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CE

THE ECONOMIC CONTRIBUTION OF HUAWEI IN EUROPE

In the year 2021

HUAWEI
11 OCTOBER 2022



HUAWEI'S ECONOMIC IMPACT IN EUROPE

■ Direct ■ Indirect ■ Induced

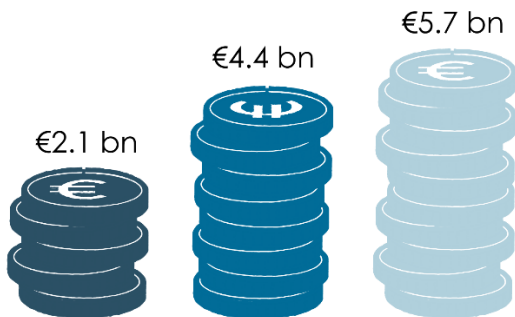
Direct effect arises directly at Huawei's local European offices through their economic activity. Indirect effect arises along Huawei's value chain. Induced effect arises through spending of Huawei's employees, suppliers' employees and sub-suppliers' employees.

ECONOMIC CONTRIBUTION (2021)



€12.3 billion

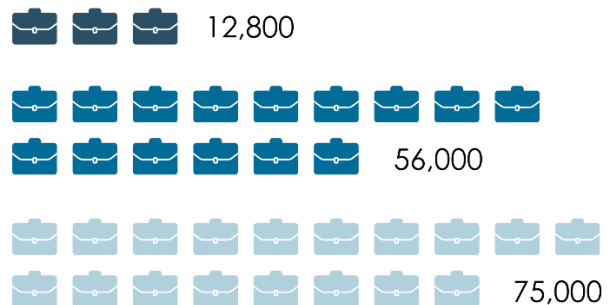
Total contribution to European value added



JOBS SUPPORTED (2021)

143,800

Total jobs supported in Europe



CONTRIBUTION TO TAX REVENUES (2021)

€5.2 billion

Total tax revenues supported in Europe



Equivalent to the average European wage for

147,000 teachers

RESEARCH & DEVELOPMENT



€18.7 billion

With a global R&D budget of €18.7 billion, Huawei was one of the largest investors in the world in 2021.



Huawei ranks Top2
in the 2020 EU Industrial
R&D Investment
Scoreboard

27

research facilities
maintained
across Europe



EU AMBITION

HUAWEI CONTRIBUTION IN EUROPE

- Increase R&D investments for a sustainable, safe, fair, and prosperous future
- Increase R&D intensity (i.e. the share of gross domestic expenditure on R&D) to ensure long-term growth and recovery after covid-19
- Increase research through Horizon Europe to achieve the EU's climate and digital goals



EU RESEARCH & INNOVATION (R&I) STRATEGY PLAN

Driving Innovation in Europe

through increased R&D investments (EUR 18.7 bn globally in 2021) and participation in Horizon Europe and other EU-funded research programmes

3,500+ patent applications in Europe in 2021

Increasing R&D Intensity in Europe

by providing funding for research projects at European universities & research institutions

Contributing to knowledge exchange / spillover

via research collaborations with European universities & research institutions

- Secure and sustainable digital infrastructure
- Proficiency in digital technology
- Digital transformation of businesses
- Digitisation of public services



EU DIGITAL COMPASS

Building digital infrastructure (5G)

as an industry leader in the field

Supporting the European population to build digital skills

through several training programmes (e.g. Seeds for the Future programme)

Empowering women to lead the digital future

by training young women's digital skills and encouraging participation in STEM subjects (e.g. European Leadership Academy (ELA), Club Tech Huawei Inspiring Girls)

- Net GHG emissions reduced by at least 55 per cent by 2030 and no net GHG emissions by 2050
- Decoupling economic growth from resource use
- Biodiversity Strategy



EUROPEAN GREEN DEAL

Supporting the green transition through fostering the digital transition

which can e.g. reduce travel-related emissions and energy consumption

Employing digital technologies to protect wildlife and ensure sustainability

via several initiatives across Europe

AUTHORS

Dr Henrik Ballebye Okholm, Managing Partner

Dr Bruno Basalisco, Director

Dr Gerdis Marquardt, Senior Economist

Lærke Kilsdal, Economist

Astrid Leth Nielsen, Analyst

ABOUT COPENHAGEN ECONOMICS

Copenhagen Economics is an expert-driven consulting company built on a deep knowledge of applied economics, and one of the leading economics firms in Europe.

