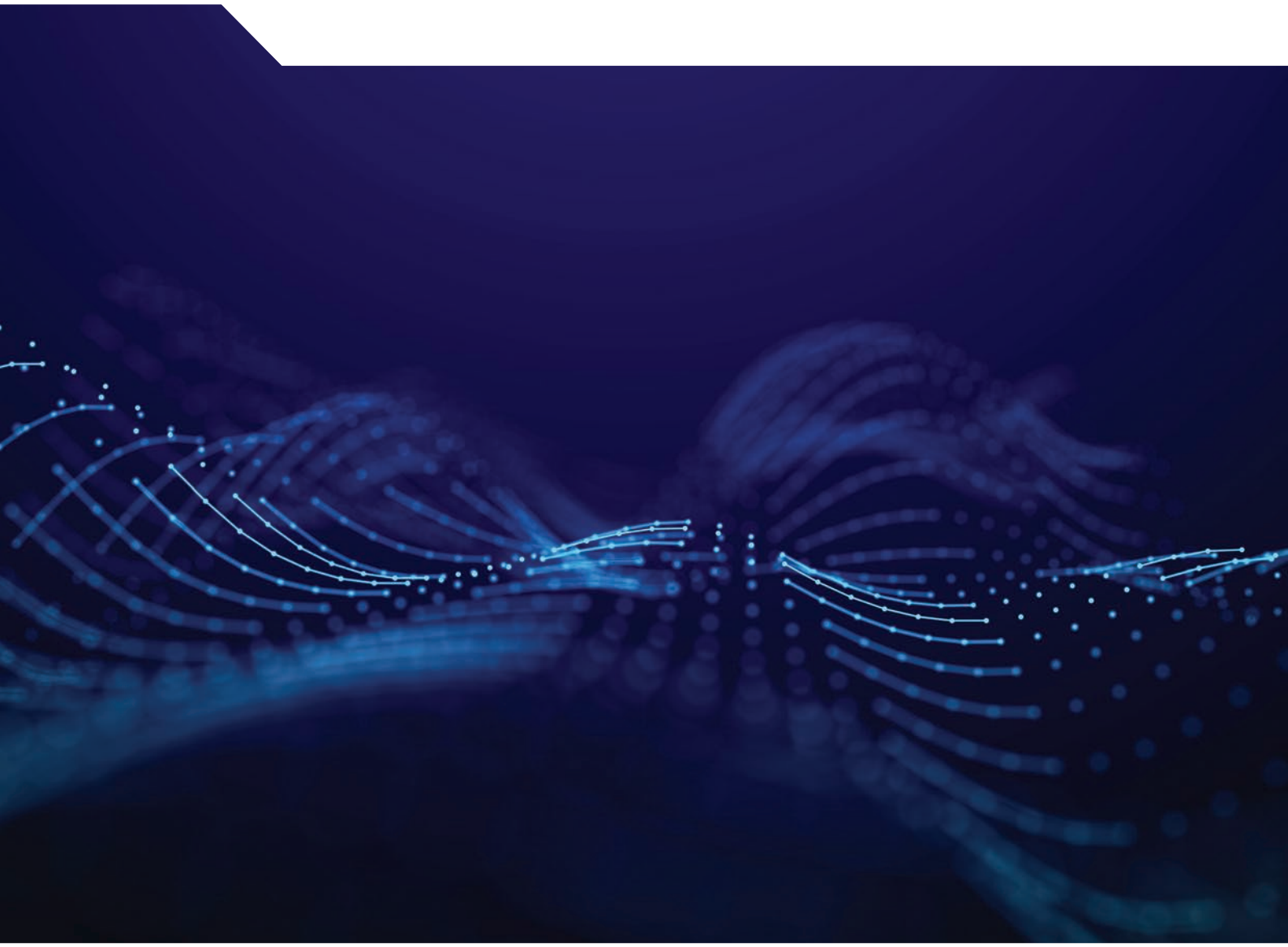
Case Studies on the Regulatory Challenges Raised by Innovation and the Regulatory Responses



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Foreword

The industrial changes brought by innovation are unprecedented in their pace, scope and complexity. This "revolution" is made of parallel technological breakthroughs that have led to the development of new products, services and business models that were hardly imaginable even a few years ago – and that keep evolving, fast.

Technological innovations also have far-reaching consequences for the well-being and cohesion of society as a whole, as well as for businesses in all sectors through their impact on productivity, employment, skills, income distribution, trade and the environment. The digital transformation, in particular, shows great potential to enhance consumer choice and subjective well-being. However, it also brings risks: it may, for example, disrupt labour markets; exacerbate inequalities; raise concerns about competition, personal data protection or discrimination (e.g. algorithmic biases); or facilitate the spread of mis- and disinformation.

Regulation plays an essential role in realising the benefits of innovation while upholding protection for citizens and addressing the potential unintended consequences of disruption. Yet, it is clear that rapid and pervasive technological changes are placing an unprecedented stress on regulatory policy systems. Regulatory frameworks might not be agile enough to accommodate the fast pace of technological development and, in many cases, rules might quickly become outdated. Regulators also lack the knowledge and capacity to assess how new technologies will affect markets and society. They therefore struggle to keep pace with the realities of this new economy, promoting economic growth while also protecting citizen. The implications of technological developments for how governments regulate are wide-ranging as they blur the traditional definition of markets, complicate enforcement, and transcend domestic and international boundaries.

The COVID-19 crisis has magnified these challenges and forced governments to rethink their rule-making activities. As noted in the *OECD Recommendation on Agile Regulatory Governance to Harness Innovation*, governments should undertake a paradigm shift in regulatory governance towards more agile, resilient and future-proof approaches. As governments rebuild, they must strive to ensure that regulations keep up with the pace and global scale of technological advances to guarantee that populations worldwide benefit from innovation. At the same time, they must be sure to manage, in a timely way, the risks they may cause and to protect the values of individual liberty, democracy, the rule of law and the defense of human rights.

This report seeks to help policy makers navigate the domestic and international regulatory challenges and opportunities raised by innovation by documenting, through a series of case studies, the different regulatory challenges raised by emerging technologies and the diversity of regulatory responses used to address them.

The report is the result of a collaboration between the Korea Development Institute (KDI) and the OECD. It is part of the OECD joint programme of work between the Regulatory Policy Committee and the Network of Economic Regulators on regulation and emerging technologies, carried out with the support of the Regulatory Policy Division of the OECD Public Governance Directorate. The Directorate's mission is to help government at all levels design and implement strategic, evidence-based and innovative policies that support sustainable economic and social development.

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Abbreviations and acronyms

ACCC	Australian Competition & Consumer Commission
ACEA	European Automobile Manufacturers Association
ACMA	Australian Communications and Media Authority
ADGM	Abu Dhabi Global Market
AFIN	ASEAN Financial Innovation Network
AFM	Authority for the Financial Markets
AGCOM	Telecommunications Regulator (*Autorità per le Garanzie nelle Comunicazioni*)
AGCM	Italian Competition Authority (*Autorità Garante della Concorrenza e del Mercato*)
AGV	Automated Guided Vehicles
AI	Artificial Intelligence
AMF	Financial Markets Authority (*Autorité des Marchés Financiers*)
APIX	Global Financial Innovation Network or the API Exchange
ARAFER	Regulatory Transport Authority (*Autorité de Régulation des Transports*)
ARCEP	Electronic Communications, Postal and Print Media Distribution Regulatory Authority (*Autorité de régulation des communications électroniques, des postes et de la distribution de la presse*)
ARCOM	Regulatory body in charge of audiovisual and digital communications (*Autorité de régulation de la communication audiovisuelle et numérique*)
ASIC	Australian Securities & Investment Commission
BCFP	Bureau of Consumer Financial Protection
BEIS	Department of Business, Energy and Industrial Strategy
B2C	Business-to-Consumers
B2P	Business-to-People
CAGR	Compound Annual Growth Rate
CCAF	Cambridge Centre for Alternative Finance
CNIL	Data Protection Authority (*Commission Nationale de l'Informatique et des Libertés*)
CRE	Energy Regulatory Commission (*Commission de Régulation de l'Energie*)
CSA	French Broadcasting Authority (*Conseil Supérieur de l'Audiovisuel*)
CSA	Canadian Securities Administrators
CSF	Center for Strategic Futures

DLT	Distributed Ledger Technology
DSA	Digital Services Act
DMA	Digital Markets Act
DNB	De Nederlandsche Bank
EBP	European Blockchain Partnership
EBSI	European Blockchain Services Infrastructure
FAA	Federal Aviation Administration
FC	Fulfilment Center
FCA	Financial Conduct Authority
FHV	For-Hire Vehicle
FIRA	Financial Industry Regulatory Authority
FSRA	Financial Services Regulatory Authority
FSS	Fintech Supervisor Sandbox
FTC	Following Too Close
FTIG	Financial Technology and Innovation Group
GDPR	General Data Protection Regulation
GFIN	Global Financial Innovation Network
GIFCT	Global Internet Forum to Counter Terrorism
GPS	Global Positioning System
G-REG	Regulatory Practice Initiative
HADOPI	Authority for the dissemination of works and the protection of rights on the internet (*Haute Autorité pour la diffusion des œuvres et la protection des droits sur internet)*
HKMA	Hong Kong Monetary Authority
ICO	Initial Coin Offerings
ICT	Information and Communication Technology
INATBA	International Association of Trusted Blockchain Applications
IoT	Internet of Things
IRGC	International Risk Governance Council
KOMET	Sweden's Committee for Technological Innovation and Ethics
LPWAN	Low-Power Wide Area Networks
MAS	Monetary Authority of Singapore
MOLIT	Ministry of Land, Infrastructure, and Transportation
NE.O	Next Generation Online Store
O2O	Online-to-Offline
RBI	Reserve Bank of India
PAR	Planned Adaptive Regulation
P2P	Peer-to-Peer
RHC	Regulatory Horizons Council

RIA	Regulatory Impact Assessment
RSB	Regulatory Scrutiny Board
SEC	Securities Exchange Commission
SME	Small and Medium Enterprise
SUAS	Small Unmanned Aircraft System
TLC	Taxi and Limousine Commission
UGV	Unmanned Ground Vehicles
UNSGSA	UN Secretary-General's Special Advocate for Inclusive Finance for Development
USPTO	United States Patent and Trademark Office
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-everything
WIPO	World Intellectual Property Rights Organisation

Executive summary

The changes brought by innovation hold great potential to enhance prosperity and well-being, but they also entail significant risks and potential adverse effects. Innovation also fundamentally challenges the way governments regulate. Policy makers and regulators must strive to maintain a balance between fostering innovation, protecting consumers, and addressing the potential unintended consequences of disruption. Several factors combine to create unprecedented challenges in the way governments and regulators operate:

- Difficulties for regulatory frameworks to keep pace with the dynamics of technological transformation;
- Difficulties in designing fit-for-purpose regulatory frameworks given that innovation frequently cuts across administrative and sectoral boundaries;
- Challenges to regulatory enforcement due, for example, to the difficulties in attributing liability when artificial intelligence in involved;
- Institutional challenges raised by the inherently transboundary nature of a number of innovations.

The report presents a series of case studies to document these regulatory challenges and the range of regulatory responses implemented or contemplated by governments.

Main findings:

- **Governments can take a variety of regulatory approaches to address the challenges raised by innovation**. These can range from explicitly preventing the development and adoption of a technological development, to adopting a "wait and see" approach to ascertain which perceived risks materialise, to developing regulatory guidance or piloting innovative approaches such as the adoption of fixed-term regulatory exemptions (e.g. regulatory sandboxes).
- **Given the dynamics of technological advances, it is likely that the appropriate regulatory approach (or mix of approaches) will require periodic adaptation to ensure regulations are fit for purpose.** A continuous monitoring of the impact of regulations, coupled with timely and proportionate revaluations of existing regulatory frameworks, appears critical to achieving this. The cross-cutting nature and sheer pace of innovation may also require a combination of different types of regulatory approaches.
- Traditional regulatory policy tools provide important opportunities to pause, consult, question and test the approaches that may help achieve general policy objectives. Yet, t**he disruptive changes brought by innovation create a strong need to strengthen and systematise the use of regulatory policy tools**. As highlighted in the *OECD Recommendation on Agile Regulatory Governance to Harness Innovation*, this could involve, in particular:
  - Developing more flexible, iterative and adaptive *ex ante* and *ex post* assessments;
  - Fostering coherence and joined-up approaches through effective co-operation between the supra national, national and sub-national levels of government;

- Developing governance frameworks to enable the development of agile and future-proof regulation such as outcome-based regulations (e.g. data-driven regulation and rules as code, co-regulation and non-regulatory approaches such as voluntary codes or standards;
- Developing new enforcement strategies to promote compliance: governments should prioritise responsive and compliance-promoting approaches to regulatory delivery focusing on outcomes and based on risk-proportionality rather than focusing primarily on the letter of the rules.

1 Overview

The pace, scope and complexity of the changes caused by innovation, let alone the current societal and environmental changes afoot, are significantly affecting every facet of the economy and society. These changes raise a number of governance and regulatory challenges for governments that need to be properly understood to target appropriate regulatory responses. A key challenge is to design governance and regulatory approaches that prevent or mitigate the potential unintended negative consequences of technological developments while reaping the opportunities they provide and not stifling innovation. This chapter presents the key insights that can be drawn from the project conducted jointly by the Korea Development Institute (KDI) and the OECD to identify the governance and regulatory challenges raised by innovation and document emerging approaches to address them.

Introduction

The pace, scope and complexity of the changes caused by innovation, let alone the current societal and environmental changes afoot, are significantly affecting every facet of the economy and society. Indeed, innovation in the 21st century has led to the development of new products, services and business models that were unimaginable just a few years ago and keep evolving quickly. Prominent examples span a wide range of areas including digital technologies (e.g. artificial intelligence, Blockchain or the internet of things), biotechnologies (e.g. gene editing) and advanced materials (e.g. nanomaterials).

Changes derived from innovation have far-reaching consequences for the well-being and cohesion of society as a whole. Likewise, they impact our economy deeply through their effects on productivity, employment, skills, resource allocation, trade and the environment. As shown by the OECD Going Digital project and reflected in the associated policy framework, digitalisation in particular is leading to profound changes in the ways people interact, create, produce and consume (OECD, 2020[1]). Digitalisation has indeed created opportunities for promoting wider consumer choice, stronger competition, economic growth, freedom of expression, and brought people, firms and organisations closer across borders.

However, if insufficiently shaped by policy, digitalisation and transformative innovations more broadly can also entail high risks and potential adverse effects by inter alia disrupting labour markets, marginalising vulnerable populations, generating market power and increasing wealth concentration. Additional challenges relate to ethics, data privacy and ownership, digital security, potential bias and discrimination, minors' protection and violent content, as well as the spread of misinformation and disinformation and their potential risks for democracy.

Through laws, regulations and other policy instruments, governments can have a major influence on the development of innovations, the realisation of their benefits for society, and the avoidance or limitation of associated risks. Regulatory quality is therefore a priority if key principles underpinning our way of life such as inclusiveness, resilience and sustainability are to be upheld in a context of high uncertainty and rapid change. Governments face several questions in this respect. How to enable innovation and accommodate technology-driven disruption while ensuring a sufficient level of regulatory protection for people and the public interest at large? How to reconcile the need for agile and flexible regulatory approaches with the need to provide stability and predictability for businesses? How to develop experimental regulatory approaches while continuing to ensure competitive markets and a level playing field? How to design, implement and enforce regulation effectively in the presence of innovations whose impact transcends administrative and jurisdictional boundaries? How can international regulatory co-operation support domestic regulatory approaches to phenomena that know no borders?

It is clear that sweeping technological advancements are creating a sea change in today's regulatory environment. The pace of development of today's technological innovations and the scope of the transformations they induce is indeed unprecedented. At times, regulatory frameworks are not agile enough to accommodate the fast pace of innovation and, as a consequence, existing rules become outdated and no longer relevant. Lack of knowledge of how innovations will affect markets and societies can make it hard for governments to keep pace in a way that avoids reducing the potential benefits of innovation, while also protecting the legitimate interests of all stakeholders. As a result, fundamental issues stemming from the widespread adoption of innovations have so far been left unaddressed, undermining public trust in governments and institutions. Governments are therefore facing a significant challenge to try to keep pace with the realities of this new economy in a way that does not hinder economic growth but that at the same time protects citizens from its most egregious effects. Beyond this pacing problem, innovations challenge how governments regulate in fundamental and interrelated ways: by blurring the traditional definition of markets, challenging enforcement, and transcending administrative boundaries domestically and internationally.

In addition, most technological innovations pose definitional challenges to policy makers. Due to the complexity, the pace and the increasingly pervasive nature of innovation, terminology and definitions are difficult to establish. The lack of agreed technical definitions raises several questions, including:

- The fact that government agencies and regulatory bodies may face an overlapping (hence confusing) range of concepts, potentially affecting the quality of their rule-making activities;
- The difficulty of finding relevant metrics to capture the pace and extent of the technological transformation;
- The fact that jurisdictions may come forward with different definitions, undermining the quality of regulatory co-operation.

The COVID-19 crisis has magnified these challenges and forced governments to rethink how they regulate. The social and economic disruption that the pandemic has wrought further highlights the strategic importance of developing more agile and co-ordinated regulatory approaches to increase responsiveness and resilience in changing environments, harness the opportunities provided by innovations and protect the public interest. As governments rebuild afresh, they must ensure that the innovation that will power economic growth and solve the world's most pressing social and environmental challenges is not held back by regulations designed for the past.

It must be stressed, however, that the disruptive nature of innovations also brings a number of opportunities for governments. These transformative changes can be harnessed to reform markets where there have been undue regulatory restrictions that impose a competitive disadvantage on incumbents rather than extend existing restrictions to new business models.

Against this background, a key challenge is to design governance and regulatory approaches (Box 1.1) that prevent or mitigate the potential unintended negative consequences of technological developments while reaping the opportunities they provide and not stifling innovation. The solution to this challenge is not rushing into regulation. Governments and regulators should, as a first step, have an understanding of the broad regulatory issues that these innovations pose when considering their approach to regulating them. Comprehending the changes underway is critical to better align policies with the many opportunities and challenges brought by innovations. Against this background, the aim of the report is twofold:

- Identify the governance and regulatory challenges raised by innovations;
- Document emerging regulatory approaches to address them.

Box 1.1. Technology governance, regulation and regulatory policy

- "Technology governance" has been defined by the OECD as the process of exercising political, economic and administrative authority in the development, diffusion and operation of technology in societies (OECD, 2018[2]). Thus, it can consist of norms (e.g. regulations, standards and customs), but can also be operationalised through physical and virtual architectures that manage risks and benefits. Technology governance pertains to formal government activities, but also to the activities of firms, civil society organisations and communities of practice. In its broadest sense, it represents the sum of the many ways in which individuals and organisations shape technology and how, conversely, technology shapes social order. In this regard, technology governance could be affected by professional norms, design standards, ethical requirements of research funders, and licensing arrangements;
- "Regulation" refers to the diverse set of instruments by which governments set requirements on enterprises and citizens. Regulation include all laws, formal and informal orders, subordinate

rules, administrative formalities and rules issued by non-governmental or self-regulatory bodies to whom governments have delegated regulatory powers (OECD, 2018[2]).

- "Regulatory policy" consists in the set of rules, procedures and institutions introduced by government for the express purpose of developing, administering and reviewing regulation (OECD, 2018[2]).

Technological innovations and new business models surveyed

This report draws on the insights derived by six case studies developed by the OECD and the Korea Development Institute (KDI). The case studies have been selected to span the different challenges raised by innovations and the diversity of regulatory responses that are being used. They cover the following areas:

- Data-driven business models;
- Digital innovation in finance;
- Smart contracts;
- Digital technologies for smart logistics;
- Sharing economy.

Key implications of innovation on markets and societies

This section briefly summarises the main transformative changes documented through the case studies (for a more detailed and comprehensive presentation of the impacts of innovation on economies and society, see, in particular, (OECD, 2018[3]), (OECD, 2019[4]), (OECD, 2019[5]) (OECD, 2019[6]), and (OECD, 2020[1])):

- **Competition**: the development of technological innovations bears important consequence in terms of competition dynamics, in particular in data-driven markets. The economic properties of digital businesses can indeed give rise to natural monopoly conditions and create barriers to entry to competitors. It may also lead to new forms of anticompetitive strategies such as algorithmic collusion. It should be stressed that the unprecedented crisis resulting from the COVID-19 outbreak could increase the concentration in data-driven markets which, in turn, may exacerbate the regulatory challenges they bring;
- **New market failures**: the rise of data-driven markets might entail new market failures such as implicit transactions, incomplete markets, information asymmetries, hold-up and locked-in phenomena;
- **Data privacy and security challenges**: with more pervasive collection of data, digital technologies carry new risks in terms of data privacy and security;
- **Reduction in transaction costs**: digitalisation can make markets work more efficiently by reducing transaction costs, leading to the development of new or transformed business models;
- **Development of decentralised exchanges**: digital technologies facilitate or stimulate decentralisation, empower the "edges" and create new forms of intermediation. Consequently, they hold the potential to generate a shift from traditional regulation towards private governance;
- **Development of networks**: as a corollary to the development of decentralised exchanges, digitalisation is leading to a wider development of networks., for market activities or in a social context, which challenges the traditional dynamics and structure of markets;

- **Shift towards services**: digitalisation has further reinforced the transition to a service economy, which conveys a number of consequences for the structure of the economy (e.g. changes in the skill mix required and in the types of capital firms need);
- **Growing powers to consumers**: digitalisation offers great opportunities to offer a wider range of products and services to consumers at lower costs. As more information becomes available as regard products or services quality, it also helps to reduce information asymmetries between businesses and consumers, thus contributing to enhance market efficiencies;
- **Socio-ethical challenges**: the pervasive use of artificial intelligence is creating challenges in terms of consumer protection, transparency, bias and discrimination. The use of algorithms might exacerbate existing biases, amplify them, or create them. The development of data driven-markets and social media platforms in particular may also contribute to the spread of false, inaccurate or misleading information. This is raising strong concerns for governments as it holds the potential to decrease public trust in government, undermine the evidence-based democratic processes and decrease citizen participation.

The regulatory challenges

Challenges to the design of fit for purpose regulatory frameworks

The transformative changes brought by innovations put pressure on governments to establish a common and consistent regulatory space. The challenges to traditional regulatory frameworks can come in different forms:

- Traditional regulation is often designed on an issue-by-issue, sector-by-sector or technology-by-technology basis and it may not be a good fit for the challenges brought about by technological developments. In many areas, innovations are indeed straddling or blurring the usual delineation of sectors. A number of economic regulators have for example been created to tackle the first convergence between the telecommunication and the media sectors. Yet, digitalisation has given rise to a new convergence in telecommunications, media markets and digital platforms, in which many components of the digital ecosystem are closely interrelated. This convergence raises questions about whether the existing regulatory mandates and remits are still fit for purpose. Digital-driven innovations in the financial sector are also blurring the boundaries across sectors and segments of the value chain, thus putting existing regulatory frameworks to the test. Examples include robo-advisors in banking, finance and insurance, as well as crowdfunding platforms. Technological innovations may also confuse the traditional distinction between consumers and producers, as is the case with the rise of individual ”prosumers” in the electricity market that both consume and supply energy to the network. These changes make it difficult to identify well-defined relevant markets and question the scope and mandate of regulators;
- Network externalities, the capacity to scale without mass and the economies of scope that characterise data-driven markets can give rise to natural monopoly conditions and create barriers to entry to potential competitors (with substantial risks that excessive prices and lack of innovation will follow). At the same time, low marginal costs and non-rivalry of many digital goods also imply that new entrants can replace an incumbent firm in a relatively short timeframe simply by offering a qualitatively superior good. These features may confuse the rationale for regulatory intervention as any action will influence the nature of competition between the incumbent and the new entrants. On the one hand, regulators may be prompted to act to avoid market capture by one player. On the other hand, undue regulatory intervention may threaten the entry of new players. While competition policy has been initially used in many jurisdictions to address the challenges brought by multi-sided platforms, recent OECD work highlights that solutions limited to competition policy will probably not suffice by themselves (OECD, 2019[4]);

- The economic properties of digital businesses also challenge the standard cost-based regulatory models as price formation in the digital economy obeys different rules. As highlighted by (Tirole, 2019[7]), "*it is now common for a platform like Google or Facebook to set very low prices – or provide a service for free – on one side of the market and very high prices on the other side. This naturally creates suspicion among competition authorities. In traditional markets, such practices could well be regarded as a form of market predation that is meant to weaken or kill off a smaller competitor. By the same token, a very high price on the other side of the market could mean that monopoly power has been brought to bear.* […] *Two-sided markets are prevalent in the digital economy, and a regulator who does not adequately account for this unusual business model could incorrectly declare low pricing to be predatory, or high pricing to be excessive, even though such price structures have also been adopted by the smallest platforms entering the market*". The economics of digital business therefore raises the question of whether the paradigm and the empirical tools traditionally used to define markets, to assess market power and the effects of exclusionary conducts remain fit for purpose (OECD, 2018[8]);
- The development of data-driven markets might have given rise to structural market failures that competition policy and data protection law may struggle to address properly. Such market failures may take the form of implicit transactions, information asymmetries or shortcomings in the definition of property rights related to data.

Failing to address these questions could expose innovators to a series of uncertainties regarding the regulatory landscape:

- Complexity of existing regulations and guidance;
- Difficulties in identifying and interpreting applicable regulations, in particular when innovation is straddling or blurring the boundaries of traditional categories and definitions;
- Belief that the interpretation of the applicable regulation may change as the innovation scales up.

Such legal uncertainties and added compliance costs may lower incentives to further develop innovation and create new markets, particularly for small businesses. This could, in turn, impede useful innovation. In addition, a regulatory landscape that is not adapted to a particular situation can generate failures to mitigate downside risks brought by innovations.

Challenges to regulatory enforcement

Innovations are challenging regulatory enforcement in several ways. One of the issues has to do with the fact that traditional notions of liability may no longer be fit for purpose due to difficulties in apportioning and attributing responsibility for damages caused – for instance, in accidents involving AI-embedded machines or devices. Since damages resulting from the use of innovations can occur across jurisdictions, coordination on enforcement among governments or agencies can be particularly challenging - either because diverging regulatory approaches (e.g. due to different cultural or political priorities) or because of difficulties in apportioning liabilities across multiple jurisdictions. This problem is exacerbated by the fact that some technological developments such as smart contracts allow economic agent shift away from traditional liability regimes, making difficult for governments to enforce them.

More generally, innovations challenge regulatory enforcement because categories, which underpinned regulations, and specific rules, which are supposed to be verified and enforced, are often not strictly applicable to new situations, products, and services. Depending on legal frameworks and enforcement approaches, governments can end up either cracking down indiscriminately on innovations that do not fit previously existing categories, or powerless to respond to emerging risks – or both at the same time.

In addition, the digital technologies may also facilitate the development fraudulent activities and law avoidance. Money laundering can for example be facilitated by the complex cross border data flows surrounding the development of data-driven activities and the possibility of using the Internet to conceal certain activities or transactions.

Institutional and transboundary challenges

As technological innovations can span multiple regulatory regimes, the usual institutional framework underpinning regulations – around line ministries and agencies – is also showing its limits when dealing with the transversal challenges raised by digitalisation. The fact that, in most cases, innovations have no regard either for national or jurisdictional boundaries puts increasing strain on regulators operating within the limits of their own jurisdictions. This feature enables companies to "forum shop" and/or avoid compliance by choosing the jurisdiction most advantageous to them and potentially avoid compliance with certain regulatory requirements, their internal tax policy, and their policy for data protection or other regulated areas. It should be noted that these transboundary challenges are exacerbated by the pacing problem: the fact that regulatory frameworks lack the agility to accommodate the increasing pace of technological developments extend the avenues for regulatory arbitrage.

The traditional institutional frameworks underpinning regulations are no longer adapted to address or effectively keep up with innovations. The mismatch between the transboundary nature of digitalisation and the fragmentation of regulatory frameworks across jurisdictions may undermine the effectiveness of action and therefore people's trust in government. It may also generate barriers to the spread of beneficial digital innovations. As such, technological innovations raise a strong need for international regulatory co-operation to deliver better results for citizens around the globe.

The pacing problem

None of the above regulatory challenges is not fundamentally new in itself. Policy makers and regulators had indeed to deal with innovations and new technologies for a long time and have to some extent factored these into their rule-making activities. What is new, however, is the unprecedented pace, scope and complexity of technological developments, which magnify the regulatory challenges described above. Part of the reasons why government struggle to keep pace with these transformative changes owe to the complexity associated with a number of innovations.

The disconnect between the pace of technology and the pace of regulation raises several potential concerns:

- Failures to deal properly with the unintended consequences of the innovation. This problem is particularly critical when the technological development hold the potential to create changes that are not (easily) reversible (e.g. gene editing);
- Barriers to the entry of new services (or increased entry costs) due to the uncertainties surrounding the regulatory landscape;
- Creation of uneven playing-fields, where new entrants face regulatory barriers to entry (or, conversely, where incumbents face higher burdens than new business models).

Regulatory approaches

Regulatory approaches can range from explicitly preventing the development and adoption of digital technologies, to adopting a "wait and see" approach to discover which perceived risks materialise, or piloting of innovative approaches such as the adoption of fixed-term regulatory exemptions (e.g. regulatory sandboxes) for innovative entrants that uphold protection for citizens and the environment.

Yet, due to the fact that an accepted conceptual taxonomy is lacking, governments often face a widespread variation of terminology about regulatory instruments. Drawing on the insights from the case studies, the following developments propose a simple classification of regulatory approaches that have been implemented or contemplated by governments.

Anticipatory governance

The rapid pace of innovation means that governments need to develop anticipatory governance approaches to allow for an earlier identification of risks and opportunities brought by technological developments (OECD, 2021[9]) and (Tõnurist and Hanson, 2020[10]). This can notably be achieved by means of structured horizon scanning, scenario planning and earlier and more active engagement with stakeholders, including innovators – all of which can also help governments prioritise innovations where regulatory reform is needed to unlock their benefits for society or minimise associated risks. A number of jurisdictions have developed institutional mechanisms to advise regulators on the innovation pathways and the associated risks and opportunities. Sweden's Committee for Technological Innovation and Ethics (KOMET) and the Canada's External Advisory Committee on Regulatory Competitiveness.

Wait and see approaches

A rather common reaction at the beginning of the technological development consists in observing how the technology develops without taking any regulatory action (during this period, innovators operate within the existing regulatory regime). While such an option could be a wise choice in the early stages of the technological development, this should be replaced by formal regulatory strategy once the evidence have been collected (through public and stakeholder engagement in particular).

Issuing guidance

Innovators often face difficulties in identifying and interpreting applicable rules, in particular when innovation is straddling or blurring the boundaries of traditional market definitions. In this context, governments can rely on soft law mechanisms such as regulatory guidance to help innovators understand how the regulatory framework applies for a specific technological development and reduce the potential regulatory uncertainty as to how to comply with existing requirements. It is important to note that guidance often occurs as a complement to wait and see approaches. Indeed, when a government formally decides to wait before issuing a regulatory decision, businesses may face regulatory uncertainties (e.g. on how to navigate the interdependences between the regulatory regimes) undermining incentives to innovate. Issuing guidance may help overcome this drawback by providing clarification and insights on how the regulatory landscape applies (governments could also use guidance to warn business about potential enforcement action in certain conditions are not met). Two main types of guidance could be distinguished: informal guidance on case-by-case basis (such as preliminary warnings, informal statements, and initial guidance on existing regulations in relation to the technology and no-action letters) and formal guidance. The latter relies of more formalised mechanisms to clarify the broader application of existing regulatory frameworks. It relies on a wide array of vehicles ranging from principles, policy guidance documents, best practices or white papers. It must be stressed that both approaches could be considered as 'soft law' and, as such, they might be subsequently challenged by the judiciary. As illustrated by the technological innovations in the financial sector, a number of governments do rely on innovation offices to provide guidance to businesses and help them mitigate the costly and time-consuming efforts to understand the regulatory landscape.

Self-regulation

As noted by (OECD, 2009[11]), "*self-regulation typically involves a group of economic agents, such as firms in a particular industry or a professional group, voluntarily developing rules or codes of conduct that regulate or guide the behaviour, actions and standards of its members. The group is responsible for developing self-regulatory instruments, monitoring compliance and ensuring enforcement*". In the EU, self-regulation has been defined as *"the possibility for economic operators, the social partners, non-governmental organisations or associations to adopt amongst themselves and for themselves common guidelines at European level*".[1] Examples of self-regulation include code of conducts or voluntary adoption of standards. When used in the right conditions, such approaches offer a number of advantages (e.g. greater flexibility and potentially lower compliance costs) that can help deliver policy objectives more effectively than regulation.

Self-regulation practices can be triggered by the existence of reputational incentives, in platform economies in particular. (Cantero Gamito, 2017[12]) states, for example, that "*by providing feedback and rating the services they have used or the products that they have bought, platforms' businesses and users are 'spontaneously' generating new rules*". In this perspective, the reputational incentive can act as a complement to the traditional regulation of market failures such as information asymmetries.

It must be underlined that self-regulation does have a number of limitations, notably because it may lack transparency and fail to reflect properly the preferences of economic agents. In addition, in the absence of a common regulatory framework, competition issues may arise: first, it may raise the need for case-by-case analysis to address competitive concerns, which is probably not desirable from an industry and government perspective given the associated cost and uncertainties. Second, businesses might self-regulation mechanisms to develop barriers to entry, asking for example new entrants to comply with excessive and burdensome rules (which could be partly designed on purpose). In this context, the success of this approach critically hinges on the capacity of governments to "*closely monitor practices and engage in regular reviews of technical standards and codes of practice in an open and inclusive way to avoid inappropriate market distortions*" (OECD, 2021[13]). (Cusumano, Gawer and Yoffie, 2021[14]) also suggest that, to yield positive outcomes, self-regulation regimes should be combined with credible threats of governments intervention.

Co-regulation

An approach that can be used to circumvent part of the difficulties associated with self-regulation is co-regulation. In the EU, it is for example defined as a mechanism whereby "*an [EU] legislative act entrusts the attainment of the objectives defined by the legislative authority to parties which are recognised in the field (such as economic operators, the social partners, non-governmental organisations, or associations)*".[2] As an intermediate solution between pure self-regulation and traditional command and control mechanisms, co-regulation brings two main opportunities: first, it offers a certain degree of flexibility under the control of governments, which is desirable to deal with the pace of technological developments. Second, it relies on a close collaboration between business and governments, which creates avenues for access to first-hand and detailed evidence on technological developments and makes sure that it complies with general public policy objectives. Governments can therefore harness this approach to better understand the risks and opportunities brought by the innovation and adapt the chosen regulatory option as necessary.

Regulatory experiments

A number of jurisdictions are experimenting with innovative regulatory approaches such as regulatory sandboxes to support the testing of new technologies and foster policy learning on how the regulatory framework may need to adapt. A regulatory sandbox generally refers to fixed-term regulatory exemptions

associated with a number of safeguards to uphold public protection. At the end of the trial period, innovators may apply for an authorisation to develop the innovation outside the regulatory sandbox. Due to the cross-cutting nature of innovation, recent initiatives have been explored for the development of cross-sector and/or multi-jurisdiction regulatory sandboxes. The objective is to promote regulatory harmonisation, reduce the potential for regulatory arbitrage and facilitate the development of innovations in different markets and jurisdictions.

Outcome-based regulation

Outcome-based regulation "*usually defines measurable outcomes that regulated firms must achieve. In focusing on outcomes rather than on inputs, it offers flexibility to businesses on how to meet to objectives, as long as they can demonstrate that the desired outcome has been achieved. Such approach theoretically allows regulated entities to choose the most efficient way to achieve the regulatory goal, while lowering compliance costs"* (OECD, 2021[15]). As for self-regulation and co-regulation approaches, outcome-based schemes appear well-suited to address the dynamic and the uncertainties of technological developments by providing flexibility to innovators. Given the pace of innovation, prescriptive regulation might indeed become rapidly outdated or excessively burdensome. Outcome-based regimes may also place fewer obstacles on the development of interoperable regulatory frameworks across countries. It must be stressed, however, that performance-based solutions are certainly not a panacea in all cases. Recent examples show that it can work poorly, especially when performance cannot be adequately defined, measured, or monitored (Coglianese, 2017[16]). A series of questions should be carefully addressed to implement such approach successfully: is the performance observable and measurable? How far does the performance target is reflecting a public policy goal? What is the relevant unit of regulation (e.g. should it be individual or aggregated)? How to allocate the burden of proof (if demonstrating compliance is too costly, it could severely undermine incentives to innovate)? What standard of proof is required? How many dimensions of the performance should be taken into account? How to rank them? As for any type of regulatory approach, failing to design properly an outcome-based scheme can prove costly, ineffective, or even counterproductive.

Means-based regulation

Means-based regulation stands in contrast to outcome-based regulation: under this approach, governments define how businesses must act (presumably to achieve a certain level of performance). This approach is also known as technology-based regulation, command-and-control regulation, specification standards, design standards or perspective standards. Information disclosure regulation, that requires regulated entities to disclose their performance levels, is a type of technology-based regulation (unless it requires firms to achieve a defined level of performance).

A number of disadvantages have been identified in the literature. (Coglianese, 2016[17]) states for example that "*for some regulated entities, the mandated means may not prove as effective as other means. Second, for some regulated entities, the mandated means may prove to be more costly than other equally effective means. Finally, by specifying how to act, means standards can inhibit innovation in finding better or cheaper ways to achieve the same outcomes*".

Outright/effective ban

As the final step of the regulatory spectrum, governments may decide to implement an outright (or effective) ban, either to protect existing markets through regulation or to protect citizens against the potentially negative consequences of a technological development.

Some considerations on instrument choice

A couple of issues should be mentioned when it comes to the choice of regulatory approach:

- As highlighted by (Department for Business, Energy & Industrial Strategy, 2020[18]), a useful distinction could also be made between economic and social regulation to help governments navigate through the various options available:
  - "Social regulation" covers liability law, labour market regulation, bankruptcy law, intellectual property regulation, product quality and safety regulation, environmental regulation, worker health and safety regulation, data protection regulation and information security regulations, and;
  - "Economic regulation" gathers abuse of dominance and antitrust regulation, market entry regulation, mergers and acquisition regulation, price regulation, quantity regulation, as well as the economic regulation of natural monopolies and public enterprises.
- Despite the broad enthusiasm outcome-based regulation has recently garnered across governments, it must be underlined that none of the above-mentioned regulatory approaches are optimal per se. The relative efficiency of each regulatory solution depends, inter alia, on the expertise of governments, the ability to measure performance, the innovation stage and the pace of the technological development. Against this background, governments should carefully scrutinise the different alternatives, paying close attention to the strengths and weaknesses of each option.
- Given the dynamics of digital transformation, regulatory responses cannot afford to be static and need periodic adaptations to keep pace with technological transformation. Continuous monitoring of the stock of regulations could help governments assess whether regulation remains fit for purpose and undertake regulatory revisions when necessary. In this regard, the International Risk Governance Council suggested that governments could engage in "Planned Adaptive Regulation" (PAR), i.e. a "*continuous or iterative re-evaluation*" of regulations (International Risk Governance Council, 2015[19]). In that perspective, governments should develop "*intentional and precursory design of institutions and processes to review and update policies in light of evolving scientific knowledge and changing technological, economic, social and political conditions*" (International Risk Governance Council, 2015[19]). Adaptive regulation might however raise challenges for governments and business as it may reduce the stability and the predictably of the rules which, in turn, might inhibit innovation. Given this potential drawback, the IRGC stated that adaptive regulation is reserved for specific cases where:
  - There is a prior commitment, planned early in the policy's design, to subject the policy to periodic re-evaluation and potential revision, and;
  - There is a systematic effort or mechanism, planned early in the policy's design, to monitor and synthesise new information for use in re-evaluations.
- This continuum of regulatory approaches should not be considered as a compilation of stand-alone blocks. As pointed out by (Coglianese, 2016[17]), regulations often combine different types of approaches. Given the sheer pace and the cross-cutting nature of technological changes, it is even more likely that the appropriate response will require a mix of regulatory approaches. As an example, self-regulation might well go hand in hand with co-regulation or guidance to provide some frameworks to business and mitigate the potential risks raised by the technology. Self-regulation can even be mandated by regulators through a regulatory measure. Governments might also want to publish guidance or code of practices to complement performance-based approaches. Similarly, it could be useful to combine regulatory sandboxes with regulatory guidance to reduce the level of uncertainty faced by business when launching a technological innovation.

Using regulatory policy tools to tackle the challenges faced by governments

The traditional regulatory policy tools provide important opportunities to pause, consult, question and test the approaches that may help achieve general policy objectives.

Given the level of technical expertise involved, the uncertainty surrounding certain digital developments and the overwhelming pace of digital transformation, governments critically need to engage a broad range of stakeholders (including regulated entities, citizens, universities, innovators, local governments, other regulatory agencies) for two main reasons:

- Creating regulatory solutions that are evidence-based and leveraging the expertise of external actors affected by the innovations and their implications. This is especially important where governments face technological developments with wide-ranging and cross-cutting implications and/or where they do not have technical knowledge or in-house capacities to deal with the regulatory challenges;
- Helping citizens understand the regulatory issues at stake, broadening the range of perspectives represented and, in turn, better delineating citizens' expectations as regard regulation. Failing to do so could potentially undermine public trust in governments and generate barriers to the spread of beneficial innovations.

In this respect, a number of jurisdictions have started putting a strong emphasis on stakeholder engagement to respond to the opportunities and challenges arising from digital technologies. As an example, the Digital Charter published in 2018 by the UK Department for Digital, Culture, Media & Sport brings together the tech sector, businesses, civil society and other interested parties to build solutions to the challenges associated with innovations. Through the Digital Charter, the government is committing, in particular, to make it as easy as possible for citizens and others to give their views and harness the ingenuity of the tech sector, and is looking to them for answers to specific technological challenges, rather than government defining precise solutions itself. This rolling program also relies on an *ex ante* assessment of new regulations to design effective regulations. The government committed to consider the full range of possible solutions, including legal changes where necessary, to establish standards and norms for the digital economy.

Another initiative has been developed by Canada through its 2019 Digital Charter, which outlines the key issues to address to create a "*new, transparent and accountable digital policy*". The digital charter, which has been informed by a broad public consultation in 2018, features a set of ten principles to guide the federal government's work. The principles cover a number of areas, including safety, security, transparency, portability, interoperability, enforcement and accountability.

Given the cross-cutting nature of innovations, regulatory co-operation between government agencies is also critical. Relevant initiatives in this area are emerging, as illustrated by the call for input on cross-sector sandboxes launched in 2019 by the Financial Conduct Authority (FCA). The FCA states that cross-sector regulatory sandboxes would bring a number of opportunities, including:

- Developing shared learnings on the risks and opportunities raised by a specific emerging technology;
- Contributing to the definition of a consistent and robust regulatory approach across government agencies;
- Improving the efficiency of the regulatory process for innovative firms in providing a unique and co-ordinated entry point to firms.

Another interesting example in this areas is the Regulatory Practice Initiative (G-REG) developed by the New Zealand's Ministry of Business, Innovation and Employment. Under this initiative, a network of central and local government regulatory agencies has been established to co-operate on regulatory initiatives.

