called 'groups of innovations', namely accommodation sharing, car and ride-sharing, peer-to-peer employment platforms and peer-to-peer platforms for sharing and circulating resources. According to the author, each group of innovation interacts with existing 'regimes', for example car and ride sharing platforms seek to introduce an alternative business model to the more conventional business model in the mobility/transportation sector.

Table 4: Martin's platform categorisation (groups of innovators), 2016

Groups of innovation	Description	Platform example
Accommodation sharing platforms	A peer-to-peer marketplace for people to rent out residential accommodation (including their homes) on a short term basis	Airbnb
	An online community of people who offer free short-term accommodation to fellow community members	Couchsurfing
Car and ride sharing platforms	Peer-to-peer car rental platforms	Easy Car Club and Relayrides
	Peer-to-peer platforms providing taxi and ridesharing services	Lyft and Uber

Groups of innovation	Description	Platform example
	A business-to-consumer vehicle rental platform offering per hour rental of vehicles located within communities	Zipcar
Peer-to-peer employment markets	Peer-to-peer marketplaces for micro employment opportunities (i.e. piecemeal contracts or hourly work)	PeoplePerHour and Taskrabbit
Peer-to-peer platforms for sharing and circulating resources	A peer-to-peer platform which enables people to freely and directly give unwanted and underutilised items to others in their local area	Freecycle
	Peer-to-peer platforms which enable communities to freely share durables goods, skills and knowledge	Peerby and Streetbank
	An online marketplace for people to sell their second-hand items to others	Ebay

Source: Martin, 2016.

Many studies typically make a differentiation of platforms according to whether the traded commodity is goods/assets or labour. Capital platforms facilitate the selling of goods or renting of assets while labour platforms match supply and demand for paid labour. A US study based on bank transactions data carried out by JP Morgan Chase & Co. Institute (Farrell and Greig, 2016) makes precisely this distinction to analyse the impact of the platform economy in terms of earned income through selected platforms. In the study, the platform economy is understood as inclusive of peer-to-peer capital platforms on which participants sell goods or rent assets (for example eBay and Airbnb) and labour platforms (for example Uber or TaskRabbit), on which participants sell time or skills. The distinction between capital and labour platforms makes it possible to distinguish the active (labour-based) income from the passive (asset-based) income.
In a 2018 update, Farrell et al (2018) built on the initial differentiation between capital and labour platforms and further disaggregated the platform economy into four sectors:

- transportation sector in which drivers transport people or goods;
- non-transport work sector in which workers offer a growing variety of services including dog walking, home repair, telemedicine, and many others;
- the selling sector in which independent sellers of goods find buyers through online marketplaces;
- the leasing sector, in which leasors find leasees to rent homes, parking spaces, and many other types of assets.

Another US survey conducted by the Pew Research Centre (Smith, 2016b) makes the distinction between digital work platforms allowing users to earn money from their labour (in terms of time and skills) (also referred to as 'gig work') and capital platforms covering home-sharing sites and online selling platforms. An expansive approach was taken to measure the prevalence of 'gig work' to include a range of tasks either performed online (for example surveys, data entries, etc.) or on location such as ride hailing, shopping and delivery, cleaning and laundry. Other tasks intermediated by work platforms - as indicated in the survey - range from very basic tasks (for example moving furniture or working as a parking lot attendant) to highly specialised white-collar work (legal services, IT consulting, etc.).

Yet, even the distinction between capital or asset-based platforms and labour platforms is somehow fluid. Drahokoupil and Fabo (2016a) suggest placing on the same continuum - albeit at different ends of the spectrum - 'platforms that facilitate access to goods or property and those that enable access to self-employed workers or services' (p.2). The authors argue that there is a labour market dimension also in physical goods platforms. This is exemplified by Airbnb whereby the renting of a property also entails the provision of associated labour services - such as cleaning, accountancy, maintenance - which can be dealt with by the hosts themselves but is often outsourced. Even if the primary goal is not to provide access to work, capital platforms may have a great impact on the labour market and contribute in various ways to a restructuring of labour relations and reshaping of local labour markets (Drahokoupil and Fabo, 2016a). A similar reasoning applies to labour-based platforms, which also require assets or capital - for example Uber requires drivers partnering with the platform to own or lease a car.

With a view to making this phenomenon more amenable to be studied, research has focused on sectors or industries where platforms are most prevalent (for example, Hawksworth, and Vaughan, 2014; Owyang et al, 2014; Owyang and Samuel, 2015; Farrell et al, 2018, PwC, 2018). There are inevitably variations in the way sectors are grouped and types of platforms covered across studies. For example, the US Piper Jaffray study examines platforms with diverse transactions business models across broad sectors or economic activities (Olson and Kemp, 2015) - namely lodging and travel, transportation, services and business services. Particularly heterogeneous is the services sector covering a broad range of platform activities including meal sharing, tasks and financials (including peer-to-peer lending and crowdfunding). With a focus on peer-to-peer transactions, a 2016 empirical study on the size of the sharing economy in France covered a wide range of goods and services, which are regarded as the 'core' of the sharing economy (DGE, 2016). These are transport services, storage services, delivery services, entertainment activities, food and catering, consumer goods, clothing, domestic services, private holiday accommodation and property rentals, and second-hand vehicle sales.

Rather than sector-based, Eurofound's platform economy categorisation differentiates platform activities depending on whether the traded commodity is labour or not. This categorisation covers a broad range of platforms providing access to accommodation, financial services, household tasks, professional services, and other platforms facilitating non-commercial transactions (including social media or networking platforms).

Table 5: Eurofound's categorisation of platform economy

Platform activity	Platform work	Example of tasks	Platform example
Accommodation	No	renting a holiday home	Airbnb and Homestay
Financial services	No	crowdfunding	Kickstarter and Seedr
Household tasks	Yes	cleaning	Hilfr and Helpling
Non-commercial services	No	volunteering, social media	Linkedin and Couchsurfing
Professional services	Yes	software development or graphic design	Upwork and 99 Designs
Transport	Yes	person transport and food delivery	Glovo and Deliveroo

Source: Eurofound, based on categorisation in online repository at https://www.eurofound.europa.eu/data/platform-economy/typology.

Yet, another way of differentiating platforms is by looking at whether platforms are for profit or not-for profit and/or the actors on the customer and the provider side are individuals or companies. For some scholars the platform economy includes only of commercial or for-profit platforms. An example is the categorisation proposed by Schmidt (2017), which classifies commercial digital platforms in terms of the commodity traded (good, services, money, communication, information, entertainment) and the type or nature of the transaction.

Table 6: Schmidt's categorisation of platform economy

Platform economy	Goods	Tangible, for sale	Amazon.com, eBay, Etsy
		Tangible, for rent	Leihdiwas.de, Airbnb
		Intangible, for sale	App store
		Intangible, for rent	Spotfy, Netflix
	Services (digital labour)	Cloud work (web-based)	Upwork, Amazon MTurk, 99designs
		Gig work (location-based)	Uber, Airbnb, Helpling
	Money	Crowdfunding	Indiegogo, Kickstarter
	Communication	Dating	Tinder
	Entertainment	Social media	Facebook, Youtube
	Information	News	Google news
		Search	Google search
		Reviews	Yelp

Source: Schmidt, 2017.

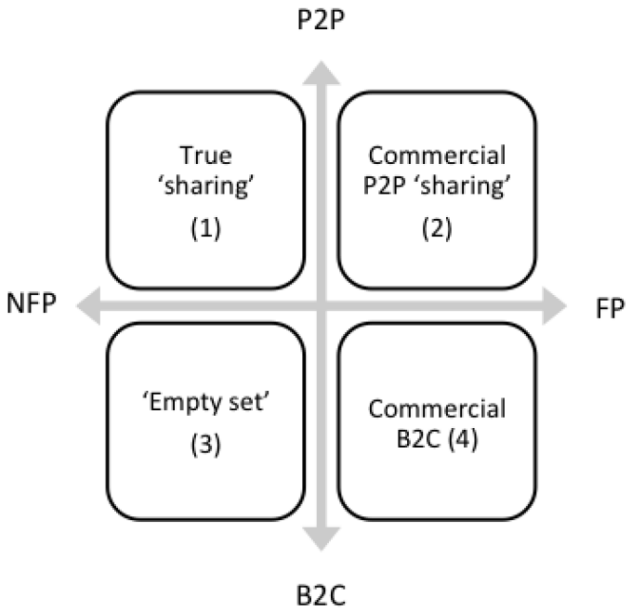
Although the distinction between for profit and not-for profit may seem straightforward, the boundaries between these models are at times fluid. A case in point is Couchsurfing, which changed its legal status from not-for profit to for profit organisation in 2010 (Belk, 2014). This shows that the allocation of a platform to a specific category is not set in stone but might require adaptation as the platforms evolve and tend to change their business models over time.

As for the distinction of platforms based on the type of provider/customer, platforms that facilitate transactions between individuals are typically referred to as peer-to-peer (P2P) and platforms where companies are involved are referred to as business-to-consumers (B2C) or business-to-business (B2B) (Botsman 2013).

Another approach to the classification of platforms is proposed by Codagnone and Martens (2016) in a two-dimension model differentiating platforms according to the dominant transaction models (P2P versus B2C) and whether they are for profit or not-for profit (with a view to assessing the needs of regulations for each segment). As shown in Figure 3, the first dimension of

the matrix locates online platforms on a spectrum from so called 'true sharing' to more commercially-driven initiatives, while the vertical dimension places them on the business-to-consumer (B2C) versus the peer-to-peer (P2P) axis. Many of the P2P platforms are owned by companies although the service providers are individuals not organised as companies and often working as freelancers or subcontractors. The authors argue that commercial platforms involving peer-to-peer transactions are the main area of focus for policy and regulations, but they also acknowledge that there are important differences between P2P platforms, which suggests the need for a differentiated approach. There is in fact a huge diversity within P2P platforms, although these are often unified under the same economic paradigm.

Figure 3: Two-dimensional typology of online platforms



Note: the Quadrant (3) of the matrix is empty because businesses are by definition for profit.

Source: Codagnone and Martens, 2016.

Although P2P non-commercial platforms use similar business models to the commercial platforms (underutilised resources, use of the platform for collaboration and sharing, peer-to-peer interaction), they are driven by social purpose and committed to creating benefits for the community (see for example repair cafes and food preps); they may eventually or may not turn into formal for profit businesses (Munoz and Cohen, 2017).
Building on Codagnone and Martens' categorisation, Statistics Netherlands (CBS) has recently proposed a three-dimensional typology of online platforms. The third dimension is used to establish whether the exchange concerns products or services (possibly using the NACE/ SBI coding[4]) (Heerschap et al, 2018).

[4] 'Standaard Bedrijfsindeling' is a hierarchal classification system of all the economic activities distinguished by Statistics Netherlands to categorise business units according to their main activity (five levels).

Also Schor (2014) draws on the distinction between for profit and not-for profit platforms and market orientation. She argues however that B2C platforms function more like a conventional business and have a different business model from P2P platforms such as Relay Rides and Airbnb. In the same vein, Cusumano (2018) argues that the underlying business models of P2P and B2C platforms are very different, with the latter being another version of traditional business – for example, Zipcar (owned by Avis) and Car2Go (owned by Daimler-Benz) could be seen as a version of traditional rental companies and potentially substituting for that activity. Arguably, some P2P companies – such as Airbnb – could be also considered not entirely new and, in the case of Airbnb, substituting for traditional bed and breakfast and holiday home rental (Cusumano, 2018).

Other platform categorisations cover mainly or exclusively peer-to-peer (P2P) online platforms, which are characterised by network-based business models (as opposed to the traditional business model). According to Sundararajan 'platforms are the person-to-person marketplaces which facilitate the exchange of goods and services between peers' (2014, p.7) and they are of many kinds (see Table below).

Table 7: Sundararajan's categorisation of P2P platforms

Platform type	Key features	Platform examples
Repurposing owned assets as 'rental' services	Generating new labour opportunities for individuals who are not professional providers	RelayRides, Getaround, Lyft, Sidecar, Airbnb, SnapGoods, Eatwith, Feastly
Professional service provision	Creating a new channel for existing providers of different services, often expanding their business opportunities in a way that allows individuals to become entrepreneurs rather than working with a traditional organisation	Uber, Kitchit
General purpose freelance labour provision	Creating new marketplaces for different kinds of freelance labour	oDesk, TaskRabbit, FancyHands
Peer-to-peer asset sales	Creating marketplaces that allow entrepreneurs to sell goods directly to consumers	eBay, Etsy
Venture financing and lending	Provision of venture funding by individuals to others	Kickstarter, Kiva, Funding Circle, AngelList, Rockethub, Indiegogo, LendingTree
Peer-to-peer education	Provision of education and training by individuals directly to groups of others	Skillshare, Udemy

Source: Sundararajan, 2014.

The UK ONS also considers the peer-to-peer model as a distinctive feature of online platforms (ONS, 2017), notwithstanding the ambiguities in differentiating between individuals and businesses (self-employed individuals may consider themselves to be a business rather than peers). In surveys, this categorisation is left to respondents, in the sense that they can define themselves as individuals ('peers') or as business that they own.

Within the peer-to-peer platforms, another possible differentiation is based on the extent to which they exert control over platform participants; to reflect this diversity, P2P platforms could be

placed on a continuum from centralisation to decentralisation (Codagnone and Martens, 2016). A case of centralisation is that of Uber which imposes tight control over drivers, while, at the other end of the scale, there is Airbnb exerting looser control over accommodation providers.

Platform work categorisation

Many empirical studies have focused on this segment of the platform economy and proposed different categorisations of platform work to make it more amenable to be investigated. Findings from these studies were compiled by Eurofound (2018c).
This was used by Eurofound as a basis for a theoretical typology of work platforms (Eurofound, 2018c) comprising of 27 classification elements or indicators and their manifestations (allowing for millions of different combinations). Using this typology, Eurofound (2018b) has identified 10 types of platform work, which have reached some critical mass and that can be differentiated on the basis of five key characteristics. These relate to the locus of the service provision (online or on-location), the scale of tasks (micro tasks versus larger projects), the skills required to perform the task, the selection process (decision made by the platform, client or worker), and the matching process (offer or a contest structure).

Table 8: Eurofound's platform work typology

	Service classification			Platform classification		
Label	**Skills level**	**Format of service provision**	**Scale of tasks**	**Selector**	**Form of matching**	**Examples**
On-location client-determined routine work	Low	On-location	Larger	Client	Offer	GoMore
On-location platform-determined routine work	Low	On-location	Larger	Platform	Offer	Uber
On-location client-determined moderately skilled work	Low to medium	On-location	Larger	Client	Offer	Oferia
On-location worker-initiated moderately skilled work	Low to medium	On-location	Larger	Worker	Offer	ListMinut
Online moderately skilled click-work	Low to medium	Online	Micro	Platform	Offer	CrowdFlower
On-location client-determined higher-skilled work	Medium	On-location	Larger	Client	Offer	appJobber
On-location platform-determined higher-skilled work	Medium	On-location	Larger	Platform	Offer	Be My Eyes
Online platform-determined higher-skilled work	Medium	Online	Larger	Platform	Offer	Clickworker
Online client-determined specialist work	Medium to high	Online	Larger	Client	Offer	Freelancer
Online contestant specialist work	High	Online	Larger	Client	Contest	99designs

Source: Eurofound, 2018b.

The skills level and format of the service provision are recurrent categorisation elements used to differentiate work platforms in empirical research. For example, Codagnone et al (2016a) make a distinction between platforms whereby work is performed remotely and delivered electronically via the internet and platforms that involve manual and locally-based labour. Within a broader platform economy categorisation, Schmidt (2017) also makes a preliminary differentiation of

labour platforms based on the location of the tasks, resulting in a demarcation between web-based or cloud work digital platforms and location-based or 'gig work' digital platforms. The web-based or cloud work digital platforms refer to platforms intermediating tasks that are performed online to an undefined group of people ('crowd work') or subdivided into micro tasks ('microtasking crowd work') or, if the task cannot be subdivided, it is assigned on the basis of an open call to the crowd ('contest-based crowd work'). Different from cloud work is 'gig work', which refers to platforms intermediating on location-based services and are most prevalent in accommodation, transportation and delivery services, household and personal services. In Schmidt's categorisation (2017), Airbnb is also classified as a work platform even if the labour element is only secondary.

Similarly, a recent survey on platform work carried out by the European Commission's Joint Research Centre (Pesole et al, 2018) goes beyond the categorisation of platform work by the locus of service provision (digital or on location) and expands the understanding of labour services (characterised as tasks) that can be coordinated via platforms, to include on-location ancillary services (for example housekeeping and cleaning) linked to short term rental accommodation (as provided by platforms like Airbnb). According to the authors, this differentiation is to some extent theoretical because in practice there are many hybrid platforms and further subcategories.

A careful examination of the business models may also allow to make further differentiation and distinguish between platforms providing professional and non-professional services, with the former being more the focus for policy and regulations (Petropoulos, 2017). Here the key criteria to make this distinction are the frequency of the service provision, a profit seeking motive and the remuneration.

In short: key considerations about platform categorisations and classifications

The categorisation/classification of platforms is the starting point of much research on the platform economy. The above review points to the lack of unifying or harmonised taxonomy. Due the variety of platform activities a comprehensive taxonomy/classification remains a challenging task. Any exercise into this direction should reflect the evolving nature of the platform economy. Platforms are moving targets in the sense that they evolve quickly; they change in a variety of ways throughout their life cycle. Apart from large platforms such as Uber and Airbnb, there are myriads of small platforms which may never reach a critical mass of users or may cease to exist after very short time. Furthermore, the business model underlying the functioning of platforms can be hybrid and it can be easily applied to new economic activities. Many platforms wear multiple hats and compete in new segments of the economy by simply leveraging technology and reducing transaction costs. For example, Facebook – typically considered a social media platform – has recently added a feature that makes it easy for people in groups to buy, sell, and trade items. Likewise, many applications used by matching platforms have social media functions that allow customers and providers to rate and review each other. One risk – which is a source of preoccupation for many – remains that some of the commercial platforms, if left unchecked, can scale up their activities quickly and by virtue of the so-called network effects can turn into monopolies (Codagnone and Martens, 2016; Schmidt, 2017), either absorbing small businesses or preventing them from entering the market altogether.

Methodological approaches to measure the platform economy

There is general consensus among academics that there is a pressing need to devise appropriate and reliable measurements (Geron, 2013) for a better understanding of the dynamics of the platform economy, its true size and impacts. This would be the starting point for addressing the much debated regulatory issues that may arise from the growth of the broader platform economy. One important question for example is to establish the extent to which the platform economy creates new value or just replaces incumbent businesses. Also, as noted by Horlacher and Feubli (2015) the value added of platform activities is not easily captured in current measures of GDP.

In terms of measurements, the available estimations on the size and scale of the platform economy and its impact on the labour market and economy are generally based on one or a combination of different methods: surveys, big data and data publicly available provided by the platforms themselves or other sources (for example platforms' websites, media reports, etc.), including administrative data originally recorded for non-research purposes.

An important shortcoming regarding the review of these studies is that in many cases little information is available about the extent to which they cover the target population. This makes it difficult to ascertain to what extent the results are generalisable to the wider population and to what extent they can be compared between studies. This is further complicated by that fact that some of the identified studies focus on one or a few specific platform types. Due to the heterogeneity of the underlying methodologies across the reviewed studies the estimates cannot be directly compared. They can only give a hint of the order of magnitude of the current participation in the platform economy and the extent to which this is growing.

For this mapping exercise, an inclusive approach was used, including as many available studies as possible regardless of their possible methodological shortcomings, to maximise the insights that – be it cautiously – can be obtained about the size of the platform economy.

Out of the scope of this review are those studies drawing solely from qualitative or ethnographic interviews (for example, Balck and Cracau, 2015; Zhou; 2015; Schor and Fitzmaurice, 2015; Ravanelle, 2017; Eurofound, 2018c).