We believe sound economic analysis can equip decision makers with the Hard Facts and Clear Stories to make better choices for the benefit of society. We are committed to delivering compelling and pragmatic economics solutions with a creative and candid approach.

Clients choose us because of our economic insights, our innate sector knowledge, our ability to build trustful relations, our attention to service, and our collaborative, one-firm working culture where we take care to field teams that best meet the needs of the client.

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As is standard in our field of professional services, research is designed so that

- i. the client chooses the research question;
- ii. we analyse and address the question to the best of our knowledge;
- iii. findings and conclusions are our own.

Professional service independence is ensured via a diversified portfolio of business, spanning the public sector and private clients across industries.

PREFACE

Huawei, a global provider of information and communications technology, infrastructures, and smart devices, has a significant share of its activities in Europe. These activities and related expenditures create not only growth, jobs, and taxes paid to national European governments but also foster innovation. In this report, we quantify the economic contribution of Huawei in Europe in the year 2021 and investigate Huawei's contribution to the European research agenda.

After Huawei began its activities in Europe with the opening of a research centre in Stockholm, Sweden, in the year 2000, Huawei has expanded its European activities and nowadays maintains 27 research facilities across Europe. In addition to leading important research projects and fostering innovation in Europe, especially in the field of digitalisation and better technology, Huawei contributes to the European economy and wider society both via its own operations and procuring goods and services from European businesses.

Huawei has commissioned Copenhagen Economics to quantify its economic contribution and investigate its contribution to innovation and long-term growth in Europe in 2021. To that end, in this study we estimate Huawei's contribution to GDP, jobs supported, and taxes paid in Europe in 2021. We also investigate Huawei's role in fostering European research and development (R&D) and examine how Huawei's activities contribute to the EU policy goals of a digital and green transition.

To quantify Huawei's economic contribution in 2021 in terms of contribution to GDP, jobs, and taxes, we use an input-output model of all countries in the world. Together with official national statistics, we have sought and obtained data from Huawei on their activities in Europe, e.g. purchases, number of full-time employees, salaries, etc. We estimate Huawei's direct, indirect and induced contribution to the EU27, Iceland, Norway, Switzerland and the United Kingdom in the year 2021.

To investigate Huawei's role in European R&D, we use literature and published data on global R&D investments and patent applications. We further map Huawei's activities to the various EU policy agendas and goals through an extensive literature review to put the findings of this study into an EU perspective.

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EXECUTIVE SUMMARY

The European Commission has set ambitious goals for the coming decade with regard to achieving sustainable growth in Europe via a digital and green transition of European businesses, consumers, and public authorities. To achieve the desired industrial and policy transition, public stakeholders and private businesses alike have a crucial role to play, and continuous innovation through increased research and development (R&D) efforts across Europe is required. Thus, Research and Innovation (R&I) policies are key priorities for the European Commission, which has defined concrete goals for Europe to boost R&D investments and achieve the green transition via, for example, EU Research & Investment Strategy Plan 2020-2024,¹ Europe's Digital Decade,² and the European Green Deal³.

Huawei, a global provider of information and communications technology, infrastructures, and smart devices and one of the leading R&D investors globally, is a prime example of how businesses, European or global, play a key role in achieving Europe's ambitions. Huawei contributes to the European economy and wider society not only via their own operations and procuring goods and services from European businesses, but also via their extensive R&D investments. Since Huawei began its activities in Europe with the opening of a research centre in the year 2000, they have increasingly fostered innovation throughout Europe and today **Huawei maintains 27 research facilities across Europe.**

Based on a global input-output model and accounting data sought and obtained from Huawei, we find that **in 2021 Huawei contributed EUR 12.3 bn to the European economy in terms of value added, supported 143,800 jobs, and generated EUR 5.2 bn in tax revenue for European governments** via direct, indirect, and induced contributions. The *direct contribution* is the value added directly at the local European offices of Huawei.⁴ The *indirect contribution* arises through Huawei's purchases from European suppliers, i.e. economic activities supported by other companies. The *induced contribution* arises through the spending of Huawei's employees, i.e. when Huawei's employees use their salary to buy goods or services, or when their activity is supported elsewhere in the economy.