Canada has also created an External Advisory Committee on Regulatory Competitiveness to advise the Treasury Board by "*supporting the modernization of Canada's regulatory system into one that further enables investment and innovation*". An objective is to provide guidance on how regulatory frameworks are necessary to deal with innovations, as well as "*champion the use of pilots*". Via its Centre for Regulatory Innovation, which aims at promoting a whole-of-government approach to regulatory experimentation to support innovation and competitiveness, the country has also carried out targeted regulatory reviews to address barriers to innovation in areas including agri-food, biosciences, transportation, clean technology and digital technologies.

As mentioned above, it is vital for governments to anticipate risks and opportunities early on, by means of structured horizon scanning, scenario planning and earlier and more active engagement with stakeholders (including the business community). While regulatory foresight is still the exception, some governments have developed specific initiatives in this area such as the Regulatory Horizons Council (RHC) established by the Department of Business, Energy and Industrial Strategy (BEIS). The RHC acts as an expert committee to identify the implications of technological innovation with high potential benefit for the economy and society, and advise the government on regulatory reform needed to support its rapid and safe introduction. It has commissioned relevant research including on the use of innovations for regulation and will also be focusing on the role of standards in promoting innovation.

Singapore has also created the Center for Strategic Futures (CSF) whose mission is to "*position the Singapore government to navigate emerging strategic challenges and harness potential opportunities by*:

- *Building capacities, mindsets, expertise and tools for strategic anticipation and risk management;*
- *Developing insights into future trends, discontinuities and strategic surprises; and*
- *Communicating insights to decision-makers for informed policy planning*".[3]

Another interesting initiative in this area is Policy Horizons Canada, a federal government organisation that conducts foresight with a view to helping the Government develop future-oriented policy and programs that are "*more robust and resilient in the face of disruptive change on the horizon*".[4] To fulfill this mandate, Policy Horizons Canada carries out the following tasks:

- Analyse the emerging policy landscape, the challenges that lie ahead, and the opportunities opening up;
- Engage in conversations with public servants and citizens about forward-looking research to inform their understanding and decision making;
- Build foresight literacy and capacity across the public service.

The European Commission has also decided to embed strategic foresight into its working methods. Strategic Foresight will inform the design of new initiatives and the review of existing ones in line with the revamped Commission Better Regulation toolbox, and help "*strengthen the Regulatory Fitness and Performance Programme, which identifies opportunities to reduce Europe's regulatory burden, and informs the assessment of whether existing EU laws remain 'fit for the future'*".[5] In addition, the mandate of the Commission's regulatory oversight body, the Regulatory Scrutiny Board (RSB), has been expanded to include foresight.

Innovations also raise a pressing need to evolve existing practices with regards to regulatory impact assessments. The Danish Business Authority has, for example, launched a set of key principles to follow during rule-making. These principles aim to develop targeted regulations that support companies' ability to test, develop and apply new digital technologies. They promote, in particular:

- *Ex ante* assessment policies to clearly define the objective of any regulatory policy proposals and develop simple and fit-for-purpose regulation, making effective use of benchmarks among different jurisdictions;
- Interagency co-ordination to ensure the consistency across administrations' approaches;

- Stakeholder engagement to understand and identify user needs and ensure user-friendly digitalisation.

Another critical need brought by innovations is to review the stock of regulations to identify those which are ill-fitted, incomplete, redundant or overlapping. Initiatives are emerging across countries, such as the publication of the "Future of Urban Mobility Strategy" in March 2019 by the United-Kingdom. In an effort to take full advantage of the opportunities offered by new urban mobility technologies, the government has established a wide-ranging programme of work, with a regulatory review at its core. The government launched an in-depth review of existing regulations, through a broad programme of work across the different transport modes, from maritime autonomy to micromobility. It considers that it is highly likely that this undertaking will necessitate new primary legislation to address the challenges identified. Priorities for the review have been given to specific areas according to their degree of importance and urgency that is by the scale and proximity of the potential impact if regulatory issues are not addressed. The following areas of focus for the regulatory review have been identified: micromobility vehicles, mobility as a service, transport data and modernising bus, taxis and private hire vehicle legislation. This will complement the regulatory review already conducted by the Department for Transport in four areas: zero emission vehicles, self-driving vehicles, drones and future flight and maritime autonomy.

Interesting responses to the transboundary challenges are also appearing. While challenging, international co-operation is critical to ensure the effectiveness of regulatory action and reduce the burden that multiple regulatory regimes may impose on businesses and citizens. Given the strong cross border effects of the digital economy, it is clear that strict domestic solutions will not suffice.

A main objective of international regulatory co-operation is to avoid arbitrages, protect privacy and consumer rights effectively and promote interoperability across regulatory frameworks, whilst creating a favourable environment for the digital economy. A number of benefits could be expected from international co-operation including:

- Help delineate common definition and guidelines for different regulatory regimes;
- Support cross-border information sharing, regulatory learning and adaptation in response to innovation. International regulatory co-operation can facilitate the sharing of knowledge and helps governments meet the challenges that others may have already encountered;
- Help overcome regulatory divergence, reduce the regulatory burden for licensing or approval and, as such, facilitate the development of beneficial innovation. The fragmentation of regulatory frameworks across jurisdictions may indeed generate barriers to the spread of beneficial digital innovations as it can be particularly difficult for business to navigate jurisdictional complexities. As underlined by (Department for Business, Energy & Industrial Strategy, 2020[20]): "*harmonised regulatory requirements directly translate into financial savings for companies and resources that could then be put back into research and development activities or other business functions*". Regulatory convergence can allow businesses to scale more quickly and to attract more foreign investments and talents. Regulatory convergence may also help reduce the adverse effects of regulatory competition, where jurisdictions "race to the bottom" to gain short term advantages.
- Promote the quality of services and products: extending the evidence base through international co-operation increases the opportunities to identify flaws or inefficiencies associated with an innovation (e.g. Fintech trials conducted by the Global Financial Innovation Network);
- Improve consumer satisfaction: harmonisation can allow consumers better and earlier access to innovations.

While international co-operation brings clear potential benefits as regards innovation, it also raises a number of challenges (Department for Business, Energy & Industrial Strategy, 2020[20]):

- The scope of the co-operation should be large enough to avoid the creation of regional silos that could potentially become incompatible with each other;

- International co-operation might be difficult when interests and regulatory landscapes are too different and when countries with more developed economies strive for exerting undue influence;
- Regulatory co-operation could risk a regulatory 'lock-in', whereby co-operation efforts leads to complex and slow-moving systems that are not agile enough to accommodate the fast pace of technological developments.

In the face of these challenges, governments will need to make the most of the wide range of possible approaches (unilateral, bilateral, and international) and the various modalities (e.g. work-sharing, harmonisation, collective experimentation, etc.).

A good example of initiative in this regard is the creation of the Agile Nations. On December 2020, seven governments (Canada, Denmark, Italy, Japan, Singapore, the United Arab Emirates and the United Kingdom) announced the creation of the Agile Nations, the world's first intergovernmental alliance aiming at fostering co-operation across borders towards more agile, flexible and resilient governance and regulatory practices to unlock the potential of innovations. The Agile Nations Charter[6] sets out each country's commitment to creating a regulatory environment in which new ideas can thrive. The agreement paves the way for these nations to co-operate in helping innovators navigate each country's rules, test new ideas with regulators and scale them across the seven markets. Priority areas for co-operation include the green economy, mobility, data, financial and professional services, and medical diagnosis and treatment.

International organisations can also foster various forms of international regulatory co-operation among governments at a multilateral level, ranging from exchange of information to the development binding international treaties, thus fostering a common approach with a broad set of actors. Recognising needs to adapt to new forms of governance required by innovations, international organisations are exploring different avenues for multistakeholder dialogue. The International Telecommunication Union develops for example standards in a variety of areas related to innovations, including on e-health, working towards safeguarding privacy and security in the use of digital technologies for health. On this specific issue, they collaborate in particular with the World Health Organisation, which supports policymakers at the local, regional and national level to ensure the sustainable, safe and ethical use of technology.

The role of the OECD is also key in this area, by enabling cutting edge policy analysis, exchange of experiences as well as the adoption of international instruments and guidance in a broad range of policy areas related to innovations. Recently, its Members adopted for example a Recommendation on Artificial Intelligence (OECD, 2019[21]) to support governments in designing national legislation for the responsible stewardship of trustworthy AI. Beyond OECD members, other countries including Argentina, Brazil, Costa Rica, Malta, Peru, Romania and Ukraine have already adhered to the AI Principles. The Global Partnership on AI, bringing together 25 members to promote responsible development of AI, has been created around a shared commitment to the OECD Recommendation on Artificial Intelligence.

Interestingly, some governments are also developing initiatives to unilaterally align with other governments' regulatory approaches or adopt international standards. As an example, the Danish Business Authority's one-stop shop for new business models conducts "neighbour checks" to understand how innovations are governed in neighbouring jurisdictions.

The regulatory enforcement challenges brought by innovations also warrant the development of new enforcement strategies to promote compliance while upholding public protection. New (digital) technologies provide, in particular, interesting avenues to enable more efficient, resilient and responsive enforcement activities. By providing better evidence, new technologies can help governments predict risk trends, target the most effective use of resources and enhance risk assessment. As part of the roll-out of Japan's "Society 5.0" governance model, the Ministry of Economy, Trade and Industry has been for example undertaking pilot studies in different sectors which involve the use of technology for compliance monitoring purposes. A promising development in this context involves a public-private action plan formulated towards the promotion of a smart industrial safety in petroleum and chemical plants. It is

predicated on the premise that the introduction of IoT, AI and other new technologies can help operators address structural challenges, such as aging facilities and a shortage of labour.

The European Commission is also using satellite data and data from in-situ sensors (e.g. ground stations, airborne sensors, and sea-borne sensors) from the EU Copernicus system to monitor a number of policies related to land use and climate change among others. Although it relies on Member States' reporting on compliance and enforcement, satellite data and other data generate through observation systems are increasingly used for the analysis of infringement cases (e.g. environment).

While these examples highlight that important steps have bene taken to address the regulatory challenges, more would need to be done to strengthen and systematise the use of regulatory policy tools. As highlighted in the OECD Recommendation on Agile Regulatory Governance to Harness Innovation (OECD, 2021[13]), this could involve, in particular:

- Developing more flexible, iterative and adaptive *ex ante* and *ex post* assessments, capitalising on the opportunities provided by digital technologies to improve the quality of evidence;
- Fostering coherence and joined-up approaches through effective co-operation between the supra national, the national and sub-national levels of government;
- Developing governance frameworks to enable the development of agile and future-proof regulation such as outcome-based regulations (e.g. data-driven regulation and rules as code (Mohun and Roberts, 2020[22]), fixed-term regulatory exemptions (e.g. regulatory sandboxes), co-regulation and non-regulatory approaches such as voluntary codes or standards. As highlighted by the OECD Global Conference on Governance Innovation[7] and a recent survey developed by the OECD for the G20 Digital Economy Task Force (OECD, 2021[23]), governments and regulators are increasingly considering innovative regulatory approaches to harness innovation;
- Develop new enforcement strategies to promote compliance: governments should privilege responsive and compliance-promoting approaches to regulatory delivery that are focused on outcomes and based on risk-proportionality rather than focusing primarily on the letter of the rules.

Notes

[1] Interinstitutional Agreement between the European Parliament, the Council of the European Union and the European Commission on Better Law-Making, April 2016.

[2] Interinstitutional Agreement between the European Parliament, the Council of the European Union and the European Commission on Better Law-Making, April 2016.

[3] https://www.csf.gov.sg/who-we-are/

[4] https://horizons.gc.ca/en/about-us/

[5] https://ec.europa.eu/info/law/law-making-process/evaluating-and-improving-existing-laws/refit-making-eu-law-simpler-less-costly-and-future-proof_en

[6] https://www.gov.uk/government/publications/agile-nations-charter.

[7] https://www.oecd.org/fr/gov/politique-reglementaire/oecd-global-conference-on-governance-innovation.htm.

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Part I Case studies on the regulatory challenges raised by innovation and the regulatory responses

2 Case 1. Data-driven markets: regulatory challenges and regulatory approaches

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Data-driven markets have increasingly widespread in economies and societies and they are now supporting many of our daily activities. They entail a number of regulatory challenges for governments that strive to enable innovation in these markets while ensuring a “sufficient” level of protection for people and businesses. This case study documents the range of regulatory challenges raised by the development of data-driven markets as well as some of the regulatory responses that have been implemented by governments. It shows, in particular, that the development of data driven markets will require new institutional solutions to strengthen co-operation across government agencies, including across borders, in order to tackle the transversal challenges of data-driven markets.

> "To achieve an economics for the common good in this new world, we will have to address a wide range of challenges, from public trust and social solidarity […] Success will depend, in particular, on whether we can develop viable new approaches to antitrust, labour law, privacy, and taxation" (Tirole, 2019[1])

Context

Data-driven markets have increasingly widespread in economies and societies and they are now supporting many of our daily activities. These markets share a number of economic properties, which allow data-driven businesses to quickly increase their scale in operations and may lead to a high level of concentration. Critical economic features include (OECD, 2019[2]), (OECD, 2018[3]), (OECD, 2019[4]) and (OECD, 2019[5]):

- **Direct network effects**: in data-driven markets, users' utility usually increases with the number of end-users consuming the same product or service;
- **Indirect network effects**: in multi-sided markets, end-users' utility on one side of the market usually depends positively on the number of users on the other market side;
- **Cross-jurisdictional scale without mass**: while the development of data-driven business might imply significant upfront (i.e. fixed) costs, the production digital services generally entails near-zero or zero marginal cost. It allows companies to scale without mass, including across borders and, in some cases, without any physical presence;
- **Lock-in effects**: the combination of network effects and switching costs (which might be psychological) holds the potential to lock consumers into a specific service.

The development of data-driven markets, which often takes place within complex ecosystems, bears a number of consequences on market and societies. Their impacts on production and consumption systems should be properly understood in order to help governments navigate the regulatory challenges and target appropriate regulatory responses. The nature of these effects can be broken down into two broad categories: the implications on market structures and the impacts on firms' strategies (for a more detailed and comprehensive presentation of these effects, see (OECD, 2018[6]), (OECD, 2019[7]), (OECD, 2019[8]) (OECD, 2019[9]), and (OECD, 2020[10])):

Impact on markets structures

- **Shift towards services**: while the development of the service sector is a longstanding phenomenon that preceded the rise of the digital economy, the rapid development of data-driven markets has further reinforced this evolution (OECD, 2019[4]);
- **Impact on transaction costs**: as stated by (OECD, 2019[5]) and (OECD, 2019[2]), digitalisation may contribute to reduce the level of transaction costs (even for cross-borders transactions), allowing the development of new business models;
- **Development of networks**: data-driven markets trigger the development of vast networks for different purposes ranging from e-commerce, sharing economy to social interaction (OECD, 2018[3]).

Impacts on firm's strategies

The development of data-driven markets is affecting firm's strategies along two key drivers: the change in competition dynamics and the growing power given to consumers.

Competition dynamics

- Monopolisation: the economic properties of online platforms (network effects and cross-jurisdictional scale without mass) may create a tendency towards the creation of (natural) monopolies and the rise of undue barriers to entry;
- New forms of anti-competitive behaviours: while big data and algorithms offer great opportunities to enhance pricing models and foster competition, it may also favour the emergence and the sustainability of tacit collusive agreements without any human interaction (OECD, 2017[11]). Beyond algorithmic collusion, concerns about types of anticompetitive conducts in data-driven markets include anti-competitive manipulation of search results, anti-competitive bundling of apps, anti-competitive use of data by platforms that are also downstream competitors or the collusion in online advertising (OECD, 2019[2]).

Growing power to consumers

Data-driven markets shows great potential to enhance consumer choice and subjective well-being. Their development has indeed created opportunities for promoting wider choice and reducing information asymmetries between consumers and businesses on the quality of a product or service (OECD, 2019[2]), allowing in turn markets to work more efficiently.

Key issues for governments and regulators

A need to rethink traditional approaches and existing tools to address the challenges raised by data-driven markets

Data-driven markets can be seen as a double-edged swords. One the one hand, it is clear that hold the potential to bring important benefits by increasing consumer choice, improving markets' efficiency, and fostering cross-border trading. At the same time, networks effects and cross-jurisdictional scale without mass have allowed data-driven businesses to gain outsized market power in some cases. A lingering concern is that the market structure may lead to anticompetitive conducts resulting in inefficient outcomes (in terms of prices, quality and incentives to innovate) to the detriment of consumers.

For that reason, governments originally addressed the challenges brought by multi-sided platforms through antitrust laws, as illustrated by the series of actions that have been launched against Google by the European Commission in 2010, 2017 and 2018. Yet, for a number of reasons, the underlying economic features of data-driven business might challenge this initial approach and confuse the rationale for regulatory intervention.

First, the development of data-driven markets raises strong interplays between competition concerns, data privacy and data security. As an illustration, it is often assumed that a response to the potential competitive concerns stemming from the accumulation of data (e.g. consumer lock-in) by data-driven businesses might be to promote the development data portability and interoperability measures from one platform to another to empower consumers and, in turn, foster competition. Such measures create however a fundamental tension with data privacy and security issues which should properly considered and addressed by governments. Part of the solution to help governments balance these competing concerns certainly lies in

the cooperation and the development joined-up approaches between competition authorities, consumer protection authorities and data protection agencies, including across borders.

Second, the economic properties of data-driven markets might raise the need to rethink antitrust tools used in traditional markets to make sure that they remain effective in the context of multi-sided platform markets. As highlighted by (OECD, 2018[12]), standard market definition exercise appears for example to be a less valuable tool for multi-sided platform: "*a traditional starting point for framing an analysis of the competitive effects of a merger, an action or an agreement is to define the relevant market(s) that might be affected* […]. *For multi-product or multi-location firms, the answer is the result of the market definition exercise, which identifies the scope of the market, and hence whether those different products and locations fall within the same or different markets. In contrast, for multi-sided platforms, the product that a platform provides to one side of the market does not compete with the product it provides to another side. In the case of multi-sided markets the question of how many markets to define cannot be answered within a market definition exercise, instead it is a conceptual question that requires an answer before any exercise to define the scope of the market can be carried out*". The emergence of new forms of anticompetitive strategies also questions the analytical tools used by competition agencies. As for algorithmic collusion for example, a key question that needs to be addressed is whether antitrust agencies should revise the traditional concepts of agreement and tacit collusion for antitrust purposes and how traditional antitrust tools might be used to tackle some forms of algorithmic collusion. While a specific regulatory approach (e.g. rules on algorithmic design) could be considered to deal with this anticompetitive practice, it must be acknowledged that any regulatory initiative may pose costs (e.g. new barriers to entry and adverse effects on the incentives to invest in proprietary algorithms) that could outweigh its expected benefits.

Third, the economic properties of digital platforms raise additional concerns around the rationale for regulatory intervention. Indeed, network externalities, the capacity to scale without mass and the economies of scope characterising online platforms can give rise to natural monopoly conditions and create barriers to entry to potential competitors, with substantial risks that excessive prices and lack of innovation will follow. At the same time, digital transformation offers potential to stimulate competition: the same economic properties may eventually shift in favour of innovative entrants, which might be able to grow rapidly and gain market shares over incumbents once they bring a new product to market, often with few employees, few tangible assets and limited geographic footprint. They can even replace an incumbent in a relatively short time simply by offering a qualitatively superior good or service. Hence, becoming a dominant platform at a discrete point of time does not come with a guarantee that the leading position will be maintained permanently or that it is invulnerable to competition. In sum, the potential for increasingly concentrated market raises arguably less concerns in situations where digital markets are contestable. This raises a clear need to understand and capture the dynamics of the industry, rather than defaulting to static or short-run markets analysis. It should also be underlined that these different (and sometimes counteracting) effects may confuse the rationale for regulatory intervention as any initiative will influence the nature of competition between the incumbent and (potential) new entrants. On the one hand, regulators may be prompted to ensure a level playing field to increase the (dynamic) competitive pressure and foster the contestability of data-driven markets (through lower switching costs for example). On the other hand, undue regulatory intervention may threaten the entry of new players and curb innovation. As a consequence, there remain active debates about what regulations are necessary, particularly in the light of their potential adverse consequences, whether intended or unintended. While it is probably difficult to define one-size-fits all policy for these issues, governments will certainly need to reconsider existing regulations to provide efficient responses. OECD tools, such as the Competition Assessment Toolkit or the Product Market Regulation Indicators already provide governments with valuable analytical frameworks to review the impact of regulations on competition in data-driven markets, but it seems that more works would still have to be done to further understand competition dynamics in online markets and define appropriate policy measures.

Data privacy and security

Central to the discussions raised by data-driven markets are the concerns around data privacy and security, notably because they are fundamental drivers of trust. As underlined by (OECD, 2019[13]) "*almost 30% of Internet users do not provide personal information to social networks because of security or privacy concerns*" and results of a survey undertaken in 2015 shows that "*about 3% of individuals on average in OECD countries reported experiencing a privacy violation in the past three months*". While these policy concerns are not new in themselves, the high and increasing number of platform users, combined with the unprecedented abundance of data shared to with online platforms (both willingly and unknowingly) and the evolving uses of digital technologies is substantially changing the scale and scope of digital privacy and security challenges. These evolutions put strain on governments regulators who need to devise appropriate regulatory regimes and encourage businesses to better manage digital privacy and security risks to foster trust and improve consumer protection.

Against this backdrop, OECD has long insisted on the need for national strategies to mitigate digital privacy and security risks, using different legal instruments such as the OECD 2013 Guidelines Governing the Protection of Privacy and Transborder Data Flows (OECD, 2013[14]) or the OECD's 2015 Recommendation on Digital Security Risk Management for Economic and Social Prosperity (OECD, 2015[15]). (OECD, 2019[13]) notes that, while technological developments offers avenues to help governments address the data privacy and security challenges, there is still a need to develop "*national data strategies, supported at the highest levels of government, that incorporate a whole-of-society perspective to strike the right balance between various individual and collective interests. Such strategies would provide clear direction to reap the social and economic benefits of enhanced reuse and sharing of data while addressing individuals' and organisations' concerns about the protection of privacy and personal data, and intellectual property rights".* Digital security and privacy concerns also raise a critical need foster international regulatory co-operation given the importance of cross-border data flows for data-driven markets. Strengthening co-ordination and co-operation across borders appears critical to avoid costly inadvertent regulatory divergence that leads to the erection of non-tariff trade barriers, and can result in a reduction of regulatory protections as regard data privacy and security.

Socio-ethical challenges

While the development of artificial intelligence (AI) associated with data-driven businesses brings outstanding opportunities in different sectors such as health, business, or education, it also raises new types of policy concerns for governments in comparison to previous technologies. A well-documented risk associated with AI systems is the potential for algorithms to create biases that could lead to unfair or unlawful discrimination creating, perpetuating or exacerbating inequalities.

As reported the OECD AI Policy Observatory, an important number of strategies and initiatives have been developed at national and international level to harness all the opportunities promised by AI while mitigating its unintended effects of AI to uphold protection for citizens. The Observatory gathers over 700 AI policy initiatives from 60 countries, territories and the EU (OECD.AI, 2021[16]). Recently, OECD member countries approved the OECD Council Recommendation on Artificial Intelligence (OECD, 2019[17]), which identifies five complementary values-based principles for the responsible stewardship of trustworthy AI. In 2021, the European Commission also published a proposal for an Artificial intelligence Act (European Commission, 2021[18]), which can been seen as the first attempt to introduce a comprehensive regulatory regime to address AI-related issues. In addition, as a fruition of an idea developed within the G7, 15 countries created the Global Partnership on AI in 2020 (the partnership now counts 25 members), a state-led multi-stakeholder initiative which aims to promote responsible development of AI. Yet, as stated by (Cameron et al., 2021[19]), "*AI policy around the world seems to have reached a tipping point, with governments now seeking ways to operationalize ethical principles into concrete policy provisions or detailed guidance for AI developers and deployers; at the same time, governments are also in the process of adapting their general*

AI framework and strategies to the specificities of individual policy domains and industry sectors. This tipping point presents a unique opportunity to strengthen international cooperation in AI policy and development while governments around the world are still in the early stages of understanding the issues and developing their approaches. Moreover, we see broad recognition that AI is of such magnitude in multiple dimensions that it requires nations to work together".

Another challenge associated with the development of data driven-markets and social media platforms in particular lies in the fact that they may contribute to the spread of false, inaccurate or misleading information. This is raising strong concerns for governments as it holds the potential to decrease public trust in government, undermine the evidence-based democratic processes and decrease citizen participation. While there is a growing agreement among governments on the need to rethink existing approaches to tackle this information challenge, this is still an area of high complexity, notably because any regulatory intervention might create risks in terms of freedom of information and expression.

Regulatory challenges for governments

Data-driven markets bring new challenges for governments as they may not fit well within existing regulatory regimes and some of them may operate in regulatory grey areas. They are putting many regulatory regimes under pressure by creating goods of services where regulatory framework could be unclear, redundant or overlapping. Adapting the regulatory frameworks requires, in the first place, a precise understanding of the challenges data-driven markets pose to the rule-making activities of governments.

Pacing problem

As for other technological developments, governments face major uncertainties on the potential immediate and tertiary risks raised by data-driven markets. Both foreseen and unforeseen risks are amplified by the accelerating speed and complexity of technological development in these markets. This is not only the types of technology that challenge existing regulatory frameworks but also the sheer pace of technological change underlying the development of data-driven markets. While the pacing problem has always be a concern for governments, it has acquired a new urgency in data-driven markets due to the scope and the speed at which businesses are scaling.

Challenges to the existing regulatory frameworks.

The traditional regulatory framework, often designed on an issue-by-issue, sector-by-sector or technology-by-technology basis, may not be a good fit for the challenges brought by data driven markets. Economies of scope that characterises digital platforms are, by definition, blurring sectoral boundaries and affecting the landscape for market competition. It may challenge governments as policy implications may extend across what are in many cases separate policy domains delineated by ministries, departments or agencies. This may require co-ordination, harmonisation, or integration, often demanding a multidisciplinary perspective. As an example, the fact digital platforms are increasingly performing similar functions to media businesses challenges the traditional approaches to media regulation.

The development of data-driven markets also create the risk of new market failures (such as implicit transactions, incomplete markets, information asymmetries, hold-up and locked-in phenomena) that should be carefully addressed by governments. A way to deal with this issue would be to make the digital data transaction explicit and empower consumers to exercise their (existing) property rights and thus exerting a decentralised discipline in data-driven markets. The definition of data property rights could enable owners to explicitly exchange information in data-driven markets or exclude any other party from accessing or using them. Yet, the definition of ownership regimes as regard data raise a critical challenge: there is indeed a fundamental distinction to be made between raw data provided by consumers and data

processed by companies. If this distinction was easy to establish, it should be possible to implement a simple ownership regime: data belong to consumers (and could be transferred at the wish of people) and processed data belong to companies (and protected through intellectual property regimes for example). However, a major drawback is that the boundaries between these types of data are not always simple to establish in a number of cases, notably because the quality of the data may strongly depend on efforts made by the company. Some argue that platforms should pay for data shared by consumers but, again, this solution raises a number of difficulties:

- In a number of cases, the data take the form of public goods: information goods are not rival in consumption (data can be replicated with no loss of quality). At the same time, data generate positive externalities and, without a proper pricing regime, data may be under-exploited or under-shared;
- Replicating an information good is generally associated with zero or near zero marginal costs;
- Data can often be reused ad libitum for different objectives (sampling, repackaging, versioning, etc.);
- Some argue that platforms do pay for the data, although this payment does not take the form of a financial transfer. The platforms provide indeed a service or a commercial transaction in exchange of the data shared by consumers;
- Beyond the very low marginal costs of information goods, the value of a single data is likely to be very low. Most of the economic value of a single data may indeed result from its aggregation with other data.

Challenges to regulatory enforcement

Data-driven markets challenge regulatory enforcement in several ways. One of the issues has to do with the fact that traditional notions of liability may no longer be fit for purpose due to difficulties in apportioning and attributing responsibility for damages caused – for instance, in accidents involving AI-embedded machines or devices.

As for other innovations, technological developments in data-driven markets challenge regulatory enforcement because categories, which underpinned regulations, and specific rules, which are supposed to be verified and enforced, are often not strictly applicable to new situations, products, and services. Depending on legal frameworks and enforcement approaches, regulators can end up either cracking down indiscriminately on innovations that do not fit previously existing categories, or powerless to respond to emerging risks - or (not so rarely) both at the same time.

In data-driven markets, regulatory enforcement is also challenged by the shift in liability from digital platforms to individual market participants and, more generally, by the shift from traditional regulation (e.g. labour law) towards contractual relations and private governance arrangements. These shifts restrain the ability for government authorities to oversee, regulate and enforce obligations in this space. Data-driven business models have also given rise to a fundamentally new way of distributing content that makes intellectual property rights difficult to enforce.

Digitalisation is also offering new ways of hiding from the law. Money laundering can be facilitated by the complex flows of data worldwide and the possibility of using the Internet to conceal certain activities or transactions. In the same vein, the collection and exploitation of data, network effects and emergence of new business models such as multi-sided platforms exacerbates the challenges to existing tax rules.

Institutional and transboundary challenges

The inherently transboundary nature of a number of data-driven markets pose new types of policy challenges that put increasing strain on regulators operating within the limits of their own jurisdictions. Indeed, businesses operating digital technologies can span multiple regulatory regimes, creating the

potential for confusion and risks. Moreover, digitalisation pays no regard to national or jurisdictional boundaries and drastically increases the intensity of cross-border flows and transactions. The phenomenon of global value chains has been "turbocharged" by Internet openness. Firms from around the world are now able to participate in supply chains and open up new markets for products and services (Centre for International Governance Innovation; Chatam House, 2016[20]). Data-driven businesses gain global reach while being able to locate various stages of their production processes or service centres across different countries. This feature enables companies to "forum shop" by choosing the jurisdiction most advantageous to them and potentially avoid compliance with certain regulatory requirements, their internal tax policy, and their policy for data protection or other regulated areas. These transboundary challenges are exacerbated by the pacing problem: the fact that regulatory frameworks cannot accommodate the increasing pace of technological development expands the avenues for regulatory arbitrage.

The global reach of these markets make it hard to identify, prevent and respond fully to the myriad effects across the globe. At the same time, policy challenges that these fast evolving technologies pose are faced by most countries in parallel. And yet, these are addressed by governments following traditional institutional frameworks around line ministries and agencies and focused within the sole national legal framework, following their own legal, cultural and political frameworks. The erosion of hitherto clearly delineated sectoral boundaries as well as the blurring of the distinction between consumers and producers compounds this challenge.

In a number of cases, the traditional institutional frameworks underpinning regulations are no longer adapted to address or effectively keep up with data-driven markets. The mismatch between the transboundary nature of data-driven markets and the fragmentation of regulatory frameworks across jurisdictions may undermine the effectiveness of action and therefore people's trust in government. It may also generate barriers to the spread of beneficial innovations on those markets.

Regulatory approaches

The developments in this section presents a selection of regulatory approaches that have been implemented across countries to cope with the governance and regulatory challenges brought by data-driven markets. It is worth noting that, given the number of policy measures taken across countries, this section is certainly not meant to be exhaustive but aims merely to shed light on interesting initiatives in this area. A number of examples come from communications and media regulatory bodies. Indeed, while all sectors are impacted by the rise of digital markets, they are usually at the front line, as they traditionally regulate communications networks and very often services provided by digital platforms are substitutes of traditional communications, information and audio-visual services.

Co-regulation and self-regulation

Self-regulation and co-regulation are instruments with no or limited government involvement. Self-regulation typically involves a group of economic agents acting together to adopt among themselves (and for themselves) rules or common guidelines that regulate behaviours. In fast-moving data-driven markets, such initiatives can lead to faster regulatory responses than approaches relying solely on governments.

Striking examples of include the Global Internet Forum to Counter Terrorism (GIFCT) (Twitter, 2017[21]) created by Facebook, Microsoft, Twitter and YouTube in 2017 or the EU Code of Conduct on countering illegal hate speech online (European Commission, 2016[22]).

In a context where conventional regulation and enforcement frameworks struggle to tackle the challenges raised in data-driven markets, some argue that the self (and spontaneous) regulation by digital platforms holds the potential to create new governance schemes, which would entail important implications for the existing paradigms framing the regulatory functions of governments (Cantero Gamito, 2017[23]). These

self-regulation properties could indeed give rise to a new, decentralised form or regulation where platforms would take part in (or compete with) the rule-making activities of governments (including in its enforcement dimension, as online platforms might also be able to offer dispute resolution mechanisms). While this prospect of private legal ordering and enforcement offer interesting avenues to address some of the challenges raised by data-driven markets, recent academic research highlights that further works would need to be done to examine the strengths and weaknesses of these emerging trends *vis-à-vis* traditional regulatory approaches.

Informal co-ordination mechanisms such as reputation and trust could also exert a strong decentralised discipline in data-driven markets. Quality compliance can, to some extent at least, be fostered through user's ratings or peer-review systems. While this remains a relatively unexplored terrain, such incentives can certainly be helpful to deal with information asymmetries in data-driven markets, as a complement to traditional regulation.

Adapting the regulatory framework

Guidelines and policy recommendations developed by economic regulators

As underlined in (OECD, 2020[25]), economic regulators are at the "*forefront of interaction with consumers, business, and government"* and, as illustrated by the initiatives below, they can play an essential role in helping governments understand the regulatory challenges at stake and target the appropriate regulatory response.

In 2020, three Italian regulators (Italian Telecommunications Authority, the Competition Authority and the Data Protection Authority) jointly published a guidance to the legislator on big data regulation and platforms (AGCOM, AGCM and Garante, 2019[26]). The report aimed to exploit synergies among the three Authorities and identify the most suitable tools for future enforcement. The recommendations include the following:

- Implement an appropriate legal framework that addresses the issue of effective and transparent use of personal data in relation to both individuals and society as a whole
- Promote a single and transparent policy on the data protection;
- Strengthen international co-operation for the governance of Big Data;
- Reduce information asymmetries between digital corporations/platforms and their users (consumers and firms);
- Identify the nature and ownership of the data prior to processing;
- Promote online pluralism through new tools, transparency of content and user awareness of information provided on online platforms;
- Reform merger control regulation so as to strengthen the effectiveness of the authorities' intervention;
- Facilitate data portability and data mobility between platforms through the adoption of open and interoperable standards;
- Strengthen investigative powers of the AGCM and AGCOM and increase the maximum financial penalties for the violation of consumer protection laws.

In a same vein, the Australian Competition & Consumer Commission (ACCC) launched an inquiry on digital platforms in 2019 (Australian Competition and Consumer Commission, 2019[27]). This report looks at the impact of digital platforms on consumers, businesses using platforms to advertise to and reach customers, and news media businesses that use platforms to disseminate their content. A number of recommendations have been put forward, including:

- Changes to merger law to incorporate, in particular, the likelihood that the acquisition would result in the removal from the market of a potential competitor;

- Proactive investigation, monitoring and enforcement of issues in markets in which digital platforms operate;
- Process to implement harmonised media regulatory framework;
- Designated digital platforms to provide codes of conduct governing relationships between digital platforms and media businesses to the Australian Communications and Media Authority (ACMA);
- Digital Platforms Code to counter disinformation;
- Strengthen protections in the Privacy Act (e.g. update personal information definition, strengthen consent requirements and pro-consumers defaults, enable the erasure of personal information, higher penalties for breach of the Privacy Act);
- Broader reform of Australian privacy law.

European Commission's legislative initiatives: Digital Services Act (DSA) and Digital Markets Act (DMA)

In January 2021, the European Commission proposed two legislative initiatives to reform the rules governing digital services in the European Union: the Digital Services Act (European Commission, 2021[28]) and the Digital Markets Act (European Commission, 2021[28]).

The projects have different goals: as per the DMA's impact assessment, the Digital Markets Act (DMA) addresses risks to contestability and fairness in digital markets where "*gatekeeper platforms*" are present. The proposal builds on a an acknowledgement of sorts that pure antitrust-based approaches have reached their limits (both regulation proposals encompass *ex ante* requirements, as opposed to traditional *ex post* interventions).

The Digital Service Act (DSA), in turn, "*addresses risks derived from the fact that very large platforms have become de facto public spaces, playing a systemic role for millions of citizens and businesses, creating a need for more accountability for the content which these providers distribute on their platforms*".

Digital Services Act (DSA)

The general objective of the DSA is to ensure the proper functioning of the single market, especially the provision of cross-border online intermediary services. This translates into a set of specific objectives:

- Maintaining a safe online environment;
- Improving conditions for innovative cross-border digital services;
- Empowering user and protecting their fundamental rights online;
- Establishing an effective supervision of digital services and co-operation between authorities.

The proposal targets illegal content, services or goods, and comes as a complement to the European Democracy Action Plan which set outs measure to counter disinformation in particular. The Commission's proposal puts forward an asymmetric approach whereby very large online platforms (more than 10% of the European Union's population, or 45 million users) will be subject to more stringent requirements. Self-regulation (e.g. codes of conduct) would also be part of the policy mix. Crucially, the proposal also seeks to strengthen oversight and enforcement. It includes provision to create a board of national Digital Services Coordinators (independent regulatory authorities in each member state will need to co-ordinate amongst themselves). In addition, the Commission would have supervisory and sanctioning powers (amounting to up to 6% of annual turnover).

It also encompasses measures to increase transparency (e.g. algorithms for targeted advertising) and put more information in the hands of the public and provide researchers with access to platform data. Transparency obligations in both the DSA and DMA proposals are expected to contribute to better enforcement of obligations under the General Data Protection Regulation.

Digital Market Act (DMA)

The general objective of the DMA is to ensure a competitive Single Market for digital services. The proposed regulatory approach is expected to "*increase the contestability of digital markets*", "*help businesses overcome the barriers stemming from market failures or from gatekeepers' unfair business practices*" and "*foster the emergence of alternative platforms*" (consumer surplus has been estimated at EUR 13bn per year. In the long run, reducing fragmentation in the internal market is also expected to enhance growth potential).

Some of the key features are the following:

- The scope of application is restricted to "*major providers of the core platform services most prone to unfair practices, such as search engines, social networks or online intermediation services*" that are considered "*gatekeepers*" either on the basis of quantitative thresholds or market investigation;
- In addition to banning a series of "unfair" practices (e.g. users would no longer be prevented from un-installing pre-installed software or apps), "*gatekeepers*" would be obliged to comply with provisions that would shift market power towards from platforms to their business users. For example, business users would be entitled to getting usable, portable copies of their data on real time and access to data generated by them and their users (also inferred data);
- "*Gatekeepers*" would also need to ensure the interoperability of the software of third parties with their own services;
- Sanctions for non-compliance are foreseen and would include fines totalling up to 10% of the worldwide turnover of "*gatekeepers"* as well as potentially breaking up certain businesses in case of recurrent infringement;
- Market investigations by the EC are also foreseen with a view to ensuring that rules remain fit for purpose and "*keep up with the fast pace of digital markets*".

Merger of regulators in France

In order to deal with the cross cutting challenges raised by digitalisation in the audiovisual landscape, the French government passed a new bill on 2019 which implements a substantial regulatory reform. A key measure is the merger of HADOPI (Authority for the dissemination of works and the protection of rights on the internet) and CSA (media regulator) to form a single regulatory body in charge of audiovisual and digital communications (ARCOM). The objective is to improve the regulatory capacity to handle all communication issues raised by the rapidly changing digital environment, including copyright protection.

The role of traditional regulatory policy tools

Regulatory impact assessment

An interesting illustration of the use of *ex ante* impact assessment in digital markets comes from the European Commission, through its legislative initiatives to revise the regulatory framework for digital markets.

The impact assessment for the Digital Services Act uses the evaluation of the 2000 e-Commerce Directive as starting point. This evaluation concluded that the Directives' core principles remain valid, but "*some of its specific rules require an update in light of the specific challenges emerging around online intermediaries and online platforms in particular*". The impact assessment points out three key problems:

- Citizens' exposure are exposed to increasing risks and harms online, especially from very large online platforms;

- Online platforms' supervision is not well co-ordinated: "*the limited administrative co-operation framework set by the e-Commerce Directive for addressing cross-border issues is underspecified and inconsistently used by Member States*";
- "*Member States have started regulating digital services at national level leading to new barriers in the internal market. This leads to a competitive advantage for the established very large platforms and digital services*."

It concludes to the need for EU level regulatory action to "*reduce legal fragmentation and compliance costs, enhance legal certainty, ensure equal protection for citizens and a level playing field for businesses, strengthen the integrity of the single market, and enable effective supervision across borders*".

The impact assessment developed for the DMA considers the proposal to be "*coherent with and complementary to the proposal for the update of the e-Commerce Directive under the DSA. The DSA is, in this context, a horizontal initiative focusing on liability of online intermediaries for third party content, safety of users online, etc., with risk-proportionate obligations. The DMA, in turn, focuses on economic imbalances, unfair business practices by gatekeepers and their negative consequences, such as weakened contestability of platform markets*". The impact assessment also notes that, "*to the extent that the DSA contemplates an asymmetric approach which may impose stronger due diligence obligations on very large platforms, consistency will be ensured in defining the relevant criteria, while taking into account the different objectives of the initiatives*". The DMA also builds on the 2019 Platform to Business Regulation.

The impact assessment points out three key concerns due to the emergence of "*gatekeeper platforms*":

- Weak contestability of and competition in platform markets (entrenched dominant position of gatekeeper platforms, which control access to digital markets/ecosystems);
- Unfair business practices vis-à-vis business users;
- Fragmented regulation and oversight of market players operating in these markets (as a result of the emergence of regulatory initiatives at national level), which "puts at risk the scaling-up of start-ups and smaller businesses and their ability to compete in digital markets".

Moreover, it concludes that the market failures undermining these problems, chiefly barriers to entry and high dependence of platform business users, won't self-correct. This situation may lead to higher prices and lower quality, and risks undermining innovation.

National regulatory co-operation

Given the cross-jurisdictional nature, regulating data-driven markets calls for increased dialogue and coherence amongst government bodies to tackle fragmentation. This may require specific institutional responses such as the creation of One Stop Shops for Business in Denmark of the Center for Data Ethics and Innovation in the United Kingdom. The Centre for Data Ethics and Innovation is an independent advisory body whose mission build on the wealth of expertise and evidence across UK to analyse the risks and opportunities posed by data-driven markets and provide guidance to the government. The key objectives are the following:

- Analysing risks and opportunities and anticipating in governance and regulation that could impede the ethical and innovative deployment of data and AI;
- Agreeing and articulating best practices, codes of conduct and standards that can guide ethical and innovative uses of AI;
- Advising governments on the specific policy or regulatory actions required to address or prevent barriers to innovative and ethical uses of data.

The Center is a core component of the Digital Charter (Department for Digital, Culture, Media and Sport, 2019[29]), the rolling program of work of the government to agree norms and rules in the face of data-driven markets.

In 2019, French telecom (ARCEP) and media (CSA) regulators signed an agreement establishing a joint division between the two institutions. The aim is to leverage the two authorities' complementary expertise to sharpen their shared technical and economic analysis of digital technology markets: content distribution methods and quality, consumer habits, vertical and horizontal relationships between digital tech value chain players, including over-the-top companies and digital platforms. The joint division will also focus on a number of topics, including: supervisory methodologies, rules and benchmarks, data-driven regulation tools for digital platforms, data collection, utilisation and retrieval, and analysing platforms' algorithms. This co-operation aims to delineate new regulatory tools to deal with the challenges raised by data-driven markets.