Table 9: Overview of identified studies

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
Airbnb, 2014b	UK	Airbnb	Administrative and survey data	n.a.	Economic impact and job creation	Nov 2012 - Oct 2013
Hawksworth and Vaughan, 2014 (PwC)	US	Crowdfunding and P2P lending and accommodation, online staffing, car sharing, streaming (video/music)	Administrative data	Forecasting method	Platforms' revenues in the five sectors	
Owyang et al, 2014	UK, US, Canada	Peer-to-peer platforms (covering 5 broad categories of collaboration: goods, services, transportation, space and money including moneylending and crowdfunding)	Survey data	Two survey rounds. First round part of a general omnibus survey (N=90,112), and follow-up survey (N=2,550)	Participation in the sharing economy (as consumer) and motivations	Oct 2013 - Jan 2014
Nielsen, 2014	World (60 countries throughout Asia-Pacific, Europe, Latin America, the Middle East, Africa and North America)	For profit good and service platforms	Survey data	Online survey (N=30,000 internet users). Non-probability sampling	Willingness in participating (as consumer) in sharing economy activities	14 Aug - 6 Sept 2013
Stokes et al, 2014 (Nesta)	UK	Internet-enabled collaborative activities across a selection of sectors (transport, holidays,	Survey data	Online survey (N=2,000 adults 16 and older). No information on sampling technique used	Participation as consumer or provider	May 2014

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
		off jobs and tasks, technologies and electronics, clothing and accessories, media, children's equipment and toys, households goods and appliances)				
Burston-Marsteller, the Aspen Institute and TIME, 2015	US	Ride sharing, accommodation, food delivery platforms and other services platforms	Survey data	Online survey (N= 3,000 US adults). No information on sampling technique used	Participation as consumer or provider in sharing activities	Nov 2015
DGE, 2015	FR	Peer-to-peer transactions involving a wide range of goods and services. Also transactions without monetary exchange covered.	Survey data	Online consumers survey (N=2,006 adults aged 18 and over). Non-probability sampling	Types of transactions, frequency, spending, offers, purchase	15-22 Oct 2014
Harris and Krueger, 2015	US	Labour platforms	Big data	Collection and analysis of google trends data	Size of the workforce engaging in the gig economy	Jan – Nov 2015
ING International, 2015	AU, AT, CZ, BE, DE, ES, FR, IT, LU, NL, PO, RO, TR, UK, US	Capital platforms	Survey data	Online survey (N= 14,829 adults aged 18 and older). No information on sampling technique	Awareness, participation, earned income and attitudes towards sharing	16 Jan - 2 Feb 2015
Kuek et al, 2015	World	Microwork and online freelancing platforms	Administrative data	Forecasting method	Market size and number of registered workers	2013 (projections to 2016)

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
Maselli and Fabo, 2015 (CEPS)	World	CoContest (design work platform)	Big data	Data collected from Google searches and web crawling	Number of submissions per designer, level of earnings (compared to local wages),	Sept 2015
Nesta, 2015	UK	Selling, lending, giving or leasing own assets or skills on the internet	Survey data	Part of a face-to-face omnibus survey (N=2,010 adults aged 15 and over). No information on sampling technique	Participation as provider and earnings Estimation of monetary value of transactions	Feb 2015
PwC, 2015	US	• Hospitality and Dining (CouchSurfing, Airbnb, Feastly,LeftoverSwap) • Automotive and Transportation (RelayRides, Hitch, Uber, Lyft, Getaround, Sidecar) • Retail and Consumer Goods (Neighborgoods, SnapGoods, Poshmark, Tradesy) • Media and Entertainment (Amazon Family Library, Wix, Spotify,	Survey data	Online survey of consumer panellists (N=1,000)	Familiarity and engagement, benefits, concerns	17-22 Dec 2014

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
		SoundCloud, Earbits)				
Berg, 2016	World (CrowdFlower) US and India (AMT)	Micro tasks platforms (CrowdFlower and AMT)	Survey data	Online survey of CrowdFlower (N=67.7) and AMT workers (N= 1,167)	Demographics, work experience and work history	Nov - Dec 2015
Collaboriamo and Trailab, 2016a	IT	Capital and labour platforms	Administrative data	Mapping exercise drawing from existing literature and information provided directly by platforms through an online questionnaire (64 out of 138 identified platforms responded)	Number of active platforms, sector distribution, demographics of platform owners and workforce	Oct 2016
Collaboriamo and Trailab, 2016b	IT	Crowdfunding platforms (divided into donation reward, DIY, equity and lending platforms)	Administrative data	Mapping exercise drawing from existing literature and information provided directly by platforms through an online questionnaire (41 out of 70 identified platforms responded)	Number of active platforms, amounts raised for each platform type, demographics of workforce	Oct 2016
De Groen et al, 2016 (CEPS)	BE	ListMinut (local personal services platform)	Big data	Web crawling; data supplemented with Belgian administrative data	Types of tasks posted / provided and hourly remuneration	23 Dec 2013 - 22 Dec 2015
De Groen and Maselli (CEPS), 2016	EU28	Uber raid-hailing platform	Big data	Collection and analysis of Google search data	Number of active workers	End of 2015
European Commission, 2016e (Flash Eurobarometer 438)	EU28	Online service platforms (renting accommodation and car sharing to small household jobs)	Survey data	Telephone-based survey (N=14,050, EU residents aged 15 years and over). Multi-stage, random (probability) sampling	Awareness and frequency of use of 'collaborative platforms'	March 2016

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
European Commission, 2016f (Special Eurobarometer 447)	EU28	Search engines, online social networks, online marketplaces	Survey data	Face to face survey (N=27,969, EU residents aged 15 and over). Multi-stage, random (probability) sampling	Frequency of use and attitudes towards online platforms	April 2016
Evans and Gawer, 2016	World (five world regions and 22 countries)	Transaction platforms; innovation platforms; integrated platforms; investment platforms	Administrative data	Data collected using different search tools and databases (Quid Web Intelligence tool, CB insights, Thomson Reuters Eikon financial database), analysed and compiled in a database	Geographic and sector distribution, ownership structure	2015
Farrell and Greig (JP Morgan Chase and Co. Institute) 2016	US	Capital and labour platforms (30 in total)	Big data	Analysis of American JP Morgan Chase customers' bank account transactions	Income from platforms	Oct 2012 - Sept 2015
Freelancers Union, 2016	US	Social media, online freelance marketplaces and sharing economy sites	Survey data	Online panel survey (N= 6,002 of US adults). No information on sampling technique used	Use of online social media and online platforms to find work	2016
Hall and Krueger, 2016	US	Uber ride-hailing platform	Survey and administrative data	Analysis of data from two online surveys of Uber drivers (N= 601 in 2014; N= 833 in 2015). Survey data supplemented by administrative data on Uber drivers' driving histories, schedules and earnings between 2012 and 2014	Demographics of Uber drivers, income situation and motivations	Dec 2014 Nov 2015

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
Jesnes et al, 2016	NO	Capital and labour platforms	Survey data	Online survey (N=1,525 Norwegian adults aged 18 and over)	Engagement in online platforms and frequency of use	2016
Katz and Krueger, 2016	US	Labour platforms	Survey data	RAND-Princeton Contingent Work Survey (RPCWS), a version of the CWS, as part of the RAND American Life Panel (N=3,850). Sample recruited through a variety of means (including a group recruited for the University of Michigan internet panel, a random digit dial sample, and a snowball sample)	Size of workforce in platform work	Oct - Nov 2015
McKinsey Global Institute, 2016	DE, ES, FR,SE, UK, US	Digital platforms for independent work, comprising platforms for people to sell goods or lease assets or provide labour services	Survey data	Online panel survey. Sampling working age population (N= 8,131)	Engagement in independent work and digital platform; motivations; and incomes earned from digital platforms	June - July 2016
Robles and McGee, 2016	US	Online labour platforms and selling sites	Survey data	Online survey (N= 2,483 qualifying respondents out of a total sample of 6,898 US adults aged 18 and over). Probability-based online sampling	Engagement in online platforms	Oct - Nov 2015

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
Vaughan and Daverio, 2016 (PWC)	BE, DE, ES, FR, IT, the NL, PO, SE, UK.	Peer-to-peer accommodation; peer-to-peer transportation; on-demand household services; on-demand professional services; collaborative finance	Administrative data	Secondary data sources used, enabling 'data translation and triangulation exercise'	Size of the platform economy in terms of value of transactions and platforms' revenue	2013-2015
Smith, 2016a	US	Labour platforms, capital platforms, and crowdfunding sites	Survey data	Panel survey (N= 4,787 US adults). Probability sampling	Attitudes, awareness and use (as clients) of online platforms	Nov-Dec 2015
Smith, 2016b	US	Capital and labour platforms	Survey data	Panel survey (N= 4,579 US adults). Probability sampling	Use (as provider) of online platforms	July-Aug 2016
Alsos et al, 2017	NO	Labour platforms and Airbnb	Survey data	Telephone survey (N=1,000 Norwegians aged 18-65 years)	Size of workforce engaging in platform work	Sept 2016-Oct 2017
Bonin and Rinne 2017	DE	Labour platforms	Survey data	Omnibus telephone survey (N=10,017, aged 18+)	Size of the workforce engaging in platform work	April-June 2017
Balaram et al, 2017	UK	Labour platforms	Survey data	Face-to-face omnibus survey (N=7,656 UK residents aged 15 and older)	Engagement in platform work, motivation, working time, work-life balance	11 Nov 2016-10 Jan 2017

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
CIPD, 2017	UK	Labour platforms	Survey data	Online survey (N=5,019 adults aged 18-70). Non-probability sampling	Size of workforce engaging in platform work, motivations and level of income	Dec 2016
De Groen et al, 2017	EU28	Labour platforms	Administrative data	Secondary data sources used to calculate estimates (data extrapolations to estimate missing data). Clustering technique used to categorise online platforms	Size of work-related platform economy in terms of gross revenues and number of active workers	2016
European Commission, 2017	BG DE, DK, ES, FR, IT, NL, PO, SL, UK	Peer-to-peer online platform in five sectors of activity: (re)sale of goods; sharing/renting accommodation; sharing/renting goods; odd jobs; and ride sharing/hiring.	Survey data	Online survey (N=10, 019 internet users)	Participation in peer-to-peer online market as consumer or provider or both	May 2016
Eurostat, 2017	EU28	Peer-to-peer accommodation and transport services platforms	Survey data	General population / household survey (N=200,000 EU residents aged 16-74). Telephone /face-to-face/web interviews. Stratified, random (probability) sampling	Share of people arranging accommodation and transport services online via websites or apps	In most countries conducted in the second quarter of 2017
Fabo et al, 2017	EU28	Transportation (of people and goods) platforms; platforms trading	Administrative data	Mapping exercise drawing from existing literature, media articles and	Number of platforms active in the EU, platform size and turnover,	

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
		online services (for example design, IT services); and platforms trading offline, local services (for example delivery or housework)		information provided directly by platforms	work assignment method and business models, required skill level of workers, number of employees	
Huws et al, 2017	AT, CH, DE, IT, NL, SE, UK	Work platform (delivery of tasks online and on-location)	Survey data	Online surveys AT, N=1,969, 18-65 years CH, N=2,001, 16-70 years DE, N=2,180, 18-65 years IT, N=2,199, 16-70 years NL, N=2,126, 16-70 years SE, N=2,146, 16-65 years UK, N=2,238, 16-75 years Companion surveys: • Telephone based survey CH, N=1,205, 15-79 years • Face-to-face survey UK, N=1,794, 16-75 years	Size of workforce engaged in platform work, frequency of work, income, employment status	22-26 Jan 2016 (UK, online) 24 March-4 April 2017 (UK, offline) 26 Feb -7 March 2016 (SE) 1-4 April 2016 (DE) 1-4 April 2016 (AT) 22-27 April 2016 (NL) 31 March-5 April 2017 (IT) 3-14 April 2017 (CH, online) 27 March-7 April 2017 (CH, offline)
Ilsøe and Madsen, 2017 (Denmark LFS)	DK	Labour platforms and capital platforms	Survey data	Ad-hoc module of the Danish LFS (N=18,043 Danes aged 15-74). Random sampling	Size of workforce engaging in online platforms and earning an income	Jan-March 2017
Jackson et al, 2017	US	'Gig economy' platforms identified in tax returns data (specific words and phrases such as ride	Administrative data	Analysis of tax returns. 109,700 individuals filing a return reporting income from online platform	Number of workers filing self-employment income and reporting income	2014

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
		share or ridesharing, or names of specific platform providers)			from an online intermediary.	
ORB International, 2017	UK	Uber ride-hailing platform	Survey data	Telephone survey (N= 1,002 Uber drivers)	Income, working time, work-life balance, motivation and employment status	8-17 Sept 2017
Statens Offentliga Utredningar (SOU), 2017	SE	Peer-to-peer assets-based and services platforms	Survey data	Online survey (N=7,069 adults aged 16-64)	Size of workforce using online platforms	Sept 2016
Statistics Canada, 2017 (LFS)	Canada	Peer-to-peer rental platforms and ride services platforms	Survey data	Telephone-based survey. (N=100,000 adults aged 18 and over). Multi-stage, random (probability) sampling	Total expenditure and use of online platforms as both provider and consumer	Oct 2016
Statistics Finland, 2017 (LFS)	FI	Airbnb, Uber, Tori.fi / Huuto.net, Solved (and others specified by respondents)	Survey data	Telephone-based survey (N= 43,000[5] aged 15-74 residents in Finland). Stratified, random sample	Income from work and non-work-related platforms	2017
Zervas et al, 2017	US	Airbnb	Survey and administrative data	Data collected directly from Airbnb website, And supplemented with other data sources (Texas Comptroller, county demographics from US	Economic impact of Airbnb on hotel industry (in revenue terms)	Jan 2003 –Aug 2014

[5] Total sample was around 98,000 persons. The sub-sample for data concerning platforms was about 43,000 persons.

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
				Census Bureau, airport passenger counts from US Bureau of Transportation Statistics (BTS), Current Population Survey (CPS) from the US BLS, and hotel reviews from TripAdvisor. Difference in difference technique for data analysis		
BEIS, 2018	Great Britain	Labour platforms	Survey data	NatCen Panel, a probability-based online survey (N=2,184, aged 18 and over). YouGov Omnibus, non-probability online panel survey (N=11,354, aged 18 and over)	Size of the workforce engaging om platform work and characteristics of platform work	July-Aug 2017
Bureau of Labour Statistics (BLS), 2018	US	Electronically-mediated work, online and in person	Survey data	Contingent Worker Survey (CWS) is a supplement to the monthly Current Population Survey (CPS). Data collected via telephone and face-to-face (N=46, 000, aged 16 and over). Probability sampling	Size of the workforce engaging in electronically-mediated work	May 2017
European Commission, 2018b	EU28	For profit and not-for profit peer-to-peer and peer-to-business online platforms in four sectors of economic activity (transport, accommodation,	Administrative and big data	Data collected through online web questionnaire sent to 1,012 identified platforms (64 full responses and 108 partial responses). Supplemented with secondary data obtained from web	Size of the collaborative economy in terms of revenues and employment	July- Oct 2017

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
		finance, and online skills including on-demand household services, on-demand professional services)		searches and web scrapping. Different data sources enabled data triangulation and validation		
Farrell et al, 2018	US	Capital and labour platforms (128 in total)	Big data	Analysis of American JP Morgan Chase customers' bank account transactions	Income from online platforms	Oct 2012-March 2018
Guarascio and Sacchi, 2018	IT	Capital platforms for intermediation services for real estate, accommodation and classified ads (Subito.it, Casa.it and Booking), labour platforms providing food-delivery (Deliveroo, Just-Eat, Foodora) and pet care services (Petme), and Italian branches of three global platforms (Amazon, Facebook and Google)	Administrative data	Descriptive analysis of data drawn from business and administrative data sources	Economic and employment characteristics of most prominent online platforms operating in Italy	2012-2016
Insee, 2018 (French LFS)	FR	Intermediaries (including digital platforms). Types of platform unspecified.	Survey data	Ad-hoc module of the French LFS (*Enquête Emploi*) (N= 3,103.000 self-employed with and without employees). Probability sampling	Access to clients through an intermediary (including a digital platform)	2017

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
Kässi and Lehdonvirta, 2018	World	Five prominent English language online labour platforms intermediating digital services	Big data	API access and web scraping. Tracking projects and tasks posted across major English-language online labour platforms	Supply and demand of online freelance labour over time and across countries and occupations. Collected data was used to construct an online labour index.	July 2016 Feb 2017 Jan 2018
MBO partners, 2018	US	Online job platforms	Survey data	Online survey (N=3,584, US residents aged 21 and older). Non-probability sampling	Size of the independent workforce and motivations. Use of digital platforms to find work.	March 2018
ORB International, 2018	UK	Uber ride-hailing platform	Survey data	Telephone survey (N= 1,001 Uber drivers)	Socio-demographics, income, working time, motivation, subjective well-being	18-28 March
Pesole et al, 2018 (European Commission's JRC)	DE, ES, FI, FR, NL, HR, HU, IT, LT, PT, RO, SE, SL, UK	Labour platforms	Survey data	Online survey (N= 32,409 Internet users aged 16-74). A commercially available list of internet users in the selected countries (CINT) used as sampling frame, with non-probability quota sampling of respondents by gender and age groups	Size of workforce engaging in platform work, their characteristics, motivations and working conditions	June 2017
PwC, 2018	AT, BE, CH, DE, NL and TR,	For profit and not-for profit peer-to-peer and business-	Survey data	Online survey (N=4,500). No information on sampling technique	Size and acceptance of platform	June-Aug 2017

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
		to-peer online platforms in selected industry segments (media and entertainment, hotels and accommodation, automotive and transport, retail and consumer goods, services, finance, and machinery)			economy in the selected sectors.	
Statistics Canada, 2018	CA	Selling sites (for example Etzy and eBay); freelance services platforms, peer-to-peer ride, delivery and accommodation services platforms.	Survey data	Online / telephone survey (N= 12,000 Canadians aged 18 and older). Two-stage, random (probability) sampling	Income from selected platform activities	June - July 2018
Weel et al, 2018	NL	On-location work platform	Survey data	Online survey. No information on sampling technique	Size of workforce engaging in platform work	n.a.
Katz and Krueger, 2019	US	AMT	Survey data	Online survey (N=2,291 AMT workers, aged 18 and older). Sample was not chosen to be representative instead selected to include a large number of workers who worked on multiple jobs, often on a casual basis, and determine the extent to which multiple job holders neglect to report that they worked on	Multiple job holding using CPS (BLS)-like question	March 2015

Publication (authors)	Geographic focus	Research focus (platform types)	Type of data	Method for data collection and/or analysis	Measurement(s)	Reference period
				multiple jobs based on the standard BLS Current Population Survey (CPS) question		
Serfling, 2019	DE	Labour platforms	Survey data	Open-access web panel survey (N=494,970). Non-probability sampling	Size of crowd work workforce, socio-demographics, remuneration, task duration, motivations and satisfaction	July 2017-15 Oct 2018

Notes: Studies covered in this paper use three main types of quantitative data for the measurement of the platform economy: survey data, big data and administrative data. Some studies combine different types of data.
n.a.- information not available.

Source: Author's own compilation.

Surveys

For the purpose of this review, official statistics are considered as those collected directly by national statistical offices or by government departments, while the non-official statistics are those whose collection is commissioned to third party organisations or carried out by and on the initiative of private organisations.

Official economic statistics

At EU level, Eurostat has plans to intensify efforts to produce statistics in this growing segment of the economy and improve the quality of existing data collections (see Eurostat Annual Work Programme 2017). In 2017, Eurostat released the results of the 2017 *Community survey on ICT usage in households and by individuals* which has some questions on the share of people in the EU arranging accommodation and transport services online via websites or apps from another private individual. Although the percentages relate only to consumers (not providers), the data are informative as they provide a proxy for the level of platform activity in the accommodation and transport service sectors across the EU.

As of February 2018, only a few national statistical offices – particularly in countries where there are some indications of a fast-growing platform economy – are exploring avenues to respond to the data gap and collect relevant data on platforms through existing statistical tools. For example, in the UK, a number of government reports have called for the development of statistical measurements to assess the contribution of peer-to-peer platforms – intermediating the access of underutilised assets or skills – to the economy (Coyle, 2016; Bean, 2015). To respond to this call, the ONS has initiated a pilot exercise to road test questions to include in existing surveys. A battery of 'sharing economy' questions were introduced for the first time in 2017 in the Internet Access module[6] of the Opinions and Lifestyle Survey (OPN), which is a multi-purpose household sample survey of approximately 3,000 adults (aged 16 and over) resident in Great Britain and it is carried out on an annual basis using computer-assisted telephone interviews (CATI). The questions relate to the use of intermediary websites or apps to arrange accommodation and/or transport (data are used as national input to the above-mentioned Eurostat's *Community survey on ICT usage in households and by individuals)*. These questions draw on the definition of 'sharing economy' formulated in the conceptual framework developed by the ONS (see chapter on definitions). Apart from these questions, there are also questions on the use of the internet for social networking and online shopping (ONS, 2017b). The sample size for this pilot was relatively small compared to other ONS social surveys. The response rate for the Internet Access module was approximately 54%.

Other sources of data collected by the ONS are the e-Commerce survey (81 sharing economy and 152 non-sharing economy businesses) and the Annual Business Survey (ABS) (45 sharing economy and 6,451 non-sharing economy businesses). In both surveys the sharing economy businesses were identified through a range of sources (for example Vaughan and Daverio, 2016). Most of the questions in the e-Commerce survey required answers in the form of yes and no. As the distribution of businesses in the Annual Business Survey is skewed towards smaller businesses, many of the standard hypotheses tests were not feasible, limiting the exploitation of the data available.

[6] As of 2018, the sample of the Opinions and Lifestyles Survey is derived from the last wave of the Labour Force Survey (LFS). The sample includes all individuals who have consented to re-contact following completion of the LFS in 2017.

The ONS is also exploring other avenues to collect relevant information through existing surveys, these are:

- The Living Costs and Food (LCF) Survey, which collects information on income and expenditure and feeds into the Consumer Prices Index (CPI)[7] and Gross Domestic Product (GDP)[8] figures.
- The time use survey used to collect information on how much time individuals spend undertaking different activities. This survey may be instrumental in recording the amount of time respondents take to prepare a room for rental through a platform and use sharing economy websites.