In addition, we also find that **Huawei boosts research activities and innovation in Europe by investing in a wide array of different R&D fields and collaborating with European researchers and universities as well as other businesses.** Huawei can thus be characterised as a driving force in achieving Europe's policy goals related to innovation and digitalisation, which both are key to enabling the green transition.

¹ European Commission (2020).

² European Commission (2022c).

³ European Commission (2022e).

⁴ The direct contribution is estimated as the sum of net profit, taxes paid, and salaries paid to employees.

Huawei supports the European economy in terms of value added, jobs and taxes

Huawei supports the European economy through its activities and operations in Europe. The activities have three types of contributions: direct, indirect, and induced contribution as previously described. Based on these three categories, we estimate Huawei's contribution to the European economy.

We estimate that across the value chain and a wide set of European industries, **Huawei's activities have supported economic activity in Europe of EUR 12.3 bn in the year 2021.**⁵ Here and in what follows, "Europe" refers to the EU27, Iceland, Norway, Switzerland, and the United Kingdom. This overall figure is composed by

- a direct economic contribution of EUR 2.1 bn
- an indirect economic contribution of EUR 4.4 bn
- an induced economic contribution of EUR 5.7 bn.

In parallel to its economic contribution, Huawei's activities also support European jobs. We find that across the value chain and a wide set of European industries **Huawei's activities have supported in total 143,800 jobs in 2021** (full-time equivalents). This includes

- 12,800 direct jobs (i.e., Huawei's employees and contractors)
- 56,000 indirect supported jobs in companies in Huawei's supply chain
- 75,000 induced jobs supported by the spending power and household consumption of all the above workers.

Furthermore, Huawei also supports the European economy through taxes paid. We find that **Huawei's business activities in Europe generated in total EUR 5.2 bn in tax revenues for European governments in 2021.** This is **equivalent to the average European wage for 147,000 teachers.** The total tax revenues is composed by

- a direct tax contribution of EUR 1.3 bn (i.e., corporate tax paid by Huawei and taxes paid by Huawei's employees)
- an indirect tax contribution of EUR 1.7 bn
- an induced tax contribution of EUR 2.2 bn.

Huawei is a key contributor to Europe's long-term R&D outcomes

R&D investments are essential to facilitate innovation and are a key driver of long-term economic growth. Thus, also under the EU policy agendas, R&D investments have become a cornerstone in strategies promoting growth. As one of the world's most prominent R&D investors, investing in a wide array of different R&D projects worldwide and in Europe, Huawei has become a key contributor to Europe's R&D ambitions.

On a global scale, Huawei invested close to EUR 19 bn in R&D in 2021. Contrary to most other global R&D investors, Huawei increased its R&D investments in 2020 and 2021 during the covid-19 pandemic, thus Huawei kept steady growth. In this period, Huawei has continued to invest

⁵ The amount of economic contribution from a firm naturally reflects the extent of activity of that firm during the analysed period. As a sensitivity test, we have compared our 2021 results with evidence in the literature for the year 2019 (see Oxford Economics (2020a)). We note a decrease in this indicator, which is broadly in line with Huawei's revenues for the EMEA region, which have decreased by 36 per cent during 2019-2021. (Note, EMEA differs from the European scope of analysis in this study.)

in R&D in Europe; as detailed in the study, this ongoing R&D investment in Europe contributes to the European R&D capacity, which in turn is a key driver for innovation and the European economy. **In 2020, Huawei ranked second on the EU Industrial R&D Investment Scoreboard**, and we also expect Huawei to be amongst the top investors globally in 2021.⁶ Huawei is also among the top patent applicants in Europe and was **in 2021 the largest patent applicant in Europe with more than 3,500 applications registered** at the European Patent Office.

Huawei drives R&D projects in Europe on a wide array of topics including rethinking fundamental theory, reshaping architecture, and reinventing software. Projects are often carried out in collaboration with top-tier European Universities, which not only ensures funding for academic research projects but also leads to knowledge sharing and spillover effects to society as a whole.

Huawei's activities support the EU policy ambitions around innovation, digitalisation, and the green transition

With its R&D investments in Europe, Huawei supports not only the EU's research and innovation goals, but also the EU's ambitions regarding the digital transition as well as the green transition as outlined in the European Green Deal.