In 2019, seven French regulatory bodies cooperated to define a common approach on data-driven regulation (Autorité de la concurrence, AMF, Arafer, Arcep, CNIL, CRE and CSA, 2019[30]). The report highlights, in particular, that data-driven regulation might be a powerful tool to reduce information asymmetries and improve transparency for consumers in data-driven markets. In practice, this would not only require to collect detailed information from regulated players, but also expanding the scope of the data collected (thanks to crowdsourcing tools for example), developing simulation-based approaches, and comparison engines. The report states that the development of data-driven regulation raises the need to increase regulatory capacities and extend their traditional regulatory tools.

Promoting good practices, sharing expertise and developing joined-up approaches through international co-operation

Data-driven markets are a key area of focus for the Agile Nations, a network created in 2020 to promote global cooperation on rulemaking in response to innovation. Co-operation activities include, in particular, sharing foresight and evidence on the opportunities and risks raised by innovation in these markets, exploring opportunities to jointly test approaches to rulemaking, supporting innovative firms to navigate participating governments' rules and co-ordinating enforcement activities as necessary to manage cross-border risks.

Beyond the Agile Nations, an interesting illustration of the opportunities provided by international co-operation to share expertise is the joint project launched by the French and the German competition authorities on the potential competitive risks associated with algorithms in data-driven markets (Autorité de la concurrence and Bundeskartellamt, 2019[31]). The report examines three practical scenarios in which algorithms may enhance collusion: explicit direct collusion, algorithm-driven collusion involving a third party and collusion induced by the parallel use of individual algorithms. The report concludes that both authorities should continue to share their expertise on the topic and to engage more broadly with businesses, academics and other regulatory bodies.

Conclusion

The rapid development of data-driven markets has far-reaching socioeconomic impacts, notably on market structures and firms' strategies. In addition, it entails a number of regulatory challenges that call for governments and regulators to ratchet up efforts to ensure the quality of their rule-making activities. There is a clear need to rethink traditional antitrust tools with a view to addressing risks of algorithmic collusion as well as the anticompetitive use of data by dominant platforms. In addition, the rationale for regulatory intervention will in many cases have to be revisited in view of the economic properties of digital platforms,

such as their capacity to scale without mass and the presence of network externalities as well as economies of scope.

Regulatory action will need to rely on a thorough understanding of market dynamics (as opposed to defaulting to static or short-run markets analysis) and make use of the full range of regulatory tools at governments' disposal, including experimental approaches, self-regulation and co-regulation. In the same vein, regulating digital platforms will require new institutional solutions to strengthen co-operation across government agencies, including across borders, in order to tackle the transversal challenges of data-driven markets. While issues pertaining to data privacy and security are not new, associated regulatory challenges have acquired a completely new dimension due to the high number of platform users and the unprecedented amount of data collected by online platforms. These challenges, together with growing concern about the ethical and social issues brought by data-driven markets (e.g. regarding transparency and equity) warrant adapting regulatory frameworks and enforcement approaches accordingly.

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3 Case 2. Digitalisation in finance: regulatory challenges and regulatory approaches

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Digital innovations in the financial sector, which are usually brought together under the umbrella term “Fintech”, are creating significant governance and regulatory challenges for governments. In the face of these challenges, regulatory action needs to strike a balance between mitigating potential risks and enabling the development of innovations that can be beneficial for the economy and society as a whole. This case study documents the different regulatory challenges raised by Fintech developments as well as some of the regulatory responses that have been implemented by governments. It shows, in particular, that innovative regulatory approaches (e.g. regulatory sandboxes) to support testing and trialling new technologies are an essential part of governments’ responses. The case study also highlights that the fast-paced, cross-border implications of Fintech innovations warrant strengthening international regulatory co-operation and further developing anticipatory approaches to regulation.

Context

Technology-driven innovations in the financial sector, which are usually brought together under the label "Fintech", are rapidly transforming the way financial markets are operating. This global phenomenon is disrupting various aspects of the financial landscape and challenging the way governments regulate.

It must be noted at the outset that, although Fintech developments raise numerous concerns that need to be addressed, many of them are not fundamentally new in themselves. Digital innovation in the financial sector dates indeed back from the 1960s with the development of credit cards and cash dispensing machines (followed by the introduction of telephone banking in the 1980s). A fundamental differentiating factor lies however in the sheer pace and the scope of financial markets innovations, which bring radical changes in traditional markets and, in turn, creates disruption in the way governments traditionally regulate these activities. Comprehending the changes underway is critical to better align policies with the many opportunities and challenges brought by innovations in this sector.

To set the scene, the following developments provide some insights on what Fintech is about, the most notable digital technologies used, and the main applications of digital technologies in financial markets.

As highlighted by (OECD, 2018[1]), several definitions of the term "Fintech" can be found in the literature on the topic, including:

- "*New entrants that promised to rapidly reshape how financial products were structured, provisioned and consumed*" (World Economic Forum, 2017[2]);
- "*Variety of innovative business models and emerging technologies that have the potential to transform the financial services industry*" (International Organisation of Securities Commission, 2017[3]);
- "*Technologically enabled financial innovation. It is giving rise to new business models, applications, processes and products. These could have a material effect on financial markets and institutions and the provision of financial services*" (International Association of Insurance Supervisors, 2016[4]).

Nonetheless, none of these definitions fully captures the diversity of financial innovations enabled by digital technologies for two main reasons:

- Technology-driven innovations in financial markets cannot be restricted to start-ups that develop new financial services, as it is often the case. Such approaches would indeed exclude major market players in the sector that also rely on technological advances to offer new or differentiated products or services;
- A clear distinction needs to be made between the underlying technology and its (innovative) application. Focusing of the technology alone leaves aside the development of new business models relying on standard technologies (e.g. peer-to-peer lending, digital payments, e-trading). Likewise, Fintech should not be reduced to innovation in financial services. Such approach would not recognise key technological innovations for standard services such as the use of biometric technologies to improve transactions' security.

This definition challenge raises might raise different concerns, including:

- The fact that government agencies may face an overlapping (hence confusing) range of concepts, affecting potentially the quality of their rule-making activities;
- The difficulty to find relevant metrics to capture the pace and extent of the digital transformation in the sector;
- The fact that jurisdictions might come forward with different legal definitions, affecting the quality of regulatory co-operation.

A way to deal with this drawback is to make a distinction between the technology and its (innovative) application. While potential applications of digital technologies in the financial sector are numerous and span across various areas such as insurance, lending, payments, financial advices and investments (OECD, 2018[1]), the main technologies used in financial services can be gathered in four broad categories:

- **Distributed Ledger Technologies** (DLTs): DLTs have first emerged as the technology behind crypto-currencies but they now have wider applications such as smart contracts. These new technologies offer multiple original ways to develop financial transactions, including trading or insurance payouts;
- **Big Data and AI**: the breath-taking surge in the volume and variety of data offer a number of opportunities to improve the efficiency of financial markets. Big data-driven analysis has for example been used to develop personalised and innovative services to customers. It offers indeed avenues to get more accurate information on customers' risk profiles or willingness to pay. This relies on existing and new data governance and sharing frameworks that enable exchange of data between public and private sectors; or between private entities at national and/or international levels. Companies may also harness big data to develop better trading activities and improve the detection of illicit activities;
- **Digital Identity and biometric technologies**: the integration of digital identity solutions (public and private) and biometric technologies (e.g. facial recognition) in the financial sector is quite often used to enhance the security of transactions;
- **Internet of Things**: connected devices are proliferating and the amount of data on consumers' behaviors is increasing sharply as a result. This information can for example be used by insurers to better target consumer profiles.

Key transformative impacts

The development of digital technologies in the financial sector brings a number of structural changes on both the production processes and the consumption systems. These transformative changes should be properly understood to help governments navigate the regulatory challenges and target the appropriate regulatory response. The developments below offer a short description of some of the key impacts (for a more detailed and comprehensive presentation of the implications of Fintech developments, see (OECD, 2018[1])).

New business models

The technological innovation in financial markets is affecting many aspects of the standard intermediation processes, leading to the emergence of new business models. A canonical example where digitalisation brings disruptive changes to intermediation relates to lending services. Technological advances have indeed enabled the recent development of new forms or financial intermediation connecting directly lenders (individuals, businesses or institutions) and borrowers (either individuals or businesses) via lending-based crowdfunding platforms (OECD, 2018[5]). Peer-to-peer lending has grown at an extraordinary rate in recent years, notably in the United Kingdom and the United States. Some argue that it offers great opportunities to make financial intermediation more transparent, stable and efficient, even holding the potential to bring an alternative to the traditional banking model.

The development of blockchain in finance also challenges all existing intermediaries, potentially proposing a completely alternative way of organising and enforcing transactions in financial markets. In the case of virtual currencies, the anonymous, decentralised nature of transactions presents a particularly difficult challenge for regulators, as regard enforcement in particular.

Robo-advisers provide new forms of intermediation as well. It can make financial planning accessible without the need to rely on a financial advisor and as such, this technological application removes a level of intermediation.

Competition

The development of Fintech bears important consequences in terms of competition dynamics. While, for different reasons (e.g. stronger reputation, better brand recognition, easier access to capital markets), traditional markets players such as banks hold considerable competitive advantage, they also face an increasing competitive pressure from new intermediaries (OECD, 2020[6]). Digital technologies may indeed help to lower the barriers to entry and allow new entrants gain markets shares. It offers avenues to decrease infrastructure costs, which help new entrants to quickly reach out the efficient scale to develop new product or services. In addition, new entrants may harness the opportunities offered by new technologies to offer less expensive, more agile, more market responsive and more tailored services to consumers. Firms such as Monzo, Wise, Stripe or HiFX have for example quickly take market shares away from traditional financial institutions by offering low or no transaction charges for local and international payments. It is worth noting that, beyond the fact that digitalisation in finance increase the contestability in existing markets, it also creates avenues for market extension. It may for example ease the access to financial services (e.g. credit, investment) for underserved citizens or businesses.

These evolutions raise a need to examine which regulations are necessary, particularly in light of their impacts on competition, whether intended or unintended. It must be underlined that, over the past few years, traditional financial institutions have been faced with increasing regulatory scrutiny, which may have undermined innovation. The disruption brought by Fintech firms raises a critical need to review these regulations with the view of assessing whether the regulatory landscape remains fit-for-purpose. A noted by (OECD, 2020[6]),"*it is clear that regulation will influence the type of competition between incumbents and entrants. A main issue is whether regulation should aim at a level playing field or whether it should favour entrants in order to promote competition*".

Markets efficiencies

Digitalisation in finance holds the potential to increase markets efficiencies along different avenues:

- Digitalisation can make financial markets work more efficiently by reducing transaction costs and information asymmetries. A number of markets imperfections lies indeed in information incompleteness on the quality of the financial product or services. The use of digital technologies in the financial sector might help improve transparency and allow economic agents to manage their personal data more efficiently, ultimately strengthening their bargaining power;
- It may foster the access to financial services for small and medium-sized enterprises (SMEs);
- It may offer more convenient, faster, secure and cheaper transactions;
- Through the use of big data, digitalisation may support the development of more tailored product or services and support fraud detection;
- It may help manage uncertainties in financial markets by promoting the diversification of portfolios.

Data security and privacy

Digital technologies have greatly increased the levels in the generation, collection, storage, sharing and use of personal data, including data collected through mobile devices.

Although the development of big data and the associated development of AI-embedded products or services can lead to positive outcomes in the financial sector, it also raises a number of data privacy and security issues. These concerns are not fundamentally new but the unprecedented amount of data made

available by digital technologies and the evolving uses of technologies in the financial sector is substantially changing the scale and scope of data privacy challenges but (OECD, 2019[7]). As noted by (OECD, 2018[1]), "*this may be particularly relevant for client-facing applications using customer data, and new devices, including those connected to the "Internet of Things." Indeed, a number of recent incidents have involved fraud and theft through mobile banking apps, and there have been breaches of personally identifiable information, particularly as a large number of mobile devices lack anti-virus software*". Beyond the sensitive personal and financial information collected by Fintech firms, some businesses are starting to harness alternative information such as social media patterns and online spending behaviours. These practices might entail new risks for financial consumers, such as the excessive use of digital profiling to unduly exclude some consumers.

Regulatory challenges for governments

If poorly designed, regulation can be a significant barrier to entry for new services in financial markets. At the same time, governments need to limit any potential unintended negative consequences of these innovations. The risks raised by technology-driven innovations in financial services include for example:

- Misuse of data;
- Inadequate disclosure and redress mechanisms;
- Lack of security;
- Misuse of new services by uninformed consumers;
- Increased risk-taking by investors (an interesting analysis on the topic is provided by (Kalda et al., 2021[8]) who find, in particular, that "*that smartphones increase purchasing of riskier and lottery-type assets and chasing past returns. After the adoption of smartphones, investors do not substitute trades across platforms and buy also riskier, lottery-type, and hot investments on other platforms*").

Governments are therefore confronted with a fundamental dilemma: how to maintain a balance between fostering innovation and protecting consumers against the potential unintended consequences of disruption brought by Fintech innovations? An essential step to overcome this issue is to identify the nature of the governance and regulatory policy challenges for governments. Given the wide range of applications of digital technologies in financial services, a comprehensive analysis of the regulatory challenges brought by Fintech goes beyond the scope of this paper. The following developments aim merely to illustrate the nature of these questions, focusing on specific applications such as robo-advisors or crowdfunding platforms.

Pacing problem

As for other sectors, the Fintech developments might create a pacing problem (Marchant, 2011[9]) due to the fact that regulatory frameworks might lack the agility to accommodate the resulting changes in due course. While this disconnect between the pace of technology and the pace of regulation has always been a concern, there is a growing consensus that the sheer pace of recent product and market innovations in the financial sector is particularly challenging.

Two interrelated reasons might explain why governments struggle to keep pace with changes arising from these innovations.

- The degree of technical complexity associated with a number of innovations in the sector;
- The astonishing pace at which FinTech can grow.

Challenges to the traditional organisation of regulation

As illustrated by online payments, which encompass a range of sectors from online banking, electronic commerce (e.g. Amazon) to payment services (e.g. PayPal), the rise of digital-driven innovation in the financial sector is blurring the boundaries across sectors and layers of the traditional value chain. It raises strong challenges for the existing regulatory frameworks as the traditional regulations are often designed on an issue-by-issue, sector-by-sector, technology-by-technology basis and, as such, they may not fit well with Fintech. The inadequacy of regulatory frameworks bears a number of negative consequences, including:

- Legal uncertainties and added compliance costs that may curb innovation and lower incentives to enter new markets, particularly for small businesses that do not have sufficient resources to offset the higher costs;
- Risk management failures (see above).

The development of technology-based financial advices (also known as 'robo-advices' or 'automated advices'), which are rapidly emerging across countries as an alternative to traditional advice paradigms in financial markets, offers an illustration to these concerns. The main objective of this application is to offer lower-cost investments recommendations, relying heavily on automation and artificial intelligence (AI). The expected benefits are twofold:

- Reducing information costs and the time consuming activities developed by standard financial advisors;
- Harnessing AI and automation to increase objectivity, consistency and transparency to overcome potential behavioural bias in the recommended investment.

One of the reason why robo-advisors challenge existing regulatory frameworks lies in the fact that they are not sector specific. This innovation span indeed different areas, from the banking sector, the insurance sector to the securities sector. This creates situations where the regulatory frameworks might be unclear, overlapping or inconsistent across sectors. In 2015, the three European Supervisory Authorities have issued a joint discussion paper to assess the potential benefits and risks of technology-based financial advices, with a view to determine if any regulatory action is needed to mitigate the potential risks (e.g. possibility that consumers could misunderstand financial advices provided) while harnessing the potential benefits (European Banking Authority, European Securities and Markets Authority and European Insurance and Occupational Pensions Authority, 2015[10]). The joint Committee notes, in particular, that "*as is often the case with financial innovation topics, the phenomenon of automation in financial advice has emerged against a background of a lack of clarity in the existing legislative framework and inconsistent regulatory treatment across the three sectors*".[1]

An associated challenge for policy makers is to determine to what extent robo-advisors actually provide financial advices and how the existing regulation of financial advices applies. As highlighted by (OECD, 2016[11]), regulatory frameworks usually state that financial advices have to be tailored to individual specific characteristics (i.e. not providing a general recommendation only). In response, claims have been made that the financial advices provided via robo-advisors should be understood as a general recommendation and not a personalised one. This discrepancy illustrates the need for a careful review of existing regulations as well as a definition of the personal details that should be taken into account to provide the financial advice (OECD, 2018[1]).

The development of crowdfunding platforms also challenges the existing regulatory frameworks and brings new questions for governments. Among others, a key issue to be considered is whether crowdfunding platforms should be allowed to perform the same functions as banks and how regulation could influence this scenario. This question confronts governments with a dilemma: as noted by (OECD, 2018[1]), "*restricting crowdfunding platforms to simple credit intermediaries limits their risks, but it also prevents*

them from experimenting with different business models that could allow them to perform the same functions as banks but with a less fragile business model".

Challenges to regulatory enforcement

An important trend that bears important consequences in financial markets is the development of AI-embedded products or services. Combination of big data and AI techniques is for example routinely used to make financial decisions, through technologically-based financial advices for example.

The development of AI in financial services is not immune to the general challenges brought by the use of algorithms in terms of consumer protection. There is indeed chances that the underlying algorithms fail to perform, either due to biases (intentional or unintentional) or to coding errors. Against this background, a key challenge faced by governments lies in the difficulty to assign liability: who should be liable for the damages caused by AI such as a bad investment choice resulting from AI-based automated decision-making processes? Who shall compensate for the economic losses incurred by Fintech customers in case of damage? It is worth underlining that issues around the identification of liability and the prevention of risks when a third party component is involved components are not fundamentally new. However, the fact that AI-embedded services become increasingly autonomous and self-learning poses new governance and regulatory challenges to define appropriate protection and ensure legal certainty, both for Fintech firms and their consumers.

In the case of robo-advisors in particular, a careful review of existing regulatory frameworks might also be needed as, in most cases, existing regulatory frameworks for financial advices do not address the need for auditing and stress testing of the advice provided. The liability issues are also particularly strong with the use of Distributed Ledger Technologies in finance. This technology departs indeed from standard liability regimes, making it difficult for policymakers to enforce existing legal frameworks.

Digitalisation in finance may also facilitate the development of outright fraudulent activities and law avoidance, leaving potentially governments with a regulatory vacuum. Money laundering is one example that can be facilitated by the complex flows of data and the possibility to use technological developments such as the Distributed Ledger Technology to hide certain transactions.

Transboundary challenges

In most cases, digital innovation in financial services pays no regard to national or jurisdictional boundaries. This may allow innovative firms to "forum shop" when it comes to their physical presence, their internal tax policy, and their policy for data protection or other regulated areas. Beyond this potential for regulatory arbitrage, the mismatch between the transboundary nature of digital innovation and the fragmentation of regulatory frameworks across jurisdictions may undermine the spread of beneficial Fintech developments and generate failures in risk management. The regulation of crowdfunding platforms provides an illustration of the differences in approaches across countries. As noted by (European Commission, 2017[12]) in particular, "*European crowdfunding sector is characterised by its highly heterogeneous nature, shaped by the different starting points of nascent national crowdfunding sectors across the EU, and largely determined by the incumbent regulatory frameworks as they pertain to crowdfunding as a novel form of technologically mediated market exchange*".

Regulatory approaches

Without any claim to be exhaustive, the developments in this section shed light on some interesting initiatives that have been implemented across countries to deal with these regulatory challenges, focusing on specific applications such as robo-advisors or crowdfunding platforms (for a thorough analysis of the regulatory approaches to the tokenisation of assets, see (OECD, 2020[13])).

Issuing guidance

Several governments have developed guidance to help reduce uncertainty about the regulatory implications Fintech developments. Examples include the regulatory guide published by the Australian Securities & Investment Commission (ASIC) in 2016 on the use of technology-based advice (Australian Securities & Investment Commission, 2016[14]), stating in particular that the regulatory requirements for technology-based advisors are the same as those for traditional models. It provides additional guidance on the obligation to:

- Establish and maintain adequate risk management systems;
- Have adequate financial, technological and human resources to provide the financial services;
- Regularly monitor and test the algorithms that underpin the advice.

Adapting regulatory frameworks

As regard technology-based financial advices, the New Zealand Ministry of Business, Innovation and Employment took actions in 2016 to broaden the definition of advice in order to accommodate automated advisors (New Zealand Ministry of Business, Innovation and Employment, 2016[15]). In 2016, the US Securities Exchange Commission (SEC) approved a rule change suggested by the Financial Industry Regulatory Authority (FINRA) to require registration as securities traders of algorithmic trading developers (Securities and Exchange Commission, 2016[16]).

As for crowdfunding platforms, (OECD, 2018[5]) conducted a review on regulatory practices in 17 OECD countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Mexico, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Sweden and the UK). The report highlights, in particular, that:

- A number of countries have adopted ad hoc regulatory approaches to deal with this new mode of financial intermediation (e.g. France, the UK and Israel);
- Other countries have introduced regulation that either applies to both lending-based and investment-based crowdfunding or appears to not make a difference between the two models (e.g. Austria, Belgium, Finland, Mexico, Portugal);
- In countries that do not have a specific regulation, crowdfunding platforms need to adapt to existing regulations on securities trading, banking or payment institutions.

Innovative governance and regulatory approaches

Some jurisdictions are experimenting innovative regulatory approaches to support testing and trialling new technologies in the financial sector. Approaches that have recently drawn the attention of governments include innovation offices or regulatory sandboxes (see Box 3.1).

Box 3.1. What is a regulatory sandbox?

As noted by (Attrey, Lesher and Lomax, 2020[17]), a regulatory sandbox generally refers to "*a limited form of regulatory waiver or flexibility for firms, enabling them to test new business models with reduced regulatory requirements. Sandboxes often include mechanisms intended to ensure overarching regulatory objectives, including consumer protection. Regulatory sandboxes are typically organised and administered on a case-by-case basis by the relevant regulatory authorities*".

Innovation offices

Several jurisdictions have implemented innovation offices to promote the development of innovation in financial services. An example is the Estonian Financial Supervision Authority (EFSA), which offers interpretations on relevant regulations applying to a proposed innovation and provides licensing guidance (Estonian Financial Services Authority, 2018[18]).

While, in practice, innovation offices might come in many different forms, a common objective is to strengthen the engagement with innovators and foster policy learning. It offers avenues to anticipate concerns early on and address them through collaborative processes with businesses. The key potential benefits are the following:

- As illustrated by recent initiatives from the Netherlands Authority for the Financial Markets (AFM) or the UK Financial Conduct Authority's (FCA) Innovation Hub, governments may rely on the information gathered trough the information offices to flesh out the evidence base for regulatory reform. They may help governments identify where the regulatory landscape is unclear, incomplete, overlapping or redundant and, as such, contribute to improve policy making;
- Innovation offices may reduce regulatory uncertainty for innovators and, in turn, lower compliance costs. As noted by the U.S. Government Accountability Office (Government Accountability Office, 2018[19]), "*the cost of researching applicable laws and regulations can be particularly significant for FinTech firms that begin as technology start-ups with small staffs and limited venture capital funding. FinTech start-up businesses told us that navigating this regulatory complexity can result in some firms delaying the launch of innovative products and services – or not launching them in the United States – because the FinTech firms are worried about regulatory interpretation";*
- Innovation offices may also help improve consumer protection, by ensuring an early identification of the potential risks raised by Fintech developments;
- They also bring the potential to stimulate competition in financial markets by decreasing regulatory barriers to entry and the regulatory uncertainty for innovators. This, in turn, can result in lower prices for consumers. The large number of firms engaging with governments through innovation offices across the world gives an indication that it may indeed favour market entry. As indicated by (UNSGSA and CCAF, 2019[20]), "*the joint AFM/DNB Innovation Hub in the Netherlands has provided regulatory clarification to around 600 firms* (De Nederlandsche Bank, 2016[21]) *while the MAS Financial Technology and Innovation Group (FTIG) has engaged with more than 500 companies from Singapore and overseas. In the U.S., the Bureau of Consumer Financial Protection (BCFP) estimates that it engages with over 100 innovative firms per month through a combination of office hours and other engagements. Another regulator, the Commodity Futures Trading Commission, met with more than 200 innovative firms during the first year its innovation office was in existence* (Forbes, 2018[22])".

Regulatory sandboxes

Regulatory sandboxes were pioneered by the UK's Financial Conduct Authority (FCA) and, since then, numerous initiatives have emerged in the financial sector, across OECD countries and beyond (Attrey, Lesher and Lomax, 2020[17]). (UNSGSA and CCAF, 2019[20]) reports that regulatory sandboxes for financial services are now planned or live in over 50 jurisdictions.

The following developments offer details on some regulatory sandboxes implemented across jurisdictions:

- **United Kingdom's Financial Conduct Authority (FCA)**: in 2015, the Financial Conduct Authority launched a new program on regulatory sandboxes to allow businesses, small or large, to test new ideas in the market with real consumers (Financial Conduct Authority, 2015[23]). The objectives of the sandbox are to provide firms with:

- The ability to test products and services in a controlled environment;
- Reduced time-to-market at potentially lower cost;
- Support in identifying appropriate consumer protection safeguards to build into new products and services;
- Better access to finance.

Since its launch, 118 firms have been accepted to test innovative products, services, business models and delivery mechanisms. In its 2017 report (Financial Conduct Authority, 2017[24]) on how on the initiative met its objectives over the first year, the FCA states the following:

- "*Access to the regulatory expertise the sandbox offers has reduced the time and cost of getting innovative ideas to market*";
- "*Testing in the sandbox has helped facilitate access to finance for innovators*"
- "*The sandbox has allowed* [the FCA] *to work with innovators to build appropriate consumer protection safeguards into new products and services*"

- **Monetary Authority of Singapore**: in 2016, the Monetary Authority of Singapore (MAS) launched the "FinTech Regulatory Sandbox" to encourage more experimentation in financial services. Any interested business can apply to experiment new ideas through the sandbox. Depending on the nature of the innovation, the MAS may relax specific regulatory requirements for the duration of the sandbox (Monetary Authority of Singapore, 2016[25]). The sandbox may not be available in two specific circumstances (Monetary Authority of Singapore, 2016[25]):
  - "*The proposed financial service is similar to those that are already being offered in Singapore, unless the applicant can show that either a different technology is being applied or the same technology is being applied differently*";
  - "*The applicant has not demonstrated that it has done its due diligence, including testing the proposed financial service in a laboratory environment and knowing the legal and regulatory requirements for deploying the proposed financial service*".
- **Abu Dhabi Global Market (ADGM)**: the ADGM is hosting a FinTech Digital Lab's to allow financial institutions and FinTech firms to collaborate, experiment and develop innovative services, with a participation from ADGM's Financial Services Regulatory Authority (FSRA).
- **Financial Superintendence of Colombia (*Superfinanciera*), Ministry of Finance and Public Credit**: in 2018 Colombia's *Superfinanciera* launched a regulatory sandbox ("*La Arenera*") to facilitate innovation in the financial sector. As noted by (Attrey, Lesher and Lomax, 2020[17]), one of the objectives is also to "*contribute to financial inclusion mechanisms by promoting business models for payment and remittance services as well as finance management services for individuals and small and medium enterprises*".
- **Hong Kong Monetary Authority (HKMA)**: in 2016 the HKMA launched its "Fintech Supervisor Sandbox" (FSS) to allow allows banks and their partnering technology firms to test innovative products without the need to achieve full compliance with the HKMA's requirements. (Hong Kong Monetary Authority, 2020[26]) reports that "*as of end-2020, a total of 193 pilot trials of fintech initiatives had been allowed in the FSS since its launch in 2016, compared with 103 as of end-2019. As of end-2020, the HKMA had also received in total 533 requests to access the FSS Chatroom for supervisory feedback at the early stage of fintech projects since the introduction of Chatroom in 2017. Around 70% of the requests were made by technology firms*".
- **Reserve Bank of India (RBI)**: with the view of developing financial services in India, the RBI launched an inter-regulatory working group in 2016 to review the existing regulatory framework. The group released a report on 2018 for public consultation, which advocates the introduction of a regulatory sandbox to promote the testing and trialling of new financial product or services. The RBI states that the regulatory sandbox allows market players (including the financial regulator, the

innovators and the final users) to "*collect evidence on the benefits and risks of new financial innovations, while carefully monitoring and containing their risks*". This regulatory approach is seen as "*an important tool which enables more dynamic, evidence-based regulatory environments which learn from, and evolve with, emerging technologies*" (Reserve Banck of India, 2019[27]).

- **Canadian Securities Administrators (CSA)**: in order to support Fintech firms seeking to test new ideas, products, and business models in Canada, the CSA launched a regulatory sandbox that provides fixed-term regulatory relief for start-ups as well as well-established businesses. This initiative is part the CSA's 2016-2019 Business Plan to better identify and understand the regulatory implications of innovations in the financial sector. As part of this initiative, Impak Finance has for example been allowed to raise CAD 1 million via a cryptocurrency crowdsale.

It is worth noting that the flexibility brought regulatory sandboxes may favour the entrance of new markets players and, therefore, stimulate competition in financial markets. It may also influence the nature of the relationship between regulators and financial industry towards a more open and active dialogue. In addition, this regulatory approach is being actively explored to promote regulatory harmonisation and foster the development of innovations in different markets and jurisdictions. It could indeed facilitate cross border extension (thus allowing business to reach an efficient level of production) and help reduce the potential for regulatory arbitrage. Examples include the Global Financial Innovation Network or the API Exchange (APIX) launched by the ASEAN Financial Innovation Network (AFIN).

The role of traditional regulatory policy tools

The traditional regulatory policy tools provide important opportunities to pause, consult, question and test the approaches that may help tackle the regulatory challenges raised by the development of Fintech. The following sections provide some insights on the range of initiatives launched by governments in this area.

Stakeholder engagement

A number of jurisdictions have started putting a strong emphasis on stakeholder engagement to respond to the opportunities and challenges arising from Fintech developments.

- In 2016, the Monetary Authority of Singapore carried out broad consultations on the regulatory sandbox approach and the creation of the Global Financial Innovation Network;
- In 2019, the Danish Financial Supervisory Authority created the Fintech Forum. The objective is to "*establish an informal forum, where the Danish FSA and the sector can discuss developments in the area of fintech. This may include discussions on how the Danish FSA can support the fintech environment within the scope of the financial regulation. The Fintech Forum can also identify unintended consequences of regulation that prevent or complicate the use of new technologies in the financial sector. Also, the Danish FSA will use the forum to gather knowledge and experience from the sector on fintech issues*" (Financial Supervisory Authority, 2019[28]);
- In 2014, UK Financial Conduct Authority (FCA) launched a call for input to understand better the needs of innovators in the financial sector to help maintain the regulatory framework fit for purpose. The results highlights that most stakeholders struggled to understand the regulatory landscape. A number of difficulties have been raised, including:
  - The complexity of existing regulations and guidance (including the FCA handbook and guidance);
  - The difficulties in identifying and interpreting applicable rules, in particular when innovation is straddling or blurring the boundaries of traditional categories and definitions ;
  - The belief that governments or regulators may change the interpretation of the applicable rules as the innovation scales up.

- Another interesting initiative has also recently been launched by the UK Financial Conduct Authority in 2019 (Financial Conduct Authority, 2019[29]). The FCA released a call for input to better understand the scale of interest and the potential of cross sector regulatory sandboxes. The objective would be to allow business to test new products, services or ideas in a controlled environment with simultaneous oversight from multiple regulators working together. The motivations underlying this initiative are twofold:
  - The fact that the transformative changes associated with technological innovations are not unique to financial services ;
  - The recognition that the cross-cutting nature of some new business models brings challenges to the traditional organisation of regulation. As underlined by (Financial Conduct Authority, 2019[29]), "*regulators have different specific remits and tools available to them, and approach innovation in different ways*" and there is "*no practical mechanism in the UK for multiple regulators to collaborate to actively explore these challenges in conjunction with industry*";

International regulatory co-operation

While challenging, international co-operation appears critical to ensure the effectiveness of regulatory action and reduce the regulatory burden that multiple regulatory regimes may impose on businesses and citizens. Initiatives to deal with the transboundary challenges raised by technology-led innovations in the financial sector are also emerging across countries:

- As reported by (Deloitte, 2018[30]), Singapore has signed 16 agreements with entities in 15 different countries to co-operate in the Fintech area. These agreements include information sharing as well as regulatory guidance to businesses. These initiatives could contribute to the definition of common standards and guidelines to help address the cross-border challenges brought by innovation in financial markets;
- In 2017, the French *Autorité des Marchés Financiers* (AMF) and the Financial Services Regulatory Authority (FSRA) of Abu Dhabi Global Market (ADGM), have signed a co-operation agreement to promote innovation in financial services in France and the United Arab Emirates. The objective of this co-operation is to enable the AMF and the FSRA to support innovative projects, share relevant information on innovation, and provide support in the context of authorisation processes where appropriate. Both authorities will also consider cross-border activities that can benefit to the growth of the financial industry in both jurisdictions;
- To strengthen the collaboration between the MENA and Asia-Pacific region, the Abu Dhabi Global Market (ADGM), is co-operating with the ASEAN Financial Innovation Network on his regulatory sandbox initiative. The objective is to enable participants to the sandbox to tap into international markets to further develop their financial products or services;
- To build on the FCA's early 2018 proposal to create a global sandbox, eleven financial regulators and a World Bank Consultative Group proposed the creation of the Global Financial Innovation Network (GFIN). The GFIN, which gathers 50 organisations, was created in 2019 to serve three main objectives (Global Financial Innovation Network, 2019[31]):
  - "*To act as a collaborative group of regulators to cooperate and share experience of innovation in respective markets, including emerging technologies and business models, and to provide accessible regulatory contact information for firms;*
  - *To provide a forum for joint RegTech work and collaborative knowledge sharing/lessons learned; and*
  - *To provide firms with an environment in which to trial cross-border solutions*".

In 2019, the GFIN announced its intention to take this initiative forward and develop cross-border testing pilots. Eight applications (out of 44 submitted across 17 regulators) have been granted the right to work with regulators on cross-border trials.

- A number of "Fintech bridges" have also been implemented across the world. As stated by (Fekete, 2018[32]), these bridges "*enable regulators to efficiently share information about financial services innovation in their respective markets, including about emerging trends and regulatory issues, aiming to foster innovation in the area of FinTech*". They offer opportunities for business scale across borders and may contribute to reduce regulatory divergence across jurisdictions. The first Fintech bridge was established in 2016 between the UK and Singapore (Fekete, 2018[32]). Another example is the UK-Australia FinTech Bridge created in 2018 2018 (Treasury of the Government of Australia, 2018[33]). Building on the existing Co-operation Agreement between the Financial Conduct Authority and Australian Securities and Investments Commission signed on 23 March 2016, the UK and Australia signed a co-operation agreement to foster co-operation between governments, financial regulators and businesses and "*encourage FinTech firms to use the facilities and assistance available in the other jurisdiction to explore new business opportunities and reduce barriers to entry*" (Treasury of the Government of Australia, 2018[33]). The agreement covers four interrelated pillars: government-to-government, regulator-to-regulator trade and investment and business-to-business. Under the regulator-to-regulator pillar, the agreement specifically mention that implementing authorities will explore the opportunities to develop faster authorisation/licensing processes (in particular for businesses already authorised in the other jurisdictions). The regulator-to-regulator authorities will also facilitate the entry of businesses in their respective regulatory sandboxes to facilitate the testing of new products and services in different jurisdictions and markets. According to (KAE, 2019[34]), there are currently 63 Fintech bridges implemented across the world between multiple jurisdictions. A first global study on 46 Fintech bridges was launched in 2018 (Irish Tech News, 2018[35]). It identifies three common characteristics across the different initiatives:
  - Bilateral mechanism for businesses seeking to access other's markets;
  - Support provided by regulators to reduce regulatory uncertainty and reduce time to market;
  - Information sharing mechanisms on emerging trends and regulatory issues.

Horizon scanning

Some governments have invested in horizon scanning activities to better anticipate the risks and opportunities brought by digitalisation in finance. As an example, the FCA's Future Horizons held a series of discussions with leading experts in financial services to look at the potential developments over the next 15 years. The work used 'stories' to create imaginary scenarios on how the future could look like. Building on this work, FCA published a report featuring a selection of these stories, underlying the main drivers of change and the challenges they could generate for policy makers. Four main themes have been considered: the role of data, platforms, innovation and uncertainty (Financial Conduct Authority, 2017[36]).

Conclusion

Technology-driven innovation has been a constant feature of the financial sector for decades. At present, their pace and scope (potential applications of digital technologies spanning across areas such as insurance, lending, payments and investment) is however leading to radical and far-reaching changes in traditional markets and thus a number of regulatory challenges. These challenges owe, among other phenomena, to the emergence of new business models, major impacts on competition and market efficiencies, and implications for data security and privacy. Another key challenge faced by governments in this context lies with difficulties in assigning and apportioning liability and the need to prevent the proliferation of outright fraudulent activities. More generally, regulatory action needs to strike a balance between mitigating potential risks and enabling the development of innovations that can be beneficial for the economy and society as a whole.

Innovative regulatory approaches to support testing and trialling new technologies are essential to that end. Regulatory sandboxes, for example, offer opportunities to roll out and test disruptive technologies in a controlled regulatory environment while helping policy makers gain valuable insights in order to identify the right regulatory (or non-regulatory) approach. Additional options worth exploring include the development of outcome-focused regulations, the creation of innovation offices and other related support mechanisms, and issuance of targeted guidance. Moreover, the fast-paced, cross-border implications of Fintech innovations warrant strengthening international regulatory co-operation and further developing anticipatory approaches to regulation.

Note

[1] The joint paper covers three sectors: the banking sector, the securities sector and the insurance sector.

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4 Case 3. Blockchain and smart contracts: regulatory challenges and regulatory approaches

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In recent years, the opportunities and challenges brought by distributed ledger technologies (DLTs) have drawn much attention from media, business, and governments. While they represent a relatively recent technology, DLTs could come to considerably redefine socio-economic systems. These disruptive changes raise a number of significant challenges for governments, who strive to find a balance between fostering this innovation while protecting consumers against potential unintended consequences. This case study documents the range of regulatory challenges raised by the development of smart contracts as well as some of the regulatory responses that have been implemented by governments. It highlights, in particular, the need for guidance and appropriate regulatory action to reduce legal uncertainty and limit risks raised by DLT-based smart contracts. It also shows that international co-operation initiatives appears instrumental in addressing territoriality challenges raised by smart contracts.

"The term smart contract is itself imperfect. A smart contract is neither smart, nor is it necessarily a contract" (Chamber of Digital Commerce, 2018[1])

Context

In recent years, the opportunities and challenges brought by distributed ledger technologies (DLTs) have drawn much attention from media, business, and governments. While this technology is still at his infancy, both in terms of development and adoption, it could come to significantly transform industries and markets. These disruptive changes raise a number of significant challenges for governments, who strive to find a balance between fostering this innovation while protecting consumers against its potential unintended consequences.

DLTs offer new ways of sharing data and organizing transactions without relying on trusted, central authorities such as banks or governments. Any public or private intermediation that would record and validate the transactions is not necessary. Instead, the third party validation is substituted by a distributed consensus on the new piece of information added to the ledger. To a certain extent, trust is replaced by parties' awareness that each party is bound by the same technological architecture and is accordingly subject to the same procedures and sanctions that the technology defines.

DLT have first emerged as the technology behind crypto-currencies (e.g. Bitcoin) but they now have wider applications such as smart contracts, which offers original ways to develop transactions across a wide range of sectors.

What is Distributed Ledger Technology?

The International Organization of Securities Commission defines DLT as "*a consensus of replicated, shared, and synchronized digital data geographically spread across multiple sites, countries, and/or institutions. DLT are technologies used to implement distributed ledgers*" (IOSCO, 2017[2]). While DLTs have a number of variable features, the most important characteristics are the following:

- Distributed: "*each node of the blockchain independently constructs its own record of transactions, meaning that there are, at all times, copies of the same ledger being maintained by each node in the network*" (Berryhill, Bourgery and Hanson, 2018[3])
- Immutable: "*through its use of cryptography, once a transaction is added to a blockchain, it generally cannot be undone. As such, all users can have confidence that, unlike in a centralised database, the record has not been altered, whether through error or misfeasance* (Berryhill, Bourgery and Hanson, 2018[3]);
- Agreed by consensus: "*no block can be added to the ledger without approval from specified nodes in the network. Rules regarding how this consent is collected are called consensus mechanisms*" (Berryhill, Bourgery and Hanson, 2018[3]).

What are smart contracts?

The term "smart contract" was first introduced by Nick Szabo in 1994 who defines it as "*a set of promises, specified in digital form, including protocols within which the parties perform on these promises*" (Szabo, 1994[4]). Four main properties can be derived from this definition:

- "*A set of promises*": smart contracts consist of contractual terms and/or rules-based operations designed to carry out an economic activity;

- "S*pecified in digital form*": smart contracts are concluded and enforced digitally, and consist of lines of code within software that execute predetermined rules when a condition occurs;
- "*Protocols*": the set of code-based rules and the data are processed by an algorithm (or a combination of algorithms);
- "*Within which the parties perform*": the execution of the contract is immutable.

(Szabo, 1997[5]) further specified that a smart contract is a "*computerised transaction protocol that executes the terms of a contract. The general objectives are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries. Related economic goals include lowering fraud loss, arbitrations and enforcement costs, and other transaction costs*." In other words, smart contracts deployed on a blockchain are a set of predefined terms agreed by contracting parties and executed by the DLT itself when a predefined contingency occurs. As such, they are not a contract in the strict legal sense but rather self-executing and self-enforcing code-based rules. The contractual terms are embodied in software code and the DLT implements the entire agreement between the transacting parties. The execution of the contract results automatically from the occurrence of a set of preconditions. This is achieved through the combination of two technologies: electronic contracting and cryptography.

The creation of blockchain platforms such as Ethereum has triggered the development of smart contracts in a wide number of sectors. Potential applications are countless and span across many sectors and activities where information needs to be communicated and stored: from to energy, telecoms, sharing economy or health care; from retail to wholesale markets; from SMEs to large multinationals and public administration. Smart contracts can also take a various forms, ranging from simple escrow schemes to complex joint ventures.

Although smart contracts hold the potential to create substantial disruption in the way contracts are concluded and executed, it should be noted that some of the challenges raised by this new technology are not out of the ordinary. As underlined by (Werbach and Cornell, 2017[6]), "*contractual agreements embodied in software code, and even their automatic performance, are nothing new. For several decades, larger corporations have used electronic data interchange formats to communicate digitally across supply chains. The internet brought electronic commerce (e-commerce) to ordinary consumers, who accede to a digital contract every time they begin a relationship with an online service provider by clicking a button*". Smart contracts with automated transactions have also existed for a very long time outside the new opportunities provided by DLT-based platforms (a canonical example is the vending machine involving automated payment). Yet, powered by DLTs, smart contracts holds the potential to create disruption along four main avenues:

- Strong reduction of the need for (central) third-parties;
- Emergence of new or transformed forms of collaboration;
- Creation of new enforcement protocols. An essential difference between smart contracts and any other form of contractual arrangement is that the DLT *automatically* performs the contract once the predefined contingency occurs;
- Diminution of the role of informal co-ordination mechanisms such as trust or reputation.