Also, Statistics Netherlands (CBS) has recently published a methodological paper proposing measurements and indicators on online platforms to link with existing statistical indicators and domains (Heerschap et al, 2018). In the paper the authors also provide key findings from existing surveys on ICT-usage of persons and enterprises. Figures on the ICT-usage of persons draw from responses to questions specifically asking about the use of Airbnb and Uber-like platforms where private persons are the providers (data used as national input to Eurostat's *Community survey on ICT usage in households and by individuals*). Statistics Netherlands also included a new question in the survey of the ICT-usage of enterprises on the perceived impact of online platforms on the turnover of enterprises. In consideration of the high number of positive answers, the authors point out that the question may not have been interpreted correctly by respondents. Another methodological issue is that it is difficult for an enterprise to judge the impact of online platforms on its turnover.

Beyond the EU, both Statistics Canada and the US Bureau of Economic Analysis (BEA) have sought to capture platform economy activity by means of business and/or household surveys. Statistics Canada carried out its first Digital Economy Survey (DES) between June to July 2018. This is a household survey of Canadians aged 18 and older. Among other things, the survey looks at ways of earning money by selling new or used products through online bulletin boards or platforms such as Kijiji, eBay and Etsy, providing online freelance services, posting creative content online, such as YouTube videos, as well as offering peer-to-peer ride, delivery or accommodation services. In the US, the Bureau of Economic Analysis (BEA) had produced exploratory estimates on the digital economy contribution to US GDP (Barefoot et al, 2018). However, the definition of digital economy only includes goods and services that are primarily digital, which means that some peer-to-peer (P2P) platforms are excluded on the basis that they also have a non-digital component of 'in-person' provision of services.

Other surveys

In the absence of official statistics, several non-official surveys have been carried out to give some indication of recent developments and provide some estimates on the size and scale of this new economy, including the participation of respondents as users and/or service providers. Most of the examined surveys were carried out ad-hoc on a one-off basis and/or were exploratory in nature.

At European level, Eurobarometer opinion surveys were carried out in 2016 to gain insight into the level of participation and engagement of Europeans in online platforms (European Commission, 2016e; 2016f). This type of surveys is typically ad-hoc and carried out for the purpose of providing EU institutions with timely policy relevant information on specific

[7] The Consumer Price Index (CPI) only covers purchases by consumers from businesses and does not record the lower prices from peer-to-peer exchanges through platforms (Coyle, 2016).

[8] Economic gains obtained from digital activities are not captured in measured GDP (Bean, 2016).

issues and feed into policy discussions (see for example European Commission, 2016b) [9]. With a large sample size, these surveys collect a range of demographic data enabling stratification and weighting to match the overall population. The Flash Eurobarometer survey carried out in March 2016 prompted a sample of 14,050 EU citizens (aged 15 years and over) on their knowledge and use of 'collaborative platforms' (European Commission, 2016e). The sampling method applied in all countries was multi-stage random (probability). It is important to bear in mind that the definition of collaborative platforms in this survey is very broad covering also platforms intermediating assets and services with limited or no labour input. Another Eurobarometer survey (European Commission, 2016f) was carried out in April 2016, with a multi-stage, stratified, random (probability) sample of a total of 27,969 Europeans (aged 15 and over) across the 28 EU Member States. The survey asked questions on the frequency with which Europeans use different online platforms – that is, search engines, online social network (for instance to share pictures, videos, movies), online marketplaces (e-commerce websites where they can sell and buy products and services provided by multiple third parties).

Also broad in scope is the exploratory study on consumer issues in online peer-to-peer platform markets prepared by VVA, Milieu, and GFK for the European Commission's DG Just (2017). The study draws on an online survey of 10,019 internet users across 10 EU Member States[10] (about 1,000 for each country) using GfK consumer panels. Respondents were selected when they had participated in commercial peer-to-peer online platform exchange as consumers, providers or both in the previous 12 months in five sectors of activities[11]. These were (re)sale of goods, sharing/renting goods, sharing/renting accommodation, sharing/hiring rides, hiring non-professionals to perform personal services ('odd jobs'). The resulting estimates on participation, revenues and expenditure on peer-to-peer platforms were obtained by extrapolating the available survey data for the EU10 to the EU as a whole. The method for estimating total expenditure and revenue used in this study is based on the median peer expenditure/revenue in each of the five sectors (rather than average values). Using average values would lead to higher estimates of the economic size of peer-to-peer markets. The survey findings (and estimations) were supplemented by desk research, screening of online peer-to-peer platforms operating in the EU, qualitative interviews with platform representatives and focus groups with active users of online peer-to-peer platforms.

Based on an equally broad definition of 'sharing economy' (encompassing both capital and labour platforms using different business models), PwC carried out between June and August 2017 an online survey of 4,500 respondents (customers and providers) across six European countries – Austria, Belgium, Germany, the Netherlands, Switzerland and Turkey (PwC, 2018). The survey was set to analyse the size and acceptance of the platform economy in seven key industry segments, namely media and entertainment, hotels and accommodation, automotive and transport, retail and consumer goods, services, finance, and machinery. No information has been disclosed explaining the sampling method used for this survey.

More specific to the UK, TNS Global conducted for the National Institute of Economic and Social Research (Nesta) a pilot survey in 2014 among a nationally representative sample of 2,000 UK adults (aged 16 and over) who were asked questions about their participation in collaborative activities across eight sectors (transport, holidays, odd jobs and tasks, technologies and electronics, clothing and accessories, media, children's equipment and toys and household goods and appliances) (Stokes et al, 2014). Later in 2015, Nesta commissioned

[9] Associated staff working document is available at http://ec.europa.eu/DocsRoom/documents/16881/attachments/3/translations

[10] Bulgaria, Denmark, France, Germany, Italy, the Netherlands, Poland, Slovenia and Spain.

[11] Respondents were not asked to indicate whether they were professional or non-professional peer providers.

Tooley Street Research to propose a method to measure participation in a range of platform activities at a household level over the previous six months and the estimated monetary value of these transactions (Nesta, 2015). The platform activities in focus were the selling, lending, giving or leasing own assets using internet technologies. In order to test this method, a sample poll was conducted in February 2015 via a face-to-face omnibus survey of 2,010 adults aged 15 and over designed to be representative of the UK population. A battery of 10 questions were designed to capture these platform activities (see Annex 2). These build on the Nesta's definition of collaborative economy involving 'using Internet technologies to connect distributed groups of people to make better use of goods, skills and other useful things' (Nesta, 2015, p.1). When respondents answered positively to any of the set of pre-defined questions, they were asked additional questions to collect information on the monetary value of each activity. Questions were also asked about the types of goods sold or given away for free and whether the income obtained was the person's main source of income. Furthermore, the survey provides information on the median value of each activity undertaken in the six-month period. Estimates are based on responses from an unweighted small number of observations, so they rather serve as illustrations. The paper proposes to calculate a composite measure to monitor the scale of this economy, by multiplying the sum of the proportion of the population engaged in each activity by the estimated median values. The study provided an estimate of the total value of the platform economy (as defined by Nesta) by extrapolating from the sample size to the UK population as a whole (and using the weighted average composite value of such activities of £35 or €40).

In France, a consumer survey conducted in 2014 by TNS Sofres on behalf of the Directorate General for Enterprises (DGE, 2015) polled 2,006 adults selected from a nationally representative sample of the French population aged 18 years and over. The survey asked about their sharing economy habits, including types of transactions they engaged in (whether involving goods or services, including those without a monetary exchange), the frequency of such transactions, as well as spending on and income from these peer-to-peer exchanges. Post-stratification techniques were applied to ensure the sample was representative at regional level. The findings were used to estimate national expenditure on categories of 'sharing economy' goods and services, based on a set of assumptions about the average value per transaction. A follow-up study drawing from the DGE survey data used additional data sources to generate estimates of total outlay on domestic services for private individuals as well as total value of purchases and sales for other goods and services not covered in the original survey (DGE, 2016).

Other insight on to the size of the platform economy comes from relatively large opinion polls conducted in the US exploring the level of participation of people as consumers and/or providers in platform activities. Such surveys cover both labour and capital platforms. An example is the nationally representative panel survey of 4,787 American adults conducted by Pew Research Centre between November and December 2015 (Smith, 2016a). The survey explored general public attitudes, awareness and use of respondents – as clients – of online labour platforms (for example TaskRabbit, Fiverr, or Amazon Mechanical Turk) and ride-haling services (like Uber or Lyft) and use – as consumers – of a range of capital platforms (selling sites of handmade and second-hand goods, bike- and car-sharing services and home sharing sites). Also, questions measuring awareness and use of crowdfunding sites were included. No specific timeframe was given to the questions. A second panel survey wave was carried out between July and August 2016 among 4,579 respondents (Smith, 2016b). Survey questions distinguished labour platforms and capital platforms (including online selling platforms and home-sharing sites). The survey measured the prevalence of so called 'gig work' by asking respondents if they had earned money in the last year through any websites or mobile apps that connect workers directly with people who want to hire them, that require workers to create a user profile in order to find or accept work assignments, and that coordinate payments to workers once their task is complete. In addition, the survey asked a series of questions about the types of jobs these users have engaged in, including online tasks (such as surveys, data entry, etc.), ride-hailing, shopping/delivery, cleaning laundry, and other tasks. For both survey waves, the data were collected through the Pew American Trends

Panel (APT), which is a nationally representative panel of randomly selected US adults living in households. Members of the APT were recruited from two large, national landline and cell phone random-digit-dial contacts. Survey questionnaires were administered online for internet users, and by mail for non-internet users. The margin of sampling error for the 2015 and 2016 survey wave was +/- 1.94 and +/- 2.4 percentage points respectively. The response rate for the 2015 survey wave was of 68.4% among online panellists and 66% among mail respondents; for the 2016 wave it was 82% among online panellists and 74% among mail respondents. Survey data were weighted in a multi-step process to address selection probability biases. Market research has also explored the size of the platform economy at global level and its potential for further growth by means of online surveys. The Nielsen Global Survey of Share Communities polled in 2013 a sample of over 30,000 internet users in 60 countries (throughout Asia-Pacific, Europe[12], Latin America, the Middle East, Africa and North America) to explore public willingness in participating in sharing economy activities. A quota sampling technique was used for this survey; the sample quotas were based on age and sex for each country based on its internet users and the sample was weighted to be representative of internet users. The survey however did not measure what people were doing in terms of platform transactions. Furthermore, as stated by the authors, the survey 'provides a perspective only on the habits of existing internet users, not total populations' (Nielsen, 2014, p.3). Between October and November 2013, also Vision Critical and Crowd Companies (Owyang et al, 2014) conducted an online survey interviewing 90,112 people across the UK, US and Canada about their participation in the platform economy (involving buying/selling goods online and using a range of professional, transportation and financial services via well-established platforms). The questions regarding the collaborative economy were included in a general omnibus survey covering a variety of topics. The survey claims to be demographically representative of the adult populations (18 years and over). The data were weighted by age, gender, region and education, to be representative of the demographics of each nation.

Another larger internet-based survey was carried out between January and February 2015 by ING International in 13 European countries (12 EU Members States[13], plus Turkey), the US and Australia. Except from Luxembourg (500), around 1,000 respondents from each country responded to the survey. The total sample size of the study is 14,829. In this survey, the platform economy was referred to as 'sharing economy' and described to participants as utilising goods (such as a car, house or lawnmower) that would otherwise be idle or unused. Only platform activities involving payment were considered. No timeframe was given to the question on participation in the sharing economy; all other questions were bound by a 12-month timeframe.

[12] The European region in the Nielsen global survey includes the following countries: Austria, Belgium, Bulgaria, Croatia, Czech Republic , Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Ukraine.

[13] The EU Member States covered in the ING survey are the following: Austria, Belgium, Czech Republic, France, Germany, Italy, Luxembourg, the Netherlands, Poland, Romania, United Kingdom and Spain.

Measuring platform work in Europe and beyond[14]

Official labour market statistics

Official labour statistics typically fall short of measuring the size and scale of activities associated with platform work; they do not have specific indicators to measure the share of the total working population engaging in work mediated by platforms. The European Labour Force Survey (EU-LFS) provides indicators to measure the share of contingent work (including self-employed, temporary and involuntary part-time workers) as well as multiple-job holding. Yet, current measures are inadequate to capture the phenomenon.

Some national statistical offices have however made attempts to measure the share of people earning an income from digital platforms through official statistics. In the UK, new questions were tested in the annual LFS pilot asking respondents whether they had used a digital platform to find work and whether it was the main source of income (ONS, 2017a). A rewording of the questions is currently under consideration.

In 2017, Statistics Finland also introduced for the first time in the national LFS a question to estimate the number of Finns aged 15 to 74 who had earned an income through platforms in the previous year. The sub-sample for data concerning platforms was about 43,000 persons. The results from this sample were weighted to correspond to the entire population (aged 15-74) and the effects of non-response on the results were corrected through weighting to produce the correct population distributions by area, gender and age. Information from the job seeker register of the Ministry of Economic Affairs and Employment were also used as supplementary data.

Similarly, Statistics Denmark randomly sampled 18,043 Danes (aged 15-74) in spring 2017 as part of an ad-hoc module of the Danish LFS and asked about earnings from digital platforms within the previous year (Ilsøe and Madsen, 2017). In both the Finnish and Danish LFS modules respondents were asked about specific platforms, and therefore the resulting estimates can be considered as conservative.

The ad-hoc module of the French LFS carried out in 2017 looked at the use of digital platforms from a different angle, asking self-employed (with and without employees) whether they accessed clients exclusively or not through an intermediary, which could be either a digital platform or a more conventional business intermediary (Insee, 2018). Given the formulation of the question, it is not possible to establish the number of respondents who access clients exclusively through a digital platform. Also, the question does not convey what is meant by 'digital platform', leaving the interpretation to the respondents themselves.

Further afield, in the US, the Bureau of Labor Statistics (BLS) reinstated in 2017 the Contingent Work Survey (CWS), which had been discontinued in 2005. In 2017, the BLS introduced four new questions with a view to measuring electronically-mediated work (not necessarily or strictly speaking platform work). The Contingent Worker Supplement (CWS) is a set of questions that has periodically been appended to the nation's monthly labour force survey, the Current Population Survey (CPS). The interviews are conducted by telephone. The four new questions added to the CWS were designed to identify people who found short tasks or jobs through a website or mobile app that both connect them with customers and arrange payment for the tasks (US BLS, 2018). The CWS questions are asked of employed people and uses a 'last week' reference period. The questions were introduced by a statement that was intended to alert respondents about the specific questions (see Annex 2) and distinguished between in-person work and work done entirely online. The electronically mediated work questions were asked to more than 46,000 people, and there were relatively few 'yes' responses – about 1,609 for the in-person question, the online question, or both. As part of the quality assurance process, a number of 'false' positive answers to both in person

[14] Research findings from studies on platform work are compiled and reported in a literature review prepared and published recently by Eurofound (2018c).

and online questions were detected, probably due to the fact that the questions were too complex and cognitively demanding (US BLS, 2018). The BLS deemed that these questions did not work as intended and therefore they would be discontinued.
Another relevant data source in the US is the Federal Reserve's Survey of Enterprising and Informal Work Activities (EIWA). This is an online survey of adults (18 and over) conducted in October/November 2015, using probability-based online sampling. The study by Robles and McGee (2016), indicated that from a potential pool of 12,480, a total of 6,898 individuals completed a survey and were asked whether they engaged in informal online and offline paid work activities in the previous six months and 2,483 (or 36% of the sample within this group) were considered 'qualifying respondents'. They were then asked whether they earned an income through a number of online platforms. A six-month timeframe was used for the questions to minimise the recall burden for respondents. Post-stratification and weighting was used to make the sample more representative of the general population and correct for sample biases. It should be noted that the questions indicated specific capital and labour platforms as source of income and this may have resulted in more conservative estimates.

As in the US, Statistics Canada added a battery of new questions to their LFS in 2016 to measure both spending within and earnings from the platform economy (termed as 'sharing economy'). The focus was, however, only on the use of rental platforms (such as Airbnb and FlipKey) and ride services platforms (such as Uber and Lyft) during a period of 12 months. The survey was conducted in October 2016, with a multi-stage, stratified, random sample of a total of approximately 100,000 Canadian adults (aged 18 and over). The response rate for the collaborative economy questions was of 88%.

Non-official and ad-hoc surveys

European sources

Besides official statistics, there are many other European and national surveys measuring platform work. An often cited study is by FEPS, UniGlobal and the University of Hertfordshire (Huws et al, 2017). As part of this study, online surveys with a total sample of 8,690 adults were conducted by Ipsos MORI in Germany, the Netherlands, Sweden and the UK. These surveys were carried out as add-ons to regular national omnibus surveys. Other surveys were conducted subsequently as part of the same study in three other countries – Austria, Italy and Switzerland. Also, a companion offline survey was carried out via face-to-face interviews in the UK to test for selection bias due to the survey mode (that is, overrepresentation in the sample of internet users) (Huws et al, 2017). All samples were stratified by age, gender, region and working status to be representative of the total adult working age population and the results were weighted to take account of known differences between online and offline populations in each country.
The approach taken in this study was to construct a composite variable of crowd work by means of a number of variables with a view to differentiating crowd workers along different dimensions from other more conventional workers. In the first instance, in order to isolate crowd work from other overlapping practices, the respondents were asked whether they generated an income by renting out accommodation online through websites such as Airbnb, selling possessions or belongings (new and/or second hand) on websites such as eBay and Amazon. The research showed that it is difficult to disentangle crowd work from other income-generating activities. To identify crowd workers, the survey asked respondents whether they had ever sold their labour via a platform in any of three pre-defined categories (see Annex 2). The survey also asked about the frequency with which crowd workers provided labour services via an online platform and the proportion of income that it provides.
Compared to some other national surveys, Huws et al's study (2017) generated higher estimates. For example, for Sweden, Huws et al (2017) found that 10% of respondents had ever done work through platforms, but the Swedish government estimates are lower. A web survey (N=7,000) commissioned by the Swedish government and conducted in September 2016 found more conservative estimates (that is, 2.5% of working age Swedes had performed

some platform work, equating to about 150,000 people) (Statens Offentliga Utredningar, 2017). Similarly, in Norway, the Labour and Social Ministry commissioned Fafo Institute for Labour and Social Research (Forskningsstiftelsen Fafo) and the Centre for Applied Research of the Norwegian School of Economics (Norges Handelshøyskole, SNF) to conduct a survey similar to Huws et al (2017). In 2016, the consortium sampled 1,525 Norwegian adults aged 18 and above. Some 10% of respondents indicated they had done work for a platform at some point and 2% said they performed platform work on a weekly basis (Jesnes et al, 2016). Researchers indicated that the percentages had significant error margins and likely overestimated the prevalence of platform work in Norway. Compared with information collected from interviews with platforms in Norway, the actual number of workers may be substantially lower than found in the survey (Dolvik and Jesnes, 2017). The study was reproduced in 2017, but this time was carried out by phone. The survey indicated specific platforms in the wording of the questions, and this resulted in more conservative estimates (Alsos et al, 2017). With regard to the wording of the questions, the authors noted that when asking about platform work, it is important to be as concrete as possible and avoid vague formulations such as 'Have you done work via digital platforms?', which result inevitably in higher estimates. This is because for many respondents, it is unclear what is meant by a 'digital platform'.

De Groen et al (2017) also draw attention to the higher estimates obtained from Huws et al's survey as compared to those from the flash Eurobarometer survey on collaborative platforms, which used computer-assisted telephone interviews (CATI) for the data collection. Notwithstanding the different formulation of the questions, the higher estimates obtained in Huws et al's study may be due to the fact that respondents in online surveys are more likely to engage in online activities and they are therefore overrepresented in the sample. Also, low-paid platform workers – especially those performing small tasks online (microwork) – may have a greater incentive in participating in online surveys that reward them for their time. Furthermore, platform workers delivering the assigned tasks entirely online may be more used to fill in forms and complete an online survey than other platform workers delivering services offline and therefore may be overrepresented among platform workers population sampled in the survey.

Box 1: A note on survey mode

Apart from the definitions of online platforms used in surveys, it is often argued that the method used for the data collection results in different estimates, which are ultimately difficult to compare. The survey mode can affect study results in several ways. Arguably, the two most important sources of bias are coverage bias and measurement bias (see for example Vannieuwenhuyze et al, 2010).

Coverage bias occurs when the mode of survey administration affects the extent to which the survey sample covers the target population. Telephone surveys are limited to respondents who have a phone (and still often even to respondents who have a landline phone). Online surveys are limited to respondents that have access to an internet connection. Even in postal or face-to-face studies sections of the population are excluded (for example, the illiterate or the institutionalised). Differences in coverage will compromise comparability if not appropriately addressed.

Many of the surveys included in this mapping exercise are carried out online. This implies that respondents have access to an internet connection and are reasonably comfortable with an online environment. These respondents are therefore likely to be more familiar with, and make more use of, online platforms than those members of the target population that have no internet access. Adjusting the sample distribution through quotas or (post-stratification) weighting cannot correct for this bias, unless internet access is provided to respondents as part of the survey design.