While the EU has set itself ambitious R&I goals considered engines for the green and digital transition in Europe, Europe did not reach its R&I intensity goal in 2020.⁷ Especially during the covid-19 pandemic, governments had to reallocate budgets from e.g. R&D to healthcare. However, as pointed out previously, **Huawei is one of the companies which continuously have increased their R&D budget and thus pushed innovation forward**.

Improving the digital skills of consumers and businesses is considered instrumental for the digital transition and set out as goals in the EU Digital Compass. **Huawei boosts the use of digital technologies not only by building secure and sustainable digital infrastructures but also by promoting programmes scaling up the digital skills** of the European population and businesses.

Europe's green transition also goes hand in hand with the digital transition, as it allows for greater efficiency. With the European Green Deal, the EU Commission aims at making EU policies fit for reducing net greenhouse gas emissions by at least 55 per cent by 2030. **Through fostering the development and use of digital technologies in Europe, Huawei also contributes to the green transition**. For example, the delivery of digital technologies by Huawei allows Europeans to travel less, the European Commission notes that switching from 4G to 5G networks generate significant energy savings all else equal, and the use of digital technologies by Huawei and their partners protects wildlife.

⁶ Data for 2021 is not yet published.

⁷ Eurostat table SDG_09_10

CHAPTER 1

**INTRODUCTION: HUAWEI IS A GLOBAL
BUSINESS SUPPORTING THE EU DIGITAL
DECADE**

One of the European Commission's core objectives is the digital and green transition of Europe. As set out in "A Europe fit for the digital age" and "The EU Digital Decade", the European Commission aims at advancing digitalisation and empowering people with a new generation of technologies. The green transition is set out in the European Green Deal, in which the European Commission describes the goal of making Europe the first climate-neutral continent by becoming a modern, resource-efficient economy.⁸ A key enabler to reaching the targets set out in the EU Digital Decade and the European Green Deal is research and innovation (R&I) and research and development (R&D) investments. Alongside public institutions, companies active in Europe play a central role in achieving the ambitious targets set out by the European Commission. One such company is Huawei.

Huawei is a leading provider of information and communications technology, infrastructures, and smart devices across the globe, with activities in many countries and regions, including Europe. Huawei employs approximately 13,000 people in Europe (across EU27, Iceland, Norway, Switzerland, and the United Kingdom). Huawei's presence in the European market has not only the potential to drive down costs for businesses and consumers using telecommunication services, as previous research by Huawei shows⁹. In addition, Huawei contributes to designing some of the essential technologies of tomorrow by investing heavily in R&D both globally and in Europe, which will help Europe in its digital and green transition. One of Huawei's core activities in Europe is the operation of its 27 European research facilities, which conduct impactful research in many fields related to digital technologies. Huawei's overarching vision and mission is to bring digitalisation to every person, home, and organisation and to leverage the prospect for the intelligent world e.g. within healthcare, energy, and digital trust.¹⁰

In this study, we investigate the extent of the economic contribution of Huawei in Europe in 2021 (see Chapter 2).¹¹ We do so by estimating Huawei's contribution to value added, job creation, and taxes paid. Additionally, we investigate how Huawei contributes to Europe's long-term R&D outcomes (see Chapter 3), and how Huawei supports the EU to achieve its policy agendas within innovation and the digital and green transition (see Chapter 4).

⁸ European Commission (2022c).

⁹ Oxford Economics (2020b).

¹⁰ Huawei (2021d).

¹¹ Europe is defined as EU (27 member states), Iceland, Norway, Switzerland, and the United Kingdom.