Key transformative impacts

The key transformative impacts of smart contracts should be properly understood in order to help governments navigate the regulatory challenges and target appropriate regulatory responses. The nature of these impacts can be broken down into four broad categories: decentralisation, transaction costs, competition and data protection.

Decentralisation

The seminal idea behind the development of blockchain was to create a decentralised electronic transaction system, in which economic agents would exchange without the intermediation of central and trusted intermediaries. While most blockchain-enabled smart contracts are not fully decentralised today, the emergence of distributed architectures challenges the traditional dynamics and structure of transactions.

The decentralised architecture underlying DLTs has two main consequences from a trust perspective. On the one hand, economics agents know that the ledger is replicated across many different nodes of the blockchain and that, if one of the nodes fails to perform, all the other nodes with copies of the ledger will have the relevant information to enforce the contract. To a certain extent, trust on the execution of the contract terms is transferred into the hands of the software code behind smart contracts. Secondly, the decentralised architecture also means that there is no need to rely on a trustworthy centralised authority to enforce the contract. The code will "simply" execute what it has been instructed to do.

The development of decentralised transactions between individually trusted parties through smart contracts is exacerbating the rise of private governance, which relies on code to execute contractual terms and address traditional enforcement issues. Smart contracts might help create new economic transactions responding to the willingness of consumers to preserve their autonomy and anonymity without a centralised third-party.

Some argue that blockchain-based contracts might be an example of institutional evolution (Davidson, De Filippi and Potts, 2018[7]) as they hold the potential to be a substitute for the economic co-ordination provided by markets, hierarchies, informal co-ordination and governments (provided that relevant regulatory governance of smart contracts are implemented). A key challenge for governments is that smart contracts allow economic agents to shift away from traditional liability regimes, making difficult for to enforce existing regulatory frameworks

In addition, it is worth noting that the decentralised architecture holds also the potential to facilitate market access to small players, in particular in situations where they would usually need to rely on centralised or intermediating trust party to conclude and enforce the contract.

Transaction costs

Since the seminal (and pivotal) paper by (Coase, 1937[8]) on the "Nature of the firm" and the follow-up works by (Williamson, 1975[9]) and (Williamson, 1985[10]), a vast body of literature has been developed on the effects of contracting costs associated with each transaction. These so-called "transaction costs", which occur both *ex ante* (e.g. information costs, bargaining and haggling costs, cost of drafting the contract, costs of protecting the property rights, costs of anticipating and developing mitigation strategies for potential contractual breaches) and *ex post* (e.g. monitoring and enforcement costs), are a key driver of the governance structures' effectiveness.

One of the main issue addressed by transaction costs economics relates to the enforcement problems once the contractual agreement has been concluded by the parties. In situations where the continuity of the exchange relation is of special importance, parties usually face a risk of *ex post* opportunistic behaviour (e.g. renegotiation). Parties might indeed engage in *ex post* contractual strategies to exploit the opportunities offered by contractual incompleteness (and most contracts are likely to be incomplete when a complex transaction is involved). This so called 'hold-up problem' could impel economic agents to invest in contractual design (e.g. completing the contract with safeguards) and monitoring activities to protect the value generated by the transaction, but this may generate substantial transaction costs. Parties could also rely on an *ex post* intervention of a third-party enforcer (e.g. court) but legal enforcement can be costly, cumbersome and prone to error (this is notably the case when contract law regimes are weak and/or when some actions or contingencies are not verifiable by third parties such as courts). These co-ordination

problems and the associated transaction costs may result in suboptimal outcomes as regard investments. In some cases, parties may even be discouraged from contracting in order to avoid transaction costs.

In this context, the self-executing and self-enforcing properties of smart contract might offer great opportunities to reduce these co-ordination costs. They should, in principle, raise fewer information asymmetries such as adverse selection and moral hazard. Beyond a potential reduction of information costs, the self-executing features of smart contracts should prevent any deviation from the contractual terms that parties have agreed upon *ex ante* and, as such, avoid *ex post* opportunistic renegotiation (and, in turn, the risk of hold up). This reduction in counter-party risks, coupled with the fact that smart contracts may also reduce ambiguities which could lie in legal contracts, may sharply reduce contractual hazards and enforcement costs. As pointed out by (Werbach and Cornell, 2017[6]), "*cost savings occur at every stage, from negotiation to enforcement, especially in replacing judicial enforcement with automated mechanisms.*"

Smart contract-facilitated transactions might also significantly reduce the role of informal co-ordination mechanisms such as trust or reputation, since they have the potential of generating 'no-party' trust. One important feature of blockchain-enabled smart contracts is that the identity (and therefore the quality or the reputation) of the economic agents does not matter much. Transactions can remain anonymous to a large extent, through using cryptographic authentication for example. By contrast, engaging in a transaction without any hint on the identity of the contractual partner could be quite unlikely to occur in 'traditional' contracts.

In that sense, some argue that blockchain-based smart contracts are *complete* arrangements, which fully suffice to co-ordinate economic agents, without the need of any institution of informal co-ordination mechanism. While there is certainly room for cautionary arguments regarding the detailed effects of smart contracts on contractual costs, they undoubtedly enable the creation of new exchange relationships (at least for simple transactions that do not require adaptation during the execution of the contract), the development of outsourcing opportunities as well as the emergence of new and transformed business models.

Competition

The development of smart contracts bears important consequences in terms of competition dynamics. On the one hand, smart contracts bring the potential to increase competition within the market (OECD, 2018[11]). They may indeed offer small players an efficient and trusted mechanism to reach out consumers and hence reduce barriers due to existing economies of scale in data-driven markets. As highlighted above, smart contract may also strongly reduce hold-up concerns during the execution of the contract and facilitate outsourcing strategies due to the reduction in transaction costs. They provide therefore avenues for small firms to scale up which, in turn, should contribute to the development of more competitive markets.

Smart contracts may however create avenues for anticompetitive strategies and, in particular, collusive practices: beyond the fact smart contracts do not allow any change in the terms of a collusive arrangement without the agreement of the other parties, they enable participants to closely monitor the prices operated by the colluders and therefore facilitate the detection of deviant strategies. As noted by (Schrepel, 2019[12]), "*smart contracts make it easier for parties to keep their word*" and, as such, they might help sustain a collusive agreement.

Data privacy

The consequence of the rapid development of DLT-based smart contracts on data protection is still a puzzle, which raises a number of challenges for governments and businesses. DLTs offer indeed a major differentiation to traditional forms of data storage and management. The decentralised architecture,

coupled with the absence of central third parties, creates strong differences from the highly centralised processes by which large platforms collect and control massive amounts of personal data.

On the one hand, smart contracts may trigger innovative forms of economic transactions that are more protective of privacy (Finck, 2019[13]). Engaging in smart contracts might indeed allow economic agents to share the data that is strictly necessary to the transaction, which stands in sharp contrast the current data economy where the pervasive collection of data, combined with the spread of algorithms, carries critical challenges in terms of data privacy.

On the other hand, the right to be forgotten (i.e. rights of data correction and data erasure) presents a conflict with the immutability properties of blockchain-based smart contracts. While the ledger's immutability is one on the most heralded features of DLTs, some argue that this concept should not be overstated as the data can still be manipulated through human intervention in some specific, yet extraordinary, circumstances (Conte de Leon et al., 2017[14]). Such efforts would however be extremely burdensome and expensive (erasure of data would require both a backward deconstruction of the blockchain and a reconstruction of the system from the point of the deleted data forward). An interesting response to this problem could be to keep personal data off-chain on content-addressable storage systems (Zyskind, Nathan and Pentland, 2015[15]). The solutions combining blockchain and off-chain storages may however require the reintroduction of an intermediated trusted third party, which could (at least partly) defeat the initial rationale behind the use of DLTs.

Regulatory challenges for governments

Pacing problem

While DLT-based smart contracts are still a recent technology with relatively rare applications, the rapid pace of change creates a potential disconnect with regulatory frameworks. As for other emerging technologies, they tend to develop faster than the regulation or social structures governing them (Marchant, Allenby and Herkert, 2011[16]).

The disconnect between the pace of technology and the pace of regulation has always been a concern. There is a growing consensus, though, that the current manifestation of the pacing problem is particularly challenging for DLTs and smart contracts. One reason why governments struggle to keep up with this rapidly growing technology lies in their intrinsic complexity. Even if governments have the technical knowledge, smart contracts create countless avenues for new transaction structures and business models that could be difficult to understand, monitor and, where appropriate, regulate.

Challenges in terms of territoriality, enforceability and liability

The blockchain technology supporting smart contracts is, by definition, a borderless technology. The fact that DLTs are not rooted in a specific location creates strong concerns in terms of jurisdiction and applicable law. For smart contracts in particular, the territoriality issues are doubled: the different parties involved (contractual parties, developers of the code, minors, validators, etc.) may indeed be subject to different regulatory regimes in their respective countries and, in most cases, there is no third party or authority ultimately responsible.

Beyond the potential for regulatory arbitrage, territorially issues increase the enforcement and liability concerns for governments and businesses (one third of the respondents to a survey developed by Deloitte in 2019 cited smart contracts enforceability as a matter of regulatory concern (Deloitte, 2019[17])).

As well as the possibility of one party breaching the contractual agreement, there are chances that the contract itself may be flawed, either due to coding errors or design errors, leading to unexpected or unintended consequences. Besides, the claim that smart contracts and their associated programming language resolves all sources of ambiguity is partially misleading (Grimmelmann, 2021[18]). The code (that

can be unobservable by the contractual parties) may also embed ambiguities that entail transaction failures and potential damage for transacting parties. As in most cases there is no third party ultimately responsible for the system and the information it conveys, who should be liable when a smart contract fails to perform due to coding or design problems? In case the smart contract is audited and certified, should the auditor be liable? These problems make it difficult to perform basic legal and regulatory functions, such as ascertain liability, determine what piece of regulation is applicable in a particular situation, carry out regulatory monitoring or enforce rules.

Recent initiatives taken by governments further highlight the paradox raised by smart contracts as regard enforcement. The conception whereby smart contracts are complete contractual arrangements (i.e. which fully suffice to co-ordinate economic agents) ultimately means that there is no need to rely on the law to enforce contractual terms. As such, the exercise of contractual interpretation becomes irrelevant. Yet, recent guidance adopted in the UK or in the Netherlands indicate that existing regulations may apply to smart contracts, implying that the general interpretation rules is still applicable. One of the key interpretation principle in the Netherlands is given by the so-called Haviltex standard. According to this principle, it is not only the text of the contract (i.e. the code) that is decisive, but also external parameters such as parties' original intentions. As a consequence, the meaning that contractual parties might have attached to the provision in reasonable circumstances would matter in interpreting a smart contract. A similar principle prevail in the UK: in 2009, a House of Lords decision[1] highlighted the importance of ensuring that the contract wording is consistent with the parties' intentions. Accordingly, and as indicated by the (UK Jurisdiction Taskforce, 2019[19]), "*when interpreting a contract, a judge strives to identify the intention of the parties by reference to what a reasonable person having all the background knowledge which would have been available to the parties would have understood them to be using the language in the contract to mean*". Such guidance raise however a fundamental question to policymakers: how could these interpretation principles combine with the idea that smart contracts take the form of complete arrangements that fully suffice to coordinate contractual parties? Some initial ideas have been put forward (see below) but the question remains puzzling for governments and, to the knowledge of the author, no formal statement or regulatory decision has yet been taken.

Challenges to the existing regulatory frameworks

Given that DLT-based contracts are cross-sectorial and involve different technologies, existing regulatory landscapes could be unclear, redundant or overlapping. The underlying reason is that the traditional regulatory frameworks are often designed on an issue-by-issue, sector-by-sector, technology-by-technology basis and, as such, they may not fit well with smart contracts' properties. It entails a number of negative consequences, including:

- Uncertainties that may undermine the incentives to enter new markets;
- Poor risk management.

Beyond blurring market and sectors definition, one of the main consequence resulting from the development of smart contracts is a shift from traditional regulation (e.g. property law) towards private governance schemes. The rise of decentralised transactions delegated to code without a public authority creates unprecedented challenges to the traditional regulatory framework.

The dis-intermediation and autonomous organisation features of DLT-based smart contracts are such that the law, most often, is perceived as a non-active element of the transactions. In this context, attributing liability, and certifying transactions, combined with the need to reconcile these technologies with data protection issues create critical regulatory challenges for governments (OECD, 2021[20]).

While smart contracts do allow transactions to happen, they can be seen, in fact, as a 'simple' code-based set of specific instructions with automated decision-making. In this sense, and despite their denomination, smart contracts differ in essence from traditional legally binding contracts. Recent technological advances

in DLTs have led to conjectures that smart contracts might largely, or entirely, replace the whole legal system. While there are robust reasons to be sceptical about this perspective (Werbach and Cornell, 2017[6]), smart contracts have certainly the potential to create "alternative" ecosystems alongside existing legal systems. In some cases, smart contracts may even be implemented into regulatory vacuum, which could led to possibilities of illicit activities (such as money laundering).

In addition, while DLT-based smart contracts may create a trust-enhancing environment, it does not ensure that the information is accurate. Governments may need to develop a legal system recognising smart contracts as tamper-proof and immutable guarantees of the veracity of data stored on the blockchain. To the knowledge of the author, such initiatives have not been launched to date.

Smart contracts also generate a tension between the very nature of blockchain technologies and the overall structure of data protection law (OECD, 2021[20]). Some argue that, in terms of data protection, the principles underlying DLTs and the General Data Protection Regulation (GDPR) are raising incompatibly problems at a conceptual level. The data protection mechanisms developed for centralised structures contrast indeed with blockchain core's elements such as decentralisation, immutability, and perpetual data storage. (Finck, 2019[13]) argues that "*the tension between the GDPR and these novel decentralised databases indeed reveals a clash between two normative objectives of supranational law: fundamental rights protection on the one hand, and the promotion of innovation on the other*".

This problem is leading, at least in the EU, to a reflection on how to ensure that smart contracts comply with the data protection regulation. Two important points of tension have been identified so far in recent works on GDPR:

- GDPR is based on the underlying assumption there is at least one legal person (the data controller) responsible for each data point. This principle clashes with the decentralised nature of smart contracts, making the allocation of responsibilities especially burdensome under this regulation;
- GDPR relies on the premise that data can be modified or erased where necessary to comply with legal requirements. Accordingly, Article 16 states for example that "*the data subject shall have the right to obtain from the controller without undue delay the rectification of inaccurate personal data concerning him or her. Taking into account the purposes of the processing, the data subject shall have the right to have incomplete personal data completed, including by means of providing a supplementary statement".* Article 17 further specifies that "*data subject shall have the right to obtain from the controller the erasure of personal data concerning him or her without undue delay and the controller shall have the obligation to erase personal data without undue delay*" (for some specific reasons listed in the article). DLTs render such provisions difficult to apply due to their immutability properties.

Is it worth noting that the uncertainties in this area are not only related to the specific features of DLTs. Part of difficulties also lies in the uncertainties surrounding some key concepts of the GDPR, such as the notion of anonymous data, the definition of the data controller, and the meaning of erasure under Article 17 (European Parliament, 2019[21]).

Regulatory approaches

A range of regulatory approaches have been implemented across countries to deal with the challenges raised by DLT-based smart contracts, which shed light on the complexity of the regulatory issues at stakes as well as the existing fragmentation of regulatory frameworks across jurisdictions.

Wait and see approaches

In many cases, governments have deliberately and explicitly chosen to observe how the technology evolves without taking any regulatory action. In 2017, the European Commission announced for example that it was "*actively monitoring*" DLTs and part of this strategy consists of the financing of pilot projects and the organisation of workshops and conferences to engage stakeholders and gather information to acquire essential knowledge. In parallel, the European Commission has launched the EU Blockchain Observatory and Forum in 2018, with the purpose of mapping key initiatives in Europe (and beyond) and reinforcing European stakeholder engagement. In a report published in June 2020, the EU Blockchain Observatory and Forum (EU Blockhain Observatory and Forum, 2020[22]) provided a set of principles to help policy makers tackle the regulatory challenges raised by smart contracts, including:

- Draft simple definitions of the technology;
- Engage with stakeholders and provide guidance on legal interpretation;
- Choose the relevant regulatory approach;
- Build capacity within government to help tackle the technical complexity associated with DLTs;
- Encourage self-regulation;
- Monitor closely the evolution of the technology and its impacts on markets and societies;
- Relying on DLTs to extend the regulatory toolbox.

In 2019, the European Commission also created the International Association of Trusted Blockchain Applications (INATBA). The objective is to bring together industry, SMEs, policy makers, international organisations, regulators, civil society and standard setting bodies to support the development of DLTs across countries and sectors.

Issuing guidance

As part of a wider work on legal issues surrounding technological developments, the UK Ministry of Justice has focused on providing increased legal certainty for smart contracts under English and Welsh law. This work has been conducted under the auspices of the UK Jurisdiction Taskforce.

In November 2019, the Taskforce published a legal statement on the status of cryptoassets and smart contracts (UK Jurisdiction Taskforce, 2019[19]) which made a series of findings including the legal implications of smart contracts. It states that there is "*no good reason for treating smart contracts as being different in principle from conventional contracts*". In case of an event external to the code affecting the transaction, the existing rules of Law should apply to solve potential disputes. The taskforce considers indeed that the three requirements for a contract could be met with a smart contract:

- The existence of an "agreement": written terms or signature are not necessary condition to form a contract under English and Welsh law and, in any case, smart contracts could well meet a statutory "in writing" requirement;
- The explicit intention to be legally bound; and
- The fact that each contractual party each party to it must give something of benefit.

It acknowledges, however, that "*the modern approach to interpretation of commercial contracts is very much focused on the language*" and, therefore, a smart contract relying exclusively on code might not create any room for legal interpretation. Such contract would be considered as a clear and unambiguous arrangement, with no robust reason to depart from it. A judge will however be able to intervene in situations where the code does not reflect the initial intentions of contractual parties or in cases of fraud.

The taskforce also makes clear that a smart contract between anonymous (or pseudo-anonymous) parties does create legal obligations, although it creates obvious difficulties in case of contract breach. The report underlines that the fact that a party does not have information about the identity of the contractual partner is not at all specific to smart contract and is fully allowed under English law.

The UK Ministry of Justice is currently working with the Law Commission of England and Wales on a project that aims to take forward the Law Commission's earlier work on smart contracts and the findings made in the Legal Statement.

In 2019, the Research and Documentation Centre of the Dutch Ministry of Justice and Security published a report on DLTs and smart contracts. The reports consider that the Dutch contract law apply to smart contracts and, as a consequence, an adaptation of regulatory framework seems unnecessary. As mentioned earlier, the Haviltex standard may, in particular, continue to apply and, consequently, external conditions (such as parties' initial intentions) would matter when interpreting contract clauses. The reports suggest however that, for smart contracts, an overriding weight may be given to the code itself for interpretation purposes.

The report also highlights that some of core contractual principles under Dutch law might be difficult to apply to smart contracts. This is the case for example of the '*force majeure*' concept. Such normative principle cannot be embedded into the code as it not strict rule governing its application. A solution would be to reintroduce a third-party in the contractual equation but this would defeat the rationale for relying on DLT-based smart contracts.

Given these difficulties, the report does not provide concrete directions and warns that that downside risks might outweigh potential benefits of using smart contracts. The formal response of the governments should be made available soon.

In the same vein, the Swiss Federal Council published a report in 2019 (Switz Federal Council, 2018[23]) to provide an overview of the legal framework applying to DLTs and smart contracts in particular and identify the need for regulatory action. The reports highlights that smart contracts cannot be seen as contracts in the sense of the Swiss Code of Obligations and that their immutability properties creates a tension with the classical private law. Against this background, the Federal Council states that "*parties wishing to conclude a smart contract should provide for suitable mechanisms for possibly changing circumstances and dispute resolution. There will certainly be further developments in the area of smart contracts, but as it is still in the embryonic stage, it seems premature to legislate at the moment*".

Adapting regulatory frameworks

Governments can enact provisions specifically tailored to DLT-based smart contracts to provide legal status to such arrangements. In Italy, the Parliament has for example passed a law provision introducing a definition of distributed ledger technologies and smart contracts in the legal framework. The law, which entered into forced in 2019, provides a legal definition of DLT and smart contract and states that the latter meet the requirement of written form (provided that the identification of the parties complies with a procedure defined by the *Agenzia per l'Italia Digitale*[2]). It also stipulates smart contracts have the same legal properties as 'electronic time stamps' defined in the European Regulation on electronic identification.[3]

Similar initiatives have been developed in the US federal states. In 2017, the state of Arizona passed an amendment to its Electronic Transaction Act adding a new article providing specific regulation for DLTs and smart contracts. As regards DLT-based smart contract, the Act states for example that:

- "*A signature that is secured through blockchain technology is considered to be in an electronic form and to be an electronic signature*";
- "*A record or contract that is secured through blockchain technology is considered to be in an electronic form and to be an electronic record*".

- "*Smart contracts may exist in commerce. A contract relating to a transaction may not be denied legal effect, validity or enforceability solely because that contract contains a smart contract term*".

As for the Italian initiative, the Act also provides definitions of DLTs[4] and smart contracts.[5] Following Arizona's initiative, Delaware, Florida, Ohio, Nevada, Tennessee and Wyoming enacted similar laws, which echoes a general understanding that smart contracts can be enforced through the existing legal system. The State of New York has also introduced amendments to the state technology law, introducing state definitions of DLTs and smart contracts to recognise them in the context of commerce.

Regulatory sandboxes

To foster innovation in financial markets, the United Kingdom's FCA has launched a number of regulatory sandboxes since 2016. The objective is to allow innovative firms to test new products, services and business models in a controlled regulatory environment. The FCA provides a number of tools to innovative firms: tailored authorisation processes, individual guidance, informal steers, regulatory waivers as well as no enforcement action letters.

The FCA has accepted a number of DLT-related projects, including on smart contracts:

- The first regulatory sandbox (cohort 1) authorised the company Tramonex to test an e-money platform based on distributed ledger technology that facilitates the use of smart contracts to transfer donations to a charity;
- During the second cohort, Oraclize tested a DLT-based e-money platform which turns digital identity cards into secure digital wallets through the use of smart contracts and fiat-backed tokens;
- Under cohort 3 and 4 of the regulatory sandbox, the firm Etherisc has also conducted a test to use smart-contracts on a blockchain to provide fully-automated decentralised flight insurance.
- Under cohort 6, the firm Crowdz UK has been accepted to test a SMEs invoice financing platform relying on DLT-based smart contracts to tokenise invoices and re-route payments.

Traditional regulatory policy tools

While little evidence is available at this stage on the use of regulatory management tools by governments to tackle the challenges raised by smart contracts, several co-operation initiatives have been launched across the world and at the EU level in particular. In 2018, seven EU member states (Cyprus, France, Greece, Italy, Malta, Portugal and Spain) signed the Ministerial Declaration on Distributed Ledger Technologies, underlining that "*as a technology based on trust,* [the Ministers] *see Distributed Ledger Technologies as being a potential game changer using – inter alia smart contracts in areas such as certifying product origin, education, transport, mobility, shipping, land registry, customs, company registry, and healthcare amongst others to transform the way that such services are delivered*". The declaration points, in particular, to the need for regulatory frameworks to allow innovation and experimentation to foster policy learning. On April 2018, 21 Member States[6] (and Norway) agreed to sign a Declaration creating the European Blockchain Partnership (EBP) and co-operate in the establishment of a European Blockchain Services Infrastructure (EBSI) to support the delivery of cross-border digital public services (since then, eight more countries have joined the partnership, bringing the total number of signatories to 30).

Conclusion

Distributed ledger technologies (DLTs) are developing fast and have the potential to redefine our socio-economic systems substantially. One key application of these technologies consists of smart contracts, which generate important disruptions by strongly reducing the need for central trusted intermediaries,

bringing about new forms of collaboration and business models, and creating new enforcement methods. DLT-based smart contracts they tend to develop faster than the regulation or social structures governing them due to their intrinsic complexity, which makes it hard for non-experts such as policy makers to enact and enforce effective regulatory approaches. In addition, DLTs being by definition a borderless technology, the fact that smart contracts are not rooted in a specific location means that determining the applicable jurisdiction and legal provisions is by no means straightforward. Moreover, the need to attribute liability, certify transactions, and reconcile these technologies with data protection imperatives creates critical challenges for governments. These challenges are compounded by the complexity of the regulatory issues at hand as well as the existing fragmentation in regulatory frameworks across jurisdictions.

While "waiting and seeing" (i.e. observe how the technology evolves without taking any regulatory action) may in some cases prove useful, governments need to deploy a range of additional measures if regulatory action is to be up to the above-mentioned challenges. Providing appropriate guidance and taking action to reduce legal uncertainty and limit risks raised by DLT-based smart contracts is particularly important, and a number of countries are already engaging in such activities. Governments can notably enact provisions specifically tailored to smart contracts in order to clarify their legal status, and put in place regulatory sandboxes to foster innovation in controlled regulatory environments. In addition, international co-operation initiatives (of which the case study provides various examples) can be instrumental in addressing territoriality challenges and supporting the development of smart contracts.

Notes

[1] Chartbrook Ltd v Persimmon Homes Ltd [2009] UKHL 38.

[2] The *Agenzia per l'Italia Digitale* is a public agency in charge of the digital agenda of the Italian government.

[3] Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC.

[4] "*Distributed ledger technology that uses a distributed, decentralised, shared and replicated ledger, which may be public or private, permissioned or permissionless, or driven by tokenised crypto economics or tokenless. The data on the ledger is protected with cryptography, is immutable and auditable and provides an uncensored truth*".

[5] "*Event-driven program, with state, that runs on a distributed, decentralised, shared and replicated ledger and that can take custody over and instruct transfer of assets on that ledger*".

[6] Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

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5 Case 4. Ridesourcing services: regulatory challenges and regulatory approaches

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To harness the potential of the ridesourcing model, governments should adopt a regulatory approach that does not unnecessarily inhibit the realisation of key benefits. An even-handed approach between incumbents and new entrants is needed, as is accommodating the ridesourcing model within regulatory frameworks and reviewing and reforming outdated taxi regulation that can undermine taxis' ability to compete effectively. At the same time, new or enhanced regulation will be required to address consumer protection concerns, equity issues and negative externalities Such regulatory interventions should focus on clearly problems and rely on a good understanding of the nature of new services and the emerging market in which they operate.

Context

General description of the technology

The ridesourcing model is based on the integration of the technologies of smart-phones, apps and GPS location into a convenient and efficient means of connecting drivers and riders and processing payments.

However, another key element of the model is use of privately owned vehicles (and their owners/drivers) on a part-time basis to provide taxi-like services. This innovation has yielded important efficiency gains, as it facilitates short-term supply responsiveness at low cost. That is, ridesourcing services can readily respond to the typically large hour-by-hour and day to day fluctuations in service demand, without maintaining large fleets of dedicated vehicles which suffer from low average utilisation rates, in contrast to the traditional taxi model.

By early 2019, less than a decade after the launch of the first ridesourcing service, the industry had estimated global revenues of $184 billion and almost one billion user.[1]

Overview of the main market players and the market structure

The provision of on-demand taxi-like services is subject to significant network effects, since expected waiting time is a key element of quality of service. Thus, companies must rapidly reach a critical scale in order to compete effectively. Individual ridesourcing markets have, from the early days of the model, also been dominated by a small number of players. Even in New York City, where ridesourcing had a market share of almost 70% in early 2019,[2] only four companies met the definition of a "High Volume For-Hire Service" established as part of the implementation of the Driver Income Rule from December 2018.[3] However, the dominant players differ widely between jurisdictions: While a few, such as Uber, have dominant positions in numerous countries, none is pre-eminent at a global level. For example, Uber exited the Chinese market after a period of strong competition with local company Didi Cuching. Thus, while individual markets typically have only a handful of players, comparison site Rideguru tracks 91 ridesourcing companies on its website.[4]

While individual jurisdictions have only small numbers of providers, competitive pressure is generally strong. This reflects several factors. One is the continuing, significant role of traditional taxi companies. Second, neither drivers nor consumers are constrained to use only one provider. Indeed, a 2018 study focusing on New York City indicated that many drivers typically work for two or more ridesourcing platforms, often simultaneously (Parrott and Reich, 2018[1]). Third, market strategies indicate a focus on gaining and retaining market share. Indeed, a key feature of the model has been a strong reliance on repeated injections of venture capital to enable companies to reach critical scale and obtain market share quickly. This business model has meant that all or most operators have recorded substantial operating losses consistently over several years. Finally, there has been increasing engagement in the market by well-established companies from other industries, including General Motors and Sony.[5]

Key opportunities and threats arising from the new technology

Opportunities

Efficiency benefits

As noted, ridesourcing evolved as a means of providing taxi-like services using part-time drivers and their existing private vehicles. As such, the model incorporates a high level of flexibility in supply. The use of existing private vehicles entails important economic efficiency benefits, given that it necessarily involves increasing the typically very low utilisation rate of private vehicles. The scope of these benefits is likely to

be substantial, given the extent of hourly and daily variation in demand for taxi-like services. Another important source of economic efficiency benefits has arisen from political economy factors: in many markets, the entry strategies adopted by ridesourcing companies have effectively overturned the long-term regulatory restraints on supply maintained in many markets.

Service quality benefits

The ridesourcing model provides opportunities for improvement in several dimensions of service quality, compared with the highly regulated taxi industry model found in most OECD countries and beyond. First, in addition to offering economic efficiency benefits, the flexible supply response enabled by the part-time use of private vehicles also enables service quality improvements by better matching demand and supply during peak periods, thus reducing waiting time, a key dimension of service quality.

Second, the automated GPS based matching of riders and drivers which represents the core functionality of the ridesourcing apps also contributes to reduced waiting times by reducing both matching times and error rates. That said, this aspect of the technology is not exclusive to ridesourcing and has been increasingly adopted by the traditional taxi industry, where this is not prevented by regulatory restrictions.

Third, the fact that vehicles are generally privately owned by their drivers and used on a part-time basis tends to favour better average quality in at least two ways: average mileages are significantly lower than for traditional taxis, while private (or intrinsic) incentives for good maintenance performance are also greater.

Security benefits

Two elements of the ridesourcing model have clear benefits improving the security of drivers and passengers, compared with traditional taxi models. First, payment is exclusively processed through the app. This means that cash transactions do not occur in ridesourcing vehicles and removes monetary incentives for aggression against drivers. Second, bookings are exclusively undertaken via the app. This removes the anonymity which is a feature of the street hail and rank segments of the taxi market[6] and creates clear disincentives to criminal behaviour for both riders and drivers. Other app features, such as driver and rider rating systems, real-time journey tracking and “panic buttons” reinforce this dynamic.

Threats

Externalities: congestion and pollution

Concerns regarding congestion and pollution in densely populated city centres have long been advanced as one justification for regulatory restrictions on taxi supply, albeit that little or no convincing empirical evidence of the actual or potential size of this issue has been adduced (ECMT, 2007[2]). As the ridesourcing industry has increasingly taken market share from the taxi industry, these arguments have begun to be advanced as reasons for seeking to limit the supply of ridesourcing vehicles. As noted above, the total market for taxi-like services has expanded substantially in jurisdictions that have facilitated the entry of ridesourcing, largely as a result of modal shift. The extent of the increase in total supply (i.e. taxis plus ridesourcing) *a priori* suggests a stronger basis for these concerns.

Some research does conclude that ridesourcing contributes materially to congestion in at least some urban contexts. However, considered as a whole the literature on this issue reaches divergent conclusions regarding the specifics of the modal shifts caused by the growth of ridesourcing and, consequently, the extent to which ridesourcing is likely to contribute to urban congestion and pollution. The picture is complicated by the fact that researchers have in many cases focused on indirect indicators, such as modal shift, rather than on measuring ridesourcing’s contribution to congestion directly.

Several researchers find strongly negative effects. For example, (Schaller Consulting, 2018[3]) finds that modal substitution toward ridesourcing has largely been at the expense of public and active transport modes, while significant numbers of new trips have also been generated. (Clewlow and Mishra, 2017[4]) report that 22% of ridesourcing users stated they would take fewer trips if ridesourcing options were unavailable. (Graehler, Mucci and Erhardt, 2019[5]) conclude that, for each year after the entry of ridesourcing, heavy rail ridership declines by 1.3% on average and bus ridership by 1.7%. This effect is considered by the authors to potentially be a major explanation of recent transit ridership declines in the United States. (Tirachini and Gomez-Lobo, 2019[6]) conclude, on the basis of a Monte-Carlo simulation, that total vehicle kilometres travelled will increase unless ridesourcing "substantially" increases vehicle occupancy levels. A recent study focusing on the United States, in turn, concludes, based on a set of fixed-effect panel models estimated using metropolitan statistical area level data, that the entrance of transportation network companies[7] led to increased road congestion in terms of both intensity (by 0.9%) and duration (by 4.5%) (Diao, Kong and Zhao, 2021[7]).

Other authors have reached more equivocal conclusions. Some suggest ridesourcing may substitute for bus travel but complement urban rail. (Clewlow and Mishra, 2017[4]) find that ridesourcing has led to a 6% decline in bus ridership and a 3% decline in light rail use in the United States, but is associated with a 3% increase in commuter rail use and a 9% increase in walking. Overall, they conclude that ridesourcing is "likely" to lead to an increase in vehicle kilometres travelled. Babar and (Babar and Burtch, 2017[8]) find ridesourcing leads to reductions in urban bus use, but increases in both subway and commuter rail services. However, the size of these impacts is correlated with the quality of transit services, with higher quality transit being associated with lesser degrees of substitution and higher complementarity. (Rayle et al., 2016[9]) conclude that ridesourcing's impact on vehicle kilometres travelled is unclear.

(Doppelt, 2018[10]) also conclude that Uber substitutes for bus travel but complements metros and subways, while highlighting the variable effect size across cities and modes. Possible reasons for the differences advanced include each mode's service area network, passenger demographic, and trip purpose. While they find that Uber is a substitute for public transport in the aggregate, the authors conclude that, because the impacts vary widely at city level, a single approach to regulating ridesourcing is insufficient. Rather, policymakers must understand their specific local dynamics in order to address key regulatory issues.

A third cohort of researchers reaches more positive conclusions. (Conway, Salon and King, 2018[11]) find ridesourcing use is associated with greater use of both transit and active transport (i.e. walking, cycling, etc), plus reduced car ownership. They argue the question of whether ridesourcing complements or substitutes for transit has more than one dimension, as it can both "compete with transit for individual trips, while complementing transit as part of a low-car lifestyle". That is, if the availability of ridesourcing leads individuals to reduce their car ownership they are likely to increase their use of both ridesourcing and transit. (Cramer and Krueger, 2016[12]) find that Uber is a complement for public transit, increasing ridership by 5% after two years on average, although the size of this effect varies widely between cities, being generally stronger in larger cities and for smaller transit agencies.

To the extent that ridesourcing complements urban rail, it will have positive congestion impacts which will at least partially offset likely negative effects due to induced trips and substitution away from non-motorised modes. The significant variation in effect sizes highlighted in some studies suggests this complementarity is likely to be concentrated in cities with higher quality transit networks. By implication, investment in improved transit networks will increase ridesourcing's complementarity with transit.

Research on modal substitution provides an indirect indicator of the ridesourcing's congestion impacts. A smaller body of research, little of which is published in peer-reviewed journals, measures congestion impacts directly (Tirachini and Gomez-Lobo, 2019[6]). The conclusions of these studies regarding the congestion impact of ride-hailing are also diverse.

In San Francisco, where ridesourcing originates, a report published by the regulatory authority finds that ridesourcing was responsible for 47% of the increase in congestion observed in the city between 2010 and 2016 and 25% of total 2016 congestion, despite accounting for only around 5% of vehicle kilometres travelled in 2016 (San Francisco County Transportation Authority, 2017[13]). This result reflects the concentration of ridesourcing journeys near urban centres and in peak periods, when congestion is greatest.

Conversely, the impact of ridesourcing on congestion seems to have been much more limited in some cities. In New York City, a report published by the Major's office found that reductions in vehicle speeds were driven primarily by increased freight movement, construction activity and population growth, rather than the growth of ride-sourcing (City of New York, 2016[14]), although more recent data show that taxis and ridesourcing vehicles collectively account for almost 30% of traffic in the Manhattan core (New York (New York City Taxi and Limousine Commission, 2019[15]). (Nie, 2017[16]) found that in Shenzen, People's Republic of China, travel speeds dropped by an average of only 5% following the entry of ridesourcing, concluding that "…ridesourcing worsens congestion for taxis in the city, but the impact was relatively mild". (Lee et al., 2019[17])find that there is an overall complementary relationship between Uber and public transit, but that Uber has a limited impact on public transit use or traffic congestion in cities with high "urban centrality".

An empirical analysis by (Li, Hong and Zhang, 2016[18]) concludes that ridesourcing services significantly decrease traffic congestion in urban areas and that "on-demand ride sharing could actually be a part of a solution to urban congestion in major urban areas." The authors provide various hypotheses as to the dynamics which could underlie the observed results, but do not directly test them.[8]

Reviewing this literature, (Conway, Salon and King, 2018[11]) conclude that the evidence on the impact of ridesourcing on congestion is inconsistent, with ridesourcing "…found to increase, decrease and have no effect on traffic congestion" by different researchers.

Working conditions

In common with other "sharing economy" innovations, concerns have frequently been raised regarding the working conditions of ridesourcing drivers. The industry is characterised as forming part of a "gig economy" which erodes employment rights and standards. The main mechanism through which this erosion takes place is the consistent treatment of sharing economy workers as independent contractors, rather than employees. In most jurisdictions, the effect of this classification is that minimum wage laws do not apply, while drivers do not benefit from other minimum conditions provided to employees.

Quantitative evidence on the incomes of ridesourcing drivers is limited, though some US data suggest below minimum wage outcomes. A recent report based on New York City data (Parrott and Reich, 2018[1]) reported average compensation net of expenses of USD 14.25 per hour, with 25% of drivers earning less than the 2019 minimum wage for New York City of USD 13.50 per hour.[9] A broader US-based study (Mishel, 2018[19]) reported average compensation of USD 11.77 per hour, with a wage equivalent[10] of only USD 9.21 per hour, which is below most State-established minimum wages, but above the Federal minimum wage.

Ridesourcing drivers have consistently been treated as independent contractors, while companies have strongly resisted attempts to challenge this classification through legal and other challenges.

The broader context, however, is one in which taxi drivers who do not own their own licence (medallion) or vehicle have typically also been treated as independent contractors, rather than employees, while concerns about low levels of remuneration, often said to be below minimum wage levels, have also been widespread. Thus, the emergence of ridesourcing has not significantly altered the position of workers in the sector, notwithstanding ongoing concerns regarding negative impacts of the gig economy in the broader economy.

Nonetheless, some legal challenges have been instituted under existing employment laws, with indications that changes in the legal status of drivers may occur in some countries. A December 2018 UK Court of Appeal decision declares ridesourcing drivers to be employees, rather than independent contractors, but is subject to appeal at the time of writing (Business and Human Rights Resource Centre, 2018[20]). In February 2021, the UK's Supreme Court ruled that a group of drivers should be classified as workers entitled to more protections.[11] The next month, Uber announced that it would reclassify more than 70 000 drivers in Britain as workers who will receive a minimum wage, vacation pay and access to a pension plan.[12]

An April 2018 California Supreme Court decision[13] proposed a broadly applicable test for determining employee status which would apparently have the potential to see both taxi and ridesourcing drivers, as well as "contractors" in a wide variety of other industries, classified as employees. In October 2020, a California appeals court on Thursday unanimously ruled against ride-hailing companies Uber Technologies Inc and Lyft Inc, saying they must reclassify their drivers in the state as employees.[14]

Equity issues

Despite being provided by private operators, the taxi industry is often seen as forming part of the public transport system. The widespread regulatory requirement that taxis accept all customers is one expression of this concept. Another is that taxis have been regarded as an important transport option for people with limited mobility. Governments have adopted a range of positive and negative incentives to ensure adequate supplies of accessible taxis and sufficient levels of access by those with limited mobility. These include provision of licences for accessible taxis on preferential terms, requirements that a certain proportion of large taxi fleets be comprised of accessible vehicles and provision of user subsidies for people with limited mobility.

The ridesourcing sector has been widely criticised for failing to make its services accessible. While some ridesourcing providers notionally allow riders to request a wheelchair accessible vehicle, they have been widely criticised for poor service provision. A 2018 report found that, even in New York City, the availability of wheelchair accessible vehicles is inadequate, with a vehicle located by Uber in only 55% of cases and by Lyft in only 5% of cases (New York Lawyers For The Public Interest, 2018[21]). Reflecting this, recent US data show that the market share of ridesourcing among people with mobility problems is substantially smaller than it is for the general population: while people with disabilities use private hire vehicles (i.e. taxis plus ridesourcing) twice as frequently as the general population, ridesourcing accounts for a significantly smaller proportion of their total private hire vehicle trips than is the case in the general population: while ridesourcing accounted for 79% of all such trips taken in 2017, ridesourcing trips account for only 28% of trips by people with disabilities (Schaller Consulting, 2018[3]).

As the success of ridesourcing has undermined the business model of the taxi sector, there has been increasing concern regarding the need to maintain an adequate level of provision of accessible services. The context is one in which the taxi industry was itself been subject to much criticism of its performance in this regard, prior to the establishment of ridesourcing, and many governments were responding by adopting increasingly stringent requirements.

Another aspect of the equity issue relates to access for people without access to smartphones and smartcards. As the ridesourcing model has been designed to rely on these tools for booking and payment processing, access has been largely denied to people who do not own them. The potential exclusion of people without access to credit cards and smartphones could become a significant issue should the availability of traditional taxis become restricted, while the size of this issue may be greater in middle- and lower-income countries.

Key transformative impacts

Main ways the innovation affects the society and economy

Service availability

Ridesourcing has captured substantial market share from taxis in most markets in which they have been able to operate relatively freely, albeit to widely differing degrees. However, as noted above, the growth of ridesourcing has also been a reflection of significant increases in the overall modal share of taxi-like services. These increases often represent the reversal of long-term declines in modal share that have been a corollary of strong supply restrictions being maintained for extended periods and the limited competitive pressures seen in tightly regulated markets subject to such quantitative restrictions.

For example, data for New York City as a whole show that total for-hire vehicle (FHV) trips per day increased by 73.4% in the three years to the end of 2017 (Schneider, 2019[22]). Other US data show that the modal share of FHVs doubled between 2009 and 2017 (Conway, Salon and King, 2018[11]).

This increase in modal share reflects strongly increasing consumer demand, due to enhanced service quality. Quality improvements are evident in lower waiting times, better perceived safety and higher vehicle and driver quality. The increased modal share also reflects the fact that ridesourcing services are often available at lower prices than traditional taxis, notwithstanding that their fares are usually unregulated, while taxi fares are regulated in most jurisdictions. It should be noted that protractedly lower ride prices could in many cases only be applied at the expense of relatively low take rates (the proportion of the fare that the ridesourcing company gets) financed through investment capital: according to a 2019 newspaper article, the 2010s were “the decade of the subsidised ride”.[15] While this trend seems to have reversed to some extent, such practices may have allowed ridesourcing companies to benefit from an uneven playing field.