Measurement bias occurs when respondents answer questions differently depending on the mode in which the question is asked. Studies have found differences between all modes, but the biggest differences are observed between interviewer-administered and self-administered

questionnaires. Evidence suggests that respondents are more honest when answering self-administered questionnaires. However, interviewers can correct inconsistencies in respondent answers, and motivate them to answer questions they might otherwise skip. As response quality is impacted in different ways by different modes, when choosing the mode, one should consider which aspects of response quality have the highest priority.
A further complication in this regard is that modes differ in both the complexity and volume of questionnaire items that can be asked. Face-to-face interviews allow for the longest and most complex questionnaires, as visual cues can be used, and interviewers can motivate and clarify. Telephone and postal interviews need to be short and simple. Online interviews can be more complex, but still need to be short.
The costs of each of the survey modes depend on the extent to which one aims to address coverage and measurement biases. Whereas face-to-face surveys tend to be time and budget intensive, gains in the cost-per-item and in fieldwork duration in population surveys are currently likely to mainly be made if one accepts that a certain degree of coverage bias is left unaddressed. Measurement biases can result in misestimation of the true size of a phenomenon. This is difficult to address, as if the true value is unknown, it is impossible to assess which mode performs best. Triangulation might offer a way out, but would require efforts to address coverage issues to ensure comparability between modes in this regard. Measurement biases remain an issue when comparing results between modes.

A different approach was used by the European Commission's JRC for the pilot online panel survey on platform work (COLLEEM)[15] (Pesole et al, 2018). Carried out in June 2017, the survey aimed at being representative of all internet users aged 16-74 years in 14 EU Member States[16], with a total sample of 32,409 (about 2,300 per country). A commercially available list of internet users in the selected countries was used as sampling frame, with non-probability quota sampling of respondents by gender and age groups. The survey contains a direct measure of labour services provision via platforms, asking respondents whether they have ever gained income from different online sources, two of which correspond to labour service platforms (online or in-person provided).
As there are biases inherent to the chosen sampling frame, the initial estimates of internet users responding positively to the initial questions (about income gained from online sources) were revised based on the properly representative estimates of internet usage from Eurostat's Community survey on ICT usage. These revisions were all downwards revisions reflecting the greater likelihood that the COLLEEM survey respondents were very regular internet users compared to the general working age population. In order to identify platform workers and restrict the definition of platform work, other questions were asked to this population cohort assessing the regularity, the time intensity and the significance of the income generated from the platform labour activity. In the survey main platform workers are defined as those who earn 50% or more of their income via platforms and/or work via platforms more than 20 hours a week. Post-stratification weights were applied to address self-selection and non-probability bias with respect to the level of formal education, frequency of internet use and employment status.
In a separate paper, the JRC has recently proposed a refinement of the approach used in the pilot COLLEEM survey to measure platform work as a form of employment (Pesole et al, 2019). This entails asking about the types of platform work performed; having established this, then ask more specific questions regarding the nature and characteristics of the work in relation to the main task category only. The tasks framework developed by Eurofound (2016)

[15] COLLaborative Economy and EMployment

[16] Croatia, Finland, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom.

can be used to compare tasks carried out as part of platform work and offline work in the traditional labour market.

Yet another approach to determine the size of the workforce engaging in platform activities defined in a broad sense (to cover both labour and capital platforms) was taken by McKinsey Global Institute, with their online panel survey of over 8,000 respondents conducted between June and July 2016 in France, Germany, Spain, Sweden, the UK and US (McKinsey Global Institute, 2016). The survey panel was a representative sample of the working-age population in each country controlling for demographics, including age, gender, and income. Respondents were asked to detail their sources of income over the past 12 months, including their primary work as well as any additional income-generating activities. The survey also measured the extent of independent work mediated by digital platforms, allowing workers to sell goods or lease assets or provide labour services. In this survey, 'independent work' is characterised by the characteristics of the work itself (not the legal arrangement), namely the high degree of autonomy, the payment by task, assignment, or volume of sales, and the short-term relationship with the customer. The EU15 estimates yield in this study are based on population-weighted extrapolation from the five surveyed countries.

A number of national surveys have been carried out in recent years, especially in the UK, where labour platforms – particularly those intermediating physical services – are garnering increasing public attention and face mounting criticisms over the treatment of their workers.

- The Action and Research Centre (RSA) surveyed 7,656 UK residents (aged 15 and older) between 11 November 2016 and 10 January 2017 as part of Capibus, Ipsos MORI's face-to-face omnibus survey[17] (Balaram et al, 2017). Data were weighted to age, region, working status and social grade within gender, as well as household tenure and respondent ethnicity. Population estimates were derived from a combination of National Readership Survey (NRS) data and the ONS's Mid-Year Estimates for 2016[18]. As part of this research, a sample of 1,918 respondents was also asked whether they would consider taking up gig work in future.
- In the UK, the Chartered Institute for Personnel and Development (CIPD) surveyed online a nationally representative sample of 5,019 people (aged 18-70) between 2 and 15 December 2016. The sample included employees in traditional employment, those engaging in platform work and the unemployed. The figures are weighted to be representative by social grade, region, gender and age and ethnicity. Within this survey, gig economy workers are defined as individuals who have used an online platform at least once in the last 12 months to do any of the following activities: provide transport using their own vehicle (for example Uber, BlaBlaCar); rent out their own vehicle (for example EasyCar, Zipcar); deliver food or goods (for example Deliveroo, City Sprint); perform short-term jobs via online platforms that connect people looking for services (for example TaskRabbit, Upwork, PeoplePerHour); other work arranged through an online platform.
- The UK governmental Department for Business, Energy and Industrial Strategy (BEIS, 2018) used two survey channels (NatCen Pane and YouGov Omnibus survey) between July and August 2017 for their estimations on the gig economy. The NatCen Panel, a probability-based online survey of 2,184 individuals (aged 18 and over) in Britain (excluding Northern Ireland), was used to estimate the number of people involved in the gig economy. Panel members were recruited through the British Social Attitudes survey whose participants were selected at random. They were first invited to participate online, and those who have not taken part were then contacted

[17] The survey questionnaire is available online at: https://www.thersa.org/globalassets/pdfs/reports/supporting-documents/good-gigs-appendix.pdf

[18] The total population for UK adults aged 15+ is estimated at 52,171,000.

by telephone to avoid digital exclusion. The YouGov Omnibus, a non-probability online panel survey conducted in five waves totalling 11,354 UK respondents (aged 18 and over), was used to explore in more depth the characteristics and work practices of those engaging in gig work in consideration of the much large sample compared to the NatCen Panel.

Also in Germany, labour platforms are the segments of the platform economy which have been most under scrutiny. There have been a number of studies estimating the size of what is often labelled 'crowd work', but most of these rely on relatively small sample sizes (below 2,200) and are unlikely to provide representative results (Serfling, 2018). There are some recent studies that rely on larger samples (for example Bonin and Rinne, 2017; Serfling, 2018; Serfling, 2019). The study conducted by Bonin and Rinne in 2017 (N=10,017) for the German Federal Ministry of Labour and Social Affairs (Bundesministerium für Arbeit und Soziales, BMAS) found that about 2.9% of the German working population had done platform work (Bonin and Rinne, 2017). This percentage according to the authors themselves was an overestimation as many of the respondents could not name a platform on which they were active, and others indicated activities which cannot be regarded as crowd work as such (for example selling goods on eBay). Following data cleaning, the revised estimate provided by the authors was of 0.85% of active crowd workers, 'which accounts for approximately 1 million Germans' (Bonin and Rinne 2017, p.9, as cited in Serfling, 2018).

As part of a 2-year research project (running from December 2017 to November 2019), a recent study co-funded by the German Federal Ministry of Labour and Social Affairs (Serfling, 2018) explored the size and characteristics of crowd work in Germany. The data for this study were collected by the Opinion Polling and Market Research Company Civey GmbH through an open-access web panel with 1.25 million active registered users in Germany. There is a constant refresh of the panel, as new users enter the Civey Polls, signup and continue polling. Panel attrition is addressed through a variety of means, for example Civey fosters intrinsic motivation by giving access to representative results and a User-Dashboard, where registered users have additional ways of analysing the polls they participated in.

The first cut in the data stream was in April 2018 (N=376,750) and the second was in October 2018 (N=494,970). As stated by the author, the study results 'do not meet the strict requirement in order to be called representative' (Serfling, 2018, p.12) and the estimates may be biased upward. This can be attributed to the sample composition – that is, internet users – in which a higher percentage of crowd workers are more likely to be identified compared to the population as a whole. Specific techniques were nonetheless applied in order to address and partly reduce selection and sampling biases arising from the use of a non-probability sample. This included the use of so-called 'riversampling'[19], which, in the context of this poll survey, consisted in embedding a polling html widget across over 25,000 newspaper sites and blogs with different political orientation to target a variety of audience. All socio-politico-demographics are self-reported. To reduce biases, quasi-randomisation was also applied via an algorithm directing the poll to relevant users. Only those for whom sufficient socio-demographic data were collected were considered part of the sample (Serfling, 2019). Other selection biases with respect to socio-demographics (for example, gender, age, education[20], marital status, population density at zip code level) were addressed by applying post-stratification weights. Remaining selection biases with regard to other socio-demographic characteristics – for which data were not collected - or unobservable characteristics could not

[19] This term originates in biology and refers to sampling water quality at different parts of the river to assess the average water quality.

[20] Education was not used as a weighting variable in the first crowdworking monitor (July 2017-April 2018).

be corrected. A number of post-validity checks were conducted to reduce noise in the data, but this comes at substantial cost of the sample size.

Finally, there are several studies drawing from surveys investigating characteristics of work associated with specific types of platform (for example on-location or online platform work) or individual labour platforms. Albeit informative, the findings cannot be generalised to all platforms.

With regard to online platform work, the ILO had commissioned a specific survey of crowd workers on CrowdFlower and AMT platforms, which was undertaken between November and December 2015 (Berg, 2016). It should be noted that there is no universal database of crowd workers, which allows drawing a random sample, and this limits the representativeness of the CrowdFlowers sample used for this study. In the case of AMT, the survey draws from the MTurk tracker website, which has been tracking the demographics of AMT workers since 2010.

The survey was divided into two parts. The first part was intended to collect basic demographics and some additional measures of crowd work experience (as well as a few questions to identify the quality of the responses). The second part of the survey included more detailed questions about work experience and work history. The first part of the survey was completed correctly by 353 globally based workers on CrowdFlower and 814 Indian and American workers on AMT. In the case of CrowdFlower, individual workers could not be identified via a unique identification and therefore could not be invited to complete the second part of the survey. There were 677 ATM workers that participated to the second part of the survey. Respondents received a small compensation for their participation in the survey.

AMT in particular has been the focus of much empirical research (see for example Irani and Silberman, 2013; Brawley and Pury, 2016) in consideration of the greater precariousness and insecurity associated with micro task platform work. AMT is also one of the oldest, most established and well-known labour platforms. Such studies typically draw from online surveys that AMT workers are invited to complete in exchange of a small compensation. Researchers have made efforts to improve the quality of the data obtained from Mturkers in online surveys and devised effective ways to address quality issues (Lovett et al, 2018).

US surveys

Prior to the introduction of the questions on electronic mediated work in the CWS, Katz and Krueger (2016) replicated the CWS between October and November 2015 – as part of the RAND American Life Panel (resulting in the Rand-Princeton Contingent Worker Survey, RPCWS). The core of the questionnaire[21] was based on the BLS's CWS but was expanded to include questions on whether workers sold services or goods directly to customers, and, if so, whether they worked through online intermediaries. A total of 6,028 individuals were invited to fill out the questionnaire, and a total of 3,850 completed the questionnaire online, for a response rate of 63.9%. The ALP sample was recruited using a compilation of methods, including a group recruited for the University of Michigan internet panel, a random digit dial sample, and a snowball sample. A set of survey weights were applied to increase representativeness that is, align the sample to the Current Population Survey (CPS) according to age, gender, race/ethnicity, education and household income groups and to account for the over-representation of self-employed among respondents. A number of questions in the survey sought to explore the size of the online gig workforce, which according to the results appears to be small. The survey also asked workers whether their main job or a secondary job involved direct selling to customers and included a battery of questions exploring the nature

[21] The questionnaire is available online at https://alpdata.rand.org/index.php?page=data&p=showsurvey&syid=441

of this direct selling (see questions in Annex 2).
In 2018, Katz and Krueger revisited their research using data from the CWS for 1995 to 2017, the 2015 RAND-Princeton CWS and administrative tax data from the Internal Revenue Service for 2000 to 2016 (Katz and Krueger, 2019). In their conclusions, Katz and Krueger themselves noted that their previous research may have overestimated the size of the workforce in 'alternative work arrangements' and pointed to the statistical difficulties in measuring platform work: 'we conclude that the basic monthly CPS and CWS instrument may have difficulty capturing changes in the incidence of casual or intermittent work in the US because of respondent reporting errors that are likely to be exacerbated during a period of changing work relationships' (Katz and Krueger, 2019, p.3). They also drew attention to some important lessons stemming from their review – in particular it is key 'to hold constant survey modes, questionnaires, and survey design features to guard against the risk that non-sampling errors dominate time-series comparisons' (p.21).

As part of their review, Katz and Krueger (2019) also conducted in March 2015 an online survey of 2,291 individuals (aged 18 and older) recruited on AMT and paid $3 (€2.7) for their participation. As stated by the authors, this sample was not meant to be representative, but was selected to include a large number of workers who worked on multiple jobs, often on a casual basis. The aim was to establish whether the standard CPS-type question on multiple job holding failed to capture a substantial amount of the secondary work that takes place. The probing question was closely patterned on the US BLS's CPS question and was the following: 'Last week did you have more than one job or business, including part time, evening or weekend work?'. After asking multiple job holders (39% of the AMT participants) how many jobs they held in the previous week, the survey asked all respondents 'Did you work on any gigs, HITs or other small paid jobs last week that you did not include in your response to the previous question?' and describe any work they had not reported. Of those who did not indicate holding multiple jobs on the first question, 61% admitted that they had failed to report working on a gig, HIT or small job in the previous week. On this basis the authors concluded that the standard multiple job holding question in the CPS leads to underestimations of multiple job holdings and presumably gig work.
In the context of the increase in the share of the contingent workforce in the US, a number of other surveys have been carried out by private organisations – for example, MBO partners and the Freelancers' union (in cooperation with online freelancing platform Upwork) – to explore the phenomenon and, in some cases explicitly linking it to the rise and expansion of the platform economy. The estimates vary depending on the definitions of 'independent work', the timeframe for the questions asked to respondents and the sampling strategy (see for an overview the gig economy data hub). For example,

- the MBO Partners' state of independence profiling survey (MBO partners, 2018), which was commissioned to Emergent Research and Rockbridge Associates and carried out online, polled 3,584 US residents (aged 21 and older) in 2018. The results were used to size the independent workforce. Responses were weighted demographically to be representative of the US population. Since 2011 the survey has been asking respondents whether they had used an online platform to find work over the previous 12 months. It should be noted that this survey counts anything above 15 hours per week as full-time, whereas full-time work is generally considered to mean 40 hours per week.
- Freelancers Union conducted an online panel survey in 2016 of 6,002 of American adults who had done paid work in the previous 12 months and distinguished between freelancers and non-freelancers. The former group were defined as individuals who engaged in supplemental, temporary contract-based work. The survey results were weighted to ensure demographic representation in line with the US BLS' 2016 labour force statistics from the current population survey and the American community survey.

Big data

New technologies offer the means to enrich the data collection for example by using proprietary commercial data (often owned by banks), web crawling, web scraping and application programming interfaces. Some statistical offices such as Statistics Canada are considering such options (Loranger et al, 2018). Similarly, the UK ONS and the Italian national statistical office (ISTAT) have plans to identify platform companies also using web scrapping.

A widely cited study on the platform economy drawing from big data is Farrell and Greig's (2016). The authors used proprietary data on JPMorgan Chase's American customers' bank account transactions to estimate participation in the platform economy, defined as including both labour platforms (for example Uber) and capital platforms (for example Airbnb). Based on frequencies of bank transactions from a total universe of 6.3 million account holders who had an account continuously for three years (from October 2012 to September 2015), Farrell and Gregg identified just over 265,000 individuals who earned an income from capital or labour platforms. The figures on labour platform participation rates are consistent with previous estimates using different methods (for example Harris and Kruger, 2015). The participation rate estimates are however based on income from only 30 identified platforms which does not represent the full universe of platforms. The data are also skewed towards an older profile of current account holders and may therefore underrepresent younger age groups who are more likely to feature as platform economy participants. In a 2018 update, JP Morgan Chase and Co. Institute (Farrell et al, 2018) used a different way of sampling. The study universe comprised 39 million anonymised bank accounts; of those, 7.2 million met the inclusion criterion of continuous active account over a 66 months-period (from October 2012 to March 2018). A larger number of platforms (128) were identified in this study. The methodology used in the above described studies can be considered robust, reliable and repeatable but such data can be accessed and used only by banks which own the data.

Some scholars have devised some other innovative methods to map the size of various segments of the platform economy such as web scraping. This allows parsing the source code of platforms' web sites, extracting and pasting into a database the most relevant or useful information depending on the research question at hand. For example, as part of the iLabour project[22] at the Oxford Internet Institute, Kässi and Lehdonvirta (2016; 2018) extracted data of five largest English-language online labour platforms (intermediating digital services)[23] through API (application programming interface) access and web scraping. These platforms accounted for at least 70% of the market by traffic. The data were used to construct an Online Labour Index (OLI), which tracks the volume of work transacted on the platforms. The OLI measures the supply and demand of online freelance labour across countries and occupations by tracking the number of open, completed and new vacancies (job, project or task) posted across platforms. The OLI also collects data on type of work transacted digitally or occupations mostly inferred using the platforms' own taxonomies. The occupations are grouped in six broadly similar occupation classes (see table 10). When platform do not provide specific information that fit into the OLI's classification, a machine learning module is used to predict the occupation.

[22] The iLabour project is funded by the European Research Council (ERC) and runs until 2020.

[23] These are Freelancer, Guru, AMT, PeoplePerHour and Upwork. Platforms for local gigs, such as Uber and Deliveroo, are excluded.

Table 10: Occupation classification used in OLI

Occupation class name	Example of work
Clerical and data entry	customer service, data entry, transcription
Creative and multimedia	animation, graphic design, photography
Professional services	accounting, legal, project management
Sales and marketing support	lead generation, posting ads, search engine optimisation
Software dev and tech	data science, game development, qa
Writing and translation	article writing, copywriting, translation

Source: Kässi, 2016, available at http://ilabour.oii.ox.ac.uk/how-is-online-work-classified/.

The growth of this market (by occupations and countries) can be tracked in real time on the online labour index interactive visualisation.

Also specific to platform work, other ad hoc statistical methods – for example based on online searches – have been used by scholars to make estimations on the number of active workers engaged in platform-mediated work. For example, US research conducted by Harris and Krueger (2015) analysed the frequency of Google searches for terms related to online intermediaries involving the use of an internet-based app to match clients to workers who perform discrete personal tasks. This definition includes services such as driving a passenger from point A to point B or delivering a meal to a customer's house but excludes the online sale of goods, the provision of impersonal services (for example teachers selling lesson plans) and renting of accommodation on lodging sites. Using Google trends data, Harris and Krueger (2015) identified the most prominent companies acting as online intermediaries and calculated rough estimates of their size and growth rate. The authors extrapolated data on a number of active Uber drivers and derived an estimate of the share of Uber drivers in the total workforce in the US engaging in online work (about 400,000 drivers in the fall of 2015). The research was based on the assumption that the number of workers providing services through an intermediary was proportional to the number of Google searches and, on this basis, Harris and Krueger (2015) made estimations of the share of the US workforce engaged in online work. Based on this same methodology, de Groen and Maselli (2016) calculated their estimations of active workers engaging in platform work in Europe.

Another way of gathering platform information is through web crawling where relevant data are systematically downloaded from platform websites and copied into a database. De Groen et al (2016) used this method to collect data from the website of the Belgian local service provider platform ListMinut including information on the workers and the tasks posted on the website as well as provided by the workers in the period from 23 December 2013 to 22 December 2015. The crawled data was used for in-depth analysis and supplemented with Belgian statistics (to identify the gender of the workers) and geographical coordinates using the postal code to estimate the distance between the location of the worker and where the task ought to be performed. The web-crawled database included observations on 14,113 workers and 9,459 posted tasks, of which only a little over 25% was matched and completed (2,396 tasks in total) in the two-year sample period. Earlier in 2015, Maselli and Fabo conducted a similar study with a focus on the Italian design platform CoContest. They extracted

information accessible from the platform website through an automatic script. The crawled data on all contests and submissions as of September 2015 was copied onto a database and subsequently analysed.
Another often cited web-crawled database is the online live Mturk Tracker set up in 2010 by Ipeirotis, which provides data on key demographic variables relating to AMT workers, based on an on-going six-question survey, as well as information on requesters and tasks.

Platform data (provided by platforms and/or derived from other sources)

Statistical offices have been exploring supplementary data sources, including administrative data, which can include more observations than household surveys, which increasingly display low response rates (The Economist, 2018). Reliable data sources – which are not systematically used – are national tax authorities and business registers. Such data may provide new information which can help addressing some of the shortcomings of survey-based measures. In an effort to estimate the size of the platform economy and its growth, a number of scholars (for example, Kuek et al, 2015; Fabo et al, 2017) have relied on secondary sources and/or data provided directly by online platforms and, in some cases, supplemented by expert interviews.