One aspect of the increased modal share of taxi-like services is the expansion in their availability, in both geographical socio-economic terms. The nature and extent of these changes necessarily varies across markets. However, the experience of New York City provides a clear example. Data for Manhattan show that, while the number of trips completed by ridesourcing vehicles increased more than tenfold, from around 600 000 to 8 million, in the four years to end-2017, the net increase in the number of trips completed by FHVs over the same period was less than 20% (The Economist, 2018[23]). Conversely, in the outer boroughs, the total number of pickups by taxis and ridesourcing vehicles increased by over 150% in less than four years, from a little over 3 million in 2014, prior to the entry of ridesourcing, to almost 8 million in early 2018. Around 90% of these pickups were performed by ridesourcing vehicles (Schneider, 2019[22]).

(Brown, 2018[24]) found that in Los Angeles, ridesourcing “extends reliable car access to travellers and neighbourhoods previously marginalised by the taxi industry”. Moreover, while audit data revealed high levels of racial discrimination in the provision of taxi services, ridesourcing data revealed almost no racial-ethnic difference in service quality. Consistent with this observation, the freeze on the issue of new ridesourcing licences adopted in New York City in 2018 was opposed by a number of human rights groups on the grounds that it would adversely affect non-white consumers who are often refused service by the taxi industry (The New York Times, 2018[25]).

Impact on taxi industry incumbents

Ridesourcing has been the most controversial app-based service innovation (or sharing economy market offer). It has been highly disruptive to incumbent service providers, substantially reducing market share, largely eliminating monopoly rents previously conferred by regulated supply restrictions and caused economic loss on a scale not seen in other markets in which new entrants have grown rapidly, such as the accommodation market (AirBnB etc). This substantial disruption largely explains the strong and sustained

attempts made by some governments to prevent ridesourcing services from establishing themselves, or to constrain the way in which they operate through restrictive regulation.

The economic efficiency benefits identified above imply that a degree of disruption to incumbents was inevitable. However similar benefits can be seen in other, far less disrupted markets. The key distinguishing feature of the taxi market is the large and sustained level of regulatory failure evident in a wide range of jurisdictions nationally. Regulatory restrictions on supply were initially justified in terms of the need to limit negative externalities (e.g. congestion and pollution) and/or underpin driver incomes, but effective lobbying by licence owners typically saw increasing imbalances between supply and demand, giving rise to rapidly increasing licence values, poor-service standards and declining modal share, as consumers increasingly sought alternatives to a taxi industry that responded poorly to their demands. By the beginning of the current decade, taxi licence (or medallion) prices, which represent the capitalised value of the monopoly rents accruing to them, exceeded AUD 500 000 in Melbourne and Sydney, USD 1.3 million in New York City and several hundred thousand dollars in many other major cities.

The rapid growth in ridesourcing services quickly overturned the regulatory supply constraints, radically reducing monopoly rents and causing the value of taxi licences to fall precipitously. This caused major disruption, particularly where licence-owners were heavily leveraged, as was often the case. The swift reversal of fortune faced by taxi licence owners has led to strong lobbying for a restrictive regulatory response. The context was generally one in which ridesourcing companies had deliberately sought to exploit regulatory ambiguity or uncertainty by claiming that features of their new service model meant that traditional taxi regulation did not apply to them.

Many governments initially responded positively to this lobbying and sought to block the entry of app-based ridesourcing. However, this response was rapidly revealed as unsustainable in many markets. From a policy perspective, the substantial economic efficiency benefits implicit in the new model became increasingly apparent while, from a political perspective, the high level of customer demand for the new services often made continued attempts to banish it from the market untenable. These negative initial responses were therefore often succeeded by the adoption of broadly-accommodating regulation (International Transport Forum, 2019[26]). Where this has yet to occur the restrictive approaches adopted typically remain under challenge.

Structural consequences

From a competitive perspective, ridesourcing appears to have had limited impact on the structure of the market for taxi-like services. This is predominantly the result of the importance of network effects in the sector. That is, the need to have a substantial and widely-distributed network of vehicles in order to respond to “on demand” service requests means that most urban taxi markets are characterised by a small number of relatively large service providers. In markets in which ridesourcing has become established, it is also dominated by a small number of players.

Conversely, limitation of the size of the fleet has not yet become a common regulatory response to the public policy issues posed by ridesourcing. This, combined with the generally lighter handed regulatory treatment of ridesourcing means that entry barriers are relatively low and that incentives to compete and innovate remain strong, relative to the pre-disruption taxi sector. This position may, however, not prove durable, as there are early signs of moves to both enact quantitative restrictions and adopt more intrusive regulation of various quality dimensions.

An example of the former is the August 2018 move by the NYC government to both enact a one-year freeze on the issue of ridesourcing driver permits and empower the regulator to regulate the number of licences on issue on a permanent basis. While the regulator has yet to exercise the latter power, the initial 12 month freeze was extended for a further year prior to its August 2019 expiry (City of New York, 2019[27]).

Some have argued that the sustained loss-making seen in the ridesourcing sector and consequent strong reliance on successive venture capital injections to underpin operations are inherently anticompetitive in nature, constituting unfair competition with the taxi industry, in particular. This concern has also been raised in other areas of the digital economy, such as in relation to Amazon's long-term loss-making business model.[16]

However, other factors suggest that the risks of market dominance are limited. The OECD has argued (OECD, 2018[28]) that "pricing below cost" tests are not fit-for-purpose as a tool for identifying predatory pricing in platform markets. Instead, the relevant question is whether below-cost pricing is profitable for the platform, either because it makes the platform a stronger competitor by expanding its user base or by preventing rivals from building their own user bases. In the ridesourcing context, a predatory pricing strategy is unlikely to be feasible, as attempts to raise prices after the initial period of building market dominance - a necessary part of an exclusionary predatory strategy – are likely to flounder due to the ability of riders and drivers to migrate to a new rival platform. The ability of both drivers and consumers to "multi-home" – i.e. to use the services of multiple platforms simultaneously – underlines this risk. While there have been instances in which taxi firms have taken legal action against Uber for predatory pricing, some ongoing, none have been successful to date.

In sum, the low level of entry barriers in the industry suggests there is little practical likelihood of predatory strategies being successfully pursued, even by competitors with access to abundant capital.

Regulatory challenges

Political economy

Ridesourcing poses acute regulatory challenges wherever the taxi industry has been subject to restrictive regulation. As noted above, the disruptive potential of ridesourcing is substantial where restrictive taxi regulation has yielded large monopoly rents for taxi industry incumbents and low levels of consumer satisfaction. Conversely, it is in these contexts that the potential benefits are greatest, in terms of economic efficiency gains and service improvement. Where ridesourcing platforms have exploited regulatory ambiguity to undertake rapid entry, strong consumer pressure to accommodate the new service model has often been generated. The first regulatory challenge is that of how to manage the transition from a largely static, heavily regulated industry to a market-driven one.

In markets in which taxi licences (medallions) have acquired large scarcity values, incumbents necessarily face large losses after the entry of ridesourcing. This has often yielded calls for government to compensate incumbents, for example through licence "buy-backs". The body of case law to date, while limited, does not appear to have ever placed a legal obligation on governments to compensate licence-holders – in the taxi industry or elsewhere – for losses of licence value following regulatory changes.[17] However, some governments have made some funding available to former incumbents.

Equal treatment of incumbents and entrants

The principle of equal treatment of incumbents and entrants derives directly from the principle of non-discrimination in law-making. It does not imply that all market segments must be subject to identical regulation, as different business models may require different regulatory arrangements. However, it does imply that regulation should not have the purpose of favouring incumbents over new entrants, or vice-versa.

The practical application of this principle in response to ridesourcing has posed a significant regulatory challenge. The changes to the market for taxi-like services that have followed the entry of ridesourcing have called into question the continued fitness for purpose of much of the regulatory structure applied to

the sector, yet reform efforts have often been piecemeal and inadequate. Common elements of taxi regulation which impede the sector's ability to compete with ridesourcing are:

- *Supply restrictions:* Where ridesourcing has been accommodated in regulation, it has generally been as "For hire vehicles" (FHVs), which have not typically been subject to supply restrictions. In this context, the maintenance of limits on taxi licence numbers effectively places significant limits on the taxi sector's ability to defend its market share against ridesourcing. Some jurisdictions (notably a number of Australian states) have addressed this issue through a combination of taxi licence buybacks, typically at a discount to the already diminished market value of the licences, combined with the subsequent removal of restrictions on taxi licence numbers.
- *Price regulation:* Price regulation is in large part a necessary corollary of restrictions on taxi supply, as it serves to limit taxis' ability to reap monopoly rents from consumers. It also responds to the information asymmetry problem in the street hail market. The major increase in supply caused by ridesourcing, together with the advent of "e-hailing", renders price regulation largely redundant. Regulating taxi prices but not ridesourcing prices limits the former's ability to compete. Conversely, while the "dynamic pricing" model used by ridesourcing services can readily be defended as being economically efficient, it has been criticised on equity grounds, giving rise to pressure for some form of price regulation in this sector.
- *Vehicle standards:* The continuation of other, restrictive regulatory requirements – for example in relation to vehicles and modes of operation - is also increasingly costly in an environment in which ridesourcing is typically not subject to the same constraints (Deighton-Smith, 2018[29]). Conversely, while a number of features of the ridesourcing model imply that the case for safety-based interventions is weaker than in the traditional taxi market (as discussed above), regulators have had to address the question of whether the incentives created are sufficiently strong and reliable as to obviate entirely the need to apply particular types of safety based regulation to the sector. Decision-making is typically complicated by the lack of data on key dimensions of safety. However, as ridesourcing has continued to expand, there are signs of regulatory attitudes coming full-circle – from initial attempts at prohibition, to accommodation via very light-handed regulation, to increasing calls for more detailed regulatory interventions, often in response to widely-publicised but apparently rare incidences of consumer or driver harms.

Regulatory enforcement

Market entry by ridesourcing companies has posed a range of enforcement challenges for regulators. A fundamental issue is that early evidence of significant consumer benefits from, and support for, the disruptive entrant raise questions regarding the appropriateness of the existing regulatory structure and, by implication, the issue of the most appropriate enforcement responses. This factor has led some regulators to make rapid changes in approach. For example, (Flores and Rayle, 2017[30]) highlight the fact that San Francisco's taxi regulators initially issued cease and desist orders to Uber in 2012, but chose not to enforce these after the company failed to comply with them. However, unwillingness to enforce existing regulation necessarily creates pressure to implement regulatory change.

At a practical level, attempts to enforce existing taxi laws have often met with very limited success. This seems to have been particularly the case where action has been taken against individual drivers. Support from ridesourcing platform operators has often meant enforcement actions have been challenged in courts, with the ambiguous status of ridesourcing in relation to pre-existing taxi and for hire vehicle regulation often meaning actions have been unsuccessful. Even where penalties have been applied, the willingness of platform operators to indemnify drivers has meant that enforcement has had limited effect.

The ambiguous regulatory status of ridesourcing has also been highlighted via higher-level enforcement actions; for example, litigation in the European Court of Justice focused on the question of whether Uber provides a transport service or a technology service for the purposes of European law. Enforcement actions

have targeted platform providers and directors in some jurisdictions and have arguably had greater effect. For example, Uber ceased operation of its UberPop service following the imposition of significant fines for the provision of an illegal transport service on both the company and two of its directors by a French court.[18] However, despite this limitation on its service offering, France remained one of the company's largest European markets.

The regulatory enforcement problems encountered by governments in respect of ridesourcing highlight the need to review and revise existing regulatory structures in a timely manner in response to disruptive innovation. This is needed both to ensure that the regulatory regime enables the benefits of these innovations to be maximised and costs minimised and to ensure that any enforcement activity is well-directed, toward addressing real harms, as well as being proportionate and appropriately targeted. That said, the rapid changes in approach to ridesourcing seen in some jurisdictions highlight the risks of undertaking regulatory actions before the market dynamics of disruptive entry are reasonably well-understood and the implications for the economy and society can be assessed.

Regulatory responses

Regulatory approaches being used or contemplated

Regulatory responses to ridesourcing have varied extremely widely, both within and between countries. Governments have differed on the fundamental question of whether to facilitate this innovation or seek to prevent it becoming established. In many cases, initially prohibitive approaches have quickly been reversed, typically in response to strong consumer pressure for it to be accommodated by the regulatory system. This includes Finland, where Uber was ruled illegal by the Court of Appeal in 2016, but where new legislation subsequently authorised its operation in 2018, and Victoria, Australia, where initial prosecutions of Uber drivers by the Taxi Services Commission gave way to new legislation explicitly recognising ridesourcing and providing for an integrated regulatory structure to govern all types of passenger vehicle services. However, ridesourcing continues to be prohibited or subject to onerous restrictions in many countries.

Moreover, the initially light-handed approaches to the regulation of ridesourcing taken in many jurisdictions appear to be giving way to more interventionist models, as the sector grows and evolves and additional policy issues associated with its operation become more apparent. The following highlights a range of regulatory responses that have been adopted in one or more jurisdictions to address these issues and discusses the potential performance of these approaches. Many of these interventions come from parts of the United States (New York City Area in particular) where the ridesourcing industry benefits from a relatively long history, a broadly permissive regulatory environment and, consequently, a high level of market penetration.

Congestion charges

Fleet-wide congestion charges are in place in only a few cities globally (notably London, Manchester, Milan, Singapore and Stockholm). However, several cities have applied congestion charges specifically to the ridesourcing sector, while some have also applied these charges to the taxi sector. While there is strong support among economists for general congestion charges, it does not follow that sector-specific congestion charges necessarily constitute an effective and equitable intervention. Proponents of such policies argue that:

- Unlike private cars, ridesourcing vehicles do not pay parking fees when operating in congested central city areas. As parking fees are increasingly being used to encourage modal shift – i.e. functioning as a de facto congestion charge – a ridesourcing specific congestion charge can be seen as an alternative means of achieving the same policy objective.

- Ridesourcing vehicles' near constant movement (both while carrying paying passengers and, typically, cruising between jobs) and their tendency to block traffic during pick-up and set-down activity mean that, per vehicle, they make a larger contribution to congestion than private cars.
- Ridesourcing vehicles and taxis can collectively constitute a very large proportion of the vehicle fleet in some dense inner-urban environments, where congestion and pollution concerns are greatest.

The design of sector-specific congestion charges adopted to date varies substantially. On one hand, New York City has adopted a flat-rate charge of USD 2.75 in respect of any taxi or ridesourcing trip entering the Manhattan core, as one of a suite of tools intended to address congestion and pollution concerns, including limits on licence issue and fleet numbers. On the other, Sao Paolo's ridesourcing-specific congestion charge[19] is much more complex. While based on a per mile charge, a system of "discounts" means the amount paid varies according to a range of parameters. While some are congestion-related (i.e. off-peak and weekend discounts), other relate to different policy objectives. These include whether the vehicle is accessible, is electric or hybrid powered, or is driven by a woman.

The principle of equal treatment of entrants and incumbents would suggest that such charges should be applied consistently to both the taxi and ridesourcing sectors. However, this approach is not always adopted. For example, while the NYC charge applies to both sectors, London recently ended ridesourcing's exemption from its fleet-wide congestion charge, while retaining the exemption for (black) taxis.

Other sector-specific charges

While relatively few cities adopted explicitly congestion-related, ridesourcing-specific charges to date, ridesourcing-specific charges based on other policy rationales are widely adopted. The two most common reasons advanced to justify such charges are:

- to address the negative social and economic impacts of the disruption of the taxi industry caused by ridesourcing
- to address strains on the viability of transit systems, which are in some cases said to be exacerbated by ridesourcing's impact in reducing ridership.

Revenues raised by these charges sometimes flow to general government revenue, but are more commonly hypothecated, typically to more than one purpose. For example, in Washington DC and Chicago, revenues are largely directed to funding the transit system. In Mexico City and Massachusetts, proceeds flow to city or State transport funds, with a proportion being directed to support the taxi industry. In Calgary, revenues support the improvement of an accessible taxi programme, while in Philadelphia funds are split between the school system and the parking authority (International Transport Forum, 2019[26]).

Several Australian State governments (e.g. Victoria, New South Wales, Western Australia) have imposed flat per-ride surcharges on the taxis and ridesourcing sectors, with the revenue being entirely hypothecated to funding schemes established to compensate taxi licence-owners for losses in licence values following the entry of ridesourcing. These schemes are notable in two respects. First, the per-ride surcharges adopted are intended to be time-limited, rather than permanent – albeit that their expected duration is several years. Second, the assistance provided to taxi licence-owners has been structured as part of a move to an open-entry taxi system, enabling the sector to compete for market share on a level playing field with ridesourcing[20] (International Transport Forum, 2019[26]). This latter initiative stands in contrast to the more common situation in which, despite the former value of taxi licences having been substantially eroded by competition from ridesourcing, governments have retained entry restrictions, thus supporting these residual values, which appear to reflect the value of taxis' continued monopolies on the street hail and rank markets.

Fleet size limits/freezes on licence issue

As noted above, the New York City government imposed a 12 month moratorium on the issue of ridesourcing driver licences in August 2018 and has subsequently extended the freeze for a further year. This is one of a suite of regulatory responses to the rapid expansion of ridesourcing that appear to be untried in other markets. It also empowered the regulator (the Taxi and Limousine Commission – TLC) to regulate the size of the ridesourcing fleet on a permanent basis in August 2018, while a June 2019 TLC report has proposed "tighter regulation of the number of licensed FHVs moving forward" (New York City Taxi and Limousine Commission and Department of Transportation, 2019[31]), modelling the impacts of this recommendation on the basis of an 8% reduction in current active FHV numbers.

These initiatives respond to concern that the very rapid growth of the ridesourcing sector was contributing significantly to worsening congestion. The TLC stated in 2018 that these measures were adopted as "second best" policies, after the failure of a proposal for the State government to adopt congestion charging in Manhattan for all private vehicles.

Fleet size limits constitute an indirect and inefficient response to congestion concerns, for several reasons. First, they target only a small part of the fleet – albeit one that has a high level of activity in the most congested areas – so necessarily have limited effectiveness. Second, they limit the ability of ridesourcing companies to operate throughout the licensed area, rather than specifically addressing areas of major congestion concern. A likely consequence of this is that any shortage of services will be felt in less well-served outer areas, rather than via a reduction in activity in the urban core. Uber reported in July 2019 that its analysis of trip data shows that poorer areas of the city have become relatively less well-served since the cap and other measures have come into effect.[21] Modelling of the TLC's proposal for tighter regulation of FHV numbers also shows that the negative impacts on service would be concentrated in the outer boroughs, rather than the city centre (New York City Taxi and Limousine Commission and Department of Transportation, 2019[31]).

Data show that the number of trips per day undertaken by ridesourcing vehicles continued to rise for seven months after the freeze was adopted and that, while it fell over the five subsequent months, the fall was significantly smaller in percentage terms than the number of trips undertaken by taxis over the same period.[22] A second proposal to adopt a congestion charge on all private vehicles was adopted by the NY State government in March 2019, however, no change to the fleet size restriction policies has been announced to date.

The adoption of fleet size limits appears not to have become a widespread regulatory response since the mid-2018 announcement of the New York City policy, however. In fact, a number of governments have explicitly rejected proposals along these lines. For example, a recent decision by Vancouver's Passenger Transportation Board explicitly rejected proposed limits on fleet size, as well as surge pricing, having concluded that these are "…*key to the models of ridehailing companies*".[23] Similarly, in 2019, the United Kingdom government rejected the recommendation of an independent review that local authorities be empowered to set limits on the size of ridesourcing fleets.[24]

Minimum utilisation rates

The New York TLC was empowered in 2018 to set minimum utilisation rates (otherwise referred to as "cruising limits", as they effectively limit the proportion of the time ridesourcing vehicles are allowed to be unoccupied, or cruising for work. In its June 2019 report (New York City Taxi and Limousine Commission and Department of Transportation, 2019[31]), it recommended that the city government adopt a cruising limit of 31% in the Manhattan core. This would represent an 8.2% reduction from the then current average of 39.2%, although the report noted that one ridesourcing company already meets this standard and that cruising levels are lower in some outer boroughs than in Manhattan. It is proposed that companies would be given one year to reach compliance, after which they would be faced with escalating fines and licensing

sanctions. Compliance would presumably require ridesourcing companies to refuse some drivers access to the App within the relevant geographical area, though the mechanics of this are not explained in the report. The report models the outcome of applying this policy in conjunction with its proposed tightening of restrictions on FHV numbers (see above) and concluded that a 24% reduction in FHV hours travelled within the Manhattan core would initially result, with a 13% increase in waiting times.

The proposed minimum utilisation rates would not apply to taxis. The TLC report does not explain the rationale for this differentiation between the two sectors. It is particularly notable given that current utilisation rates are significantly lower for yellow taxis than ridesourcing vehicles,[25] while yellow taxis are more strongly concentrated in the Manhattan core than are ridesourcing vehicles.

Return to base requirements

Some jurisdictions (e.g. Germany[26]) have regulated to require ridesourcing vehicles to return to their depots after each ride is completed. These rules have in some cases been justified as means of minimising congestion and pollution issues by reducing the time ridesourcing vehicles spend cruising the streets while waiting for their next engagement. Alternatively, they are seen as attempts to enforce in practice the requirement that for hire vehicles are restricted to serving the pre-booked market, with taxis retaining the monopoly of the street hail and rank markets. However, there are clear efficiency costs associated with such requirements, while they can also be seen as contrary to the principle of equal treatment of incumbents and entrants.

Driver income initiatives

New York City has also responded to concerns about driver incomes and working conditions by moving to regulate ridesourcing driver incomes. The “Driver Income Rule”, adopted after an independent review (Parrott and Reich, 2018[1]), is intended to guarantee a minimum, post-expenses hourly income for drivers, at a level equivalent to the NYC minimum wage. It is also intended to provide a financial incentive for ridesourcing companies to increase their fleets’ utilisation rates, thus reducing ridesourcing’s contribution to congestion. To achieve these two goals, the rule specifies minimum per-trip payment requirements via a formula which includes time and distance elements, modified by an utilisation rate. In practice, the minima payable per mile and per minute are higher where a ridesourcing company has a lower utilisation rate, and vice versa. The intended outcome is that the minimum hourly driver income will not change with the company’s utilisation rate. Its designers estimated that the rule would increase the average net incomes of drivers previously receiving less than the minimum wage by 22%.

Limited data on the impact of the rule are available, as it took effect only in February 2019. However, reports from June 2019, based on data compiled by the regulator, found that post-expense driver incomes hat increased from $ 14.22/hr to $ 16.63/hr, though short of the target of $ 17.22/hr. Conversely, while the income formula’s designers predicted price increases of less than 5% and increases in waiting times of 12 – 15 seconds due to moves to raise utilisation rates, early reports suggest that price increases have been of the order of 10 – 20%, while ridesourcing trip numbers fell by almost 16% between March and August 2019. Notably, while Lyft challenged the rule on the basis that the utilisation rate element unfairly disadvantaged smaller competitors who were less able to keep utilisation high, the reduction in trip numbers appears to have been predominantly felt by Uber, which saw an 18.7% reduction in trip numbers from March to July 2019.[27]

The rule applies only to ridesourcing drivers, despite concerns regarding taxi driver income levels being at least as acute. The regulator notes that the formula-based approach is not applicable to the taxi business model, while other efforts (notably capping licence lease fees) have previously been implemented in attempts (albeit unsuccessful) to support taxi driver incomes. However, the differential approach to the

strongly competing taxi and ridesourcing sectors necessarily raises concerns regarding the principle of equal treatment of incumbents and entrants.

Accessibility requirements

Another, apparently unique NYC regulatory initiative is the adoption, in late, 2017 by a rule requiring that 5% of FHV dispatches (including ridesourcing) be of accessible vehicles as from January 2019, rising progressively to 25% by 2024 (New York City Taxi and Limousine Commission and Department of Transportation, 2019[31]). The Rule sets the target in terms of the number of dispatches, which provides FHV dispatchers with flexibility to determine how many accessible vehicles they need in order to meet the 5% requirement. The NYC Rule appears to be the first to regulate the provision of accessible services by ridesourcing companies.

Notwithstanding long-standing government policies supporting the expansion of the number of accessible vehicles in the taxi fleet, activists brought and settled a discrimination suit against the city government in 2013. The terms of the settlement led to the adoption of a Rule requiring that 50% of the taxi fleet be wheelchair accessible by 2020.

Overview

Ridesourcing brings important economic efficiency benefits and has been embraced enthusiastically by consumers where it has been able to operate relatively freely. This necessarily implies that attempts to prohibit its operation or regulate it in unduly restrictive ways will have real welfare costs. This suggests that they are unlikely to succeed in the long term. Nonetheless, ridesourcing remains either prohibited or heavily restricted in its operations in many jurisdictions. In other jurisdictions in which ridesourcing has been accommodated by the regulatory system and the sector has grown to maturity, there are increasing signs of more interventionist regulatory approaches developing.

A key issue is that ridesourcing-specific regulations seek to deal with externality issues that are of more widespread concern. For example, while ridesourcing may have had significant effects on congestion in some cities, policies such as limits on the fleet size or utilisation rate of the ridesourcing sector are clearly second-best when considered in the absence of a congestion charge that addresses the contribution of the whole vehicle fleet to this issue. Similarly, where there are concerns regarding the impact of the "gig economy"' on employment terms and conditions, attempts to set minimum income rules for this sector constitute an inadequate substitute for policies that address broader deficiencies in employment laws. The long-term influence of the taxi sector on the political process suggests that pressures to adopt such sector-specific rules may be motivated, at least in part, by desire to influence the competitive position of ridesourcing vis-à-vis the traditional taxi sector.

Role of regulatory policy tools in tackling the regulatory challenges

The 2012 Recommendation of the OECD Council on Regulatory Policy and Governance (OECD, 2012[32]) highlights the importance of the tools of regulatory policy as promoting evidence-based policy making and thereby ensuring that regulations are of high quality, in the sense that they confer benefits on the society that are larger than the costs they impose and thus contribute to social well-being. Ensuring that the key regulatory policy tools are applied in a timely and systematic way can contribute substantially to ensuring that governments develop optimal regulatory responses to the opportunities and challenges posed by the development of the ridesourcing market. In particular:

Conduct reviews of significant regulation against clearly defined policy goals

The above discussion highlights the need to review and revise the body of taxi regulation in response to the innovations and challenges brought by ridesourcing. Widespread and long-running dissatisfaction with the body of taxi regulation in many jurisdictions, with common charges of "regulatory capture" underlines the need for coherent and systematic approaches to the review task. As the Recommendation notes, reviews should be conducted having regard to clearly identified and defined policy goals. Such approaches are particularly important in the context of taxi regulation, which has developed in incremental and ad hoc ways in most countries and has rarely been subject to first principles reviews.

The need for *ex post* review also extends to regulation adopted in response to the development of ridesourcing. Indeed, the risk of regulatory failure is relatively higher in contexts in which existing markets are disrupted by new business models and policy makers are poorly placed to predict or understand their likely impacts on markets and the broader economy.

Integrate regulatory impact assessment (RIA) into the early stages of the regulatory process

RIA is a fundamental tool of evidence-based policy making. It is based on the key principles of clearly specified policy goals, systematic identification of all options capable of achieving the goals, careful analysis of the benefits and costs of each option, with definition of an appropriate baseline scenario (which in rapidly transforming contexts will typically require a dynamic perspective), quantification of impacts wherever feasible, and a rigorous comparison of the impacts of the options against explicit criteria.

The RIA discipline thus increases transparency as to the implications of different regulatory choices and highlights the broader social costs of regulation that favours sectional interests. These characteristics are particularly important given the history of taxi regulation and can highlight areas in which proposals to regulate ridesourcing are driven primarily by (or would have the effect of) defending the impacts of incumbents, at significant cost to consumers. This is likely to be particularly important in relation to externality issues such as congestion and pollution, where a clear focus on the relative performance of different policy tools is needed to ensure sound policy choices.

Adopt principles of open government, including transparency and participation in the regulatory process

Citizens are increasingly asking to be involved throughout the policy cycle to ensure that policies address their needs and demands and that their opinions and concerns are heard. This new culture of governance, which places citizens and other stakeholders at the centre of public policies and service delivery, is known as open government. It is defined by the OECD as "*a culture of governance that promotes the principles of transparency, integrity, accountability and stakeholder participation in support of democracy and inclusive growth*" (OECD, 2017[33]). The Recommendation of the Council on Open Government recognise that many intermediary forms of participation exist, and maps the different existing relationships between citizens and governments, ranging from weaker to stronger forms of participation: information, consultation and engagement (OECD, 2017[33]).

Enabling effective participation in the regulatory process is also a means of preventing the outcome being captured by well-organised special interests, develop tailored and more responsive regulatory proposals as stakeholders provide their expertise and perspective on areas in which governments have less knowledge and understanding, making them more likely to achieve their objectives. It exposes claims to scrutiny and brings forward different perspectives.

Recognise their shortcomings and potential areas for improvement

More importantly, if government policy making is transparent, accountable and participatory, there will be more stakeholder buy-in with the proposals and ultimately more trust and compliance with the regulatory proposal. Wide and inclusive participation in regulation-making can also help to identify unanticipated impacts of regulatory proposals, as well as providing information the acceptability or perceived legitimacy of proposals. Involving a greater range of voices, particularly marginalised demographics, will give governments greater insight into service gaps and necessary reforms. However, participation opportunities must be well-designed, to ensure that all relevant interests are able to engage effectively. Failure to do so can lead to unbalanced outcomes and enable organised interests to prevail and lose confidence n the regulatory process

The strongly differing perspectives on key issues in the taxi and ridesourcing sector, including the implications of ridesourcing for service availability, accessibility and equity, congestion and pollution, and employment conditions make it particularly important that policy making incorporate open government principles. This helps ensure both that all perspectives are brought forward and that they are subject to sustained, critical scrutiny.

Conclusion

The ridesourcing model has the potential to deliver significant economic efficiency benefits, while also being among the most disruptive market innovations of recent years. The size of the available welfare benefits means that governments should adopt a generally permissive regulatory approach which does not unnecessarily inhibit the realisation of these gains (International Transport Forum, 2019[26]). This implies adopting an even-handed approach as between incumbents and new entrants, rather than seeking to manage or minimise disruption via interventions that would limit the ability of ridesourcing to compete and reduce the available welfare benefits. Such an approach should include both accommodating the ridesourcing model within regulatory frameworks and reviewing and reforming outdated taxi regulation that can undermine taxis' ability to compete effectively.

At the same time, the existence of legitimate consumer protection concerns, equity issues and externality impacts implies that new or enhanced regulation is likely to be required. Such regulatory interventions should be based on addressing clearly identified market failures and equity issues and a sufficiently clear understanding of the nature of new services and the emerging market in which they operate are sufficiently well-understood, to avoid imposing ineffective regulation with unanticipated costs.

Notes

[1] https://www.statista.com/outlook/368/100/ride-hailing/worldwide.

[2] www.toddwschneider.com.

[3] These were Juno, Lyft, Uber and Via. Driver Income Rule: https://www1.nyc.gov/assets/tlc/downloads/pdf/driver_income_rules_12_04_2018.pdf.

[4] https://ride.guru/content/resources/rideshares-worldwide.

[5] The former has a significant stake in Lyft, while the latter is offering a taxi-hailing service in Tokyo.

[6] And, to a lesser extent, the phone booking market.

[7] Transportation network companies "use online platforms to provide rides on demand by connecting passengers with drivers using their private vehicles based on real-time information" (Diao, Kong and Zhao, 2021[7]).

[8] This include the higher average occupancy of ridesourcing vis-à-vis taxis (Rayle et al., 2016[9]), research indicating that the availability of car sharing options reduced car ownership, wider modal-shift impacts of using ridesourcing, the impact of surge pricing in moving trips to less congested times and higher capacity utilisation in ridesourcing than taxis (citing Cramer and Kruger 2016

(Cramer and Krueger, 2016[12]), who find that "the efficiency of Uber is much higher than traditional taxis" due to higher utilisation rates).

[9] The 25 the percentile average wage was found to be USD 13.31 per hour. Note that the NYC minimum wage will rise to USD 15 per hour from end-2019, https://www.labor.ny.gov/workerprotection/laborstandards/workprot/minwage.shtm.

[10] i.e. After payment of social security contributions and other charges paid by employers of wage-earning employees.

[11] https://www.supremecourt.uk/cases/docs/uksc-2019-0029-judgment.pdf.

[12] https://www.nytimes.com/2021/03/16/technology/uber-uk-drivers-worker-status.html.

[13] Dynamex Operations West Pty Ltd vs Superior Court. https://scocal.stanford.edu/opinion/dynamex-operations-west-inc-v-superior-court-34584.

[14] https://www.reuters.com/article/us-uber-california-drivers-iduskbn27805f.

[15] https://www.latimes.com/business/technology/la-fi-tn-uber-ipo-lyft-fare-increase-20190511-story.html

[16] See, for example: https://www.yalelawjournal.org/note/amazons-antitrust-paradox.

[17] In the taxi context, the predominant body of case law comes from Ireland and follows the removal of supply restrictions in 1999. Other cases also come from the United States.

[18] The decision was upheld on appeal to the European Court of Justice. An initial ruling concluded that ridesourcing services were transport services, rather than IT services, as Uber had argued. https://www.ft.com/content/317b96dc-3c96-11e8-b9f9-de94fa33a81e; https://curia.europa.eu/jcms/upload/docs/application/pdf/2017-12/cp170136en.pdf.

[19] For a discussion of the Sao Paolo congestion charge, and its rationale, see (Biderman, 2018[34]).

[20] Taxi licences, which had retained a residual value of around AUD140 000 after ridesourcing was legalised, are henceforth available on demand at administrative cost. At the same time, driver licensing has been integrated across the taxi and ridesourcing sectors and vehicle standards have been harmonised, with a number of previous taxi-specific standards eliminated.

[21] https://nypost.com/2019/07/22/uber-says-de-blasios-ride-share-rules-hurt-poor-new-yorkers/.

[22] Between March and August 2019, ridesourcing trip numbers fell approximately 15.7%, while taxi trip numbers fell 22.7%. See https://toddwschneider.com/dashboards/nyc-taxi-ridehailing-uber-lyft-data/.

[23] https://vancouversun.com/news/politics/no-supply-caps-or-price-surge-restrictions-for-ride-hailing-companies-in-b-c.

[24] The report of the "Task and Finish Group": https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/745516/taxi-and-phv-working-group-report.pdf. The government response is summarised here: https://www.inlinepolicy.com/blog/new-regulations-for-taxis-and-ride-hailing-in-the-uk.

[25] As of August 2019, ridesourcing vehicles covered 1.9 trips of 18 minutes duration per active hour, for an average of 34.2 active minutes per hour, of 57% active time, while taxis covered 1.9 trips of 14.3 minutes duration, for an average of 27.2 active minutes per hour, or 45.3% active time. See: www.toddschneider.com.

[26] https://www.nytimes.com/2018/11/19/technology/uber-growth-ipo-germany.html.

[27] See http://www.businessinsider.fr/us/uber-lyft-rides-decline-after-new-york-minimum-wage-2019-7; www.toddschneider.com.

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6 Case 5. Regulatory challenges brought by technologies and business models for smart logistics

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Safely deploying drones in delivery services requires testing and experiments in various service environments. However, the number of facilities where the experiments can be conducted is still too small and the authorisation process is complicated. The development of robotics and IoT technologies, in turn, has led to the creation of various express delivery services. This case study concludes that it may be beneficial to consider relaxing existing regulations in Korea so offline retailers can compete with online retailers on equal terms. In a similar vein, there is a need for standardising technical components for truck platooning technology, as well as for undertaking regulatory reform in areas such as the use of pedestrian image and object location information, while taking better account of autonomous driving's implications.

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Introduction

In this chapter, we introduce relevant technologies and services for smart logistics and discuss future directions for regulatory policies in South Korea. To this end, we first explain the role of key technologies for smart logistics. Then, we explore the market size and prospects of services based on these technologies. This resulted in three main topics emerging in the field of smart logistics: drone delivery, express delivery services, and autonomous trucks with platooning.

Smart logistics overview

Smart logistics can be broadly defined as an intelligent logistics system to control, manage, and operate all logistics activities in real time through integration with newly emerging technologies such as Information and Communication Technology (ICT), Artificial Intelligence (AI), robotics, etc. We start this section by introducing the concepts and key technologies with a market outlook.

Concepts and key technologies of smart logistics

Smart logistics are available with the rapid development technologies that can be applied to the transportation of goods and services securely, automatically, and more efficiently without human labor. Below, we summarise eight key technologies that constitute smart logistics.

Artificial intelligence (AI)

AI provides opportunities to save time, reduce costs, and increase productivity and accuracy. AI-based predictive information is used to enable the proactive operation of logistics activities.

The use of artificial intelligence is expected to reduce physical labor in smart logistics significantly. In other words, by combining AI-powered robots, computer vision systems, interactive interfaces, autonomous vehicles, etc., it is possible to add convenience to human labor in logistics operations. Intelligent robots can efficiently and quickly sort out shipments in the form of letters, parcels, and pallets and sort and scan millions of shipments that have been handled by existing personnel.

Robotics

One of the most formidable challenges facing the logistics industry today is the availability of labor. With the development of e-commerce, the volume of shipments has increased along with a corresponding rise in the demand for logistics workers to handle the increased volume. It is expected that a decrease in the size of the available working population will occur due to a decrease in population. Robotics is emerging as a countermeasure to solve this problem in an effective manner, and robots deployed in logistics will take the form of “eyes, hands, feet, and brains”

Augmented reality

Augmented reality can fuse the boundaries of the digital and physical worlds to provide new perspectives on logistics planning, process execution, and transportation.

Big data analysis

Innovation in logistics systems can be implemented through new ways of data collection, analysis, and forecasting. With digitisation, vast amounts of data are collected as part of numerous logistics processes. Therefore, data-based analysis can be utilised to derive new business models based on the optimisation of logistics capacity, improvement of customer environment, and risk management using big data.

Internet of Things

The Internet of Things (IoT) has the capability to connect all things to the Internet and accelerate data-based logistics. Everyday objects can transmit, receive, process, and store information, which can be used for autonomous and event-driven logistics processes.

Next-generation networks and communication technologies are the basis for the implementation of IoT technology in the overall logistics environment. In the field of logistics, next-generation intelligent networks can improve cost efficiency, connectivity, and localisation. Logistics with transparency and traceability is becoming increasingly popular in the logistics and supply chain with new Low-Power Wide Area Networks (LPWANs), 5G, and low-orbit satellites that have emerged as next-generation communication technologies.

Virtual reality

Virtual reality in logistics has evolved in the areas of manufacturing, distribution, and supply chains. By allowing users to design, simulate, and evaluate environments in 3D, logistics providers can make better informed decisions to optimise logistics flows and monitor processes.

Drones

Drones are not only utilised for the first and last delivery, but also for production logistics and surveillance. Drones will not become a substitute for traditional land transportation but will be valuable in places where access is dangerous or where delivery is required remotely. Drones are not subject to traffic jams, and can be an effective tool to ensure on-time delivery services. Drones' delivery distances are usually quite restricted due to their limited battery size. However, by co-operating with trucks that can hold and charge drones, the distance of drone delivery services can be significantly expanded.

Blockchain

Blockchain technology ensures transparency and traceability within the supply chain. In addition, it supports rapid and concise international trade logistics, contributing to the process automation of logistics. In international trade logistics including procurement, transportation management, tracking, customs co-operation, and trade financing, the expedited documentation and handling of freight with blockchain can reduce time and costs significantly.

We introduce five representative facets of smart logistics (transportation, storage, information, connectivity, packaging, and unloading) in Table 6.1.

Table 6.1. Facets of Smart Logistics

Type	Definition	Technology cases
Transportation	Carrying cargo to the destination by using various transportation methods	• Drones and small delivery robots used in urban and suburban areas to reduce logistics costs • Smart truck SW for control and monitoring of the whole process of logistics transportation
Storage	Activities to store and manage goods indoors and outdoors such as yards, warehouses, and houses	• Smart Fully Automatic Unmanned Logistics Center to Improve Labor Convenience • Optimal placement facility technology to improve the storage efficiency of the warehouse
Unloading	Loading and unloading and the transporting of cargo in logistics facilities that handle cargo, such as cargo terminals	• Automatic loading and unloading / picking system using robots to shorten the loading time and improve accuracy • Augmented / virtual reality based wearable devices to improve the working environment
Packaging	Activities to protect the quality and value of cargo, to facilitate storage and handling, and to promote product sales, from production to consumption	• Smart label technology to improve the visibility, quality assurance and traceability of packaged products • A cyclic logistics packaging system (RTPS) for organic and systematic management and the control of goods and information in the supply chain to support the recovery and reuse of transport packaging containers
Information	Information technology to effectively process various data generated and traded in the logistics process, and to support the organic flow of information disconnected from the logistics supply chain.	• IoT-based logistics information system to improve the speed of logistics processing and services • Technology using cloud-based big data to optimise the courier paths and thereby improve arrival time accuracy

Source: Ministry of Land, Infrastructure and Transport, Korea.

Market outlook for smart logistics

Smart logistics systems are evolving thanks to the integration of ICT technology. Since it is difficult to distinguish an independent market for smart logistics, in this section, we estimate the market demand for smart logistics in terms of the market outlook for closely related sub-fields.

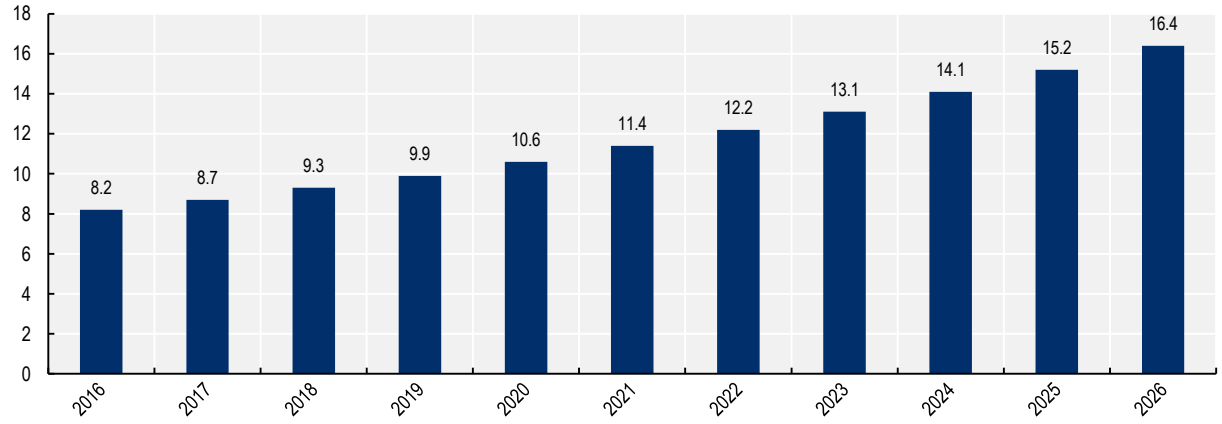
First, we consider the size of the Third-Party Logistics (3PL) market as a specialised logistics industry. As shown in Figure 6.1, the global 3PL logistics market is expected to grow from USD 8.7 trillion in 2017 to USD 16.4 trillion in 2026 (CAGR 7.3%). In particular, demand related to e-commerce has witnessed a steep increase. The demand for improved inventory management, delivery systems, and freight forwarding is expected to drive growth in the overall logistics market.

Next, we estimate market outlooks for smart logistics with the market outlook for technologies closely related to smart logistics, including Automated Guided Vehicles (AGVs) and Drones.

Market outlook for AGVs

Automated Guided Vehicles (AGVs) refer to a system that assists transporting items in manufacturing facilities, warehouses, and distribution centers without any permanent conveying system or manual intervention. The global AGV market was valued at USD 3.39 billion in 2020, and CAGR is expected to be 13% from 2021 to 2028 (Grand View Research, 2021[1]).

Figure 6.1. Global logistics market size forecast (trillion USD)



Source: TMR (Transparency Market Research, 2016[2]).

According to the market research institute Markets and Markets, the global market for Unmanned Ground Vehicles (UGVs) for industrial self-driving land vehicles is expected to grow to USD 2.3 billion in 2020 to USD 4.5 billion by 2030 due to increasing use in commercial sectors. (Markets and Markets, 2020[3]).

Global market size for commercial drones

The global market for drone transportation and logistics was estimated at USD 12 Billion in the year 2020 and is projected to reach a size of USD 45.5 Billion by 2027, growing at a CAGR of 21% from 2020 to 2027. Specifically, the global commercial drone market is projected to record 22.1% CAGR and reach USD 33.6 Billion by the end of 2027. According to the United States Federal Aviation Administration (FAA, 2019), the number of commercial drones registered between 2019 and 2023 is expected to triple. For the calendar year 2018, more than 175 000 commercial owners/operators registered their equipment. By the end of 2018, there were more than 277 000 non-model aircraft registered since registration opened. FAA projected the non-model SUAS (Small Unmanned Aircraft System) sector will have over 835 000 aircraft in 2023 (Global Industry Analysts, 2021[4]) (Federal Aviation Administration, 2019[5]).

Emerging topics in smart logistics

Based on the key technologies and market outlook for closely related sub-fields of smart logistics, we observed that the key features of smart logistics include drone-based delivery, automation (without human labor) in terms of new technology, and reliable and high-speed delivery services in terms of new business models. Thus, this section focuses on three major topics that are emerging in the area of smart logistics: drone delivery, express delivery services, and autonomous transportation with truck platooning. We investigated the roadmap for technological development regarding each topic. Further, we examined the current and future regulatory status as well as planned changes. Last, we identified regulatory challenges where the planned or current regulations may have room for improvement in order to incorporate new technologies and business models. A brief summary of the three topics is provided below, and the topics will be discussed in detail in the next sections.

1. Drone delivery: Recent developments in technologies for motors, robotics, and telecommunication are opening an era of drone-based transportation as a mode of smart logistics.
2. Express delivery services: Based on Online-to-Offline (O2O) technologies, the boundary between online and offline has blurred, and logistics companies are now capable of providing express delivery services with smart logistics.

3. Autonomous trucks with platooning: Advances in autonomous driving techniques have enabled (semi)-automatic transportation through the platooning of trucks, which can support the majority of ground transportation logistics.

Smart logistics with drones

Attempts to utilise drones for delivery have gained momentum worldwide. Delivery volume and the speed of delivery facilitated by drones have emerged as the competitive power for many business models. Therefore, most companies are in the process of increasing their workforces and equipment investments in the area. However, the return on these investments has decreased due to the limited on-ground capacity. As increased costs of logistics mostly drive the cost for the last mile delivery, drone delivery services can be a viable solution to increase the efficiency of last mile delivery services.

Delivery using drones can be classified into two categories: i) direct delivery by drones and ii) the collaboration of drones with trucks. In areas with sufficient logistics centers, drones can be utilised to ship directly from warehouses to consumers. If the delivery distance is long, carrying a drone on a truck may be suggested. When co-operating with trucks, drones are transported to a flyable distance, from which they complete delivery and return to the truck.

Drone-only delivery

The advantage of using drones for delivery is that it can reduce costs and delivery time, is more environmentally friendly, and is free from road conditions. However, drone delivery involves the issues of safety, noise, and accessibility because the delivery takes place by air. Accordingly, commercialisation has been limited due to various regulations regarding aviation.

Starting with Google's affiliated company Wing, companies such as Amazon and Uber have also been trying to obtain permissions from the various aviation administrations. The service has been started or tested mainly in small cities or suburban areas. Due to the limitation of battery capacity, the delivered packages mostly weigh less than 5kg and the flight range is mostly within a radius of 10 kilometers. While drones are currently used to mainly deliver small items, as technology evolves, they will be equipped to accommodate more weight and will become the future version of last mile delivery. Examples of the most up-to-date drone delivery technologies are introduced in the following paragraphs.

Drone delivery by Google Wing

In April 2019, Google's affiliate Wing started operation and this was recognised as the first commercial application of drones in the United States by the Federal Aviation Administration. It launched its drone delivery service in Christiansburg, Virginia, USA on 18 October 2019. The US aviation authorities did not insist on regulating drone delivery, but opened the way for the 'drone delivery' business with a regulatory solution that applied an existing charter license.

So far, long distance commercial delivery using drones has not been permitted in the United States. The US drone regulations that were enacted in 2016 prevent commercial drones from flying out of the pilot's sight. Long-range drone flights were only allowed for testing purposes. Because of this, Wing was authorised to ship commercial drones in Australia, instead of the United States.

Google Wing delivered more than 100 of Walgreen's orders via drones that day. James Ryan Burgess, CEO of Wing, said, "*Christiansburg, a small town with a population of 22 000, is easy to fly in drones because it doesn't have many high-rise buildings and obstacles. The goal is to deliver items with a maximum weight of 1.5kg as soon as they are ordered*".

The Wing drone with a wingspan of 1.5m and a weight of 4.5 kg is capable of carrying objects weighing up to 1.5 kg and flying at a speed of up to 113 km per hour. It is equipped with an additional motor to prevent falls and all flights are supervised remotely by the pilot. There are plans to expand the flight radius from four miles (about 6.4 km) to more than 12 miles (about 19.3 km). Amazon's experiment on drone delivery

One of the companies that experimented with delivering goods by drone is a part of the global e-commerce company, Amazon. In July of 2016, Amazon launched a drone delivery service called Amazon Prime Air. Amazon attracted attention by completing delivery via drone to customers living near Cambridge, England. All of the delivered goods weighed more than two kilograms, including TV set-top boxes and popcorn. At that time, delivery took about 13 minutes.

Given that the delivery time for the existing "Amazon Prime" delivery service is about two hours, delivery service through drones is expected to significantly shorten that time. The industry expects that delivery via drones will account for more than 80% of all deliveries in the next five years, especially since fast delivery services are gaining popularity.

Drone-truck co-operation for delivery

Long distance delivery with drones is being made possible by loading drones onto trucks. This compensates for the drawback of drones for long distance delivery. It can also overcome the inefficiency of truck deliveries owing to geographical conditions that restrict ground transportation.

Drones are loaded with cargo in autonomous trucks, and the drones are dispatched to deliver goods to their final destinations as they move around the shipping area. After delivery, they return to the autonomous truck and their battery starts recharging. Drones check addresses and deliver packages to the final destinations automatically.

UPS's drone truck co-operation

On February 20, 2017, the UPS tested a hybrid electric autonomous truck and a drone to transport cargo. The test was conducted in Tampa, Florida, where the population is low, reflecting the characteristics of drones that are unsuitable to fly over long distances. The UPS explained that drone delivery would provide faster and cheaper shipping. Unmanned aerial vehicles also save fuel and time because there are fewer stops.

The UPS claims that reductions of up to 1.6 km per day per delivery could save up to USD 50 million a year. They could also enhance the efficiency of delivery and reduce the costs of redundant operations. Unmanned aerial vehicles also save fuel and time because there are fewer stops.

However, regulations are holding back development of this technology. Under the Federal Aviation Administration (FAA) regulations, it is difficult for UPS drivers to monitor the drone's flight status at all times, which reduces the mileage and delivery time of drone-truck co-operation.

Amazon's patent on drone-truck co-operation

On 24 December 2019, Amazon registered a unique drone-related patent (registration number: US10514690) with the United States Patent and Trademark Office (USPTO). The patent describes how to build a system to support co-ordination between unmanned autonomous vehicles and drones.

Both ground vehicles and drones are managed by a central system. The ground vehicle is dispatched for delivery after completing the loading and unloading in the warehouse, and starts the deliveries in order. When the ground vehicle arrives near the customer's address, the drone does the other part of the service that used to be the driver's job. The drone loads the goods from the vehicle and places the order in front of the customer's front door, on the balcony, or at a designated location.

With this system, drones do not need to travel long distances. This is because the ground vehicle approaches a point that is at least three meters away from the destination. The drone does not fly the long distance from the warehouse to the destination, so there are no battery concerns. The risk of accidents is reduced and the probability of noise problems is low, as it does not pass over people or private property.

The ground vehicle also charges the drone. This is a great advantage for drones with limited flight times. Ground vehicles do not have to be cars. They can be anything from small mobile robots to large trucks.

While it is not yet certain, it is highly likely that the patented technology will be implemented in the near future. Amazon started investing in electric vehicle startup Rivian and autonomous startup Aurora this year, which are expected to accelerate its utilisation of autonomous driving technology.

Regulations on drone-delivery services in Korea

Korea's current aviation laws strictly restrict drone flights. The Korean regulatory agency is mainly concerned about safety issues. There are various pilot projects in the island/mountainous regions, but strict regulations prohibit drone deliveries in densely populated areas. Furthermore, since most of the residential units in Korea are apartments, it is difficult to secure spaces for drones to take off and land. As residences are densely distributed in metropolitan cities of Korea, dense radio waves around the residential areas can disturb the signals controlling the drone and cause it to crash.

Current regulations

To use drones commercially in Korea, regulations require the registration of businesses operating ultralight flight devices under the Airline Business Act and subscription to insurance or deduction. Foreigners or foreign corporations cannot register a business in this area under the current law.

When the maximum takeoff weight of a drone exceeds 25kg, flight approval is required (not necessary for flying in a light aircraft special area) and safety certification must be obtained. Owners or operators of non-business drones exceeding 12kg in weight and all business drones shall declare the device, receive a declaration number and mark the drone. While drones with a maximum takeoff weight of 25 kg or less do not require flight approval in principle, flight approval is required to fly at altitudes of 150m or more. A pilot's certificate (a type of driver's licence) is required for drones with a weight exceeding 12 kg. For flying a drone and taking aerial shots, it is necessary to obtain aerial photography permission separately from flight approval. Lastly, in order to manufacture, sell or import new drones in Korea, radio certification must be separately obtained. Table 6.2 represents the summary of regulations in each country.

Regulation reform roadmap in Korea

Korea has not yet implemented regulations that are sophisticated or realistic enough to support commercial drone-based projects. The tryouts of modulating regulations such as allowing flights without prior approval and expanding the altitude range more favorably turned out not to be of much help for commercialisation. Accordingly, the Ministry of Land, Infrastructure and Transport in Korea has materialised regulatory issues through the Drone Regulation Breakthrough Roadmap with the goal of establishing commercialised drone delivery by 2025.

Table 6.2. Drone regulation levels (selected countries)

	Korea	United States	People's Republic of China	Japan
Report & Register	For business or over 12kg	For business or over 250g	Over 7kg	Over 200g
Qualification	Over 12kg For business* * 14 years old and older	For business* * 16 years old and older	Over 7kg	Over 200g
Altitude Limits	Lower than 150m* * From ground, water surface or structure	Lower than 120m* * From ground, water surface or structure	Lower than 120m* * From observer or pilot	Lower than 150m* * From ground or water surface
Flight Zone Restriction (radius)	Seoul (9.3km) Airport (9.3km) Nuclear Plant (19km) DMZ Area	Washington (24km) Airport (9.3km) Nuclear Plant (5.6km) Stadium (5.6km)	Beijing, Airport, Nuclear Plant Area	Tokyo (All) Airport (9km) Nuclear Plant Area
Flight Speed Limits	Unrestricted	Lower than 161km/h	Lower than 100km/h	Unrestricted
Out of sight, Night flight	Principle not allowed, but exceptions allowed * * Test flight, flight in pilot project area	Principle not allowed, but exceptions allowed * * Per case through Waivable Regulations	Principle not allowed, but exceptions allowed* * Cloud system access or separate report required	Principle not allowed, but exceptions allowed
Flight Above Crowd	Principle not allowed, but exceptions allowed* * Dangerous flight prohibited	Principle not allowed, but exceptions allowed	Principle not allowed, but exceptions allowed* * Cloud system access or separate report required	Principle not allowed, but exceptions allowed* * Keep over 30m away from people, vehicles, buildings, etc.
Drone Usable Range	Unrestricted* * Exclude projects that threaten the safety and security of the people	Unrestricted	Unrestricted	Unrestricted

Source: (MILT, 2019[6]).

Specifically, the Korean government established a plan to implement drone delivery for islands in Korea by 2020 as the first phase. Further, by 2023, the government plans to introduce delivery/equipment standards to ensure the safe and convenient delivery of goods to dense areas such as houses and buildings. By 2025, the system will be improved so that drone delivery is available on a full-fledged basis.

The Ministry of Land, Infrastructure and Transport in Korea announced a roadmap for preemptive regulatory reforms in the drone sector in 2019. Under this plan, drones were reclassified into three stages of industrial application and technical scenarios and subdivided based on infrastructure and utilisation. Through this, a total of 35 regulatory issues were identified while considering the balance between safety and commercialisation.

Table 6.3. Development stage scenarios

Development stage	Stage 1	Stage 2	Stage 3 and after
Year	Present ~ 2020	2021 ~ 2024	2025 ~
Flight type	Remote control	Partial mission delegation	Autonomous flight under direction
Transport capacity	10 kg or less	50 kg or less	200kg ~ 1ton
Flight area	Population rarity, invisible region	Populated areas, visibility	Populated areas, invisible region

Source: (Ministry of Land, Infrastructure and Transport, Korea, 2019[7]).

Technological roadmap (scenarios)

Scenarios were drawn in stages by predicting the development of drone technology. They describe flight technology, transport capacity, and changes to the flight area in five stages.

First, as for flight technology, to make drone delivery universal and achieve economies of scale, autonomous flight should be fully operational. The steps leading to full autonomy in drone flight are shown in Table 6.4.

Second, for transportation technology, currently the capacity is at a level that delivers items that weigh less than 10kg within 5km. Air transportation is expected to reach a level where more than 1 000kg can be delivered over 500km as shown in Table 6.5.

Table 6.4. Flight technology development scenario

Stages	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Development	**Pilot Flight**		**Autonomous Flight**		
(Concept)	Remote Control	Partial assignment	Commission	Remote supervision	Full autonomy
	Man direct steer	Man direct steer only for difficult missions	Man commissioned → Flight autonomous	Fligth autonomous Man intervenes when needed	No need of intervention

Source: (Ministry of Land, Infrastructure and Transport, Korea, 2019[7]).

Table 6.5. Flight technology development scenario (2)

Stages	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Development	**Cargo Loading**		**Human Boarding**		
(Concept)	10 kg or less, ~ 5km	50 kg or less 5 – 50 km	2 seater (200 kg) 50 ~ 50 km	4 seater (400 kg) 50 ~ 500 km	10 seater (1 ton 500 km~

Source: (Ministry of Land, Infrastructure and Transport, Korea, 2019[7]).

Last, for the flight area, safety and security issues are crucial. Flights are currently permitted only in areas with less dense populations, but they may gradually move into the middle of a city center where radio waves can possibly disturb them and flight visibility is not secured as presented in Table 6.6.

Table 6.6. Flight area expansion scenario

Stages	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Development	**Population Rare Area**	**Population Dense Region**			
(Concept)	Invisibility, non-urban area	Visibility, downtown area	Invisibility, use of urban area control station		Radio wave invisible zone, Inner City Radio Shading Area

Source: (Ministry of Land, Infrastructure and Transport, Korea, 2019[7]).

Implications of regulatory challenges

The Ministry of Land, Infrastructure and Transport of Korea has planned various projects to identify and improve regulatory issues related to the commercialisation of drone delivery. By 2022, the Ministry is planning to commercialise drone delivery in non-urban areas. Furthermore, the Ministry expects to expand drone-based delivery to densely populated urban areas by 2025.

In order to solve the safety concerns, noise issues, and radio frequency problems, which are the biggest problems of drone delivery, Korean government agencies such as the Ministry of Land, Infrastructure and Transport and the Communications Commission are trying to prepare regulations through specific projects. The regulations are designed mostly in terms of qualifications and responsibilities. They also deal with issues of the availability of flights in specific regions based on the nature of the flight area. Relevant regulatory improvement projects are shown in Table 6.7.

Table 6.7. Korean government agencies' regulation-related projects

Regulation issues	Project name	Due
Safety	Advancement in drone insurance system	2021
Flight region	Establishment of standards fro drones to fly major national facilities and control areas	2021
Safety	Establishment of drone accident report management system	2021
Safety	Drone flight record and pilot qualification management system	2021
Radio frequency	Frequency discovery to support long-distance driving	2021

Source: (Ministry of Land, Infrastructure and Transport, Korea, 2019[7]).

However, there is still room for improvement regarding commercialised drone delivery in terms of regulatory design. The most urgent problem is how to secure a flight location by reforming the current regulations. In order to commercialise technological advancements, numerous test flights must be conducted. In Korea, however, flight spaces are strictly limited. Currently, there are only ten pilot airspaces without flight restrictions in the country. Prior permission is required to fly a drone within a 9.3 km radius of major facilities such as an aerodrome. It takes more than a week to check the flight area for each test flight and obtain approval from local aviation agencies and the Ministry of Defense.

To secure more flight locations, the security issue must eventually be resolved. However, the Ministry of Land, Infrastructure and Transport has only come up with a plan for 'selective and optional allowable zones' so far. It is a plan to designate and operate special zones in highly populated areas such as city centers. However, more flight-permitted areas are required to ensure the robustness of drone delivery services.

Regulations on express delivery services

Emergence of express delivery services

Traditionally, offline-based retailers (i.e., brick-and-mortar retailers) and online-based retailers have targeted different customer clusters with obviously different service features. Recently, however, as delivery lead times get shorter, an increasing number of customers prefer online shopping due to its high convenience. According to data from the Ministry of Trade, Industry and Energy on retailers' sales in 2019, sales at offline stores including supermarkets and mega-stores declined 0.9% compared to the previous year. On the other hand, the sales of online stores increased by 14.2%. The sluggish sales of offline stores were largely due to the country's rapidly growing e-commerce industry.

This shows a major change in the retail industry, where the hegemony of distribution is moving from offline to online. For example, the sales of large discount stores (-5.1%), Super Supermarkets (-1.5%), and department stores (-0.1%) decreased due to the widespread availability of online shopping, which led to a drop in overall offline sales. A closer look at the financial data of South Korea's largest retail giant, E-mart, reveals that its operating profit dropped by 67.4% from 462.8 billion won in 2018 to 150.7 billion won in 2019. In the case of Lotte Mart, after having a deficit of 25 billion won, it decided to phase out over 200 small offline stores. The profitability of the nation's large retailers is going downhill, and online distribution is occupying the position that offline distribution has lost.

When it comes to the fresh grocery category, businesses specialising in the grocery delivery market emphasise convenience without physically visiting stores and immediacy, which incorporates the strengths of both online and offline shopping. Along with fast delivery services reshaping grocery shopping habits in Korea, they have grown to take a considerable amount of profit away from store-based retailers in the industry. The market size for express delivery services (in Korea, this is commonly called "by-dawn delivery") grew exponentially from WON 10 billion (USD 8.7 million) in 2015 to an estimated WON 400 billion last year, according to the Rural Development Administration.

Therefore, it is inevitable for store-based retailers to operate an online channel together with their existing stores so that they can offer the high value of timeliness via a fast delivery service. This expansion from offline to online is made possible through omni-channel operations technology. Omni-channel offers great accessibility in terms of speed and convenience by flexibly serving both online and offline customers. Improved technologies in ICT and logistics have opened the era of omni-channel in the wake of customers becoming familiar with the online environment.

In response to this change in customer behaviors, offline markets are making efforts to expand online services so that consumers can use the omni-channel that signifies the shift from offline to online. In terms of the availability of existing stores, there are no fixed costs and the extra cost of starting a business is not significant. In addition, the existing infrastructure and coverage schemes enable much quicker responses to orders.

In this section, we focus on regulatory issues in the field of express delivery services that involve improved technology for speedy logistics and omni-channel operations. We first examine new business models with relevant business cases of express delivery services in Korea.

Online early morning delivery cases

Market Kurly: Dawn delivery/early morning delivery

In 2015, an online grocery startup called Market Kurly first introduced the concept of dawn delivery. Its "*Saetbyul* delivery" (delivery made at dawn) delivers food products by 7 a.m. if customers order before 11 p.m. the previous day. While next-day delivery ensures the goods reach the customer within the shortest timeframe possible, dawn delivery shortens the timeline to the very next morning.

According to Market Kurly, products are packed and dispatched from its logistics center in Songpa-gu to some 480 deliverymen by 2:30 a.m. every day. As of August last year, an average of 12 000 orders were received every day for *Saetbyul* delivery. Thanks to increasing consumer demand for fresh food in the morning, the company achieved 46.5 billion won in sales in 2017, which corresponds to a 167% on-year increase. Further, sales of some 160 billion won were forecasted for 2018.

Market Kurly remains the dominant player in the dawn delivery market and it was responsible for some 79.5% of the relevant logistics as of August 2018, according to Statistics Korea. The company has expanded its horizons by offering not only fresh food, but also side dishes and home-meal replacement kits for parties.

Coupang: rocket fresh

In October 2018, Coupang rolled out Rocket Fresh, which ensures the delivery of some 4 200 fresh foods and other items by 7 a.m. the next day. This early morning delivery service allows consumers to receive fresh food for breakfast. If the order is made before midnight, they can receive the food items by 7 a.m. the following day. The company organises some 3 000 deliverymen known as Coupang Man into teams with different work schedules. For dawn delivery, a Coupang Man works from 10 p.m. to 8 a.m.

The "Rocket Fresh" service has been seeing significant growth recently. While Coupang has other competitors in the overnight fresh food delivery sector, it is confident that it has an upper hand based on its extensive scale of investments, loyal customer base, reputation of reliable deliveries, and wider range of food choices. Coupang's early morning deliveries currently cover up to 2 600 types of food, including fruits, vegetables, meat, fish, eggs, milk, and ice cream.

Starting January 2019, the service is now available not only in Seoul but also other major cities, including Busan, Daegu, Daejeon, Gwangju, Ulsan, Cheonan, Gimhae, and Sejong. The company has been focusing on enlarging its logistics centers and expanding coverage nationwide. At the moment, it has

dozens of logistics centers scattered around Incheon and Cheonan, covering a total of 1.1 million square meters. The company decided to double that size by building new mega logistics centers in 2020. The company expects membership of its Rocket Wow Club, which enables free delivery for all Rocket Fresh orders, to rise further. As of February 2019, the Rocket Wow Club had 1.6 million members.

Regulations on work hours for offline retailers in Korea

Unlike online-based retailers, store-based retailers can take advantage of their existing selling infrastructure without setting up additional centers for online retailing to expand their business. Furthermore, their original coverage in local areas guarantees much faster and cheaper delivery to local customers than delivery services departing from distant distribution centers. Super Supermarkets (SSM) are located in almost every local area and manage to cover as much demand as possible through the chain management of conglomerate retailing companies. Despite these advantages in terms of much more accessible locations and already existing physical storage spaces, regulations on the large-scale stores' business hours pose limitations to their making use of available resources.

Online-based retailers offer mail-order services via online marketplaces or transactions. They do not have physical stores to sell products face to face but operate based on a few (or several) distribution centers that handle all the parcels to be delivered to customers in each of their service areas. Basically, those businesses are registered as mail-order businesses and they are not subject to any specific restrictions on business hours. They can sell products for the whole day and deliver them when they want, regardless of time.

According to the Retail Industry Improvement Act (Box 6.1), large discount stores /SSMs/quasi-superstores registered as distributors are subject to compulsory closedowns and restrictions on business hours. They must close the store from midnight to 10 a.m. and shut down for two days per month. They cannot register as a mail-order company (like other online retailers) at the same time to compensate for the closedown time. Therefore, even if they offer online selling and delivery services, the operating hour restrictions still apply equally. Although compulsory closure dates can be adjusted in consultation with local governments, this has only been allowed in very rare instances. Large retailers that have changed their mandatory holidays to a weekday are only about 10-20% of the total over the past eight years. Since early morning delivery works as a dominant option when customers lack access to the offline store and it brings about competitiveness in the industry, the time restriction is a huge regulatory hurdle for the industry and the well-prepared existing businesses.

Box 6.1. Article 12-2 of the Retail Industry Improvement Act

Article 12-2 (Restrictions, etc. on Business Hours of Superstores, etc.):

1. The Mayor of a Metropolitan Autonomous City or the head of a Si/Gun/Gu may order discount stores (including a store that is established within a superstore and meets the requirements for a discount store) and quasi-superstores to restrict business hours or suspend business, designating a date for compulsory closedown as prescribed in the following subparagraphs, where deemed necessary for the establishment of sound distribution order, employees' health rights, and win-win development for both superstores, etc. and the small and medium distribution industry: Provided, That the foregoing shall not apply to a superstore, etc. prescribed by ordinance of the local government concerned, in which the sales of agricultural and fishery products under the Act on Distribution and Price Stabilization of Agricultural and Fishery Products account for at least 55% of the annual turnover:
    - Restrictions on business hours;

- Designation of a date for compulsory closedown.

2. The Mayor of a Metropolitan Autonomous City or the head of a Si/Gun/Gu may place restriction on business hours from 0 a.m. to 10 a.m. pursuant to paragraph (1) 1.
3. The Mayor of a Metropolitan Autonomous City or the head of a Si/Gun/Gu shall designate two days for compulsory closedown each month pursuant to paragraph (1) 2. In such case, a day for compulsory closedown shall be designated from among holidays, but it shall be possible to designate a day, which is not a holiday, for compulsory closedown through agreement with interested parties.
4. Matters necessary for imposing restrictions on business hours and designation of a day for compulsory closedown under paragraphs 1) through 3) shall be prescribed by ordinance of the local government concerned.

Such restrictions on large offline retail companies may also affect the consumer's right to buy and choose. In an emergency such as the recent situation created by COVID-19, if restrictions on online operations remain in place for large offline stores, they cannot share the excess demand for online options. In fact, there were cases where some daily necessities were sold out at Coupang, South Korea's largest online retailer, and consumers were unable to purchase daily necessities on weekends when large retailers were closed due to mandatory closedown regulations. Large discount stores have widespread distribution infrastructures, online ordering options, and delivery systems built by region, enabling a more stable supply of goods and systematic delivery systems. The Korea Chain Store Association submitted a proposal to the government to improve the distribution system and distribution infrastructure during a national emergency situation, such as a quarantine.

The Korea Chain Store Association also submitted a proposal to the government for a plan to improve the distribution infrastructure for the country's emergency services, including daily necessities and self-protection products. It suggested that restrictions on closedown days be relaxed, at least temporarily, for online purchase and deliveries through hypermarkets.

Big retail shops' detouring strategies

Utilising existing stores and adding online channels

Walmart in the US has adopted a strategy of using more than 4 800 stores across the US as shipping bases, instead of establishing a large-scale logistics center, even as Amazon has been encroaching on the market with its fulfilment services. Walmart acquired e-commerce platforms such as Jet.com and Flipkart in 2016 and has since made intensive investments to strengthen its delivery competitiveness. Through this, the company established a delivery system that covers online and offline demand and recorded growth in sales and net profit. Similar to Walmart's strategy, many large retailers in Korea are also opting to provide additional online channels or fulfilment services to take advantage of existing stores. Although existing stores are being replaced with online distribution centers, they are still subject to mandatory shutdown and business hours restrictions in the same way as those under the Retail Industry Improvement Act.

Lotte Mart: Digital fulfilment store

Since March 2020, Lotte Mart has been operating its Gwanggyo Store and Junggye Store as "Digital Fulfilment Stores". It aims to operate omni-channel stores that integrate online and offline modes. For the first time in the industry, the company has introduced an "Immediate Delivery" service that delivers goods within an hour and a half when a consumer orders delivery at a location within five kilometers of the store. This goes beyond the existing concept of Coupang's Rocket Delivery or Market Kurly's Dawn Delivery.

If a consumer orders online and visits the store, they can also use either “drive pick” that directly loads items into their car, or “store pickup” where the consumer receives them directly from the store after ordering online. Conveyor belts and vertical lifts were installed to facilitate the rapid movement of goods in the store. When an online order comes in, an employee at the store picks up the items from the store shelves and puts them on the belt. In the warehouse behind the store, the goods are automatically sorted according to their destination and the delivery process begins. An autonomous driving product transport robot has been introduced for in-store pickup.

In addition, ICT technology is being used to provide a more diverse and unique purchasing experience. There are plans to expand the application of ICT to nine large cities and metropolitan areas in the future. Up to 21 dark stores, which are warehouses equipped with separate online delivery equipment at the back of the store, will be built.

Homeplus: Fulfilment center & store

In order to increase sales by expanding its online business, Homeplus formed a strategy to be more cost effective and time saving by converting existing stores to serve as additional fulfilment centers so that the company does not need to spend extra money and time to construct totally new logistics centers. Homeplus plans to significantly strengthen its online logistics functions at 140 stores nationwide by 2021 and increase online sales to WON 2.3 trillion by 2021 from WON 600 billion in 2019.

Accordingly, the number of “Pickers”, employees specialising in shopping and picking up items, will be expanded from 1 400 to 4 000 and the number of cold chain delivery vehicles will be increased substantially from 1 000 to 3 000, aiming to increase the number of daily deliveries from 33 000 to 120 000.

In areas where online delivery is heavily concentrated, the company plans to build fulfilment center (FC) stores that upgrade store logistics functions and scales one step further to meet demand. Starting with the Gyesan Branch in 2018, the Anyang Branch and Woncheon Branch have been changed to FC Stores. FC services are expected to expand to 10 branches by 2021.

In the case of the Homeplus Gyesan Branch in Incheon, the first basement level is no different from that of a regular store, but there are more than 7 000 square meters of distribution center on the second basement level. A total of 46 delivery trucks are lined up and waiting for delivery. Pickers move around the shelves where only 3 000 types of core products with high online ordering frequency are displayed. The number of online shipments at the Gyesan Branch, which was about 200 per day, increased to 1 450 per day, more than seven times since the FC opened. In the case of the Anyang Branch, a “two-way walk-in cooler”, where refrigerated and frozen products can be taken out for both the store and fulfilment center, has also increased pickers’ convenience.

Homeplus is also expanding same-day delivery services in Seoul to customers of The Club, an online mall opened in June 2019 that combines the discounts offered to warehouse retailers with a conventional grocery store experience. ‘Special Stores’ will also play a part in supplying products for Homeplus to fulfil same-day delivery orders, as their inventory is used for ‘The Club’. ‘Special Stores’ combine the low prices of bulk discount warehouses with a conventional grocery store experience. They are newly equipped with their distribution centers, the fulfilment centers (FC), for online services. The retailer had been offering same-day delivery in four selected regions where Homeplus Special Stores are located. The company said it would expand same-day delivery beyond Seoul in the future. Customers will be able to receive packages dispatched from Homeplus Special Stores on the same day if they place orders before 4 p.m.

New fulfilment center for online selling

E-mart's new fulfilment center: NE.O for online selling

As E-mart is subject to the regulation on business hours, the company established Next Generation Online Stores (NE.O) for its online service to extend its business hours and meet online demand in a timely manner. It required a huge investment to build the new system and facilities. Emart has made large investments and currently runs logistics centers in Yongin and Gimpo, which are equipped with automation facilities as well as a stock prediction and management system.

The company has already invested 150 billion won in its second NE.O location in Yongin and expects to spend a similar amount for its third distribution center. Focusing on the establishment of an advanced storage and logistics system, it planned to complete construction of a 52 535 square-meter logistics center in Gimpo, Gyeonggi Province by the end of 2020. The center will become the third NE.O. Following the construction of the NE.O 003 Logistics Center with cold chain systems that manage stock in a temperature-controlled supply chain, the company expects to beat its rivals. "We plan to expand our dawn delivery service to additional regions across the country within this year after NE.O 003 opens in December," an SSG.com official said.

The company ultimately aims to set up a system to send products stocked at the NE.O 003 Logistics Center for same-day or three-hour delivery.

Thanks to the separate fulfilment center, E-mart was able to launch 'Good Morning SSG' in 2018, betting on the fast-growing online delivery market of fresh goods. The service allows orders to be placed as late as midnight with deliveries guaranteed to arrive within a preferred delivery slot between 6 a.m. and 9 a.m. or 7 a.m. and 10 a.m. the next day. Daily necessities and fresh food products are among the most popular items delivered by E-mart.

The retail market has been moving rapidly toward a more online-friendly environment. That is why offline retailers have been trying to extend their coverage to the online market with omni-channel operations. They have aggressively adopted state-of-the-art technology while making the most out of their existing resources. However, the current regulations on large-scale offline retailers make them less competitive with regard to online delivery services. According to the regulations, the offline retailers must close the store from midnight to 10 a.m. and for two days a month. This applies to their new online business model as well, and this is a major obstacle to providing early morning delivery services. Moreover, they are not allowed to register as a mail-order company like other online retailers for their online services, which would help overcome these restrictions.

Despite these regulations, leading offline retailers in Korea such as Lotte Mart, Homeplus and Emart have made various attempts to operate online. Lotte Mart installed conveyor belts and vertical lifts in their stores to utilise their existing shop as a fulfilment center. Homeplus, with 140 stores nationwide, has also utilised their stores as fulfilment centers in that their store floors share fulfilment centers and shopping areas. In the case of Emart, they made major investments in two large distribution centers for online delivery services. They established this business sector as an independent company, which made them provide early morning delivery just as online retailers do.

Nevertheless, these attempts by existing online retailers are not yet performing optimally. The closure of several Lotte Mart stores demonstrates that these efforts are not enough to overcome the regulations that block them from offering their services on a 24/7 basis to customers. Considering these working hour regulations were first raised ten years ago in order to protect local retailers from large-scale markets, it seems reasonable to revisit the effectiveness of the regulations and go through a major reform. Experts are of the view that big markets are no longer the threat to local markets they were before. Rather, it can be said that large-scale markets are threatened by online retailers.

Regulatory challenges for truck platooning

Truck platooning technologies

Truck platooning refers to a technology in which two or more vehicles form and operate a convoy connected to one another. In other words, it uses vehicle connection technology to share information so that the vehicles behind can follow the truck located at the front autonomously.

Since it is not yet possible for vehicles to drive autonomously, a method by which vehicles can be connected by technology is being studied. In terms of hardware, the technology of sensors that collect data and the technology of semiconductors that process computations have been fully developed. In terms of software, Artificial Intelligence has greatly improved through machine learning and deep learning. Thanks to these comprehensive technological advancements, the technology has improved to the point where the system can drive directly and the driver can respond appropriately to the system's request. In the future, the level of involvement required of the driver will decrease gradually. However, autonomous vehicle technology alone is not enough to help the logistics industry because the driver still needs help.

We will cover the basics of driving technology and the regulations required for the commercialisation and development of these technologies for truck platooning.

Truck platooning concept

Platooning is a technology in which two or more trucks connected to one another form a convoy. The truck at the front plays the role of leader, and the trucks behind follow the path of the leader truck. As a result, the driver needs to drive manually only when he or she needs to leave the procession or drive independently.

Advantages of truck platooning

Below is the list of advantages of truck platooning.

- Fuel savings: since several trucks run close to each other, air resistance and fuel consumption are reduced;
- Environmental protection: leading trucks reduce CO2 emissions by more than 8% when using platooning technology. Following trucks reduce CO2 emissions by more than 16% when using platooning technology (ERTICO, 2016[8]);
- Increased safety: autonomous driving and V2V (Vehicle-to-Vehicle) technology enable rapid stopping for the entire truck procession. This is five times faster than when a person responds to a sudden stop signal/warning;
- Economic effect: the effective use of roads reduces transportation time and traffic. Moreover, based on self-driving technology, drivers can do other tasks such as making telephone calls.

Technological development forecast

- According to the reports from the European Automobile Manufacturing Association and McKinsey (McKinsey, 2018[9]) (ACEA, 2017[10]), the development of truck platooning technology will roll out in four waves. It starts with trucks platooning guided by drivers and will eventually run without drivers. The main roll-out phases are presented below: 2018-2020: A driver in each truck. Two drivers platoon two trucks on an interstate highway. Drivers drive individually on non-interstate highways.

- 2022-2025: A driver is placed in the leading truck. Platooning is allowed only on interstate highways between dedicated truck stops with two trucks, with a single driver in the leading vehicle. Drivers drive individually on non-interstate highways.
- 2025-2027: A driver is engaged for pickup and drop-off. Autonomous trucks ride on interstate highways without drivers (platooning two or more trucks when possible). Drivers drop off trucks at dedicated truck stops.
- 2027-: Driverless. Autonomous trucks drive individually on all highways and in platoons of two or more trucks.

European Automobile Manufacturers Association (ACEA)

Europe's ACEA has also established four steps that are similar to McKinsey's (ACEA, 2017[10]).

- Step 1: Platooning is possible between trucks of the same manufacturer. It is designed to enable platooning between trucks of the same manufacturing line and the same brand through technology dissemination within the manufacturer. This has already been successfully tested by Volvo.
- Step 2: Free multi-brand platooning without boundaries is enabled between manufacturers. In the future, we will establish international standards for platooning technology and equipment, and develop freely for any truck. However, Phase 2 is still a step in which the driver should actively intervene.
- Step 3: Minimise the role of drivers based on self-driving technology. Like a passenger aircraft that minimises the role of the aviator through autonomous flight technology, it is a step to minimise the driver's role in platooning to guarantee the driver some rest or additional working time.
- Step 4: Fully automated platooning is enabled. The following trucks, other than the leader trucks, which are at the forefront, are operated through full autonomous driving without a driver.

Necessary conditions for the commercialisation of truck platooning

The necessary conditions that should be addressed to commercialise truck platooning for ground logistics are as follows. First, the platooning technology requires autonomous driving, as well as inter-vehicle connectivity and integrated operating systems. The technology is being developed under various conditions such as vehicle spacing, vehicle speed, distance error, maximum number of following vehicles, communication cycle, time required for side and rear side breaks, and rate of fuel economy.

Second, it is necessary to expand the infrastructure such as driving space and electronic markings on the road to enable platooning. To this end, the process of securing various real cases through the pilot operation of platooning in the current road traffic environment should begin.

Last, the active co-operation of logistics companies is required. Governmental land management departments and trade-related departments that require logistics efficiency for platooning dissemination should be involved in the process. Moreover, incentives should be provided for technology development and dissemination. Furthermore, legal requirements for platooning and new insurance systems need to be established.

Policy for truck platooning technologies

The European Truck Platooning Challenge, launched in 2016, conducted various technical studies and pilot operations. The platform was used to discuss the policies dealing with platooning in Amsterdam, the Netherlands. Likewise, governments worldwide are preparing a foothold to introduce truck platooning.

Some countries have started relaxing existing regulations on the road and others like Korea are reforming regulations for the upcoming change.

Regulation-relaxation approach

Exempting platooning from the state's FTC Rules, US

According to a guide on automated vehicle platooning for legislators, "Following Too Close (FTC)" statutes are a major issue in discussions on platooning legislation. FTC rules vary by vehicle class and rule types. Vehicle classes are "Cars", "Heavy trucks", and "Caravans" and rule types are "Reasonable and prudent", "Time", "Distance", and "Sufficient space to enter and occupy without danger". FTC statutes deal with safety issues related to inter-vehicle distances, and they vary among regions. Some non-state areas such as the District of Columbia and Guam do not have these rules. Regions without FTC rules rely instead on broader reckless driving statutes.

In order to authorise automated vehicle platoons, the United States need to exempt this service from existing FTC rules. However, some FTC rules are spread across several class sections, making it tricky to set up a standard. In 2016, US jurisdictions authorised automated vehicle platooning. In 2015, Utah became the first state to exempt automated vehicle platooning from FTC rules and authorise the testing of connected vehicles, when it enacted the first law in the US that supports attempts to apply vehicle platooning. Florida followed suit in 2016. Also in 2016, Michigan enacted a comprehensive automated vehicle law that included an FTC rule exemption.

Mitigation policy for automotive safety standards, US

Although this policy is not directly related to crowded driving, it is meaningful in that the safety standards for automobiles that limit the scope of developing platooning trucks are relaxed and applied. In the US, general automakers must meet approximately 75 automotive safety standards in order to be approved for operation. The US government said it would exempt the application of automobile safety standards if there were any vehicles among self-driving cars that meet certain conditions for technological development. In February 2020, the US Federal government first allowed self-driving cars to operate without the essential equipment for driving, such as a steering wheel or pedals. The autonomous vehicle, R2, developed by the startup Neuro, was granted a car license and approved for operation. The R2 is a low-speed electric vehicle with a maximum load weight of 1134kg and a maximum speed of 40km/h. The vehicle does not have a steering wheel or pedals that have hitherto been essential for driving.

The US collaborated with Peloton Technologies, Texas

In Nevada and Virginia, their deregulation allowed a platooning test. According to a report from the Competitive Enterprise Institute, ten states passed a plan to reduce the distance between platooning trucks to within 40 feet in 2017 (Safety Distance Maintenance Issues). However, in-truck radio transmission technology and automatic stop technology must be installed. By 2018, 34 states in the United States were enacting or discussing platooning and related laws, with legislation extending to Georgia, Tennessee, and Texas.

Regulation-reform approach

Korea's preemptive regulatory reform roadmap

Since 2018, platooning technologies have been the first pilot project of the Preemptive Regulatory Reform Roadmap. Preemptive regulatory reforms are intended to pre-emptively tackle various problems arising from regulations that have not kept up with new industries and technologies. In the present case, it is impossible to operate platooning trucks due to the obligation to secure a safe distance in accordance with

the existing current laws and a joint risk prohibition clause that prohibits two or more cars from being lined up one behind the other or side by side. To address this, demonstrations have been permitted on test roads and within certain areas, and after a number of tests, the Road Traffic Act will be revised to implement actual truck platooning in 2022, including reducing the mandatory safety distance.

Korea's truck platooning demonstration

As part of the Preemptive Regulatory Reform Roadmap, in November 2019, Hyundai Motor Company succeeded in demonstrating the first truck platooning in Korea. At Yeoju Smart Highway (Yeoju Test Road), two trailer trucks with a maximum weight of 40 tons were connected. Yeoju Smart Highway is a test bed built by the government along a 7.7km section of the central inland highway to develop autonomous co-operative driving technologies such as Vehicle-to-everything (V2X) wireless communication. Vehicles for research on self-driving technology often run on this road, so driving conditions are almost the same as those of general highways. The technologies that have been successful in this demonstration include cluster driving formations, cut-in/cut-out of other vehicles, simultaneous emergency braking, and vehicle-to-vehicle communication technology. For safety, the top speed was limited to 60 km/h. The self-driving group demonstration project was planned to be expanded in 2020. As mentioned above, the project will increase the number of units on Yeoju Closed Road to three units, and the two units verified on the Closed Road will also be demonstrated on the general road. Up to four units will be tested in 2021, and the Road Traffic Law will be revised after 2022 according to the test results.