Data on tax returns

Some national statistical offices are in the process of reviewing administrative data sources with a view to collecting information on the platform economy. A case in point is the UK ONS which is considering the analysis of tax returns from her Majesty's Revenue and Customs (ONS, 2017a). In the US, this type of analysis was carried out on an exploratory basis by the Office of Tax Analysis of the U.S. Department of Treasury in 2017 on a sample of 2014 individual tax returns (Jackson et al, 2017). Here there is also the issue of underestimation as not all individuals earning an income through platforms may file any tax returns. There is also the likelihood that amongst those indicating a gig economy income, for a significant share this income may be a small part of their overall income.
There are sporadic independent studies on specific platforms using tax data obtained from tax authorities. For example, Fafo Institute for Applied Social Science collected tax data from the Norwegian Tax Administration about UberPop drivers (see Alsos et al, 2018).

Data from business registers and databases

Information about online platforms can be also drawn from business registers and databases. A case in point is a recent study on online platforms carried out by the Italian National Institute for Public Policy Analysis INAPP (former ISFOL) covering the 2012-2016 period (Guarascio and Sacchi, 2018). The analysis started with a desk research for the identification of platform companies operating in Italy and collection of detailed economic and employment information on platform businesses from business registers and administrative data sources. The collected data were used for a preliminary descriptive analysis to examine the employment and economic dynamics of prominent online platforms in Italy (for which sufficient information was available). Economic and employment information were drawn from the AIDA Bureau Van Dyik (BvD) database containing balance sheet information on the universe of Italian limited liability companies. The data used for the analysis concerned revenues, value added, profits, taxes and social security contributions per employee, number of employees and contracts (by type), gross worker turnover. These data were supplemented with detailed information on employment contracts (hirings, terminations, changes of contracts, etc.) from the Italian Labour Ministry's administrative register, which draws from companies' mandatory communications (Comunicazioni Obbligatorie, COB). The analysis specifically focuses on platforms offering intermediation services for real estate, accommodation and classified ads (Subito.it, Casa.it and Booking), labour platforms providing food-delivery (Deliveroo, Just-Eat, Foodora) and pet care services (Petme) and Italian branches of three global platforms with fast market penetration, that is, Amazon,

Facebook and Google, on which many platform businesses tend to rely to organise and carry out their activities. This is a preliminary analysis carried out as part of a broader research project, with a view to developing a set of quantitative indicators for inclusion in a survey targeting both online platforms and service providers/workers.

Studies based on secondary sources and platform disclosures

Global platform surveys have explored the platform economy from different angles and/or looking at specific segments of this economy. Drawing from publicly available platform data, a global study carried out by Kuek et al (2015) for the World Bank assessed the size of what they labelled 'online outsourcing' (including online freelancing and microwork) – in terms of revenues and number of active workers. Data used to estimate the geographical distribution of workers engaging in online outsourcing came from three individual platforms Upwork, CrowdFlower, and Amazon Mechanical Turk. To establish the profile of platform workers, publicly available quantitative data were combined with data from qualitative interviews. From a different perspective, a global platform survey conducted between March and June 2014 polled online executives and managers from 110 for profit and not-for profit platforms operating in North America, Europe and Latin America and looked at the challenges to growth for platforms (see Wagner et al, 2015).

At EU level, a 2016 study conducted by PwC for the European Commission's DG Grow focused on five broad economic sectors – peer-to-peer accommodation, peer-to-peer transportation, on-demand household services, on-demand professional services and collaborative finance (Vaughan and Daverio, 2016). These sectors were further split into sub-sectors. The PwC study calculated estimates on the size of the platform economy in each of these sectors, drawing from a range of secondary sources (over the period 2013-2015), including statistical databases, company websites, media information about individual platforms, publicly available company financial information, investor reports, financial statements. For each sub-sector, PWC conducted 'a data translation and triangulation exercise' (p.11). In such studies, triangulation entails the use different types of data to arrive to estimates. Typically, unknown figures are estimated on the basis of known figures; for example, in the 2016 PwC study, platform revenues were estimated on the basis of the number of customers and the average price of service. The study also relied on assumptions on regional penetration of major platforms (and collaborative economy services in general) in order to translate sub-sector sizing estimates to the EU market.

Following the same market sizing and forecasting approach, an earlier study conducted by PwC (Vaughan and Hawksworth, 2014) estimated the potential size of the revenue for five sectors (P2P finance, online staffing, P2P accommodation, car sharing and music and video streaming) compared to traditional sector group (equipment rental, B&B and hostels, car rental and DVD rental). The sectoral coverage in this earlier study included the video and music streaming sector and excluded on-demand household services. Estimates on revenues were based on historical industry and company revenues.

De Groen et al (2017) also used the 'triangulation approach' to estimate the size of the work-related platform economy in Europe in terms of gross revenues and number of active workers in 2016. Gross revenues referred to both the compensation for the execution of the task, activity or job, as well as the fee charged by the online platform for the services provided. The active workers included both the actual employees responsible for the running of the platforms and the service providers performing the tasks via the platforms.

In their analysis, the authors partly relied on information on labour platforms from the JRC database, recently enriched with data on the number of unique visitors to platforms' website and location of visitors. These data come from Amazon's Alexa for August 2017 and served as a proxy for the amount of activity on a platform.

As the JRC dataset provides information on gross revenues for the platforms' global activities, De Groen et al (2017) interpolated the data to scale the revenues from the global level to the EU level by multiplying data on global revenue with the platform's share of

unique visitors in the EU. This is based on the assumption that platforms generate the same gross revenue per unique visitor regardless of where they operate. Another limitation that the authors were faced with was the lack of information on revenues and number of active workers for many platforms. The authors used a hierarchical clustering technique to categorise the platforms in recognition of the fact that the business model underlying the functioning of these platforms is different; the clusters were identified using key variables drawn from the literature; these were skill level, location of service provision, market sector and types of services offered by the platform, and whether the platform intermediates a task via an app or not (as the number of unique visitors does not capture all online platform activities). These variables determining clusters may however only determine part of the revenues per unique visitor. The three identified clusters in the analysis were broadly similar to the three platform work types examined in recent Eurofound research (Eurofound, 2018b). Information on gross revenues for geographical areas and unique visitors was available for about 1/3 of the platforms in each cluster. Only some platforms for which information was available in each cluster were used for their estimations of gross revenue; the estimates were used instead when data in the dataset were missing. A similar estimation approach was used for determining the number of active workers or service providers in the EU.

Another recent EU study prepared for the European Commission's DG Grow (European Commission, 2018b) provided estimates on the size of what was labelled the 'collaborative economy' in terms of revenues and employment in four sectors at country level: transport, accommodation, finance, and online skills (on-demand household services, on-demand professional services). In the study, the revenue estimates were based on the results of an online survey of platforms. The results were supplemented by usage data on each platform collected from search engines and internet traffic. Based on survey responses, the authors calculated ratios of revenue/usage for each sector and applied the revenue/usage coefficient to platforms that did not respond to the survey. Therefore, the reliability of the revenue/usage ratios is partly dependent on the survey response rate, which was around 11%. Furthermore, the revenues for the calculation of the ratio were adjusted using the per capita GDP figures of the various Member States[24], which may not entirely reflect price differences for sector-specific collaborative economy services. The amount of employment in the collaborative economy was estimated by dividing revenues at country and sector level by turnover per person employed for the respective services sectors, based on Eurostat data. The estimation is therefore based on the assumption that employment is linked with sector revenues.

As pointed by the authors themselves, the results borne out of this study cannot be directly compared with the other studies mentioned above, and the reasons for this is to be ascribed to the fact that 'the definition of collaborative economy has been interpreted differently in each study, the studies have covered different types and numbers of platforms, while different terminology (that is, in the finance sector 'market size' versus 'volume' or 'transactions' versus 'platform revenues') and methodologies have been used' (European Commission, 2018b, p.16).

There are various mapping studies of online platforms drawing from publicly available information, which have been carried out in recent years. One difficulty in mapping the platform economy is that most platform companies are privately held start-ups, and there is limited information available to the public regarding their size, growth rate, revenues, or profitability. As for labour platforms, most service providers or platform workers are not classified as employees, and therefore information on the number of active workers is not always available – the disclosure of this information is at the discretion of individual platform companies. In spite of these limitations, efforts have been made to compile relevant information on platform companies.

In 2015, the Center for Global Enterprise launched an initiative to build a global database of platform companies as part of the Emerging Platform Economy project (Evans and Gawer,

[24] International platform revenues were allocated to a single country based on URL code

2016). A requirement for the inclusion of platform companies in the database was that they met a threshold of $1 billion (€0.9 billion) market cap or valuation. The platform companies were identified by consulting platform experts and scholars and via a range of search tools and databases (for example Quid Web Intelligence tool, CB insights, Thomson Reuters Eikon financial database). A total of 176 platform companies were identified including large publicly traded companies as well as smaller private companies (for example Uber and Airbnb). As of 2015, the total value of these companies was over $4.3 trillion (€3.8 trillion), which is a testimony of the size and scale that the platform economy has achieved in recent years.

Narrow in scope is the mapping exercise conducted by Fabo et al (2017) for the European Commission's JRC, which identified 199 service platforms active in the EU either originating within or outside the EU (typically in the US). For the purpose of this study, three main types of platforms were considered: transportation platforms, which can be further divided into platforms that either focus on the transportation of people or goods; platforms trading online services (for example design, IT services); and platforms trading offline, local services (for example delivery or housework). Platform information collected in the database was collected from the company websites and through the media, supplemented by information obtained from an online survey sent to the identified platforms. Only 11 platforms responded to the survey (5% response rate), many of which did not release sensitive information, which they deemed to be part of their competitive advantage, for example about the turnover. Also the quality of the data reported by the platforms and collected in the database is uncertain as such data are not necessarily subject to external audit.

A mapping of platforms on national scale was carried out in Italy by Collaboriamo and Trailab (2016a). The information in the database was collected via desk research, publicly available information about platforms and a survey questionnaire administered in October 2016 to 138 active platforms operating in Italy and identified in the mapping exercise (64 of the total sample participated in the survey). Crowdfunding platforms were identified by the same organisation in a separate study (Collaboriamo and Trailab, 2016b); information was collected via an online survey questionnaire administered in October 2016 (of the total sample, 41 platforms participated in the survey).

Platforms' impact studies and surveys

Many platforms do not publish or make readily available data, which is regarded as important part of their competitive advantage and therefore they prefer to keep it confidential. Nonetheless some platforms have begun to measure their economic or environmental impact or conduct surveys among their members.

Airbnb has been conducting local impact studies since 2012 to show its (positive) economic and environmental effects on local communities (Airbnb, 2014a)[25]. Airbnb carried out the first of such studies at nationwide scale in 2014. The study reviewed impacts across the UK (and within London and Edinburgh). It draws on data about Airbnb hosts and visitors in the UK (for the period between November 2012 and October 2013), including an analysis of booking data, and supplemented by an online survey of UK hosts and guests visiting the UK, London and Edinburgh with a total of 3,956 responses. There is also a growing number of independent studies on the economic impact of Airbnb on the hotel industry and accommodation market (for example Guttentag and Smith, 2017; Zervas et al, 2017; Ključnikov et al, 2018; Dogru et al, 2019; Heo et al, 2019) and housing market (Horne and Merante, 2017) in individual cities. Different data sources, methods and statistical techniques

[25] See Airbnb blog site at https://www.airbnbcitizen.com/celebrating-earth-day-with-new-data-on-airbnbs-environmental-impact/; http://blog.airbnb.com/economic-impact-airbnb and http://blog.airbnb.com/environmental-impacts-of-home-sharing/.

were used across these studies, depending on the specific research focus. For example, Zervas and colleagues (2017) investigated the impact of Airbnb entry in the Texas hotel market on hotel revenues. To quantify this impact, they used the difference in difference empirical method identifying the Airbnb treatment effect by comparing differences in revenue for hotels in cities affected by Airbnb prior and after the Airbnb market entry, against a baseline of differences in revenue for hotels in cities not affected by Airbnb. The data were mainly collected directly from the Airbnb website, and supplemented by data assembled (used as control variables) from a range of publicly available sources (for example, monthly hotel room revenues from the public records provided by the Texas Comptroller of Public Accounts, demographic data from the US Census Bureau, airport passenger data from the US Bureau of Transportation Statistics, hotel reviews from TripAdvisor). The full raw dataset spanned a period from January 2003 to August 2014.

Box 2. A snapshot of findings from platforms' own impact studies using undisclosed methodologies

Ridesharing platform BlaBlaCar reported in 2015 on its environmental impact stating that it saved 1,000.000 tons CO2 over the previous two years, which equates to what 250,000 cars emit every year assuming four tons per car per year. These savings are attributable to higher occupancy rate (2.8 passengers per car) compared to the average rate (1.7 passenger per car) (BlaBlaCar, 2015). Another study on the environmental impact of both P2P and B2C car sharing platforms found that together a reduction of 8-13% GHG emission is achieved (Nijland et al, 2015). It is suggested that this reduction is lower for the P2P car sharing platforms as they rely on a less new and fuel efficient fleet of cars compared to those of B2C cars, which are generally new and less polluting (Frenken, 2017).

Data made available by other platforms operating in the UK indicate that people renting out their own cars through Easy Car Club earn an average of £1,800 (€2,040) a year (Wosskow, 2014) , and Zipcar members save around £300 (€340) per month compared to owning a car.

Ride-hailing platform Uber commissioned the Benenson Survey Group (BSG) to conduct a web survey of Uber's driver-partners in December 2014 in 20 cities or market areas (representing 85% of all of Uber's US driver-partners). The survey was conducted again in November 2015 in 25 cities or market areas (representing 68 % of Uber's US driver-partners). A total of 601 drivers completed the 2014 survey and 833 drivers completed the 2015 survey. The BSG surveys used a stratified design, and weights were derived to make the sample representative of all drivers in terms of the services they offered (uberX, UberBLACK or both); other strata were drawn in proportion to the population and self-weighting. Although the response rate to the surveys was only around 10%, based on a comparison of aggregated administrative data, the (weighted) respondents were not very different from the full set of driver-partners in terms of their average working hours or hourly earnings. The survey data were subsequently used by Hall and Krueger (2016) in their analysis of the labour market for Uber's driver-partners, their motivations for partnering with Uber, and contrasted their demographic characteristics with those of conventional taxi drivers and chauffeurs in the same market, based on data from the American Community Survey (ACS) as well as all workers. Hall and Krueger supplemented the survey data with anonymised administrative data on Uber drivers' driving histories, schedules and earnings between 2012 and 2014.

Uber also commissioned similar surveys in the UK. A survey was conducted via telephone in September 2017 by market research company ORB International, polling 1,002 Uber drivers throughout England, Scotland and Wales (ORB International, 2017). The data were weighted to ensure they were representative of the total distribution of drivers who use the Uber app across the UK. The findings of the survey touch on income, working time and work-life balance, motivation for driving for Uber and employment status. In March 2018, ORB International conducted for Uber another survey interviewing via telephone a sample of 1,001 drivers who used the Uber app in London at the time the survey was run. To ensure that the survey covered only 'current' drivers active in London driving with UberX or UberPOOL, the

pool of drivers was limited to those who fulfilled a number of criteria which were the following: completed 80% of total trips in London; completed at least one trip in the last four weeks; had worked eight weeks in the last year; completed an average of one or more trips per week; completed 90% of their journeys using UberX or UberPOOL. The 1,001 drivers interviewed in this survey were randomly selected from a random sample of 16,000 driver records (containing unique identifiers and telephone numbers) provided by Uber to ORB International, drawing from a population of about 38,000 drivers who fulfilled the above criteria. In the case of non-response from a selected respondent, or being unavailable at the time of the call, a call-back was scheduled. These survey data were used by Berger and colleagues (2018) to explore further Uber drivers' backgrounds, earnings and well-being. The analysis also drew from additional data sources, which included administrative data from Uber, data from the UK Labour Force Survey (January-March 2018) and the Annual Population Survey (April 2016-March 2017).

Conclusions and discussion

Measurement challenges and data limitations

This mapping of measurements has started with a review of the many terms and definitions used to measure the platform economy and pointed to the definitional variety and complexity in the relevant research. The lack of an agreed international term and definition poses methodological challenges as it makes comparisons of estimates very difficult across studies, not only between countries but also within countries.

This mapping also shows that it is difficult to capture statistically the continuously evolving platform economy, which is, by its nature, cross-sectoral and does not readily fit official sector classifications, which are functionally-based such as the European Nomenclature of Economic Activities (NACE). It is possible for any businesses in any sector to contribute to the platform economy. The sector categorisation of platform companies is also a contentious issue (Eurofound, 2018b) and it is not clear whether platforms are to be considered tech companies, with the algorithm as a core element of their functioning, or rather classified according to the relevant economic sector based on the type of service they provide (transport, professional services, etc). Platform companies also change their business model dynamically, which makes it difficult to categorise them, complicating longitudinal comparisons.

Variables such as revenues and employment generated by the platform economy – in the case of peer-to-peer platforms – cannot be easily monitored due to the network-based business model characterising online platforms, which spreads the supply across a wide range of small service providers. Major publicly traded platform companies publish annual reports, which provide some information on platform revenues, but the data typically refer to platforms' global activities. The same applies to the number (directly) employed by platform companies. A number of studies – identified in this mapping exercise – providing various estimates (particularly in revenue terms) on the scale of specific segments of the platform economy do not disclose the methodologies and data sources used as basis of their estimations (for example, World Bank, 2013; Goldman Sachs, 2015; Olson and Kemp, 2015). Other empirical studies drawing on secondary sources tend to rely on speculative assumptions for the extrapolation of estimations to the whole platform economy, based on public information available on individual platforms in specific sectors (Vaughan and Daverio, 2016; Kuek et al, 2015). This method may not sufficiently take into account the diversity of platform businesses within the platform economy (for example in terms of business models, development stage of platforms, etc) and country specificities in the case of international comparative research. Such studies typically have also to deal with a high number of missing values, which may undermine the reliability of the generated estimates.

To add a further layer of complexity, service providers engaging in peer-to-peer platforms – who derive an income from selling or renting assets and/or providing services – are individuals and not businesses, and administrative business statistics do not pick up on these activities.

Statistical offices may obtain aggregate information on productive activities of households directly from the digital intermediary platforms in their jurisdictions (Loranger et al, 2018). Yet, while data collection via official statistics, by their nature, is national in scope, the platform economy is transnational and may not lend itself to be captured in national data sources (Kässi and Lehdonvirta, 2018).

A non-negligible aspect in data collection via official statistics is that it is a costly endeavour, which cannot be repeated on a regular basis and tends to be done on a one-off basis. As illustrated in this review, most surveys have small samples and mainly focus on platform work (see also OECD, 2019) or individual platforms. It is often the case that platform workers are given a monetary incentive to participate in surveys, which raises a host of ethical concerns and possibly biases the results. There is some experimentation underway by some national statistical offices in relation to most appropriate statistical channels to collect information on the size of the platform economy (or specific segments such as platform work). With regard to surveys, common issues typically relate to the survey mode and

sampling method to correct for sample biases, wording of questions (which often are too cognitively demanding and inevitably rely on subjective interpretation), reference period to reduce the recall burden on respondents (for example, last week, last 6 months, last 12 months), and the range of platform activities to cover.

One approach being explored by some national statistical offices (for example the UK ONS and Statistics Netherlands) is to include a set of questions (as a module) in existing surveys, although there are always limitations to the number of new questions that can be included. Existing surveys that lend themselves to this exercise are for example those on ICT usage of businesses and individuals[26], the budget and time use surveys, and, not least, the Labour Force Survey (with regard to platform work). Important drawbacks are that some of these surveys are not carried out on an annual basis but less frequently, and specialised modules to capture platform economy phenomena would only be added on an even less frequent basis. This would undermine data timeliness.

Box 3: Specific statistical challenges in measurements of platform work

According to Hathaway (2015), broad surveys are unlikely to capture the real employment effects of the platform economy. Hathaway (2015) argues that platform work tends to be concentrated in certain industries (specifically ground passenger transportation and accommodation) and geographic locations. Therefore, studies analysing data at higher levels of sector and geographic aggregation may miss the increase of platform related employment.

Another difficulty has to do with the current ISCO/occupation classification, which does not allow to identify platform workers; for example, it may be easy to identify taxi drivers but it is more or less impossible to distinguish between taxi drivers partnering with a ride hailing platform (such as Uber) – based on the extent to which they work for the platform – and other (self-employed) taxi drivers in the traditional economy. There have been some attempts in different countries to measure the size of platform work via Labour Force Surveys but also measurements in labour statistics result in reporting errors. Katz and Krueger (2019) point to the statistical difficulties when the world of work is changing, in particular in capturing multi job holding, which is an important part of measuring platform work. The so-called 'unbundling of tasks' (Pesole et al, 2018, p.34) inherent in platform work poses a further difficulty for measurements; platform work often consists of individual atomised tasks as opposed to bundles of tasks as in a job or occupation in the traditional sense.

It is also challenging to estimate the volume of work and of traded tasks. In most EU Member States, platforms are not legally obliged to make available information on the number and volume of transactions. Also, many work platforms do not disclose information such as the approximate numbers of service providers and clients. When they do share their statistics of the number of registered providers, this may not be a precise measure of their active workforce (Stewart et al, 2015).