Logistics service using autonomous vehicles in Korea

The Ministry of Land, Transport and Maritime Affairs decided to designate and operate a pilot operation district that grants special permissions such as the paid transportation of passengers / cargo and auto safety standards using autonomous vehicles within a certain region through the enactment of the "Autonomous Vehicle Act" in April 2019. Accordingly, in the pilot operation area, which took effect from May of that year, logistics services using autonomous vehicles were allowed through special cases such as the truck platooning method. The foundation for demonstrating and commercialising platooning technology was prepared. The designation period for the pilot operation district was set within the range of five years. In the pilot operation district, if a business operator wants to provide paid services by applying the special regulations of the "Cargo Vehicle Act", he or she can submit a vehicle registration certificate to check the driving safety of the autonomous vehicle.

Major issues related to truck platooning regulations

Regulations on truck platooning present several major issues from various aspects. The challenges of each issue are summarised as a list below.

- Definition of a driver: The current Road Traffic Act stipulates various obligations necessary for transportation on the premise that the driving is done by people. Based on the new premise that the driving is performed by an autonomous system, it is necessary to newly define various requirements for transportation. In particular, there is a need to address the differences between lead vehicles and following vehicles.
- Vehicle care duty: To date, the driver's car management obligations have been regulated through the duty to inspect cars and to prohibit the maintenance of badly damaged cars. In addition, there is a need to define obligations that are consistent with autonomous vehicles. In particular, there is a need to update the software version so that truck platooning can be run without problems and redefine the obligation to check before operation.

- Definition of an autonomous vehicle: Under the current law, the concept of “autonomous driving” is defined as 'the car’s ability to drive by itself without the driver or passenger's operation. Truck platooning needs to be defined for each level of technology (Driver in Each Truck, Driver in Leading Truck, Driver for Pickup and Drop-off, Driverless).
- Control of driving: Truck platooning regulations are needed for situations in which control of driving must be transferred from the system to people. A unified standard for the transfer of control will allow the driver to cope with the safe and fast transfer of driving control.
- Accident liability: Under the current law, in the event of an accident caused by the operation of a car, the driver shall be liable for civil damages and criminal liability may be imposed on the driver. In the event of an accident during truck platooning, it is necessary to clarify who is liable for civil and criminal proceedings (Driver in the leading vehicle, driver in a following vehicle, company of the platooning system, company of the vehicle).
- Vehicle insurance: While it is mandatory for the car owner to be insured in the event of a car accident, the accident insurance responsibility is unclear for autonomous driving. The insurance system should be improved according to the results of defining the civil liability and criminal responsibility upon occurrence of an accident during autonomous driving.
- Accident record system: If an accident occurs during autonomous driving, it is essential to analyse the responsible materials between the driver and the system by analyzing the accident record. To this end, specific standards for the establishment of an accident record system and the installation and analysis of an accident recorder should be prepared.
- Pedestrian image information: Under the current laws, it is mandatory to obtain prior consent to collect and process video information of pedestrians while driving. However, autonomous driving needs to process information on pedestrians collected in real time, so the relevant regulations should be revised to allow the collection and processing of video information without prior consent.
- Information on the location of things: Under the current laws, when collecting objects’ location information while driving, the owner's prior consent must be obtained, but this is practically impossible. The collection of simple location information rather than individual location information should be treated as an exception within the principle of informed consent.
- Maps for autonomous vehicles: For autonomous driving, lane information is required instead of road units. This requires precise maps with more information than conventional navigation and ADAS maps. However, there is no specific regulation on the type of information a precision map should contain. Moreover, it is not clear how secure it should be.
- Safety distance: Under the current law, platooning is not allowed due to the obligation to secure a safe distance and the Prohibition of Common Dangerous Acts that prohibits two or more cars from moving forward, backward, or side to side jointly. Therefore, in order to allow platooning and establish differentiated safe distances on trucks that are clustered, special provisions for securing safe distances and prohibiting common dangerous acts should be introduced. In this regard, it is necessary to refer to technical studies such as Nonlinear Spacing Policies for Automated Heavy-Duty Vehicles to define a reasonable safety distance.

Infrastructure information in standard format

There is an international infrastructure information standard format that enables communication-based autonomous driving for some road segments such as highways. However, the standardisation of infrastructure communication and remote-control signals for all roads in Korea has not yet been prepared.

Edge computing and cloud computing: At present, it is difficult to transmit information on security issues such as video information for pedestrians collected and processed during autonomous driving and location information for objects to a cloud server. Therefore, it is necessary to define criteria for classifying information to be transmitted to the cloud server for processing by cloud computing as well as information to be processed by edge computing inside the vehicle.

Safety latency level: Autonomous vehicles using cloud computing can cause major problems when delays in data transmission and reception occur. Therefore, a clear assessment of the speed of data transmission and reception in real time is required to mandate that the system warn the driver at the moment of delay beyond the threshold.

Regulators are not yet ready to accommodate all these issues within their regulation system. Since a conducive regulatory framework is critical for developing the truck platooning services in the business sector, it is important to identify relevant regulations and verify the potential terms that can cause issues and the areas where new regulations are required to clarify potential misunderstandings preemptively.

Implications of regulatory challenges

In case of the US, regulations that prevent platooning implementation have been relaxed to some extent. Specifically, automobile manufacturing regulations were relaxed to meet only certain standards applicable to autonomous vehicles. The majority of states also agreed to lower the vehicle distance limit to 40 feet.

A guide for legislators on automated vehicle platooning identified “Following Too Close (FTC)” statues as a major issue with the regulations varying among states. Exempting platooning from states’ individual FTC statues has paved the way for the authorisation of automated vehicle platooning services.

On the other hand, some countries including Korea are approaching regulations via a bottom-up method. They are trying to identify possible problems arising from these new technologies, and put together relevant regulations. It is a different from the approach adopted by the US in that the latter exempted platooning from existing policies.

Korea just started test driving in 2019 and designing regulations based on the results of the tests could be one of the safest ways to apply new technology. However, when the technology is ready for commercialisation, it might be helpful to adopt a relaxation approach. Building up regulations from the bottom by going through test operations only allows a handful of demonstrations under strict supervision. Thus, Korea’s approach could slow down the commercialisation of truck platooning and a careful revisit of regulation strategies will be needed.

Conclusion

This chapter introduced the concepts of smart logistics and relevant technologies. Smart logistics depend on state-of-the-art technologies to control, manage, and operate all logistics activities. The global logistics market is expected to grow at a CAGR of 7.3% over the next decade, and markets for the related technologies such as commercial drones, automated guided vehicles, and unmanned land vehicles are also expected to grow rapidly. The enlargement of the e-commerce market was made possible by these technologies and e-commerce is expected to sustain this level of growth powered by these technologies.

Among these core technologies of smart logistics, we have introduced technology and regulation issues on drone delivery, early morning delivery, and truck platooning. We focused on the critical regulation issues related to these topics.

Regarding drone delivery, we observed the need for expanded flight locations. In order to commercialise technological advancements, numerous test flights must be conducted. In Korea, however, flight spaces are strictly limited. The country only has ten pilot airspaces without flight restrictions. Prior permission is

required to fly a drone within a 9.3 km radius of major facilities such as an aerodrome. In addition, security issues have been the greatest obstacle. It takes more than one week to check the flight area for each test flight and obtain approval from local aviation agencies and the Ministry of Defense. The Ministry of Land, Infrastructure and Transport, the Ministry of Science and Technology, and the Ministry of Defense should co-operate to secure more flight location sites.

For express delivery services, we observed the retail market's rapid movement toward an online-friendly environment. Regardless of this change in retail markets, the regulations protecting local retailers from large-scale markets discourage offline retailers from making their business model more online friendly. The regulation restricts operating times from midnight to 10 a.m. and this has proved to be a huge obstacle for offline retailers to gain competitiveness in the e-commerce market. It has been especially critical in the case of early morning delivery, for which it is important to operate 24/7. Regardless of these offline retailers' new investments, their business performance has lagged behind that of existing online retailers. Since ten years have passed from the time of adopting these regulations, they need to revisit incorporating the recent changes in technologies and business models and offer a level field for all players in the market.

In the case of truck platooning, safety-related challenges present the most significant concerns for commercialising this technique. One of the most important legislative issues is the distance between vehicles. Current platooning mostly violates the lower limit on inter-vehicle distance regulations. We compared the cases of the US and Korea, which show differences between the relaxation and reform of regulations. The US adopted an approach of exempting platooning from existing regulations. On the other hand, Korea partially authorised test operations under supervision and in restricted environments. In the technology developing stage, it is preferable to go through a variety of scenarios. However, considering the quick commercialisation and development of platooning technology, an approach of partial relaxation seems more suitable and needs to be considered.

In the end, we would like to emphasise that for smart logistics to be adopted in our daily lives, technologies and regulations must evolve and complement each other. Those who develop technology should make efforts to better understand regulatory issues, and those who create regulations should carefully study the technological and business aspects.

As a future study, we believe that the following directions are worth further investigation. First, to commercialise drone delivery services, a new route system for drones at the national level should be established. The permitted routes should be determined depending on the size and specifications of the drone, and a traffic signal system incorporating the drone traffic should be developed to prevent collisions along the routes. It is expected that drone delivery services will be available in real life only after such a system regarding safety and operation standards is established.

Second, for express delivery services, it is important to understand the stakeholders affected by regulations. In this regard, the regulations on the large offline retailers should be reconsidered so that they can compete with emerging online retailers in the market on equal terms. It is recommended that the different interests and incentives of large offline retailers, traditional small and medium offline retailers, and online retailers be carefully co-ordinated to properly improve the existing regulations.

Last, for truck platooning technologies, it is suggested that the role of cloud computing and edge computing be clarified before standardising the data and communication systems. When the standardisation is achieved, the establishment of reference points for various deregulations will follow; for example, a reasonable safe distance can be set according to the level of the reaction speed of the truck and the level of braking technologies.

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7 Case 6. The Korean experience of sharing economy and its policy implications

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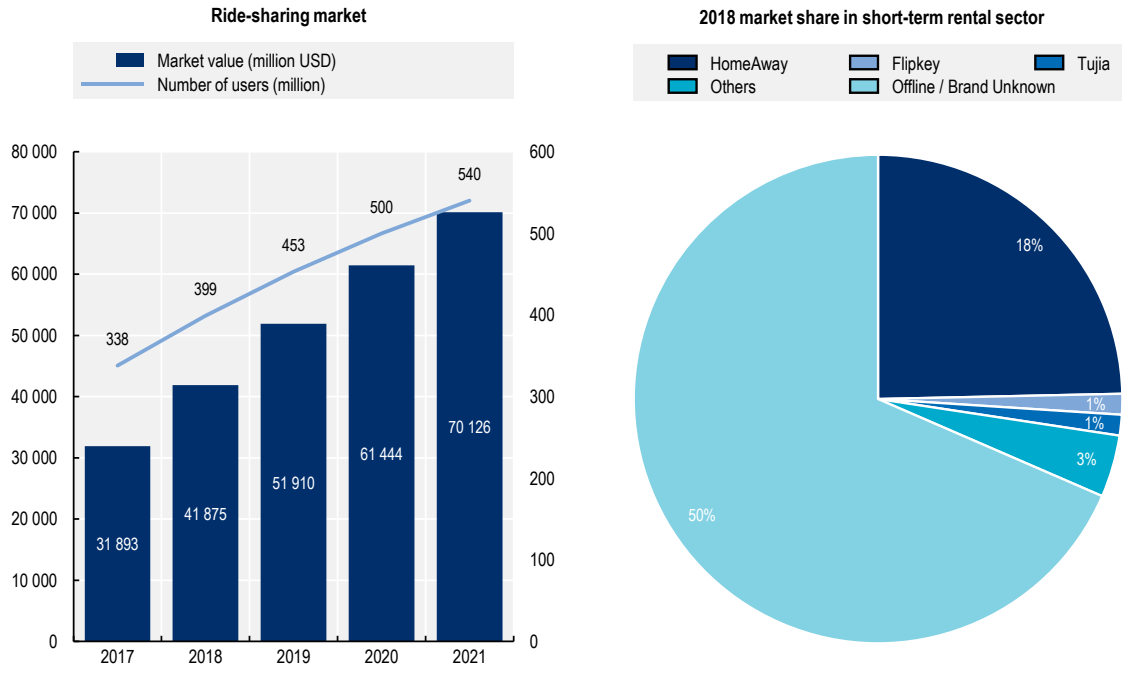
The benefits of the sharing economy include potentially lower transaction costs of services, leveraging of excess capacity, improved customer experiences, and potential for stimulating new types of consumption.
However, the introduction of the sharing economy firms is not without potential problems; e.g. around regulatory equity, crowding out of existing transactions, potential transaction risks, and safety threats. This case study presents recommendations on the appropriate regulatory frameworks for the development of the sharing economy in Korea. These recommendations seek to provide regulatory equity and flexibility while addressing regulatory enforcement difficulties by delegating implementation to platforms, and are expected to be instrumental in fostering innovation in the country's new growth engines.

Introduction

Sharing economy: status and prospects

The rapid growth of the sharing economy and so-called "sharing economy firms" is well-defined and evident. (Jiang, 2019[1]) finds that the share of Americans who have used ride-sharing services, namely Uber and Lyft, more than doubled to 36% in 2018, compared to only 15% in 2015. Zipcar, an America-based car-sharing company, reports that the number of its members exceeded 1 million in 2016 in more than 500 cities worldwide. In the accommodation-sharing sector, another American player Airbnb has excelled. In 2018, its revenue marked a record-high of USD 3.6 billion, a significant increase from 2.6 billion in 2017 (iPropertyManagement, 2020[2]). The company's revenue in 2020 reached comparable levels (USD 3.4 billion) despite the impact of the health crisis on the tourism and accommodation sectors.

Figure 7.1. Growth of ride-sharing and accommodation-sharing markets



Source: (Statista, n.d.[3]); (Yong, 2019[4]).

PwC (2015) expects the global market value of the five sectors of sharing and platform economy to grow from 15 billion USD in 2013 to 335 billion USD by 2025 to match the performance of the traditional economy sectors. The same report finds that collaborative finance, accommodation sharing, ride sharing, and vehicle sharing would become the fastest growing sectors within the sharing economy. In 2015, the total revenue from short-term Person-to-Person (P2P) accommodation rentals, such as Airbnb, occupied 2% of the American accommodation market. However, (Olson and Kemp, 2015[5]) expect this number to increase by as much as 10% by 2025, with revenue of 107 billion USD. At the same time, ride-sharing platforms represented by Uber would also experience a significant growth, representing 5% of the global taxi market worth USD 90 billion.

Sharing economy in Korea: an overview

In the early 2010s, the sharing economy in Korea has been led by a number of start-ups who advocated Korean versions of Airbnb and Uber.

While Korea is yet to catch up with the global pace of the sharing economy market, the Korean market has also experienced rapid development based on outstanding Information and Communication Technology (ICT) infrastructure. In 2019, the Korean sharing economy attracted investment worth 276 billion KRW, only to come in second after the smart healthcare sector. There exists public consensus that the sharing economy is indeed an inevitable phenomenon. A survey conducted by the Economic Information and Education Center at the Korea Development Institute (KDI) in 2019 found that while only 29.7% of the general public had experienced sharing economy services, nearly 70% expected Korea's sharing economy to continue its growth in the next five years.

Scope and structure

Peer-to-peer transactions utilising privately owned assets are nothing new. However, the recent developments in Information and Communication Technology (ICT) have enabled the phenomena of sharing economy to operate more frequently and to stand out as an entirely new economy. In fact, with the sharp increase in the number of smartphone users, transactions and exchanges utilising digital platforms show high potential to become a significant part of the mainstream economy. While the proliferation of the sharing economy is now an undeniable trend, it raises several issues with respect to the current governmental systems and procedures due to its differences with the incumbent industries. Ensuring and promoting healthy competition among the incumbent and new business models is therefore up to the regulatory authorities who must address the question of whether sharing economy platforms should be subject to different regulatory treatments. While sharing economy platforms such as Uber and Airbnb have experienced noticeable growth since their establishment, conflicts with incumbent businesses continue to arise. The two major causes of discontentment are summarised in Table 7.1.

Table 7.1. Causes of discontentment and claims of respective market players

Category	Incumbent industries	Sharing economy firms
Entry barrier	"Sharing economy platforms are threats to existing businesses."	"Incumbent players are demanding over-protective measures that increase entry costs for sharing economy platforms."
Regulatory equity	"Sharing economy firms are not subject to classical rules and regulations."	"Regulations designed for traditional business practices are applied inappropriately to newly evolved business models."

Source: Authors.

This study thus analyses the key issues pertaining to the sharing economy in Korea, and presents implications for government policies to support its sustainable growth. First, this study proposes regulation-in-proportion as a new regulatory framework. Differentiating professional suppliers from non-professional suppliers provides several benefits that help ensure regulatory equity. By categorising the two parties based on a set level of transaction, professional and regular suppliers may decide how much to supply with respect to their capability. Non-professional players, on the other hand, are given an option to reduce the costs they incur in abiding by the one size-fits-all regulations and instead benefit from eased regulations. The regulation-in-proportion framework, however, involves some difficulties in its enforcement process. Consequently, in order to ensure effectiveness of the proposed regulatory framework, this paper further proposes imposing specific regulations on the sharing economy platforms.

The remaining part of the paper is organised as follows. Section 2 reviews and organises various definitions of the sharing economy, while Section 3 presents the cases and issues associated with the sharing economy in Korea. Section 4 provides regulatory alternatives in detail, and finally Section 5 presents the conclusions.

Setting the framework: concepts and components

Previous discussions

The concept of "sharing" is not an entirely striking phenomenon in the modern society. In fact, it has been present around the world as one of the long-standing principles of managing common assets and resources. The concept has been particularly useful, specifically in cases where it is difficult for an individual to possess specific resources, tools, and infrastructures that are necessary for leading a proper economic life. The community-wide management of limited resources, such as library services and carpools, has generally proven effective in achieving optimised utilisation.

Yet, the concept of "sharing economy" may be considered a relatively new phenomenon with no crystal-clear definition and boundaries. Its ambiguity has been extensively disputed, but the concept "still lacks a shared definition" as (Botsman, 2013[6]) criticises. (Lessig, 2008[7]) is widely accepted to be the first to introduce the modern definition of sharing economy, by differentiating it from commercial economies and highlighting social relations as the means of resource allocation. While not providing a formal definition, the OECD refers, in the context of domestic activities, to new "sharing economy" platforms allowing people to rent, exchange or share their apartment or car, and points out that these initiatives "challenge existing regulation of established markets and call for balanced policy responses that enable innovation while protecting the public interest" (OECD, 2015[8]).

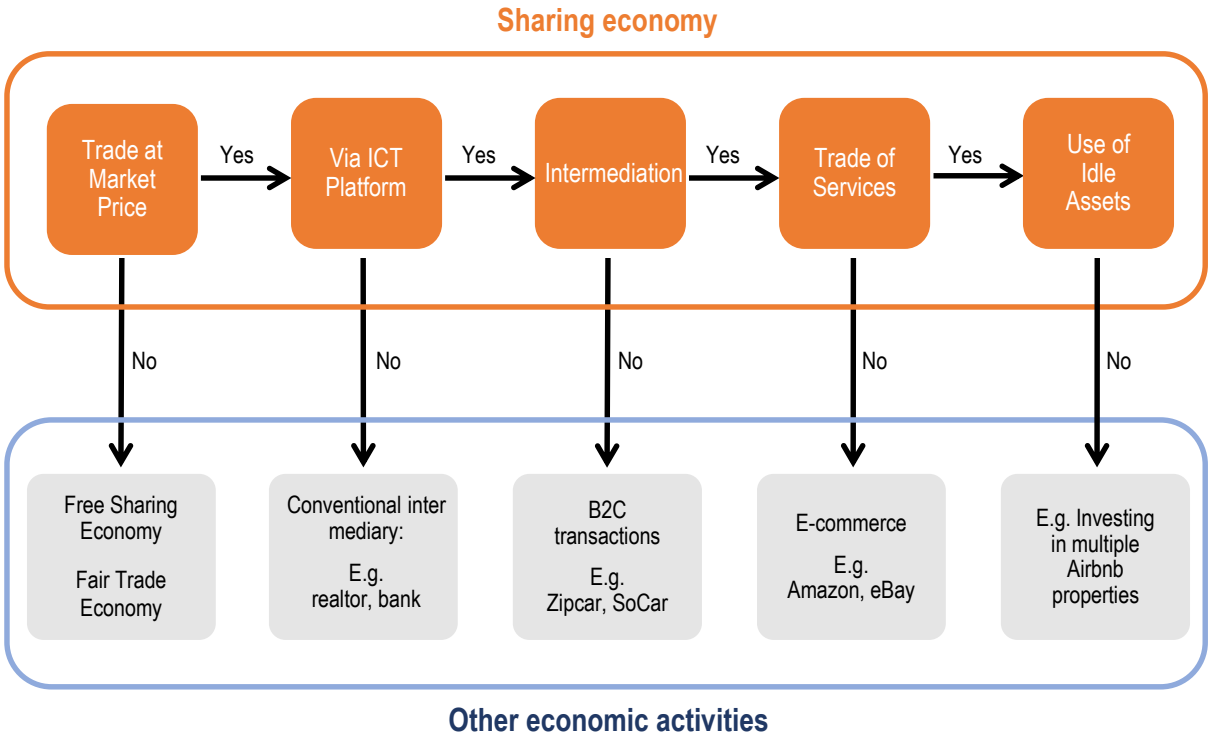
Due to lack of statutory basis and consensus, companies whose business models connect individual customers through ICT platforms generally claim themselves to be sharing economy firms.

A narrow definition with a focus on the sharing of idle assets

As (Botsman, 2015[9]) claims, the narrow definition does not include every efficient matching of supply and demand in the scope of sharing economy, unless the practice involves "true sharing" and collaboration. True sharing in this context involves sharing of idle or under-utilised assets. (Kim, Lee and Hwang, 2016[10]) recognise the five characteristics of the sharing economy as follows: 1) utilisation of the ICT platform; 2) transaction at market prices; 3) transaction of services; 4) transaction via intermediaries; and 5) transaction of idle assets. The five core components of the sharing economy are what differentiate the sharing economy from other economic activities that have existed before.

Figure 7.2 differentiates sharing economy from other similar economies, based on the definition stated above. The first criterion is whether a transaction occurs at the market price. Failure to meet this criterion means the practice is a non-profit transaction, and thus cannot be included in the scope of sharing economy. The second criterion is whether the transaction takes place via ICT on-demand technology. An on-demand transaction represents a real-time searching for a supplier who can meet a consumer's demand using smartphones and/or the Internet. A practice via a conventional intermediary does not therefore qualify as a part of sharing economy. The third criterion is the use of intermediation. Zipcar, for example, utilises on-demand technology in renting the company-owned vehicles to consumers. Consequently, Zipcar's business practice serves as an example of the Online-to-Offline (O2O) economy, but not as that of the sharing economy. The fourth criterion is whether the subject of transaction is limited to services. If the subject of transaction is a tangible commodity, such transaction comes under the scope of a traditional e-commerce activity, such as that of Amazon and eBay.

Figure 7.2. Identification tree of the sharing economy



Source: (Kim, Lee and Hwang, 2016[10]).

The last criterion is the use of an idle asset. Only if an empty room or a vacant house is rented through an online accommodation-sharing platform, such practice may fall within the scope of sharing economy.

Arguably, the narrow definition is not sufficient to encompass numerous sharing economy activities, which have grown out of the original Peer-to-Peer-based sharing of goods and services to much broader opensource communities. Even Uber and Airbnb, the so-called flagships of the sharing economy, fail to fit such definition completely, as neither of them shares idle assets. Instead, those activities can be seen as mere encashment of assets that come along when selling one's services.

A Broad definition with a focus on ICT platform applications

The sharing economy previously defined by Lessig takes the form of pure sharing and bartering. However, the use of ICT-based platforms has brought about different interpretations of sharing economy. Recent definitions of sharing economy are not based solely on collaborative consumption. Rather, they focus more on whether certain activity creates certain economic values and whether it utilises digital platforms in exchanging products and services. In the early stages of sharing economy, the scope of transactions was limited to Peer-to-Peer (P2P) transactions, in which individuals exchange economic value via an ICT-based intermediary platform. P2P transactions are thus the most basic type of sharing economy activities. Business-to-People (B2P) transactions are made when a sharing economy firm behaves as a direct supplier of products and services. The government-driven sharing economy is also typical in Korea. The government participates in the sharing economy as a supplier, although profitability is not guaranteed in this instance.

Table 7.2. Categorisation by parties of interest

Type	Relationship among participants	Examples
Peer-to-Peer (P2P)	Individual ↔ Platform ↔ Individual	Airbnb
Business-to-People (B2P)	Firm (+Platform) ↔ Individual	Zipcar, Socar, GreenCar, Kickgoing
Government-to-Citizen (G2C)/ Not-for-Profit (NFP)	Government (+Platform) ↔ Individual	Seoul Bike

Source: Authors.

According to Alex Stephany (Stephany, 2015[11]), the chief executive officer of JustPark, one of Europe's leading sharing economy businesses, the sharing economy creates value in making use of underutilised assets to reduce the need for ownership of such assets. Consequently, the paradigm of the sharing economy needs not be limited to interpersonal exchanges but rather extends to B2P models. Under such circumstances, companies such as Zipcar may be included in the scope of sharing economy.

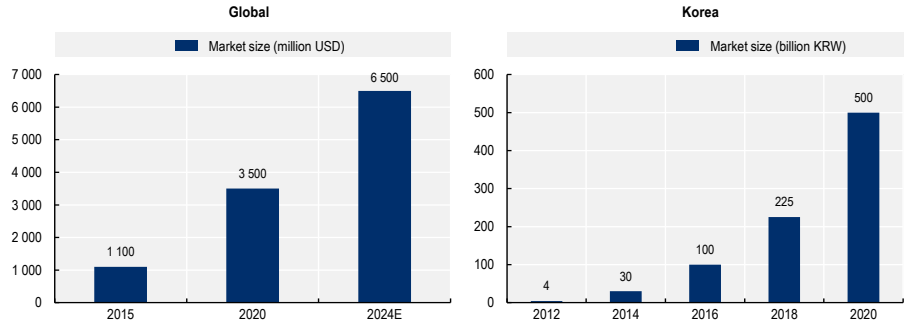
Table 7.3. Overview of Korean sharing economy (selected platforms)

	Socar	GreenCar	Kickgoing	SeoulBike
Business Model	Car-sharing	Car-sharing	Electronic scooter-sharing	Bicycle-sharing
Service Launch	November 2011	October 2011	September 2018	October 2015
Subscribers	Approx. 7 million	Approx. 3.5 million	Approx. 1 million	Approx. 3 million
Serviced Zones	4 000 stations in 110 municipalities	3 200 stations in 88 municipalities	Selected areas in Seoul Capital Area	2 500 stations around Seoul
Number of Vehicles	14 000	9 000	20 000	37 500
Ownership information	Largest shareholder: SK	Mother Company: Lotte	-	Operated by: Seoul Metropolitan Government

Source: (Socar, 2021[12]), (Kang, 2021[13]), (Lee, 2021[14]), (Seoul Metropolitan Government, 2021[15]).

The Korean government, in its Sharing Economy Stimulation Plan presented in January 2019, officially defines the sharing economy as an economic model in which individuals, enterprises, and public institutions utilise platforms to share assets and services and thereby promote economic efficiency. The Bank of Korea also defines online platforms such as Airbnb and Uber as part of the sharing economy.

Figure 7.3. Scope of the sharing economy in GDP calculation



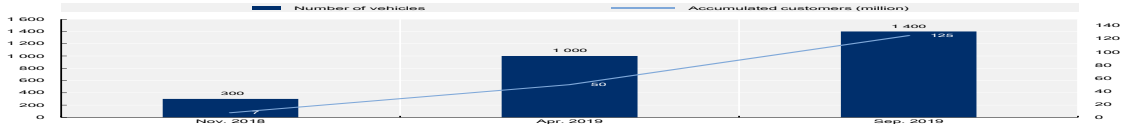
Source: (Bank of Korea, 2017[16]).

This chapter also intends to investigate Korean cases under the broad definition of sharing economy, and aims to capture a wider range of phenomena and analyse the regulatory issues related to sharing economy.

Core components

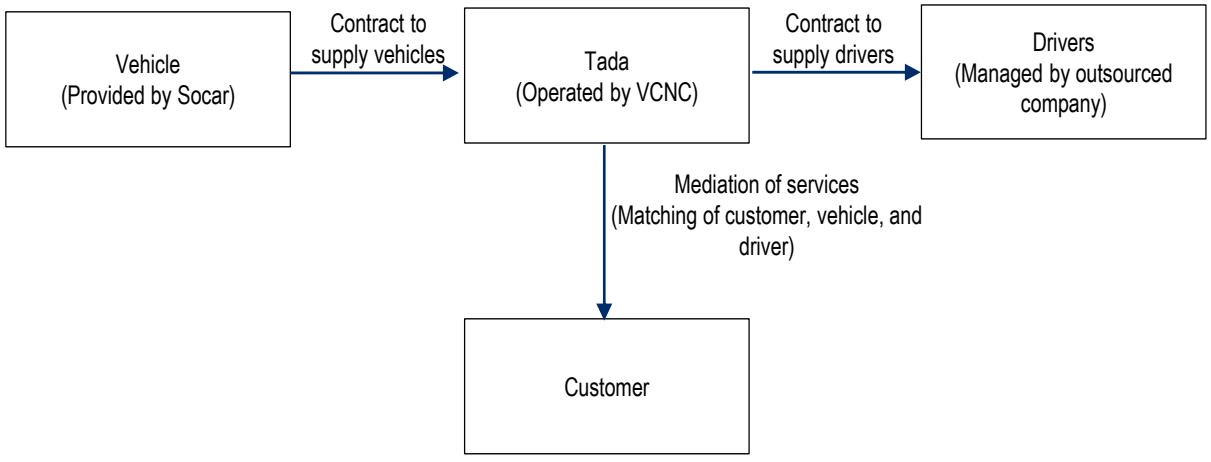
The fundamental difference between classical economies and the sharing economy is the utilisation of ICT-based platforms. An ICT-based platform is defined as a tool that mediates the exchange of goods and services by matching supply and demand. In fact, it is the mediation of ICT-based platforms that has ushered in the modern sharing economy.

Figure 7.4. Visual definition of classical economies



Source: Authors.

Figure 7.5. Visual definition of sharing economies



Source: (Kim, Lee and Hwang, 2016[10]).

As visualised in Figure 7.5, suppliers and consumers search for each other via an ICT platform. When a match and a deal are made, the former provides the latter with the rights to access the assets at the market price, while both parties are charged with a brokerage fee for their use of the platform.

The development of ICT has fulfilled the basic requirement of sharing economy. It is now difficult to imagine sharing economy activities without the intervention of Internet and smart devices. Supplies and demands can be met in a simple manner, and goods and services may be exchanged in real time. Consequently, the objectives of sharing and exchange no longer have to be limited to tangible assets. While mobility and short-term rental platforms have largely dominated the sharing economy domain, opportunities in numerous other professional services are also on the rise.

Table 7.4. Categorisation of the sharing economy by shared assets

Category	Sectors	Shared assets
Tangible assets	Point-to-Point (P2P) Mobility	Car / Bicycle
		Ride / Carpool
	Space	Accommodation
		Office
		Parking lot
		Kitchen
Intangible assets	Talent / Knowledge	Talent / Knowledge
	Finance	Crowdfunding

Source: Authors.

Sharing of tangible assets includes the sharing of vehicles, accommodation and spaces. Such form of the sharing economy activity provides extra profit to suppliers who are willing to share their assets with consumers. The California-based accommodation-sharing platform Airbnb would be the most representative business model of tangible asset sharing. In the meantime, sharing of intangible assets represents provision of intangible contents or services such as education and ride services. When intangible assets are shared, the supplier provides the appropriate service to the consumer, who then pays for the service.

Sharing economy in Korea: status and limits

Status and characteristics

The majority of Korean sharing economy start-ups were established after 2012, when Uber and Airbnb first started operations in Korea. The domestic business models have been largely influenced by global companies, and thus are not significantly differentiated from those of Zipcar, Uber, and Airbnb. In fact, some of the early sharing economy companies emphasised that they are Korean versions of the aforementioned flagship companies. One outstanding difference, however, is that Korea's ride-sharing sector has slowed down whereas Uber, a ride-sharing platform, has grown into one of the largest sharing economy companies overseas (Telles, 2016[17]).

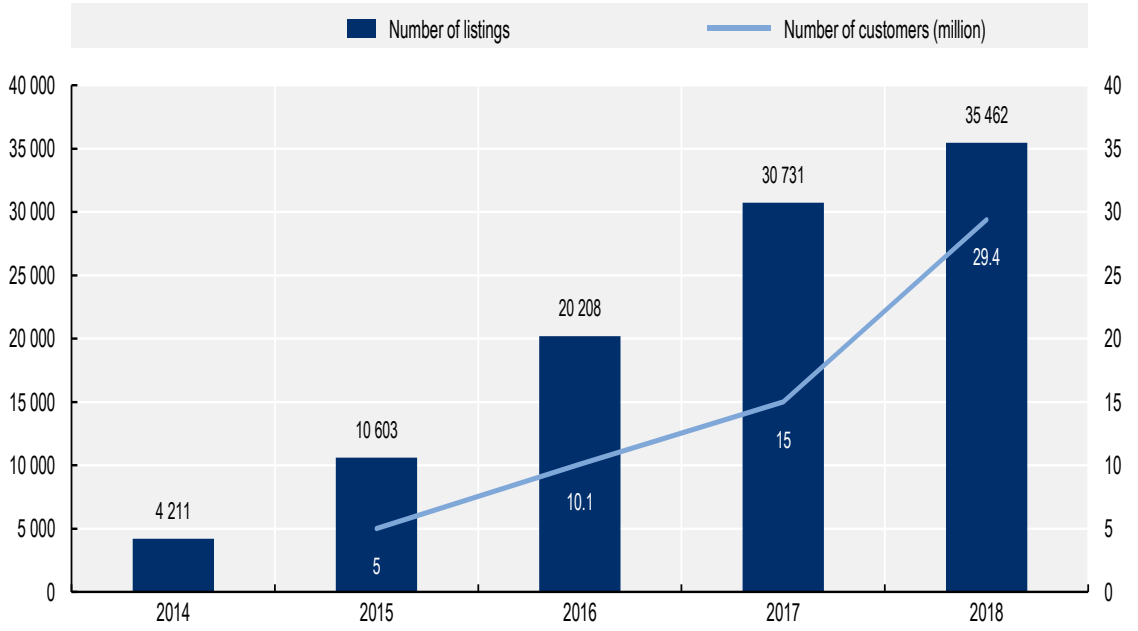
Results of a survey by (Korea Development Institute (KDI), 2019[18]) reveal that Korean citizens deem ride-sharing to be the most necessary service for vitalisation of the sharing economy. Among the respondents, 31.4% chose ride-sharing as the most important service for improving the overall quality of transportation services and resolving traffic issues.

Such slow progress in the ride-sharing sector may be the outcome of the prolonged controversy in the process of introducing Uber in Korea. It is highly likely that the controversy regarding the legal soundness of Uber, which occurred in the early stages of development, has interrupted the successful and sustainable expansion of the ride-sharing industry.

Last, as demonstrated by the widely-known Zipcar, Uber, and Airbnb, the sharing economy and its participants are vulnerable to network effects. (United Nations Department of Economic and Social Affairs, 2020[19]) points out that the sharing economy is characterised by its "winner-takes-most" type market despite the generally low marginal costs across platforms. Typically, one or two sharing economy firms dominate their respective sectors, and such trend is largely owing to the network effects that create high barriers to entry. The Korean sharing economy is not an exception. While 49 sharing economy firms are registered on Sharehub, their presence in the Korean sharing economy is trivial. For instance, the conglomerate-backed Socar and GreenCar dominate the car-sharing sector, the most successful sharing

economy sector. The network effect is even more evident in the accommodation-sharing sector where the market share of Airbnb is close to 99%.

Figure 7.6. Sharing economy sectors in need of the most improvements

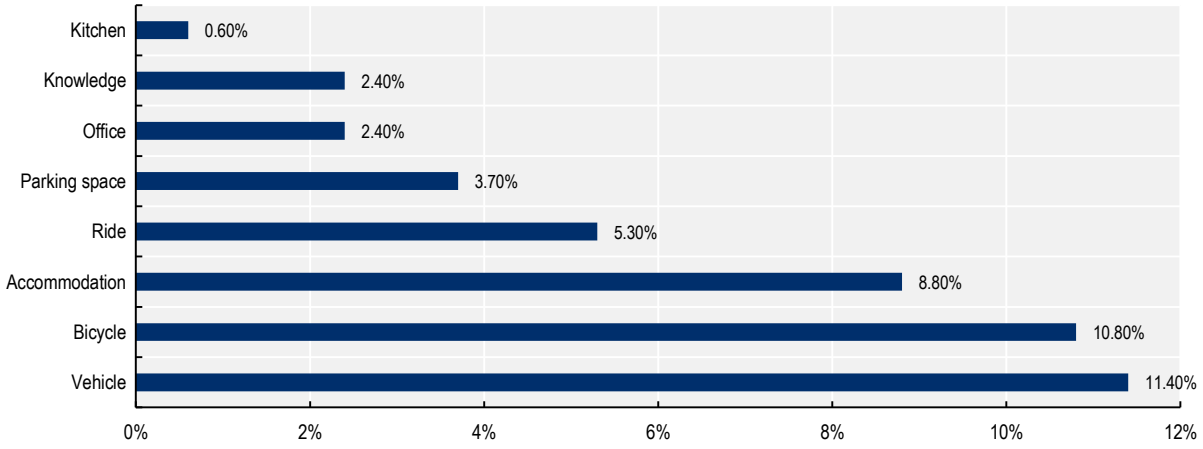


Source: (Korea Development Institute (KDI), 2019[18]).

Car-sharing

The car-sharing services have successfully responded to the fluctuating demands of various consumers on hour-to-hour basis. Since the introduction of Zipcar in 2010, the sector has experienced remarkable growth both globally and in Korea. Guidehouse Insights projects the global car-sharing market size to increase by CAGR of 21.8%. Such trend is also observable in Korea, where the car-sharing sector is by far the largest and the most representative sector of the sharing economy.

Figure 7.7. Expected growth of the car-sharing sector



Source: (Samjong KPMG Economic Research Institute, 2018[20]).

Although many associate the sharing economy only with start-ups, it is less likely to be the case in the car-sharing sector where incumbent companies have successfully entered the market via direct investments or acquisitions. For instance, instead of trying to use its existing business to compete with car-sharing services, Avis Budget Group acquired Zipcar for approximately 500 million USD in 2013 (Zipcar, 2013[21]). While most domestic start-ups face financial difficulties in the early stages, the two Korean car-sharing companies, Socar and GreenCar, have successfully landed in the market, thanks to large funds from major conglomerates. The domestic market leader Socar secured more than sixty-six million USD investments from SK until 2017, while its close competitor GreenCar has been acquired and operated by Lotte, since 2015. Market dominance and network effects are evident and expected to continue. As of 2018, the combined market shares of the two companies reached a record-high 87%.

Table 7.5. Status of the domestic car-sharing market (Socar & GreenCar combined)

	2013	2014	2015	2016	2017	2018
Registered users	172 340	1 020 000	2 700 000	4 400 000	5 800 000	7 700 000
Serviced areas	929	2 050	3 900	5 250	5 830	6 800
Number of vehicles	1 314	3 665	6 512	12 200	14 150	17 500

Source: (Kim, 2019[22]).

Unlike the classical commercial economy, the sharing economy is rather a dis-ownership model and values utilisation more than ownership. Thus, the sharing economy essentially puts greater social values in bringing significant economic and environmental benefits, including solving the issues faced by the wealthy population, protecting the environment, and creating jobs. (Cannon and Summers, 2014[23]) suggest that one benefit of the rapid growth of car-sharing services is a reduction in carbon dioxide emissions.

The social efficiency benefits of car-sharing have also been largely advertised in Korea. It is estimated that each shared vehicle effectively replaces 8.5 private vehicles (The Seoul Institute, 2015[24]). The domestic market leader Socar also claims that their 10 000 vehicles have reduced the need for purchasing about 75 000 vehicles in Seoul. As previously discussed, Stephany's definition of sharing economy includes a model that reduces the need for ownership of under-utilised assets (Stephany, 2015[11]). Consequently, the social benefits that Socar and GreenCar have brought to the Korean society make the car-sharing platforms fundamentally different from traditional rental car businesses.

Ride-sharing

In Korea, the perception that ride-sharing is essentially illegal is rampant among the public. If an activity does not fit perfectly into the existing regulatory framework, or if there are apprehensions that it may negatively affect the incumbent businesses, it is usually subject to the existing regulations. Ride-sharing platforms such as Uber and Tada, whether global or domestic, stand officially banned from the Korean market, as the court ruled that they illegally used private vehicles for commercial purposes. Since its introduction to the domestic market in 2013, Uber has faced significant resistance from the taxi industry that accuses the service of regulatory arbitrage and unfair competition. Domestic ride-sharing platforms introduced after the suspension of Uber X service in 2015 have also been subject to controversy.

Launched in October 2018 by the car-sharing platform leader Socar and mobile application developer Venture Creators & Company, Tada started its application-based van-hailing service using 11-seat Kia Carnival vans and outsourced drivers. Only a year after its establishment, Tada became a leading domestic ride-sharing service with 1 500 vehicles and 9 000 drivers as of December 2019.

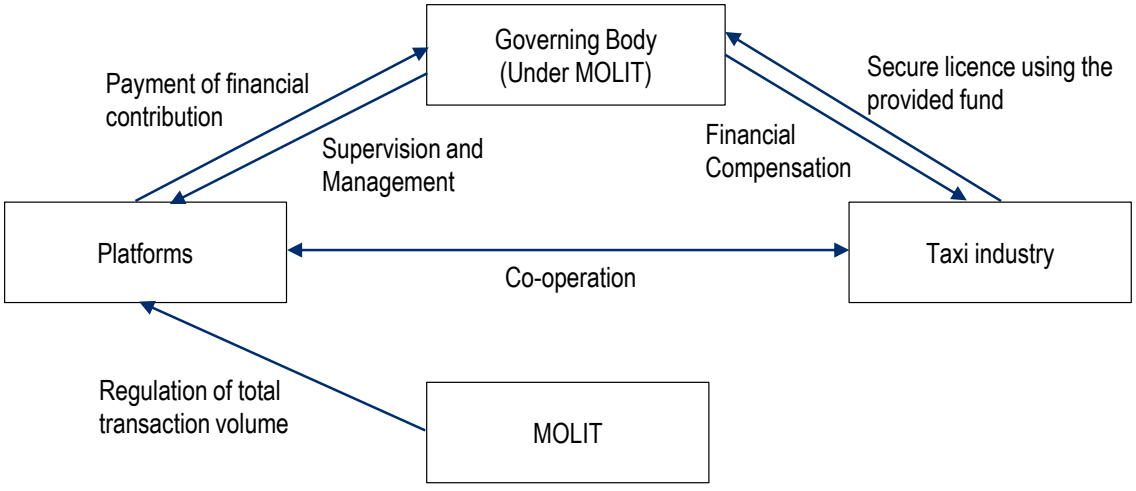
As summarised in Table 7.6, Tada claims its service complies with the Transportation Law that permits companies to provide drivers for rental vehicles with 11 seats or more. However, it has faced enormous setbacks from taxi drivers who called Tada illegal because the company transports passengers for profit by hiring drivers who do not hold appropriate taxi licenses.

Table 7.6. Contentious clauses between Tada and the taxi industry

Act	Content
Passenger Transport Service Act Article 4	Any person who intends to engage in passenger transport business prescribed by the Presidential Decree shall prepare a business plan and obtain a license from the "Mayor/*Do* Governor" or register with the Mayor/*Do* Governor, as prescribed by Ordinance of the Ministry of Land, Infrastructure and Transport.
Passenger Transport Service Act Article 34	No person who rents a commercial motor vehicle from a car rental business shall use such motor vehicle for transport with compensation or sublet the motor vehicle to any third party, and no person shall arrange such activities.
Enforcement Decree of Passenger Transport Service Act Article 18	Exceptionally, a person who rents a commercial motor with 11~15 seats from a car rental business entity may sublet the motor vehicle to a third party.

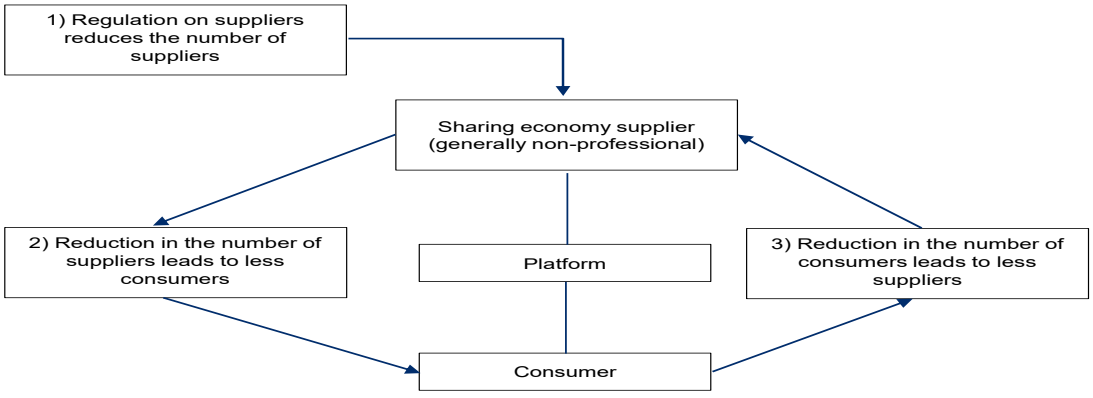
Source: (Korean Passenger Transport Service Act, 2021[25]).

Figure 7.8. Operation status of Tada



Source: Venture Creators & Company.

Figure 7.9. Operation structure of Tada



Source: Authors.

While Articles 4 and 34 of the Passenger Transport Service Act apparently prohibit the use of a rented motor vehicle for transport with compensation, Tada took advantage of the regulatory loophole specified in Article 18. This generated dramatic reactions from local taxi drivers. While Tada gained popularity among consumers, the ultimate result has been gloomy for the ride-hailing service. In March 2020, the National Assembly passed a law that effectively banned operations of services like Tada.

Box 7.1. South Korea passes bill limiting softbank-backed ride-hailing service Tada

Reuters, 7 March 2020

South Korea's parliament on late Friday passed a controversial bill to limit the ride-hailing service Tada, dealing a blow to a company that has been a smash hit since its launch in late 2018 but faced a backlash from taxi drivers angry over the new mobility services.

South Korea's National Assembly passed a revised passenger transport service act requiring rental vans with 11 to 15 seats for tour purposes to be used for at least six hours and stipulated that they be rented or returned at airports or seaports.

The current law bars rental car services from offering drivers, with the exception of vans with 11 to 15 seats – which are provided by Tada.

South Korea restricts ride-hailing to only licensed taxis and bans the use of private cars for the purpose. Tada has been exploiting a rule that allows the rental of chauffeur-driven 11-seaters to operate its ride-hailing services, drawing fierce opposition from the taxi lobby and regulators.

The passage of the bill comes after Tada was cleared of charges of transport law violations in court in mid-February. Prosecutors had sought one-year jail terms for executives of Tada and its parent firm Socar, arguing Tada was a de facto unlicensed taxi service.

Following the passage of the bill, Lee Jae-woong, an entrepreneur and head of Tada's parent company, said on Facebook he would halt Tada's services and apologised to users, while asking who would dare to take on challenges and nurture innovative startups in the country. The revised law is set to take effect 18 months after it is proclaimed.

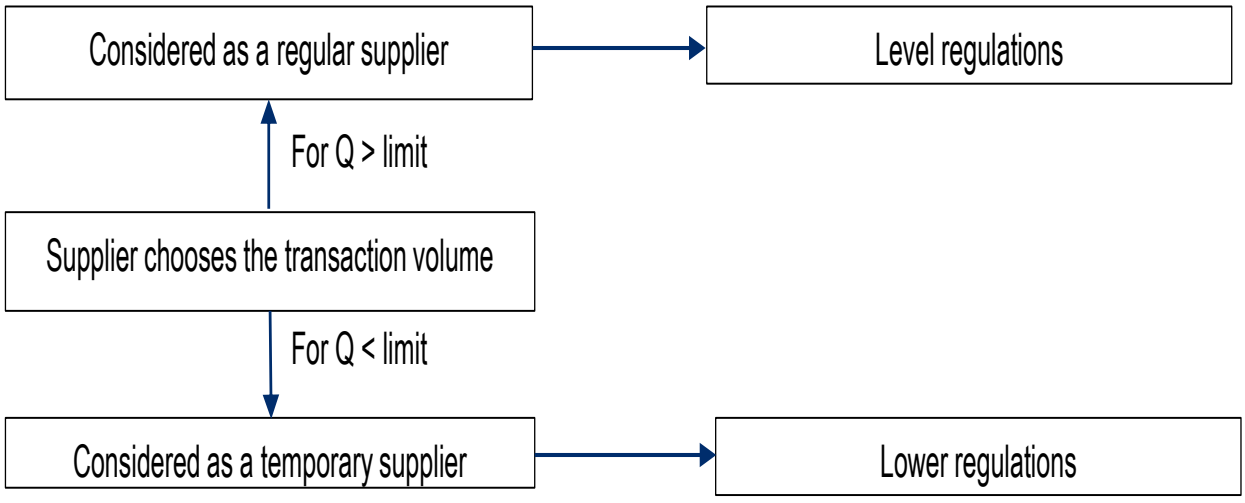
Tada, launched in October 2018, has won 1.7 million users as it capitalised on growing demand and the funding muscle of its Japanese backer SoftBank Group Corp.

Source: (Chung, 2020[26]).

Accommodation-sharing

Accommodation-sharing is also gaining popularity in the Korean market. Yet, unlike the car-sharing sector where domestic platforms excel, the Korean accommodation-sharing sector is entirely dominated by Airbnb, an America-based platform. This is mainly due to current regulatory arbitrage that ironically makes it very difficult for domestic start-ups to enter the market and make profits. In 2018, Airbnb hosted more than 2.9 million customers and created domestic economic ripple effect worth USD 1.3 billion.

Figure 7.10. Increase in the number of Airbnb listings and customers



Source: (Airdna, n.d.[27]).

Airbnb dominates Korea's accommodation sharing market. The platform reports that more than 2.9 million tourists booked accommodation in Korea through Airbnb in 2018, up 56% from 1.9 million in 2017. The market shares of domestic accommodation-sharing platforms cumulatively account for less than 10%. This is due to the utilisation of regulatory arbitrage, provided by the current Tourism Promotion Act. The Act prohibits accommodation-sharing service providers in urban areas from hosting domestic tourists, significantly limiting business opportunities for both Airbnb and domestic platforms.

Box 7.2. Airbnb calls for law revision in Korea

The Investor, 15 October 2018

Airbnb launched a campaign on Oct. 15 to call for a revision of the law to allow South Koreans to share their homes with domestic travellers in the country's major cities, it said.

Under Korea's Tourism Promotion Act, residents in urban areas, excluding rural communities defined by law, can only share their homes with foreign tourists.

The global room-sharing platform said it has sent an email to more than 100 000 of its members to sign up for a petition calling for a change in the law.

Source: (Song, 2018[28]).

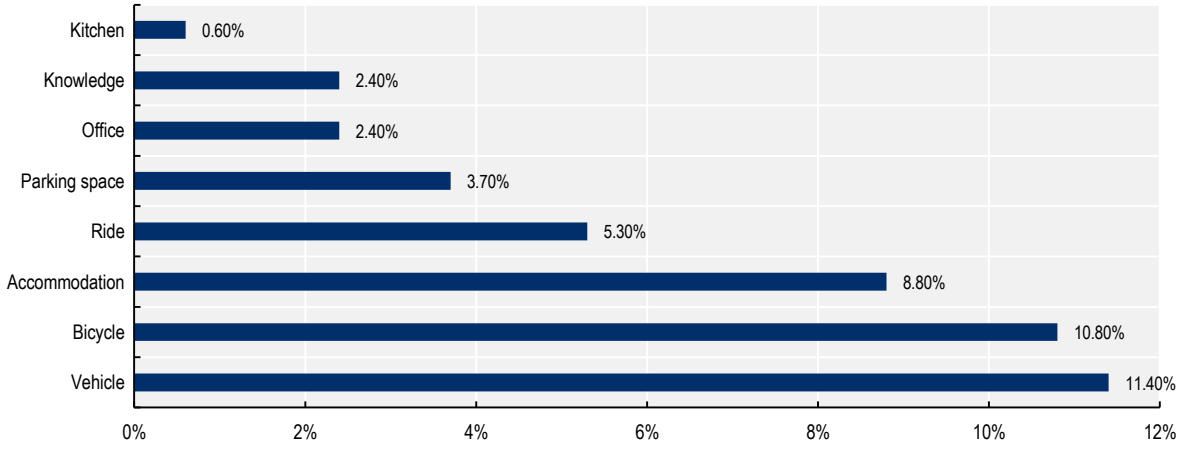
The situation, however, is slightly more positive for the US-based platform. As international inbound guests are more familiar with Airbnb, the majority of tourists rely on the global platform when searching for accommodation-sharing opportunities in Korea.

Cases of failure: sharing of intangible assets and government-run sharing

Not all sharing economy models have been popular or successful in Korea. The domestic emergence of the sharing economy is mainly due to the growth of B2C type sharing businesses, and consequently, those with fewer economic resources find themselves in a difficult situation. Particularly, the sharing of intangible

assets, such as knowledge, has been noticeably unpopular in the Korean sharing economy. The results of a KDI survey show car-sharing to be the most commonly used sharing economy service in Korea, followed by bicycle-sharing, accommodation-sharing, and ride-sharing services. In the meantime, sharing of spaces (parking space, office, and kitchen) and intangible assets (knowledge) are less common.

Figure 7.11. Experience with sharing economy services



Source: (Korea Development Institute (KDI), 2019[18]).

Sharing economy platforms require the thorough support of feasible revenue generating business models. From a theoretical perspective, sharing economy platforms must possess certain values in order to differentiate themselves from incumbent business models. However, they can sustain these values only when they are able to operate in the market. The business models of Zipbob, Wisdom, and Passion University, well-known intangible asset sharing platforms, were highlighted for their innovative ideas. The three platforms aimed to make meaningful changes in the society through active sharing of knowledge, talent, and time.

Eventually, the three platforms faced termination in 2018. The first-generation social ventures suffered due to the inability to find profitable business models and lack of adequate funding. Under the Korean sharing economy, intangible asset-sharing start-ups are usually faced with difficult financial situations and the public's indifference.

Table 7.7. Terminated intangible asset-sharing platforms in Korea

Company	Platform / service	Establishment	Termination
Zipbob	Social dining	2012	2018
Wisdom	Human-library	2012	2018
Passion University	Career searching	2012	2018

Source: (Park, 2018[29]).

Cases of failure: government-run sharing

The public sector's contribution to the expansion of the sharing economy in Korea is also compelling. While the central government has been hesitant to promote potentially innovative services, the local governments have driven the expansion of sharing economy in Korea. In fact, more than fifteen cities have implemented their own version of the sharing economy policies. The capital city of Seoul, in particular, has been

operating various sharing services since 2012 under its 'Sharing City Seoul' project. The project is designed to restore reliable relations and to reduce the wasting of resources with a view to resolving urban economic and environmental problems. Seoul promotes sharing economy as a key to solving numerous social issues related to transportation, parking, and environment, and proposed a plan to support 300 sharing economy entrepreneurs by 2018 (The Seoul Institute, 2015[24]).

In addition to supporting the sharing economy ecosystem and platforms, the local governments have turned themselves into active participants. The front-runner among such cases is Seoul Bike, the capital city's government-run public bicycle-sharing service. As a part of the aforementioned Sharing City Seoul project, the City of Seoul has managed and operated Seoul Bike since 2015. The service has received overwhelming support from the public, with more than 50 000 daily transactions.

Table 7.8. Seoul bike statistics

Category	2015	2016	2017	2018	2019
Total rentals	114 000	1 612 000	5 031 000	10 062 000	14 177 000
Average daily rentals	1 000	4 000	14 000	28 000	52 000
Registered users	34 000	211 000	597 000	1 093 000	1 664 000

Source: (Jang, 2019[30]).

However, the public-driven sharing economy also has boundaries. The so-called tragedy of the commons may easily occur in the absence of rules and penalties. (Ostrom, 2002[31]) suggests the principles that are indispensable to making the sharing economy sustainable. First, clearly defining who may utilise the shared assets is imperative. Furthermore, it is necessary to establish standards to determine the specific time and place for exchange of workforce, tangible assets, or technology. The toughest obstacle to preserving the government-run sharing economy is the users' lack of responsibility. From 2016 to 2019, 156 803 Seoul Bikes have broken down. The irresponsible behaviour of some users causes inconvenience to other participants and the public. In fact, the majority of Seoul Bike users chose damage and breakdown as one of the biggest inconveniences of the bicycle-sharing service (Kim and Kim, 2018[32])

Box 7.3. One in Four Rented Bike Helmets in Seoul Missing or Stolen

The Korea Herald, 25 July 2018

Around 25% of helmets provided by the Seoul Metropolitan Government for cyclists were stolen over a four-day period, according to the City on Wednesday.

The City of Seoul operated a helmet rental system on a trial run from Friday to Monday at 30 stations in Yeouido for cyclists who ride the City's bikes in preparation for the mandatory use of helmets that will start on 28 September.

However, the helmet rental system hit a serious roadblock as 218 of 858 helmets disappeared, deepening the concerns of the City. The helmets were placed in the bike's carrier baskets or storage boxes, allowing anyone to use them.

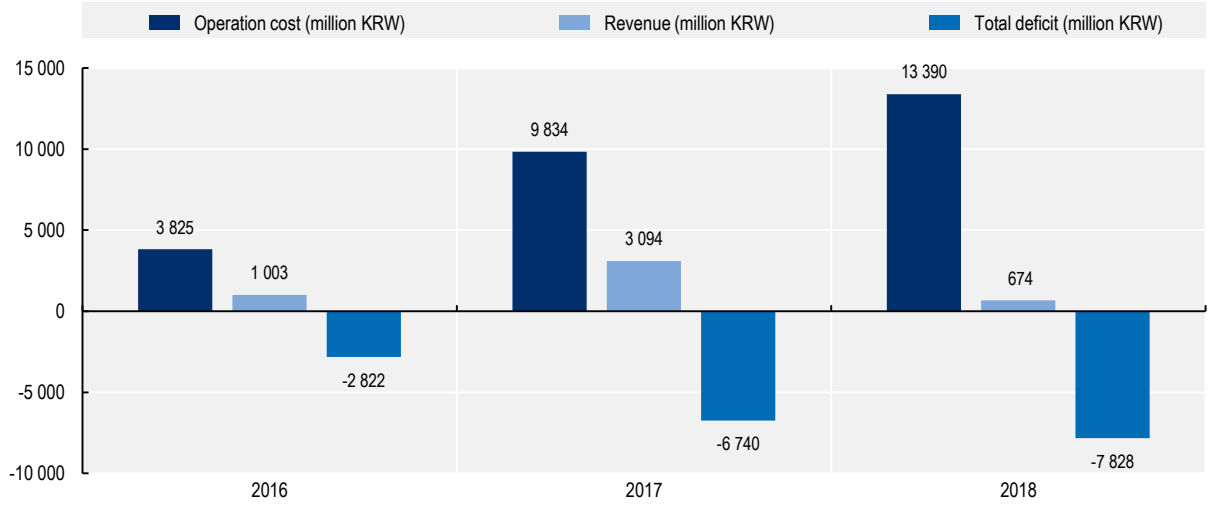
City officials did not put tracking chips on the helmets because of the limited annual budget set at around WON 1.2 billion (USD 1.07 million).

The City will continue to operate the helmet rental system and see if measures can be taken to prevent helmet theft or if they will have to scrap the rental system altogether.

Source: (Chyung, 2018[33]).

Yet, the deficit from operating Seoul Bike significantly increased from 2.8 billion KRW in 2016 to 7.8 billion KRW in 2018. By 2018, more than 150 thousand bikes were damaged and repaired. In 2018, Seoul Bike's helmet rental system also faced a serious setback, as 218 of the 858 helmets were lost or stolen over a four-day period. Seoul Bike has proved to be another example of the well-known tragedy of the commons, a situation in a shared-resource system where individual users act independently according to their own self-interest and behave contrary to the common good of all users by spoiling the shared assets.

Figure 7.12. Deepening deficits of managing Seoul Bike



Source: (Kim, 2019[34]).

Another issue is the government's presence in the micro-mobility market. The City has been acting as a monopoly and essentially creating network effects in Seoul's bicycle-sharing sector. Ultimately, Seoul Bike is deterring the entrance of other bicycle-sharing start-ups and competing against other domestic micro-mobility start-ups such as Lime. Whether it is appropriate for the government to run its own sharing economy business model, despite enormous deficits, must be subjected to further discussion.

Issues around sharing economy in Korea

Conflicts with incumbent businesses

One of the major issues in the process of introducing sharing economy in Korea is continuous conflicts with incumbent business sectors. As sharing economy transactions substitute certain incumbent transactions providing similar services, they are likely to reduce the profits of incumbent businesses. According to a survey conducted by (Kim, 2019[35]), utilisation of the sharing economy services is highly likely to reduce the use of incumbent services.

Table 7.9 shows the impact of sharing economy on incumbent businesses. When asked which type of existing transactions consumers reduced to use sharing services, nearly 90% of accommodation-sharing consumers and car sharing consumers answered that they did reduce some type of existing transaction models. While the reaction of the hotel businesses and the taxi industry is perhaps exaggerated, the Korean hotel industry is certainly expected to experience negative impacts due to the growth of the accommodation sharing services. In an empirical study conducted using Korea's real data, there was a loss of approximately 0.16% in the room sales of the hotel industry for every 10% increase in the supply of accommodation facilities via Airbnb.

Table 7.9. Impact of sharing economy on traditional transactions

Which type of existing transaction did you mainly reduce for sharing transactions?

Accommodation-sharing consumers		Car-sharing consumers	
Type	Percentage	Type	Percentage
Hotel	33.6	Public transportation	29.8
B&B / pensions / guest house	31.6	Taxi	23.2
Motel / Inn	12.4	Own car	23.0
Resort / condominium	11.2	Rental car	12.0
No change	11.2	No change	12.0

Source: (Kim, 2019[35]).

Table 7.10. Estimated impact of accommodation-sharing on the incumbent hotel industry (2010-14)

Analysis object	Room sales	-0.16**
	Room price	-0.13***
	Room occupancy rate	-0.04

*, **, and *** denote significance levels of 1%, 5%, and 10%, respectively.
Source: (Kim, 2019[35]).

While it is still controversial, Tada can be considered a business utilising a new technology. Potentially, other ride-sharing services that exploit regulatory grey areas may continue to emerge. A complete revision of current regulations is therefore necessary, in order to prevent further social discord. In 2018 for example, Kakao Mobility, a Korean mobile giant, officially delayed the formal launch of its carpool service due to fierce protests by the taxi industry. However, Kakao, with its financial capability to stack up taxi licenses, eventually secured nearly 1 000 taxi licences by acquiring taxi companies to operate a Tada-like service, Kakao Venti.

Box 7.4. Kakao Mobility launches van-hailing service in a compromise with the taxi industry

MK, 12 December 2019

After folding its fledgling ride-sharing business due to opposition from die-hard taxi drivers, Kakao Mobility Corp. this time engaged the taxi industry to launch a van-hailing service in a compromise to avoid a clash with the existing car-hailing service and regulations.

The mobility business unit of Korea's messenger app giant Kakao Corp. launched hybrid ride hailing service on vans dubbed "Kakao T Venti" on Wednesday, with an initial fleet of 100 large vans running within Seoul. The beta version has gone into service through the company's existing taxi-hailing app Kakao T, with the new service offered through a pop-up message for users to hire a van taxi. The company will decide on the official launch based on the response to its trial service.

Kakao T Venti is offered together with licensed taxi drivers and can avoid the legal contradiction Tada has faced for arranging van drivers for its ride-hailing service, according to the company. After its initial launch was stopped due to a series of taxi drivers' suicides, Kakao Mobility has engaged the taxi industry by purchasing seven legitimate taxi operators along with over 600 taxi licenses. It already has its app-based taximeter authorised by the Provincial Government of Seoul.

Source: (Oh, Hong and Cho, 2019[36]).

Platform labour workers in regulatory grey area

A greater issue related to sharing economy arises when it goes beyond the increase in the utility of consumption. In fact, regulatory loopholes and regulatory arbitrage led to the creation of digital platform monopoly and platform workers. The sharing economy platforms externalise their workforces through indirect employment and/or in the form of a sub-contract.

In fact, the sharing economy platforms are expanding employment opportunities in ways that were neither easy nor safe under the existing criteria. There exists controversy over the working conditions sharing economy platforms impose on their workers. Some argue that the sharing economy platforms are essentially shifting their risks to platform workers.

Box 7.5. Long working hours, falling wages threaten S. Korea's gig economy workers

Yonhap News Agency, 15 January 2020

Platform workers, the lifeblood of the country's emerging gig platforms that offer delivery, ride-hailing and housekeeping services, are often exposed to dire working conditions such as low pay and long working hours, a study showed on Wednesday.

In contrast to the notion that the lifestyle would give workers the freedom to choose their work schedules, a study by the National Human Rights Commission showed that gig economy workers often worked as much as full-time employees but faced job uncertainties and low wages.

A majority of the surveyed workers said they opted for their careers on hopes they could freely choose the hours they work. However, the study showed that gig economy workers on average worked 8.22 hours daily, five to six days a week. Their working hours could be longer given the "hidden working hours" in which they stay on the platforms or in mobile chat rooms to find new gigs, the study said.

The study hinted that the gig economy workers, mostly in their 40s and 50s, had few options over choosing the type and scope of their work and relied heavily on piecemeal jobs.

The average ages of those providing housekeeping services and driving services were 55 and 50, respectively, while the age of cargo drivers averaged 46, according to the survey.

A total 64% of the surveyed workers did not have second or third jobs and were key breadwinners for their families, with their earnings accounting for 79% of their household income. Their monthly income averaged WON 1.52 million (USD 1 313).

Despite the not-so-favorable working conditions, 90% of gig drivers and 80% of parcel delivery workers said they could not refuse certain gigs on fears it would hurt their job prospects. The study, meanwhile, highlighted that the rapidly growing platform industry and the fresh inflow of new workers is forcing the workers to work for less. There were roughly 500 000 gig economy workers in Asia's fourth-largest economy in 2019, accounting for around 2% of all employed workers, according to the Korea Employment Information Service.

Source: (Lee, 2020[37]).

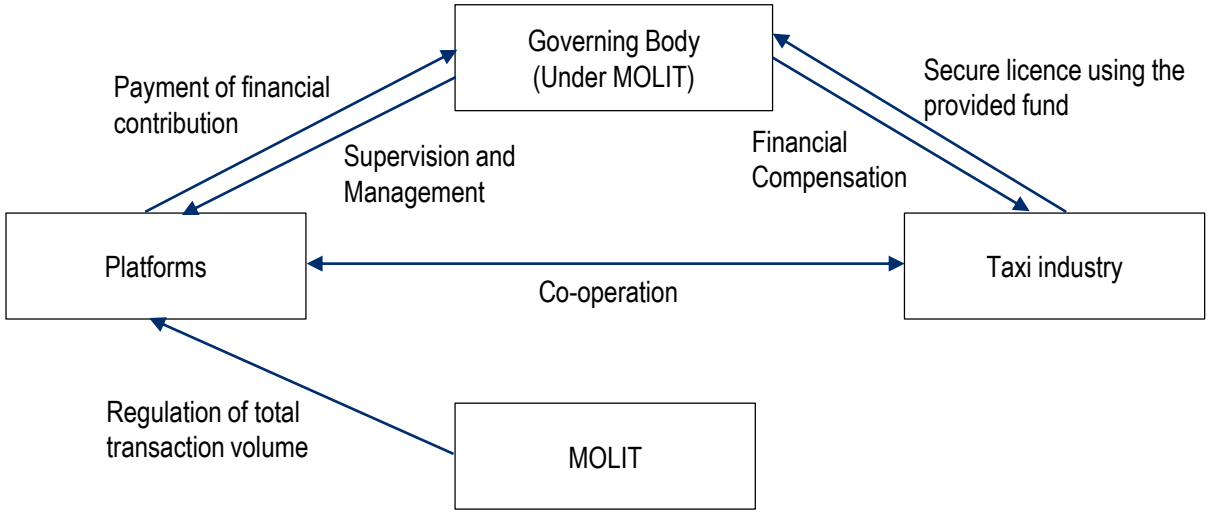
The lack of protection is particularly evident in the Korean ride-sharing businesses. As demonstrated in Figure 7.13, Tada drivers are not employed by the platform. In other words, the platforms are circumventing the current regulations. Meanwhile, courts in a number of jurisdictions worldwide are ruling against the likes of Uber by imposing the reclassification of platform-based drivers (see case study 4 for more details).

This consequently raises the necessity of proper regulatory frameworks specifically targeting the professional platform providers.

Government efforts towards social compromise

In order to resolve the issues surrounding the introduction of sharing economy, in early 2019 the Korean government prepared a plan to vitalise the sharing economy. According to the plan, the Ministry of Land, Infrastructure, and Transportation (MOLIT) will set up a governing body to manage transportation service providers. Suppliers of platform transportation services will contribute to fund the existing taxi industry. The government will also regulate the total number of platform providers.

Figure 7.13. Visualisation of revised government plan for platform transportation services



Source: Authors.

In the accommodation-sharing sector, the Korean government is planning on implementing a form of transaction-volume-based regulation, allowing domestic tourists to avail accommodation sharing services while limiting it to 180 days per year.

Table 7.11. Current legal framework for accommodation-sharing

	*Hanok**-sharing	Rural	Urban	Government Plan
Domestic Tourists	Allowed	Allowed	Not Allowed	Allow up to 180 days
International Tourists	Allowed	Allowed	Allowed	Allow

* Houses built in traditional Korean style.
Source: (Yang, 2018[38]).

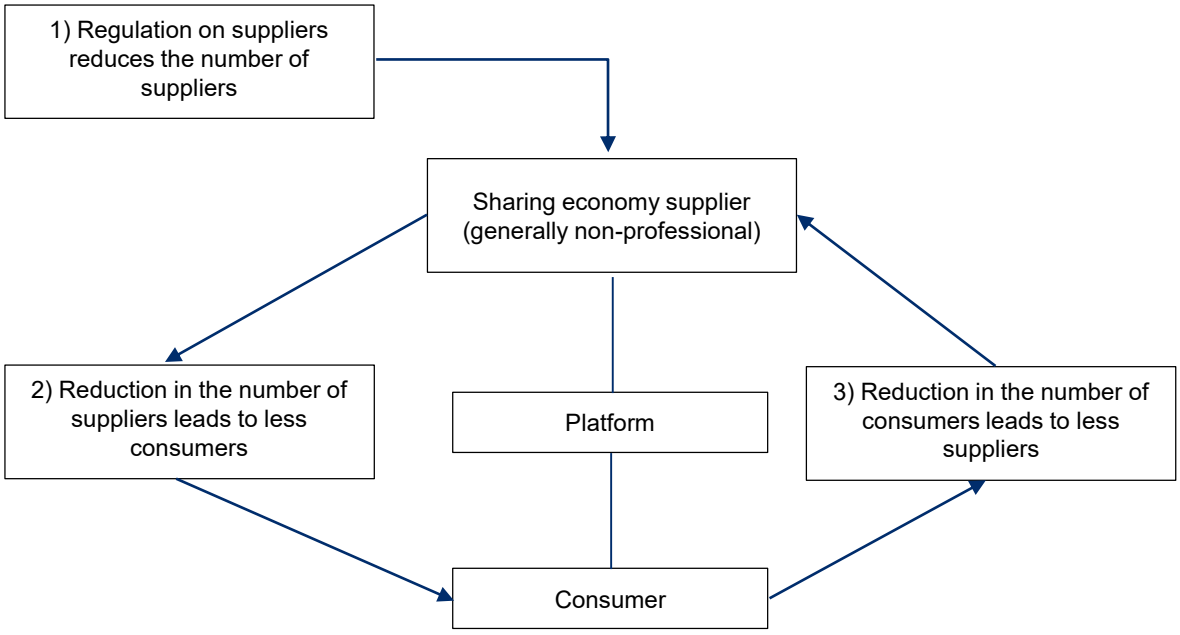
A Need for alternative regulatory strategies

What conventional regulations can do to the sharing economy

Sharing economy is a relatively new economic phenomenon that has developed recently. Consequently, appropriate regulations remain to be prepared. 'The Basic Act on Sharing Economy' was proposed at the National Assembly in 2018, but it is yet to be enacted. The problem rises as the current law fails to regulate

the sharing economy at a desirable level. As previously identified, it is not yet clear which statute can be applied to the sharing economy. Under the current law, for example, accommodation-sharing does not completely belong to any industry classification, and therefore, the regulation fails to provide clear direction for those who wish to enter the accommodation-sharing business. A similar issue in the ride-sharing sector has caused even greater social discord. Conflicts between incumbent industries and ride-sharing platforms have occurred in numerous other economies such as the United States, the United Kingdom, Germany and Australia. However, controversy over accepting ride-sharing services is particularly severe and seemingly perpetuating in Korea. While Uber withdrew its Uber X services in 2015, domestic start-ups such as Tada and Kakao Mobility have been forced to terminate operations or to abide by conventional regulations.

Figure 7.14. Vicious circle under conventional regulations



Source: Authors.

The purpose of regulatory alternatives

The sharing economy, with its platform services or third party intermediary, has entered a number of existing markets. In this process, it is inevitable for the sharing economy firms to collide with the incumbent businesses that have already been operating in the market. For example, ride- sharing services share the market with the existing transportation businesses such as taxis, while accommodation-sharing services share the market with the existing accommodation providers such as hotels and motels. Since the sharing economy firms and the incumbent businesses compete for limited demands in a similar market, it is imperative that both the incumbent businesses and the sharing economy firms comply with virtually the same level of regulations. The complaints raised by the incumbent businesses may be reasonable. In fact, a number of firms self-proclaim themselves to be “sharing economy firms” even though their business models are not essentially different from those of the existing businesses.

Under current regulations, however, it is not easy to distinguish which sharing economy models require regulatory improvements, and which models can operate under the existing regulations. Socar, for example, owns vehicles and rents them to consumers on an hourly basis. However, the company still

considers itself a sharing economy firm, while some argue that its business model is nothing more than a short-term rental car.

The problem with the modern sharing economy is that it involves some professional suppliers. While sharing economy is based on the utilisation of idle resources, the professional suppliers generally secure resources in order to conduct business. In such case, it is not possible to consider the resource as idle because it is purchased and managed solely for rental purposes. Even if the professional suppliers utilise idle assets, they still cannot fit the definition of sharing economy firms if they continuously and repeatedly conduct such businesses for profit. Thus, there exists no reason for regulators to provide regulatory arbitrage for professional suppliers.

Yet, there are also non-professional suppliers in the sharing economy. These non-professional suppliers usually lack expertise and capital to properly abide by the current laws, which are designed to regulate businesses operating in a Business-to-Consumer (B2C) format. In ride sharing services, for example, current regulations mandate that all suppliers acquire license and complete some degree of safety training. While platform operations are not directly subject to these regulations, the suppliers specifically come under the scope. However, it would be nearly impossible for all non-professional suppliers to acquire licenses and complete mandatory training. Further, in the case of accommodation sharing, forcing all non-professional suppliers to equip themselves with foreign language services and/or training in traditional cultural experiences ultimately raises entry barriers. If such non-professional suppliers face increased costs and excessive entry restrictions, it is highly likely that they lose the desire to participate in the sharing economy.

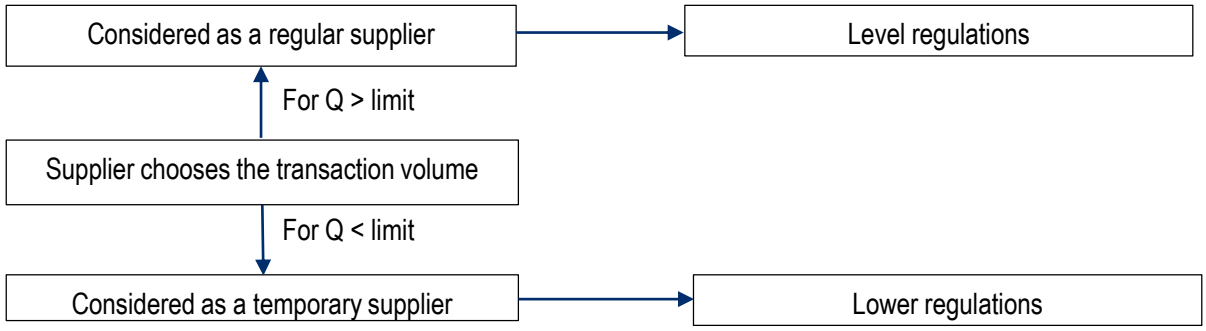
Some participants will be professional and some will be non-professional. Classical regulations on suppliers will therefore affect the non-professional suppliers first, followed by professional suppliers through indirect network externalities. Consequently, it is difficult for the participants of the sharing economy to predict whether they are subject to the existing regulations and how they apply. It is therefore important and necessary to provide regulatory schemes specifically targeting the sharing economy suppliers, in order to ensure stability and economic viability for the participants.

The issue of stability and predictability due to regulatory arbitrage is not only the problem of the platform operators and suppliers. Indeed, incumbent businesses may become the victim of the sharing economy firms potentially taking advantage of the market through regulatory arbitrage. While incumbent businesses are already subject to certain regulations, sharing economy firms may take undue advantage of lack of proper regulations. The incumbent businesses must pay the costs before the regulatory bodies introduce appropriate regulations for the new entrants. The purpose of regulatory alternatives should therefore be to assure fair regulation of both incumbent business and sharing economy firms, and to facilitate the advancement of a potentially more flexible and efficient economic paradigm.

Alternative 1: Regulation-in-proportion (transaction-volume-based regulations)

In order to respond to the concerns regarding conflicts with existing businesses properly, the regulator must guarantee regulatory equity. This will provide a level playing field in which incumbent businesses and sharing economy suppliers can compete based on fair terms. In view of the unique characteristics of sharing economy, regulations must be linked to the volume of transactions, as proposed by Kim, Lee and Hwang (2016). In other words, a transaction limit should be determined in order to categorise those who exceed such limit as “professional and regular operators”, and subject them to traditional supplier regulations. Likewise, entities that do not exceed the limit are categorised as ‘non-professional and temporary operators,’ and are subject to lower regulations.

Figure 7.15. Visualisation of regulation-in-proportion



Source: (Kim, Lee and Hwang, 2016[10]).

Existing suppliers that wish to operate under fewer regulations can opt to reduce their transaction volume, and new suppliers wanting to become regular operators can do so by meeting the traditional regulatory requirements. Transaction-volume-based regulations guarantee autonomous right of choice to respective suppliers, while demanding that they pay the price for the benefit of lower regulations by a reduced transaction volume.

By tailoring the level of regulation to the volume of business activity, regulation-in-proportion can respond to the fairness concerns that a classical regulation may unduly burden small-scale suppliers. At the same time, the transaction-volume-based regulation can ensure that the impacts on small-scale businesses are distributed proportionally. By raising the costs of engaging in the activity, the transaction-volume-based regulation requires the suppliers to internalise some of those costs. Additionally, from the regulator's perspective, because the transaction-volume-based regulation depends on quantifiable measurements, it can offer the prospects of certainty and efficiency to both regulators and the regulated parties.

Alternative 2: Platform regulation (delegated implementation)

The implementation and actual enforcement of the transaction-volume-based regulation involves evident difficulties. In order to ensure the practicality and effectiveness of the proposed framework, information about the transaction volumes of the respective suppliers must be properly provided to regulators. In order to benefit from eased regulations, however, sharing economy suppliers have an incentive to under-report their transaction volumes. The quality and sustainability of imposed regulations would be another issue. Given the number of suppliers, it would be difficult for regulators to identify false reports and violations. Consequently, obtaining the data necessary to develop and enforce the transaction-volume-based regulation will be a challenge without the co-operation of platforms that hold the data. In order to respond to this concern, certain obligations will have to be imposed on the sharing economy platforms. Since such platforms possess detailed data on transactions and, compared to suppliers, have a relatively low incentive to report falsely, it should be made mandatory for the platforms to submit and report required transaction information on a regular basis.

While platform operators play a central role in the sharing economy, they do not own products nor do they make direct transactions with consumers. However, despite such characteristics, platform operations are the main pillar of the sharing economy. First, platform operators introduce and engage in all transactions that take place between suppliers and consumers. Consumers must go through the platform in order to find the suppliers who can meet their demands. After signing up on the platform, the consumer selects the desired supplier by reviewing the information provided by the platform. At the same time, the platform provides the consumer's information to the supplier in order to help the supplier decide whether to accept the consumer's demands.

Table 7.12. Potential Issues with transaction-volume-based regulations and countermeasures through delegated implementation

Issue	Counter-measure
Incentive to under-report transaction volume	Platforms report on behalf of suppliers
Taxation and registration	Platforms register on behalf of suppliers and withhold the registration of offenders
Insufficient regulations on non-professional suppliers	Platforms provide regulatory measures for suppliers

Source: Authors.

In addition, payments for the use of shared goods and services are, in most cases, made through platforms. By linking the suppliers and consumers, the platform operators help both parties significantly reduce the cost of searching. Further, the platforms play an important role in fostering trust between the participants.

The role of the platform operators as the main pillar is not only limited to that of an intermediary. So far, platform operators are the only participants in the sharing economy who can regulate the other parties. They can impose certain obligations on the suppliers and consumers in exchange for providing linkage services. Thanks to the presence of the platform operators, suppliers are able to find reliable consumers easily. This is partly because the platform operators take over the transaction costs and issues of information asymmetry. In turn, it is platform operators that have enabled non-professional and temporary suppliers to participate in the sharing economy.

Co-regulation: an ideal way forward

Platforms such as Airbnb and their participants are working together to regulate consumers and suppliers voluntarily and to reduce transaction risks significantly through various means. The most representative of these standards is the reviews and reputation system. Some even conduct self-operated ex-ante screening or engage third-party verification agencies. However, such co-regulation model is yet incomplete and imperfect without appropriate government intervention.

Software platforms largely attempt to assure quality through reputation systems. For example, a defective vehicle is likely to be rated poorly and removed from the platform or brought to the platform administrator's attention. Similarly, Airbnb guests review hosts, alerting others to potential shortcomings. This approach tends to be more flexible. One key question is how well ratings actually work. By all indications, customers hesitate to provide negative ratings, and Uber itself has indicated that in San Francisco, only 1% of Uber drivers received one or two stars. Moreover, when ratings are optional, they may be unrepresentative: Airbnb's analysis indicates that those who left no reviews tended to have worse experiences than customers who submitted reviews.

In this context, when dealing with these risks, government policies need to play a supplementary role while focusing on regulating platforms rather than the other participants. Thus, regulatory intervention may be desirable in such cases as users or service providers may be unable to assess the risks properly and may thus fail to take appropriate precautions.

Conclusion

The practices of exchanging and sharing goods and services have been observed in nearly all societies. Such practices tended to be completed within an intimate group of trusted individuals. However, the potential pool of people to share is growing exponentially, thanks to the ICT-enabled platforms that connect new members from around the globe. Sharing of assets that once required years of trust now takes place

instantly. The ICT-based sharing economy activities, through real time matching of supplies and demands, offer enormous potential for economic growth, sustainability, connectivity, and equity of access.

The rapid growth of the sharing economy in Korea suggests that sharing economy firms are providing a unique and valuable platform to connect service providers and consumers. This study discussed a number of benefits, challenges, and social issues introduced by sharing economy. The benefits include potentially lower transaction costs of services, leveraging of excess capacity, improved customer experiences, and potential for stimulating new types of consumption. However, the introduction of the sharing economy firms is not without potential problems. These drawbacks include issues around regulatory equity, crowding out of existing transactions, potential transaction risks, and social safety problems.

While the Korean government is actively involved in efforts to settle conflicts between the incumbent industries and new platform companies for their mutual and sustainable growth, the sharing economy business models are bound to cause social discords as they expand rapidly into the existing businesses. A long-term and durable regulatory framework is therefore necessary. In such context, this paper recommends two regulatory frameworks.

The transaction-volume-based regulation will categorise professional suppliers based on the designated level of transaction. This gives professional suppliers additional leg-room to decide how much to supply based on their capability to abide by the regulations. In the meantime, non-professional and temporary suppliers may benefit from eased regulations and reduced costs. The ultimate aim of the proposed regulatory framework is to provide regulatory equity by giving an option to suppliers whether to participate as a professional supplier. Moreover, the regulation of platforms will resolve difficulties in enforcing the transaction-volume-based regulation by delegating implementation to platforms.

The sharing economy in Korea is unique in its character, in the way that it has faced particularly severe opposition from the existing businesses. An effort to promote the innovative sharing economy models without abandoning important aspects of the current industrial organisation is urgent. Setting up an appropriate regulatory framework would be vital to fostering innovation in the country's new growth engines.

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Case Studies on the Regulatory Challenges Raised by Innovation and the Regulatory Responses

The pace and scope of innovation are challenging the way governments regulate. Existing regulatory frameworks might not be agile enough to accommodate the fast pace of technological development and, as a consequence, rules might become outdated. Beyond this pacing problem, technological innovation also blurs the traditional definition of markets, challenges enforcement and transcends administrative boundaries domestically and internationally.

This report, which results from a joint project between the OECD and the Korea Development Institute, presents a set of case studies illustrating the different regulatory challenges raised by emerging technologies and the diversity of regulatory responses used to address them. The case studies cover data-driven business models, digital innovation in finance, smart contracts relying on distributed ledger technologies, digital technologies for smart logistics, and the sharing economy.

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