Live tracking of platforms and users and datasets compiled through web crawling, scraping and APIs access (see for example, Ipeirotis, 2010; De Groen et al, 2016; Kässi and Lehdonvirta, 2018; Fabo et al, 2017) provide some insight into the scale and scope of platform work. Such methods offer ways to enrich the data collection from official statistics and make it possible to get hold of platforms' data that would be otherwise inaccessible. These are however time-consuming and labour-intensive data collection methods, which also come with their own caveats. Big data sources tend to be unstructured, unrepresentative/ biased, and require much statistical effort to be processed. There are also ethical concerns and data protection issues as the data gathered by means of web crawling and scraping is used for purposes other than those for which they are originally recorded and consent given by users in

[26] Some questions about the use of online platforms are already included in national statistics as part of a European agreement; national data are used as input to Eurostat's *Community survey on ICT usage in households and by individuals.*

the first place upon registering to the platform's site. Among other things, this raises a whole array of legal and compliance issues, especially in the context of the new EU General Data Protection Regulation (GPDR).

Besides survey measures, there are various estimates based on platform disclosures and impact studies funded by the platforms themselves. Albeit informative, data sources and methods used are often not obvious and the findings cannot be verified and replicated as they are based on proprietary data of the companies themselves and not on publicly available data. The data made available are often partial or disaggregated across country boundaries and the figures only relate to the participation in a single platform. Such studies are usually carried out as a one-off, which does not allow gauging changes over time. Not least, the results from impact studies directly funded or carried out by the platforms themselves may also be biased as these studies are at least partly used for marketing purposes and it is in the interest of the platforms to show positive impact.

Concluding remarks

As highlighted by the experts consulted as part of this mapping exercise, there is a need for greater cooperation among national statistical offices, possibly under the leadership of Eurostat or another relevant European or international body, to establish a common approach to measurements of the platform economy and ensure better comparability of estimates. The starting point is to critically review the definitions currently in use and come to an agreement on what businesses or parts of them are to be considered as belonging to the platform economy, what aspects are to be measured and how to do so. As pointed out by the consulted experts, for example the concept of 'idle capacity' - underlying many broad definitions of collaborative or sharing economy - is particularly problematic when applying it to individuals' time or skills. Underutilisation is more straightforward when applied to physical assets.

The debate on definitions is bound to continue. Also narrowing the definition to platform work may miss more long-term developements and fail to capture indirect economic and employment effects of platforms with a limited or no labour element. The assumption is that such platforms would nevertheless contribute to a restructuring of labour relations. They also have an impact on incumbent businesses for example by forcing them to change their business model to keep or mantain their market share.

Based on the exploratory work done by some national statistical offices (for example the UK ONS), the use of terms such as sharing or collaborative economy is not particularly useful when collecting data from individuals. For this reason, the ONS has rather opted for the inclusion of questions in the *Internet Access module of the Opinions and Lifestyle Survey* asking respondents about the use of websites or apps for arranging accommodation and transport. The questions are a proxy for the level of platform activity in the country (from the consumer side), albeit limited to two economic sectors (chosen because of the greater policy interest in these sectors). Responses to these questions are used as national input to Eurostat statistics on ICT usage of persons, therefore allowing for cross-country comparisons. Possibly additional questions could be included in these statistics, covering some other sectors where there is evidence that platforms are growing in importance and reaching some 'critical mass' as regards the number of users.

With regard to platform work, the mapping in this working paper has highlighted the difficulty in measuring the share of people working on platforms through surveys, including the labour force surveys, by virtue of the casual and discontinuous nature of the work (which is often supplementary to the main paid job). As work arrangements change, taken-for-granted concepts such as jobs, employers, wages take on new meanings. There may be a need to nuance those concepts in order to build useful frameworks to support the data collection on the platform economy.

Some national statistical offices in Europe have started some cooperation and are in the process of exploring the range of options to improve the data collection with a view to monitoring, among other things, patterns of atypical work that reflect the use of online platforms. Official statistics should lead the way and provide the reference point which all other studies can refer to and build on. The labour force survey remains the reference statistical source and most appropriate instrument to capture the share of the population engaging in work mediated by platforms (as a share of the working population) in consideration of both the large sample size and rigorous sampling technique used.

The JRC (Pesole et al, 2019) has recently proposed two approaches to measure platform work; one approach aims at measuring platform work as individual participation in the labour force through surveys (as done in the LFS for traditional employment) and the other approach consists in measuring platform work as labour input using platform data, and mimicking measurements in national business statistics.

In spite of the many limitations, ad hoc online surveys using unconventional sampling techniques should not be discarded, as they remain valuable approaches with a view to measuring the growth of platform work and/or exploring specific aspects – for example working and employment conditions – associated with this new form of work. Such surveys could use the same wording as questions developed for official statistics. This allows comparing specific groups of platform workers (for example Uber drivers) to LFS respondents in the same or equivalent occupation.

The problem of most web surveys resorting to unconventional sampling techniques is that they sample from an unknown universe, in the sense that there is no baseline number of platform workers from which to sample. Sample frame issues are typically handled by means of weighting and post-stratification, which is however not sufficient to ensure survey representativeness. It may be argued that the relevant population from which to sample are the internet users (as opposed to the general population) on the assumption that platform workers are necessarily bound to use the internet.

Other information about the platforms such as turnover, number of employees, etc. can be collected from business registers and business surveys. This information is instrumental in understanding what platform businesses look like. A valid approach in the identification of platform businesses in national accounts is that based on a decision tree (as proposed and used by the UK ONS and Statistics Netherlands) drawing from a given definition. This helps to reduce discretion by providing a framework to classify businesses beyond the definition and it allows building a list or register of platform businesses. Administrative data derived from business registers and administrative data sources can also be used for counterfactual analysis to shed some light on the extent to which companies facilitating the selling of goods and access to services via a platform differentiate from those that do the same without a platform in the same sector of activity.

It is also crucial for national statistical offices to establish and/or maintain close cooperation and dialogue with large individual platforms as well as trade bodies representing businesses that define themselves as being part of the sharing economy (for example Sharing Economy UK or SEUK, Sharing Economy Ireland) with a view to collecting/sharing quantitative data and understanding better their business models.

Furthermore, information about online platforms can be also retrieved directly from the platforms' web sites or APIs. Some platforms are willing to provide APIs albeit with some restrictions and there are terms and conditions that apply. If these options are not available, the last resort is web scraping, which should be done ethically and following the guidelines or indications provided by the platforms' sites, in a way that data are retrieved without damaging the business, overloading the servers, and also compromising any future cooperation with the platforms. In line with the new GDPR rules, data anonymisation is required during the data collection. This puts an extra layer of complexity and also requires validation by a legal office when done directly by the national statistical offices. In the context of the implementation of

the GDPR, the legality of web scraping is not entirely defined. This is still an unchartered territory that would require more clarity and attention from legislators.

A number of studies have resorted to the triangulation method (drawing from different types of data) as a way to generate estimates on the size of the platform economy (for example in terms of revenues and number of users or service providers). Some of the statistical techniques (for example the clustering technique to categorise platforms) used to analyse the data are promising but the quality of the estimates is reliant on the quality and availability of the data inputted, which is often problematic. The paucity and quality of the data remains an issue to address. One possible route is to make mandatory at least for the larger platform companies the sharing of data with public authorities (for example tax authorities) but also give an incentive to do so. In some EU countries some favourable tax regimes for platform workers and/or work platforms have been introduced (for example in Estonia and Belgium). As part of these new tax systems, a wider range of data could be collected from platforms, which could be used by national statistical offices or other public authorities for monitoring the growth of the platform economy. National authorities may require platform companies to provide data on the number of their active workers and clients, the countries where they are located, how many and what type of tasks/jobs are posted and performed via the platforms, and other information related to their business models (which often platforms are reluctant to share as this information is deemed an important part of their competitive advantage).

An avenue worthwhile exploring is the use of administrative data (from business registers and tax returns) collected by public authorities, which could supplement current statistics and address some shortcomings of survey-based measures. Some national statistical offices are considering such possibilities. In the case of large banks, one option is for national statistical offices to get hold of anonymised bank transactions data in order to track income from platforms (as in the JP Morgan & Chase Institute's study, see Farrell and Greig, 2016) as a proxy of the scale of the platform economy.

To conclude, there is no single best method to determine the size of the platform economy but a variety of methods depending also on the research question. As pointed out by the consulted experts, there is also a need to go beyond the question on the size of the workforce engaged in platform work. For example, the issue of the dependency on an individual platform (for example, due to the inability to transfer ratings from one platform to another, or through exclusion clauses or because of de facto monopolies) does not necessarily concern only platform workers but touches on broader issues of business regulation. From a policy making perspective, it is important to protect people from becoming too dependent from a monopoly power and reduce the risk to which the market exposes them. Individuals selling or lending or swapping assets through online platforms should be in a position to diversify their customer base and use different platforms. Most of the policy interest has been so far on platform work because of the regulatory issues at stake (for example linked to employment status). Yet, there are wide ranging implications arising from the growth of platforms, for example in terms of competition, tax evasion, data protection, consumer protection, etc. that deserve more attention and should be investigated further and monitored with a view to giving a broader picture of an evolving and fast growing platform economy.

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Annex 1: Estimates and key findings from identified empirical studies

Listing below is chronological (from oldest to most recent publications) and by author within each year.

Publication (authors)	Estimates / Key findings
World Bank, 2013	• Crowdfunding market expected to expand significantly. Estimated that crowdfunding investments will amount to $96 billion (€86 billion) a year in developing countries alone by 2025.
Airbnb, 2014a	• Airbnb guests consume less energy by 63-78%, less water by 12-48% and generate less GHG emissions by 61-89% compared to hotel guests.
Airbnb, 2014b	• Between November 2012 and October 2013 some 63% of Airbnb hosts in the UK reported that Airbnb income helped them pay bills they would otherwise struggle to pay, and a typical Airbnb host earns £3,613 (€4,092) by renting out for 33 nights a year.[27] • Airbnb generated £642 million (€727 million) in economic activity in the UK in one year and supported 11,629 jobs.
Hawksworth and Vaughan, 2014	• Collaborative economy worth $15 billion (€13.4 billion) (or 5% of total revenue) in the five sectors (car and room sharing, crowdfunding, personal services and video/audio streaming) and could reach $335 billion (€299 billion) by 2025. • Corporate revenue in the UK was of about £500 million (€567 million) in 2013. Revenues predicted to rise to £9 billion (€10 billion) by 2025.
Owyang et al, 2014	• 113 million platform users or so called 'sharers' (80 million in the US, 10 million in Canada and 23 million in the UK) reported having used a website or mobile app in the previous 12 months for any of a pre-defined list of platform services. • Sharing has a small gender gap, sharers (engaged only in buying and selling pre-owned goods) tend to be younger (18-34) and are more likely to engage in many different kinds of online activities. Sharing is more an urban phenomenon. • About 75% of respondents mention convenience as a reason for sharing and more than half mention price.
Nielsen, 2014	• Willingness to share assets with others is higher in developing regions (Asia-Pacific: 78%; Latin

[27] https://www.airbnb.ie/press/news/new-study-airbnb-community-generates-824-million-in-economic-activity-in-the-uk

Publication (authors)	Estimates / Key findings
	America: 70%) than developed regions (Europe: 54%; North America: 53%). • 17% of those willing to participate in the platform economy are Millennials (aged 21-34), followed by 14% of Generation X respondents (aged 35-49), with baby boomers (aged 50-64) and 65+ respondents lagging behind (8% and 2% respectively).
Stokes et al, 2014 (Nesta)	• 25% of the UK adult population shared online in some way. 20 % of respondents bought or sold used goods in the previous year, and only 8% had borrowed or lent something for free. • Participation ranged considerably across different sectors, and only 1% of respondents accessed or offered odd jobs and tasks through websites, mobile devices and apps.
Burston-Marsteller, the Aspen Institute and TIME, 2015	• 44% of American adults have used collaborative platforms, in the capacity of lenders and borrowers, drivers and riders, hosts and guests. This account for more than 90 million people in the US. • About 42% (or 86 million people) have used at least one service offered by a platform and another 22% (or 45 million people) have worked through a platform (offered at least one service through a platform). • On the supply side, the services offered are mainly home repair and moving (11%), ride sharing (10%), accommodation (9%), and food delivery (7%) and car rental/sharing (6%). In terms of income, 39% of households earn less than 25% of their income from the platform economy, and 29% rely heavily on income from platforms. • About 36% of workers earning less than 40 % of their monthly income and 33% earning more than 40% of their monthly income from platforms, see the platform economy as their primary source of income.
DGE,2015	• French households spend an estimated 8% of their money and earn approximately 9% of their income through the sharing economy.
Harris and Krueger, 2015	• Identified 26 prominent companies acting as online intermediaries. • Estimated 0.4% of the US employment engaging with an online intermediary in the gig economy (600,000 workers) in the fall of 2015.
ING International, 2015	• Around 5% of European consumers have declared having participated in the sharing economy (9% in the US). Participation is highest amongst younger generations (under 35) and well-educated.

Publication (authors)	Estimates / Key findings
	• Factors influencing participation in the sharing economy are that it saves money, it is good for the environment, it is an easy way to earn some extra money and it helps build communities. On average, a third of European consumers think their participation in the sharing economy would increase over the next 12 months. • The majority of Europeans who shared an asset for money earned €1,000 or less in the last 12 months. Median of earnings for sharers in Europe was around €300.
Goldman Sachs, 2015	• As of 2014, $4.7 trillion (€4.2 trillion) of revenue at the traditional financial services companies were at risk for disruption by the new technology-enabled entrants. • About $1.5 billion (€1.34 billion) was pledged on crowdfunding platform Kickstarter in the period 2010-2014 with a single largest campaign Pebble time raising $17 million (€15 million).
Kuek et al, 2015	• Global annual gross market size (including workers' earnings and fees charged by platforms within online outsourcing) was about $2 billion (€1.7 billion) in 2013. • Projected market size for 2016: $4.8 billion (€4.2 billion). • About 47.8 million registered workers on the platforms, of whom 10% active.
Maselli and Fabo, 2015	• About 70% of the total sample of registered designers on CoContest platform who entered at least one submission (516) were from Italy, 8% from Serbia and the rest spread across various countries. • Italian designers received 30% lower remuneration than their counterparts in the Italian local market, while Serbian participants earned on average €69 per submission, that is three times higher than on the Serbian local market.
Nesta, 2015	• Most popular platform activity relates to the selling of assets over the internet (17% of the total sample) and providing donations or funding (17%). • A smaller share of respondents had sold or given away their skills using the internet (5% and 4% respectively). Taking all the categories together, about 31% of the sample had engaged in any type of activities listed above in the previous six months leading to the survey.

Publication (authors)	Estimates / Key findings
	• Estimated total value of the platform economy (as defined by Nesta) in the UK of around £1 million (€1.1 million) in the six-month period[28].
Olson and Kemp (Piper Jaffray), 2015	• Airbnb hosts' share of the accommodation market could increase from 2% (as of 2015) to as much as 10% by 2025 in the US. • Peer-to-peer ridesharing platforms estimated to account for $5.2 billion (€4.6 billion) in global revenues, compared to a global $90 billion (€80 billion) taxi market.
PwC, 2015	• Familiarity and engagement: 44% US adults were familiar with the sharing economy; 18% have participated in the sharing economy as a consumer, and 7% as a provider. • Benefits: 86% agree it makes life more affordable; 83% agree it makes life more convenient and efficient; 76% agree it is better for the environment; 78% agree it builds stronger community; 63% agree it is more fun than engaging with traditional companies; 89% agree it is based on trust. • Concerns: 72% agree they feel that the experience is non consistent and 69% that they would not trust sharing economy companies until they are recommended by others they trust.
Wagner et al, 2015	• The majority of the surveyed platforms see a need to grow across borders. Particularly Europe-based platforms face particular difficulties to further develop their business, especially compared to businesses in the US. • The diversity of regulatory framework may represent an important challenge for platforms, which makes business expansion a costly endeavour.
Berg, 2016	• 37% of 686 U.S. AMT workers held AMT as main source of income. Of the 128 surveyed Indian workers, 49% relied on platform work as their main source of income.
Collaboriamo and Trailab, 2016a	• Identified 138 platforms active in Italy. Of these, 47 operate in handling transportation and personal services. • More than half of all identified platforms are located in the North of Italy.

[28] The authors themselves noted that 'the value of collaborative activity as defined in this way is very small'.

Publication (authors)	Estimates / Key findings
	• About 31% of the total sample estimated to have more than 30,000 workers and clients.
Collaboriamo and Trailab, 2016b	• Identified 70 crowdfunding platforms active in Italy. These were classified in five categories (Donation Reward, DIY, Equity, Lending and Crowdfunding). • On average, 5.9 persons work for crowdfunding, of whom 3.0 employees, and 2.7 are younger than 35 years.
De Groen et al, 2016	• Of the 2,396 completed tasks (between 2013 to 2015) on Belgian local service provider platform ListMinut, 31% were in home repair. An additional 27% took place in tasks related to gardening, followed by two occupations that were nearly equally large, namely animal care or pet sitting with 10% and transport services with 11%. • Hourly remuneration on this platform varies according to the task category, but it is on average €17.8 per hour (after fees).
De Groen and Maselli, 2016	• Estimated there were about 100,000 active participants in Europe (or 0.05% of total EU employment) engaged in platform work at the end of 2015 (of whom about 65,000 active through Uber).
DGE, 2016	• In France, total spending on sharing economy goods and services (excluding private property rental and second-hand vehicle sales) amounted to €37.3 billion in 2014. • Sharing economy accounts for less than 10% of household spending and income. • Carpooling is the single biggest peer-to-peer expenditure item in the 'travel' category. • Private holiday rentals account for 30% of total spending on holiday accommodation. • Households spend more than €2 billion a year on peer-to-peer food transactions. • Peer-to-peer transactions make up more than 10% of total spending on durable consumer goods, cultural goods, clothing and footwear. • Private property rentals account for 65% of the non-holiday rental market. • Second-hand car sales make up one quarter of all car sales in France.
European Commission, 2016e (Flash Eurobarometer 438)	• 17% of EU respondents had used a collaborative platform at some stage as a service provider or client. Of the group of respondents who had used a platform, 5% said they offered their services regularly (every month). • Respondents in France (36%) and Ireland (35%) were most likely to have used collaborative

Publication (authors)	Estimates / Key findings
	platforms, whereas respondents in Cyprus (2%) and Malta (4%) were least likely to have done so.
European Commission, 2016f (Special Eurobarometer Survey 447)	• 60% of internet users use an online social network at least once a week, and 30% use online marketplaces with the same frequency.
Evans and Gawer, 2016	• Identified a total of 176 platform companies (operating transaction, integrated, innovation and investment platforms) worldwide with a market valuation of $1 billion (€893 million) or more. • Transaction platforms are largest in number (160), but integrated platforms (six identified) have the highest market valuations. • North America and Asia are home to a large and diverse group of platform companies; Europe is significantly lagging behind. Of the 160 transaction platforms identified globally, only 7% are headquartered in Europe. • A total of 27 platform companies in Europe across 10 countries, including seven EU Member States. Altogether they represent over 4% by market value. The UK has the largest number with nine followed by Germany with five, Russia with three, and France, the Netherlands and Sweden with two each. The remaining four European platforms are located in Ireland, Israel, Luxembourg and Norway. • Only 13 privately owned platforms (out of ta total of 107 identified) were founded in Europe. Public platform companies are fewer in number (overall 69) but typically run much larger operations. Only 14 were identified in Europe.
Farrell and Greig, 2016	• Estimated that around 4% of the universe had received at least one payment in the three-year period from any of the identified platforms. Of those, around 20% received an income from labour platforms and 80% from capital platforms. • In the most recent month (September 2015), about 1% of adults in the sample had earned an income from the platform economy and this monthly participation had increased 10-fold from 2013 to 2015. • Labour platforms are growing at a faster rate than capital platform, which, however, continue to be significantly larger. In the most recent month available (September 2015), about 0.4% of adults in the sample received an income from labour platforms and 0.6% from capital platforms. • The profile of work platform participants is different from capital platform participants.

Publication (authors)	Estimates / Key findings
Freelancers Union, 2016	• Estimated 55 million Americans engage in some type of freelance work. • 54% of freelancer workers had been paid for projects that they had found and completed online. • Compared to previous survey waves, the 2016 survey reported that an increasing share of freelancers had found work through social media (36% in 2016; 31% in 2015), online freelance marketplaces (21% in 2016; 19% in 2015) and sharing economy sites (12% in 2016; 10% in 2015).
Hall and Krueger, 2016	• About 24% of the surveyed Uber drivers, earnings through Uber constituted their only source of personal income. • For 16%, Uber was the largest but not the only source of income, and 38% of drivers used Uber derived income as a supplement to other income and not as a significant source.
Jesnes et al, 2016	• Identified 30 platform work platforms and 30 'capital platforms' (such as Airbnb and Etsy) in Norway in 2015.
Katz and Krueger, 2016	• In 2015, 15.8% of workers in the US relied on alternative work arrangements – defined as temporary help agency workers, on-call workers, contract workers, and independent contractors or freelancers – as their main job (up from 10.7% in 2005). • Within this group, workers providing services through online intermediaries, such as Uber or Task Rabbit, accounted for 0.5% of all workers in 2015. • The incidence of alternative work arrangements had increased from 10.7% in 2005 to 15.8% in 2015.
McKinsey Global Institute, 2016	• Estimated that 9 million people (in the EU 15 and US) earn an income through labour platforms (for example Deliveroo, TaskRabbit, Uber and Upwork), 13 million by selling goods (via for example Etsy, eBay, DaWanda) and 3 million leasing assets (via for example Airbnb, Boatbound, Getaround, BlaBlaCar). • About 70%, of respondents whether primary or secondary job holders, report engaging in independent work by choice, preferring greater autonomy and flexibility than traditional jobs typically offer. Also the majority of this group are casual earners, using independent work to supplement other sources of income.
Robles and McGee, 2016	• Estimated that the incidence rate of platform work in the US is in the range of 4.3%.

Publication (authors)	Estimates / Key findings
	• 32% of the (2,483) 'qualified respondents' reported having participated in online selling of new or used goods in the previous six months (leading to the survey), 12.9% engaged in online tasks for pay and 10.7% rented out property or other items they own, through websites, newspaper ads, flyers, etc..
Smith, 2016a (Pew Research Center)	• 72% of American adults have used at least one of 11 different shared and on-demand services. • 15% of American adults used ride-hailing apps. • Around one-in-ten Americans have used a home-sharing site such as Airbnb or HomeAway to stay in someone's home for a period of time. • Around one-in-five American adults have contributed to an online fundraising project on a site like Kickstarter or GoFundMe, and 3% of Americans have created their own fundraising project on one of these sites. The majority of crowdfunding users have contributed to a handful of projects.
Smith, 2016b (Pew Research Center)	• About 8% of American adults reported having earned money from some type of digital work platform in 2015, often by doing online tasks. • As to capital platforms only 1% of respondents reported having used home-sharing sites to supplement their income but a much higher percentage (18%) earned money by selling goods online.
Vaughan and Daverio 2016	• Identified 273 collaborative platforms comprising work platforms as well as capital (rental and accommodation) platforms. • Estimated that the platform economy in five key sectors generated revenues of €3.6 billion in the EU in 2015 (less than 0.1% of EU GDP). • Transportation platforms generated revenues of €1.65 billion, followed by accommodation (€1.15 billion), household services (€450 million), collaborative finance (€250 million) and professional service (€100 million). • Online platforms facilitated transactions of around €28 billion in 2015; the value of transactions grew by 56% in 2013 and 77% in 2014.
Alsos et al, 2017	• 0.5 to 1% of the Norwegian working age population (18-65 years) had used a platform to earn income in the previous 12 months.
Balaram et al, 2017	• Estimated that there are 1.1 million people in Britain's gig economy; around 3.1% of British adults aged 15+ have tried gig work of some form (1.6 million adults in the UK's working age population).

Publication (authors)	Estimates / Key findings
	• Of the 2.2% who indicated they were currently active in gig work, 80% worked less than 16 hours per week. Only about 8% of gig workers indicated that they did platform work full-time. • One in four young people (aged 16-30) would contemplate engaging in some form of it in future.
Bonin and Rinne, 2017	• About 2.9% of the German working population had done platform work and 3.1% found work via an app (no timeframe in the question).
CIPD, 2017	• 4% of all respondents aged 18-70 were identified as platform workers, based on their participation in platform work at least once over the past 12 months. • Extrapolating for the working age UK population of people 16 years old and over, an estimated 1.3 million adults would be active in platform work.
De Groen et al, 2017	• Estimated that the platform economy (extrapolating from data available on work platforms) in the EU generated around €4.5 billion in gross revenue for 2016 (equating to 0.03% of EU GDP) and had about 12.8 million active workers.
European Commission (DG Just), 2017	• 72% of respondents had acted both as consumers and providers on P2P platforms and most of them had used only one platform (respectively 78% peer consumers and 79% peer providers). • More than three quarters of respondents reported having concluded one or more transactions on a P2P platform over the previous 12 months – 73% had used platforms for the sale and resale of goods; 8% platforms for odd jobs, 12% platforms for sharing/renting of goods, 14% accommodation renting/sharing to 15% of the online population using ride sharing/hiring platforms. About half of both peer providers and consumers (54%) use these P2P platforms monthly or weekly. • A substantial proportion of peer providers in the accommodation sector rent out accommodation on a regular basis, 15.9% once a week and 20.6 % once a month; the remainder rent out with lower frequency (35.7% do so a couple of times per year and 27.8% once a year). • With respect to the full sample of internet users in the EU10, a total of 65.4%, reported some earnings or spending from transactions on P2P platforms in the previous 12 months. • Based on the available data for the EU10 on participation and expenditure, the study extrapolated to the EU as a whole and estimated 191 million citizens across the EU28 have engaged in some P2P transactions over a 12-month period and spent €27.9

Publication (authors)	Estimates / Key findings
	billion per year on online P2P platforms in the five sectors considered. • A total of 485 platforms identified in the EU, of which only 4% are very large with over 100,000 unique daily visitors.
Eurostat, 2017	• 18% of all EU respondents arranged accommodation online and 8% arranged transport services online from another private individual. • The UK is the country with the highest share of individuals arranging accommodation (34%) and transport services (27%) online from another private individual.
Fabo et al, 2017	• Identified a total of 199 domestic and international platform operating in the EU28. Of these 199 platforms, 173 are work related platforms. • Half of the largest platforms originate outside the EU and tend to be leaders in large number of industries. • France and the UK have about 50 platforms each. Germany, the Netherlands and Spain had about 40 platforms. Belgium and Italy had about 30 platforms each. Most other countries in the EU28 had about 20 or fewer platforms. • Most of the platforms tend to employ a small number of employees (apart from the service providers). Only 36 of the platforms employs at least 50 people. The total employed directly by platforms in the EU possibly in the range of several thousands.
Huws et al, 2017	• The sale of goods online – taking many forms – is the most prevalent income-generating activity. Between 50% to 66% of respondents (depending on the surveyed country) reported earning an income online which involve the sale of own possessions (for example via eBay). • A lower share of respondents (ranging from 9% to 22% depending on the surveyed country) said that they ever sold their labour via online platforms (9% in the Netherlands and the UK, 10% in Sweden, 12% in Germany, 18 in Switzerland, 19% in Austria, and 22% in Italy. • Lower are the percentages of those engaging with platform work at least weekly (ranging from 5% to 12%) and at least monthly (ranging from 6% to 15%).
Ilsøe and Madsen (FAOS), 2017	• 2.4% of the population – equivalent to more than 100,000 of Danish adults – had earned money via digital platforms within the previous year (from Q1 in 2016 to Q1 of 2017). • About 1% earned money through a labour platform (equivalent to about 42,000 persons) – for example

Publication (authors)	Estimates / Key findings
	Happy Helper, Upwork, Worksome, and Uber – and 1.5% earned money via a capital platform such as Airbnb or GoMore. • Earnings via digital platforms are supplementary to other sources of income; most of those who obtained an income via digital platforms earned less than DKK 25,000 (€3,330) annually before taxes. • The profile of those earning money via labour platforms and capital platforms is also very different; high-skilled and high-earners across different age groups are overrepresented among Danes supplementing their income from capital platforms, while young, low-paid, low-skilled, unemployed, immigrants and workers with temporary contracts tend to be overrepresented among those supplementing their income with earnings from labour platforms.
Jackson et al, 2017	• In 2014, 24.9 million individuals filed returns reporting the operation of a non-farm sole proprietorship and 16.8 million earned a profit (and paid self-employment tax) from those activities. • Of the16.8 million tax filers, about 109,700 individuals filed a tax return reporting income from participating in a 'gig economy' or online platform-based business (representing about 0.7% of all workers)[29]. • 39 % of 'gig economy' participants were primarily wage earners and an additional 19.5% reported a mix of earnings from wages and self-employment.
ONS, 2017	• 28% of British adults used intermediary websites or apps to arrange accommodation in a year and about 22% arranged transport services through similar means.
ORB International, 2017	• 91% drivers said being 'very/somewhat satisfied' driving with Uber while 89% would 'recommend driving with Uber to others interested in driving'. 92% also stated that Uber is a good company to work with' and just 18% would prefer to be working with another taxi or minicab company. • 94% of drivers said they 'joined Uber because I wanted to be my own boss and choose my own hours', with just 6% saying they 'joined Uber because I couldn't find other work'.

[29] The indicated percentage is in the range of the estimates obtained in other studies on the gig economy (albeit using different methods): 0.5% of the working-age population are gig workers in Katz and Krueger (2016), 0.6% in Farrell and Greig (2016), and 0.4% in Harris and Krueger (2015).

Publication (authors)	Estimates / Key findings
	• When asked whether they would rather remain self-employed or be classified as a worker or employee of Uber, 80% of drivers say they would prefer to stay as an independent contractor. • 50% of drivers said that since using the app their income has increased with just 11% saying it has decreased. • More than four in five (82%) drivers said Uber is their main source of income with 10% saying it tops up other sources of income and 8% saying it is one of a few different main sources of income. • 14% drive a set number of hours, with two-fifths (40%) deciding how many hours to drive depending on what else they have going on and 32% setting a goal for the total amount they want to earn in a given day, week or month.
Alsos et al, 2018	• There were 1,298 active UberPop drivers in 2016 in Norway, earning a total of NOK 114 million (€11.7 million). The total revenue for UberPop in Norway in 2016 was about NOK 140 million (€14.4 million).
Kässi and Lehdonvirta, 2018	• The volume of new vacancies has grown 20% from the start of the data collection in 2016 (to 2018). Software development and technology work ranks as the biggest occupation category and growing the fastest (in terms of the number of projects posted to online labour platforms), followed by creative and clerical work. • Breaking down the index by employer/client country, the US has kept its dominant position as employer country, followed by the UK, India and Australia.
PwC, 2018	• Overall 44% have used share economy offers across the six investigated countries in selected industry segments in the previous year (leading to the survey). • Highest usage in media and entertainment (28%), followed by hotels and accommodation (22%), automotive and transport (19%), retail and consumer goods (19%), services (14%), finance (11%) and machinery (10%). • In the previous year, share economy users spent on average €816. Turkey shows the highest averae spending on share economy offers in the previous year (€1,031 per user) followed by Switzerland (€939), Germany (€884), Austria (€599) and the Netherlands (€506).

Publication (authors)	Estimates / Key findings
Statens Offentliga Utredningar (SOU), 2017	• About 4% of working age Swedes had looked for work on platforms and 2.5% had performed some platform work, equating to about 150,000 people.
Statistics Canada, 2017	• 9.5% of the Canadian population had used ride and accommodation services through platforms between November 2015 and October 2016, while only 0.3% had offered ride services and 0.2 % had offered accommodation.
Statistics Finland, 2017	• 0.3% of Finns aged between 15 and 74 earned more than 25% of their income from work related and non-work related platform activities over the previous 12 months, which would be approximately 14,000 people.
Zervas et al, 2017	• Estimated that 1% increase in Airbnb listings causes a 0.05% decrease in hotel revenues in the US state of Texas. In Austin where Airbnb supply is the highest the causal (negative) impact of Airbnb on hotel revenues is in the 8-10% range. • Low price hotels and non-business hotels were the most affected and in response they appeared to take related strategies such as lowering their prices, thus benefiting all customers.
BEIS, 2018	• Estimated that 4.4% of the whole British population (65 million excluding 1.8 million people in Northern Ireland) worked in the gig economy in the previous 12 months (BEIS, 2018a). Extrapolated to the entire population, the size of the gig economy is estimated to be about 2.8 million people. • 87% of gig economy workers earned less than £10,000 (€11,380) in the last 12 months. The researchers calculated the estimated mean income from the gig economy was £5,634 (about €6,400). However, this is skewed by a relatively small proportion of high earners. The median gig economy income is £375 (€427). 25% of platform workers earn an hourly income of less than £7.50 (€8.55), the then minimum wage.
Bureau of Labor Statistics (BLS), 2018	• In May 2017, there were 1.6 million electronically mediated workers, accounting for 1.0 percent of total employment. The estimates include all people who did electronically mediated work, whether for their main job, a second job, or additional work for pay. • Of all workers, 0.6 percent did electronically mediated work in person and 0.5 percent did electronically mediated work entirely online.
European Commission, 2018b	• Revenues (gross output) of the collaborative economy was estimated to be 0.17% of EU GDP

Publication (authors)	Estimates / Key findings
	with the finance sector (including crowd-lending and crowd-equity funding) accounting for the largest proportion of revenues, followed by accommodation. • 700 platforms identified operating in the EU, of which a small number of international platforms account for approximately 40% of total revenues. • About 395,000 people in the EU worked in the collaborative economy in 2016 (89,500 online skills; 67,300 in finance; 113,300 in accommodation; 124,800 in transport), representing about 0.15% of EU employment.
Farrell et al, 2018	• About 1.2% of account holders in the sample received a platform income in each month and 1.6% of the 39 million accounts that were open and active in any time in the observed 6-year period (that is, including more recently opened account). The transportation platforms have grown to dominate in terms of number of participants and total transaction volume. • The average earnings decreased in the transportation sector (in the period 2013-2017) but increased in the leasing sector. • Income from platforms is sporadic – 58% of platform workers in transportation had earnings in three or fewer months in the year ending July 2017.
Heerschap et al, 2018	• In 2018, about 21% of the Dutch population (12 years and older) used an Airbnb-like accommodation in 2018 from a private person, including renting through a platform like Facebook and Marktplaats (Dutch eBay). In 2017 this was about 19%. • In 2018, about 7% of the Dutch population (12 years and older) made use of Uber-like transportation services which was supplied by a private person. In 2017 this was 5%. • Four out of ten (42%) surveyed enterprises selling via online platforms indicated a positive impact of these platforms on their turnover. Only 8% perceived a negative impact of online platforms on their turnover, although they sell via online platforms. The remaining platforms indicated no significant impact.
Insee, 2018	• 200,000 self-employed (with or without employees) accessed clients through an intermediary (including a digital platform).
MBO partners, 2018	• The percentage of respondents who said they have used an online platform to find work over the

Publication (authors)	Estimates / Key findings
	previous 12 months increased from just 3% in 2011 to 22% in 2018.
ORB International, 2018	• Most of Uber's drivers are male immigrants primarily drawn from the bottom half of the London income distribution. • Most transitioned out of permanent part- or full-time jobs and about half of drivers' report that their incomes increased after partnering with Uber. After covering vehicle operation costs and Uber's service fee, the median London driver earns about £11 (€12) per hour spent logged into the app. • Uber drivers report high levels of life satisfaction. • Important motivations to joins the platform are the flexibility and autonomy that it offers.
Pesole et al, 2018 (European Commission's JRC)	• About 10% of the adult population on average has ever used online platforms for the provision of some type of labour services. • Less than 8% do platform work with some frequency, and less than 6% spend a significant amount of time on it (at least 10 hours per week) or earn a significant amount of income (at least 25% of the total). • About 2% work via platforms more than 20 hours a week and/or earn 50% or more of their income via platforms.
Statistics Canada, 2018	• 28% of respondents reported making money through online platforms, mainly by selling new or used products through online platforms such as Kijiji, eBay and Etsy.
Weel et al, 2018	• About 0.4% of the Dutch working population is active in platform work (about 34,000 workers).
Katz and Krueger, 2019	• 0.5% to 1.5% of the workforce was engaged in online work for the sample period from late 2015 to the end of 2017.
Serfling, 2019	• A share of 4% of respondents currently engage in crowd work. Excluding those who are not remunerated, this share decreases to 2.6%. Another 2.9% report that they could imagine participating in crowd work in the future and 2.3% report having participated in crowd work in the past. • 47% of crowd workers do not rely on crowd work as a primary source of income while 28% state that crowd work is their main source of income. • 41% of all respondents work less than 10 hours a week as crowd workers.

Source: Author's own compilation

Annex 2 – Questions included in surveys

Listing below is chronological (from oldest survey identified) and then alphabetical within each year. The questions listed below are only those measuring the scale of the platform economy or specific segments such as platform work in terms of participation /use of online platforms (as providers and/or consumers).

Survey	Publication	Questions
Nesta Public Survey, **2014**	Stokes et al, 2014	We would now like to ask you some questions about different ways of getting goods and services apart from just buying them. The survey is about ways you can get goods and services such as sharing, swapping, trading, renting, second hand etc. From car rental to libraries to launderettes, alternatives to individual ownership are not new. However, digital technologies (like websites, mobile devices and apps) have helped us connect with more people and changed the types of things we use and how we interact. These activities have been described by some as the 'collaborative economy'. Popular examples of the collaborative economy include Freecycle, Zipcar, Airbnb, and TaskRabbit. QUESTION 1: I am going to show you a list of different types of goods and services and for each one I would like you to tell me the ways you have accessed each or offered them someone else in the past 12 months. So thinking about [INSERT EACH SECTOR BELOW], which have you done in the past 12 months? SECTOR: Transport – [e.g. cars, bikes] • Holidays – [e.g. travel and accommodation] • Odd jobs and tasks – [e.g. odd jobs, pet walking, babysitting] • Technology/electronics – [e.g. computers, game consoles, televisions] • Clothing and accessories • Media – [e.g. books, music, DVDs] • Children's equipment and toys • Household goods and appliances – [e.g. pet–related goods, furniture, tools] RESPONSES 1. Borrowed from a person I know 2. Borrowed from a person I don't know 3. Leased/rented from a company or organisation 4. Leased/rented from a person I don't know 5. Bought used/second hand/preloved from a company or organisation

		6. Bought used/second hand/preloved from a person I don't know 7. Given for free/donated 8. Exchanged/swapped/bartered with a person I don't know 9. Lent to a person I know 10. Lent to a person I don't know 11. Leased/rented to a company or organisation 12. Leased/rented to a person I don't know 13. Sold used/second hand/preloved to a company or organisation 14. Sold used/second hand/preloved to someone I don't know 15. Gave for free/donated 16. Exchanged/swapped/bartered with a person I don't know 17. None
American Trends Panel (ATP), **2015**	Smith, 2016a	Ask ALL Do you ever use any of the following things? a. A bike-sharing service (Y/N/No answer) b. A car-sharing service like ZipCar or Car2Go (Y/N/No answer) ASK IF ONLINE SHOPPER Do you ever… a. Buy used or second-hand goods on websites like Ebay or Craigslist (Y/N/No answer) b. Buy handmade or artisanal products on websites like Etsy (Y/N/No answer) Do you ever do any of the following things? a. Work in a shared office space where anyone can pay to use an office or work area for a short period of time b. Order groceries online from a local store and have them delivered to you using a service like Instacart, Peapod, or Fresh Direct c. Hire someone online to do a task or household errand, using a service like TaskRabbit, Fiverr, or Amazon Mechanical Turk d. Rent clothing or other products for a period of time using a site like Rent the Runway e. Purchase a ticket to a sporting or entertainment event from a ticket reseller like StubHub or SeatGeek f. Use programs that offer same-day or expedited delivery of items you purchase online, like Amazon Prime or Google Express

		ASK ALL Do you ever use ride-hailing services like Uber or Lyft? (Yes, I have done this/ I have not done this, but I have heard of it / I have never heard of this before /No answer) ASK IF USE OR HAVE HEARD OF RIDE-HAILING SERVICES Have you ever ridden with someone you know using a ride-hailing service like Uber or Lyft, even if you did not request the ride yourself? (Y/N/No answer) ASK IF USE RIDE-HAILING SERVICES How often do you use ride-hailing services such as Uber or Lyft? (Daily or almost daily /Weekly/ Monthly/Less often /No answer) ASK ALL Have you ever contributed money to support a fundraising project on a website like Kickstarter or GoFundMe? (Yes, I have done this / I have not done this, but I have heard of it / I have never heard of this before /No answer) ASK IF CROWDFUNDING USER How many different projects have you contributed to using these sites? (1-5 / 6-10 / 11 or more / No Answer) ASK IF CROWDFUNDING USER Which of the following types of projects have you contributed to? a. A project to help a person in need (with things like medical or legal bills, or unexpected debt) (Yes, have done this / No, have not done this/ No answer) b. A project to fund a new product or invention (Yes, have done this / No, have not done this/ No answer) c. A project to fund a new restaurant or other type of business (Yes, have done this / No, have not done this/ No answer) d. A project for a musician or other creative artist (Yes, have done this / No, have not done this/ No answer) e. A project for a school (Yes, have done this / No, have not done this/ No answer) ASK ALL: LOD1. Do you ever stay overnight in a private residence that you booked using an online service like AirBnB, VRBO, or HomeAway.

		(Yes, I have done this / I have not done this, but I have heard of it / I have never heard of this before / No Answer)
American Trends Panel (ATP), **2015**	Smith, 2016b	ASK ALL Thinking about ways you might earn money… In the last year, did you earn money by selling something online? (Yes/NO/No answer) ASK IF SELL ONLINE Which of the following have you sold online in the last year? • Used or second-hand goods • Items that you made yourself • A line or brand of consumer goods (such as makeup, clothes, or health/fitness products) • Something else • No answer ASK IF SELL ONLINE How important are social media sites like Facebook and Twitter when it comes to finding customers and marketing the items you sell online? (Extremely important / Somewhat important / Not very important/ Not important at all/ No answer). ASK ALL Some people find paid jobs or tasks by connecting directly with people who want to hire them using a particular type of website or mobile app. These sites require workers to create a user profile in order to find and accept assignments, and they also coordinate payment once the work is complete. In the last year, have you earned money by taking on jobs through this type of website or mobile app (for example, by driving someone from one place to another, cleaning someone's home, or doing online tasks)? (Yes / No / No answer) ASK IF HAVE EARNED MONEY FROM ONLINE GIG WORK What sorts of jobs or tasks have you performed in the last year using these services? • Driving for a ride-hailing app (such as Uber or Lyft) • Shopping for or delivering household items • Performing tasks online (like completing surveys or doing data entry) • Cleaning someone's home or doing laundry • Something else • No answer

		ASK ALL In the last year, did you earn money from renting out a house or apartment on an online home-sharing site (such as Airbnb or VRBO)? (Yes / No/ No answer)
Enterprising and Informal Work Activities (EIWA) survey, **2015**	Robles and McGee, 2016	*Screener question:* In the last 6 months, have you been paid for the following? 1. Completing online tasks through websites, such as Amazon Services, Mechanical Turk, Fiverr, Task Rabbit, YouTube. Such tasks might include editing documents, reviewing resumes, writing songs, creating graphic designs, rating pictures, posting videos, blog posts, etc. 2. Renting out property, such as your car, your place of residence, or other items you own, through websites, newspaper ads, flyers, etc. 3. Selling new/used goods, handcrafts, etc., online through eBay, Craigslist, or other websites 4. Other online paid activities. *Questions asked to 'qualified respondents':* In the last 6 months, have you earned any money using any of the following internet sites or mobile apps? 1. Airbnb (www.airbnb.com) 2. Amazon Mechanical Turk (www.mturk.com) 3. Care.com (www.care.com) 4. Craigslist (www.craigslist.com) 5. eBay (www.ebay.com) In the last 6 months, have you earned any money using any of the following internet sites or mobile apps? 1. Etsy (www.etsy.com) 2. Fiverr (www.fiverr.com) 3. Freelancer.com (www.freelancer.com) 4. Uber (www.uber.com) In the last 6 months, have you earned any money using any of the following internet sites or mobile apps? 1. Lyft (www.lyft.com) 2. Sittercity (www.sittercity.com) 3. Task Rabbit (www.taskrabbit.com) 4. Upwork (formerly eLance/oDesk, www.upwork.com) 5. Other websites which enable informal paid activities or side jobs (please specify) [TEXT]

ING International survey, **2015**	ING International, 2015	• Have you ever heard of the sharing economy? Yes, and I have participated in it; Yes, but I have not participated in it; … • Do you think your participation in the sharing economy in the next 12 months will … increase, stay the same, decrease, no opinion. • How much money have you earned in the past 12 months through sharing something you own? [Answers between €1 and €50,000]
Nesta collaborative economy pilot survey (UK), **2015**	Nesta, 2015	• Have you sold any of your own personal items or possessions on the internet to someone who you did not already know? • Have you given away for free any of your own personal items or possessions on the internet to someone who you did not already know? • Have you rented out a room, your home, a property you own, or your land using the internet for up to six months to someone who you did not already know? • Have you sued the internet to arrange to drive or give a lift to someone who you did not already know to their festination for a fee? • Have you used the internet to arrange to drive or give a lift to someone who you did not already know to the destination for free? • Have you used the internet to lend a vehicle, a piece of equipment (such as a tool) or any other possession belonging to you to someone who you did not already know for a fee? • Have you used the internet to lend a vehicle, a piece of equipment (such as a tool) or any other possession belonging to you to someone who you did not already know for free? • Have you used the internet to offer your personal skills or undertake work directly to someone who you did not already know for a fee? This must not have involved an agency or third party. • Have you used the internet to offer your personal skills or undertake work directly to someone who you did not already know for free? This must not have involved an agency or third party. • Made a donation or provided funding using the internet to an organisation that you would not otherwise have donated to.

RAND-Princeton Contingent Work Survey, **2015**	Katz and Krueger, 2016	• Q23 Did you work on any gigs, HITs or other small paid jobs last week that you did not include in any of your answers so far? Yes/No. If q23 = Yes • Q23b. How many hours did you spend working on those gigs, HITS or other paid jobs last week? 1 to 100 hours or more. • q23c Did any of those gigs, HITS or other paid jobs you worked on last week involve working through an online app, such as TaskRabbit or Uber? Yes/No. • q31 On either your main job or a secondary job, do you do direct selling to customers? 1 Yes /2 No IF q31 = Yes THEN q32 • q32 Do you do direct selling to customers on your main job or a secondary job, or both? 1 Main job/ 2 Secondary job/ 3 Both • q33 Does your direct selling involve goods or services? 1 Goods /2 Services /3 Both/ 4 Other (please specify) • q34 Do you work with an intermediary, such as Avon or Uber, in your direct selling activity? Yes /No • q35 Do you work with an online intermediary to find customers, such as Uber or TaskRabbit? Yes/No/Other
Ad-hoc survey, **2016-2017**	Huws et al, 2017	Participants were asked to code as many categories of income-generating activities via platforms: Any crowd work; Rent to paying guest (e.g. Airbnb); Sell/resell on own website; Sell self-made products (e.g Etsy); Resell products on online marketplace (e.g. Amazon); Sell own possessions (e.g Ebay). *[crowd workers identified with following question]* Ever sold [your] labour via an online platform in any of the following three categories [names of platforms varied in each country depending on which platforms were considered to be best known locally] • Carrying out work from your own home for a website such as Upwork, Freelancer, Timeetc, Clickworker or PeoplePerHour. • Carrying out work for different customers somewhere outside your home on a website such as Handy, Taskrabbit or Mybuilder. • Carrying out work involving driving someone to a location for a fee using an app or website such as Uber or Blablacar

Flash Eurobarometer Survey, 438, **2016**	European Commission, 2016	Respondents were prompted on their knowledge and use of 'collaborative platforms' defined for the interviewees as follows: 'A collaborative platform is an internet-based tool that enables transaction between people providing and using a service. They can be used for a wide range of services, from renting accommodation and car sharing to small household jobs'. Q1 Which of the following matches your experience regarding this type of platform? 1. You have never heard of these platforms 2. You have heard of these platforms but you have never visited them 3. You have been on one or more of these platforms and paid for a service once 4. You use the services of these platforms occasionally (once every few months) 5. You use the services of these platforms regularly (at least every month) 6. Other (SPONTANEOUS) 7. None (SPONTANEOUS) 8. Don't know. (Filter: Q2 asked if respondent has visited these platforms [3,4 and 5]) Q2 Have you ever provided services on these platforms? 1. No, you haven't 2. You have offered a service on one or more of these platforms once 3. You offer services via these platforms occasionally (once every few months) 4. You offer services via these platforms regularly (every month) 5. Other (SPONTANEOUS) 6. None (SPONTANEOUS) 7. Don't know.
Labour Force Survey (LFS), **2016**	Statistics Canada, 2017	Peer-to-peer ride services 'services that connect riders and drivers through a mobile application that acts as an intermediary and processes the payment from the rider to the driver' 1. In the past 12 months, did you use ride services such as Uber, Lyft, etc.? 2. In the past 12 months, what was the total amount that you personally spent on these ride services in Canada? 3. In the past 12 months, did you offer ride services such as Uber, Lyft, etc.? 4. In the past 12 months, did you offer private accommodation services such as Airbnb, Flipkey, etc.? Private accommodation services

		'services that connect travellers and hosts through a mobile application or website that acts as an intermediary and processes the payment from the traveller to the host' 1. In the past 12 months, did you use private accommodation services such as Airbnb, Flipkey, etc.? 2. In the past 12 months, what was the total amount that you personally spent on these private accommodation services in Canada? 3. In the past 12 months, what was the total amount that you personally spent on these private accommodation services outside of Canada?
RSA/Ipsos MORI Capibus Survey on the Gig Economy **2016-2017**	Balaram et al, 2017	As you may know, 'gig work' is a way of finding work in the form of short term 'gigs', where customers often request work via an online tool, like a website or mobile phone app. 'Gig workers' often use these websites and apps to find customers and carry out work at short notice. The next few questions are about the ways in which you personally may have interacted with these services. WQ01A In which, if any, of the following ways have you ever personally carried out paid work using a website or mobile phone application? Please select all that apply to you, personally: 1. Providing a driving or taxi service, for a fee, by finding passengers through a website or app such as Uber or BlaBlaCar 2. Providing professional work, such as consultancy, legal advice, accounting services, through a website or app such as UpWork, PeoplePerHour or Freelancer 3. Providing creative or IT work, such as writing, graphic design, or web development, through a website or app such as UpWork, Freelancer, PeoplePerHour, Fiverr or Toptal 4. Providing administrative work, such as data entry or 'click work', through a website or app such as Clickworker, PeoplePerHour or Freelancer 5. Providing skilled manual work, such as plumbing, building, electrical maintenance and carpentry, through a website or app such as Rated People, MyBuilder or TaskRabbit 6. Providing personal services, such as cleaning, moving, or DIY tasks, through a website or app such as TaskRabbit, Hassle or Handy

		7. Providing delivery or courier services, through a website or app such as Deliveroo, UberEATS or Just Eat ASK ALL WHO HAVE EVER CARRIED OUT ANY FORMS OF GIG WORK (WQ01A = 1-7) *WQ01B* And which, if any, of the following services have you ever personally used to carry out this sort of paid work? 1. Amazon MTurk 2. Clickworker 3. Deliveroo 4. Freelancer 5. Grub Club 6. Handy 7. Hassle 8. Mybuilder 9. My ShowCase 10. PeoplePerHour 11. RatedPeople 12. Staff Heroes 13. Taskrabbit 14. Taskpanda 15. Timeetc 16. Upwork 17. Uber 18. UberEATS 19. Other (please specify)
Special Eurobarometer 447, **2016**	European Commission, 2016f	D79. For each of the following activities, please tell me if it is an activity that you do, or not, on the internet. 1. Use search engines, websites to help you find what you are looking for on the internet. • Every day or almost every day • Two or three times a week About once a week • Two or three times a month • Less often • Never • Don't know 2. Use an online social network for instance to share pictures, videos, movies, etc. • Every day or almost every day • Two or three times a week • About once a week; • Two or three times a month • Less often • Never • Don't know

		3. Use online marketplaces, e-commerce websites where you can sell and buy products and services provided by multiple third parties (e.g. you can buy clothes, books, travels from different brands and different sellers, or sell these products and services). • Every day or almost every day • Two or three times a week • About once a week • Two or three times a month • Less often • Never • Don't know
Alsos et al, 2017	FAFO, 2017	Recently, there has been a lot of attention around companies that use apps and websites to convey work and services. This is usually called the sharing economy. During the last 12 months, you have done some of the following ... 1. Did you work as a bicycle courier for Foodora? 2. Worked as a cleaner for WeClean? 3. Worked for Upwork or Konsus? 4. Worked as a driver for Haxi? 5. Did a job you found on FINN småjobber? 6. Did you do a job on Mitt anbud.no? 7. Rented a home on Airbnb? 8. Done assignments you have found on other apps or websites 9. None of the aforementioned
BMAS survey, 2017	Bonin and Rinne, 2017	1. Are you currently doing work assignments for money that you are getting over the internet or through an app? Yes/No/I Don't know [*Erledigen Sie derzeit für Geld Arbeitsaufträge, die sie sich über das Internet oder eine App besorgen? Ja/Nein/ Weiß nicht*] 2. Even if you are not doing it now, have you ever done work assignments for money through the internet or an app? Yes/No/I Don't know [*Auch wenn Sie es derzeit nicht tun, haben Sie vielleicht früher schon einmal für Geld Arbeitsaufträge erledigt, die sie sich über das Internet oder eine App besorgt haben? Ja/Nein/ Weiß nicht*] 3. Are there any other adults in your household who are getting paid jobs via the Internet or an app? Yes/No/I don't know [*Gibt es in Ihrem Haushalt derzeit andere Erwachsene, die sich über das Internet oder eine App bezahlte Arbeitsaufträge besorgen? Ja/Nein/ Weiß nicht*]

CIPD survey, 2017	CIPD, 2017	Thinking about the last 12 months, which, if any, of the following have you done via an online platform (i.e. website) or app (i.e. mobile device application) to earn money? 1. Provided transport using my vehicle (e.g. Uber, BlaBlaCar etc) 2. Rented out my vehicle (e.g. EasyCar, Zipcar etc) 3. Rented/shared my accommodation (e.g. AirBnB, tripping, HomeAway 4. etc) 5. Delivered food or goods (e.g. Deliveroo, City Sprint) 6. Performed short-term jobs via online platforms that connect people looking for services (e.g. TaskRabbit, Upwork, PeoplePerHour etc) 7. Sold things I have created via online platforms (e.g. Etsy) 8. Other work arranged through an online platform Still thinking about the last 12 months, what contribution did the following type of work make towards the total income you received from paid work over the past year? 1. Provided transport using my vehicle (e.g. Uber, BlaBlaCar etc) 2. Rented out my vehicle (e.g. EasyCar, Zipcar etc) 3. Delivered food or goods (e.g. Deliveroo, City Sprint) 4. Performed short-term jobs via online platforms that connect people looking for services (e.g. TaskRabbit,Upwork, PeoplePerHour etc) 5. Other work arranged through an online platform	
COLLEEM survey (JRC), **2017**	Pesole et al, 2018	Have you ever gained income from any of the following online sources? 1. Providing services via online platforms, where you and the client are matched digitally, payment is conducted digitally via the platform, and work is location-independent, web-based (e.g. Upwork, Freelancer, Timeetc, Clickworker, PeoplePerHour and others) 2. Providing services via online platforms where you and client are matched digitally, and the payment is conducted digitally via the platform, but work is performed on-location (i.e. in-person) (e.g. Uber, Deliveroo, Handy, TaskRabbit, MyBuilder and others)	

Crowdworking monitor, **2017-2018**	Serfling, 2019	Do you complete paid tasks that are conveyed via online platforms or online marketplaces?' (in German: 'Arbeiten Sie für bezahlte Arbeitsaufträge, die Sie über Online-Plattformen oder -Marktplätze vermittelt bekommen?') Six pre-defined answer categories, of which three 'yes' answers with indication of propensity to engage in crowd work in the future (willingly (1) more, (2) the same or (3) less), two 'no' answer categories with an indication of (4) future intention to crowd work or (5) past crowd work experience, (6) a remaining 'not at all' answer category. (A battery of questions on task duration and search time were included for the calculation of the various income variables)
Contingent Work Survey (CWS), **2017**	US BLS, 2018	• Q1 Some people find short, in-person tasks or jobs through companies that connect them directly with customers using a website or mobile app. These companies also coordinate payment for the service through the app or website. For example, using your own car to drive people from one place to another, delivering something, or doing someone's household tasks or errands. Does this describe ANY work (you/NAME) did LAST WEEK? If 'yes' to Q1, follow-up 'which job' question (Q1a). • Q1a Was that for (your/NAME's) (job/(main job, (your/NAME's) second job)) or (other) additional work for pay? • Q2 Some people select short, ONLINE tasks or projects through companies that maintain lists that are accessed through an app or a website. These tasks are done entirely online, and the companies coordinate payment for the work. For example, data entry, translating text, web or software development, or graphic design. Does this describe ANY work (you/NAME) did LAST WEEK? • Q2a Was that for (your/NAME's) (job/(main job, (your/NAME's) second job)) or (other) additional work for pay?
Denmark LFS, **2017**	Ilsøe and Madsen, 2017	• Have you earned money in the past 12 months by performing work done through websites or apps - for example, via Uber? (Yes / No) • In the past 12 months, have you earned money by renting your property or your property through websites or apps for example via Airbnb? (Yes/No)

Finland LFS, **2017**	Statistics Finland, 2017	During the past 12 months have your worked or otherwise earned money through the following platforms: 1. Airbnb, 2. Uber, 3. Tori.fi/Huuto.net, 4. Solved, 5. Some other, 6. None of the above'. Those who selected 'some other' (to specify).
Internet Access module of the Opinions and Lifestyle Survey, **2017**	UK ONS, 2017a	<u>Transport</u> In the last 12 months have you used any website or 'app' to arrange transport services (e.g. car travel) from another private individual? 1. Yes, intermediary websites or 'apps' dedicated to arranging transport services (such as Uber, Lyft, BlaBlaCar, Liftshare etc.) 2. Yes, other websites or 'apps' (including Facebook, Twitter etc.) 3. No, I have not <u>Accommodation</u> In the last 12 months have you used any website or 'app' to arrange accommodation (room, apartment, house, holiday cottage, etc.), from another private individual? 1. Yes, intermediary websites or 'apps' dedicated to arranging accommodation (such as Airbnb, HomeAway, Onefinestay, SpareRoom etc) 2. Yes, other websites or 'apps' (including Facebook, Twitter etc.) 3. No, I have not
NatCen Panel and YouGov Omnibus survey, **2017**	BEIS, 2018	Thinking about the past 12 months Which, if any, of the following have you done in order to make money, using a website or app? 1. Provided transport using your vehicle (for example via Uber, Hailo, etc.) 2. Provided food delivery services (for example via Deliveroo, UberEATS, etc.) 3. Provided courier services (for example via CitySprint, AnyVan etc.) 4. Performed short-term jobs found through the website or app (for example via TaskRabbit, Upwork, PeoplePerHour, Fiverr, etc.) 5. None of the above
Statens Offentliga Utredningar (SOU), **2017**	Statens Offentliga Utredningar (SOU), 2017	In which, if any, of the following ways have you ever personally carried out paid work using a website or mobile phone application? 1. Providing a driving or taxi service, for a fee, by finding passengers through a website or app such as Uber or BlaBlaCar 2. Providing professional work, such as consultancy, legal advice, accounting

		services, through a website or app such as UpWork, PeoplePerHour or Freelancer 3. Providing creative or IT work, such as writing, graphic design, or web development, through a website or app such as UpWork, Freelancer, PeoplePerHour, Fiverr or Toptal 4. Providing administrative work, such as data entry or 'click work', through a website or app such as Clickworker, PeoplePerHour or Freelancer 5. Providing skilled manual work, such as plumbing, building, electrical maintenance and carpentry, through a website or app such as Rated People, MyBuilder or TaskRabbit 6. Providing personal services, such as cleaning, moving, or DIY tasks, through a website or app such as TaskRabbit, Hassle or Handy 7. Providing delivery or courier services, through a website or app such as Deliveroo, UberEATS or Just Eat
Survey on ICT-usage of persons, **2017** and **2018**	Statistics Netherlands (CBS)	Have you booked an accommodation with private persons such as a room, apartments or holiday home, in the past 12 months through a website or app? • Yes, via a specially designed website or app, such as Airbnb • Yes, via another website or app, such as Facebook • No • Don't know In the past 12 months, have you ordered a transport service, such as a taxi ride, with a private person via a website or app? • Yes, via a specially designed website or app • Yes, via another website or app • No • Don't know
UK (pilot) LFS, **2017**	ONS (2017a)	In the last 12 months have you used a digital platform to find work on a short term, payment by task basis? Does the work you found on a digital platform provide your main source of earnings over the past three months?

Source: Author's own compilation

Annex 3 – List of online platforms

The table below lists the online platform identified in this mapping exercise.

Platform name	Traded commodity	Type of activity
99designs	Service	Professional services
Airbnb	Service	Accommodation
Allegro	Goods	Retail
Amazon	Goods	Retail
Amazon Mechanical Turk	Service	Professional services
appJobber	Service	Professional services
Apple app store	Goods	Smartphone apps
Apple Pay	Service	Payment system
Apple TV	Entertainment	Content streaming
Be My Eyes	Service	Professional services
Bing	Information	Online search engine
Bing maps	Information	Online map service
BlaBlaCar	Service	Transport
Booking.com	Service	Accommodation
Canalplay	Entertainment	Content streaming
Clickworker	Service	Professional services
Couchsurfing	Service	Accommodation
CrowdFlower	Service	Professional services
Deezer	Entertainment	Content streaming
Deliveroo	Service	Transport
Easy Car Club*	Service	Transport
Eatwith*	Goods	Social dining
eBay	Goods	Retail
Facebook	Communication	Social network
Feastly	Goods	Retail
Food Swaps*	Goods	Swapping food
Freecycle	Goods	Retail
Freelancer	Service	Professional services
Getaround	Goods	Retail
Glovo	Service	Transport
GoMore	Service	Transport
Google	Information	Online search engine
Google local	Information	Social network
Google maps	Information	Online map service
Google Play	Goods	Smartphone apps
Helping	Service	Household tasks
Hilfr	Service	Household tasks
Homestay	Service	Accommodation
Kelkoo	Information	Price comparison
Kickstarter	Service	Financial services (crowdfunding)
LinkedIn	Communication	Social network

ListMinut	Service	Professional services
Lyft	Service	Transport
Netflix	Entertainment	Content streaming
Oferia	Service	Professional services /household tasks
PayPal	Service	Payment system
Peerby	Service	Sharing network
PeoplePerHour	Service	Professional services
Relay Rides	Service	Transport
Seedr	Service	Financial services (crowdfunding)
Sidecar	Service	Transport
SnapGoods	Goods	Borrowing/renting goods
Spotify	Entertainment	Content streaming
Streetbank	Goods	Sharing network
Taskrabbit	Service	Professional services
TripAdvisor	Information	Accommodation
Twenga	Information	Retail
Twitter	Communication	Social network
Uber	Service	Transport
Upwork	Service	Professional services
Yelp	Information	Social network
YouTube	Entertainment	Content streaming
Zipcar	Service	Transport

*Note: * Apps no longer exist.*

Source: Author's own compilation.

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