CHAPTER 2

HUAWEI SUPPORTS THE EUROPEAN ECONOMY IN TERMS OF VALUE ADDED, JOBS, AND TAXES

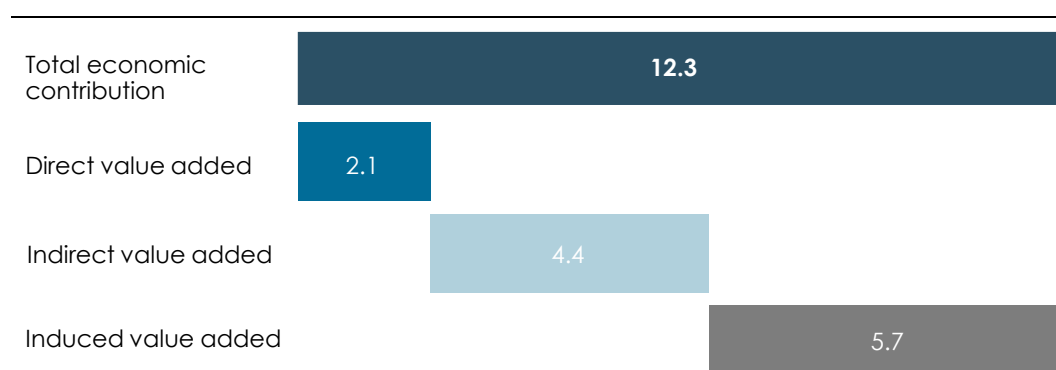
To start our assessment of Huawei's overall contribution to the European economy, policy agendas and the wider society, we analyse its economic contribution in Europe in terms of value added throughout the economy (section 2.1), jobs supported (section 2.2), and tax revenue generated for European governments due to Huawei's operations (section 2.3). We base our analysis on data provided by Huawei and utilising a global input-output model.

Specifically, we estimate Huawei's total economic contribution by analysing three contributions: direct, indirect, and induced contribution. The direct contribution measures thereby Huawei's contribution through its own European operations whereas the indirect contribution measures the contribution arising from money spent by Huawei on its European suppliers. The induced contribution captures consumer spending on the European market funded by wages paid to Huawei's employees and those employed along its supply chain.

2.1 HUAWEI CONTRIBUTED EUR 12.3 BN TO THE EUROPEAN ECONOMY IN 2021

We find that in 2021 Huawei contributed in total EUR 12.3 bn to the European economy in terms of value added.¹² In this study, we define "Europe" as EU27, Iceland, Switzerland, Norway, and the United Kingdom. This total number covers three different channels of impact, the *direct impact*, the *indirect impact*, and the *induced impact*; see Figure 1.

Figure 1
Value added by Huawei in Europe, 2021
EUR bn



Source: Copenhagen Economics based on financial numbers provided by Huawei and OECD input-output table 2021.

¹² We estimate value added by Huawei as direct expenditures or due to Huawei's expenditures elsewhere in the value chain (included in the indirect and induced effects).

The *direct contribution* arises from Huawei's own European operations. It reflects the value created directly by Huawei, i.e. the value added through Huawei's own operations, and is approximated by summing Huawei's profits (measured by EBITDA)¹³ and salary payments.

The *indirect contribution* of EUR 4.4 bn arises from Huawei's purchases from European suppliers. It reflects the value created by Huawei's suppliers and sub-suppliers, i.e., how expenditures by Huawei support an increased economic activity throughout the entire value chain. The indirect effect captures thereby the increase in business-to-business activity in Europe due to the presence of Huawei.

To understand what this indirect contribution along the value chain means for business-to-business activity in Europe, we have conducted interviews with some of Huawei's suppliers and collaborators. These conversations showed that Huawei does not only facilitate knowledge sharing by procuring from and working together with other businesses, but also facilitates businesses to enter new markets, expand, innovate, and adopt new solutions. For example, SUSE, a global provider of open-source software, which offers joint solutions with Huawei, reports that its cooperation with Huawei facilitated easier access to new market segments and wider geographical markets; see Box 1. A German manufacturer of semiconductors also describes that Huawei is known for adopting new solutions quickly, which encourages European businesses to accelerate the development and introduction of new products; see Box 2.

BOX 1: Case Study

Collaboration with Huawei allowed SUSE to enter new segments and geographical markets



SUSE, founded in Germany, is a global leader in innovative, reliable, secure enterprise-grade open-source solutions, relied upon by more than 60 per cent of the Fortune 500 to power their mission-critical workloads. SUSE specialises in Business-Critical Linux, Enterprise Container Management and Edge solutions.

Since 2017, SUSE has been collaborating with Huawei. The two companies are bundling their knowledge and offering joint solutions combining Huawei hardware with SUSE Linux software. SUSE and Huawei continuously work together on developing their products further and training their partners (e.g., IT retailers), who are in direct contact with the end-users.

The cooperation between SUSE and Huawei has offered new opportunities through knowledge and technology sharing between the two companies.

The cooperation with Huawei has, for example, allowed SUSE to enter a new market, i.e. the market of telecom equipment. Without cooperation with Huawei, it would have been difficult for a software developer like SUSE to enter such a market.

The cooperation with Huawei has also made it easier for SUSE to be active in other geographical markets with a strong Huawei presence such as Asia, the Middle East, and Africa.

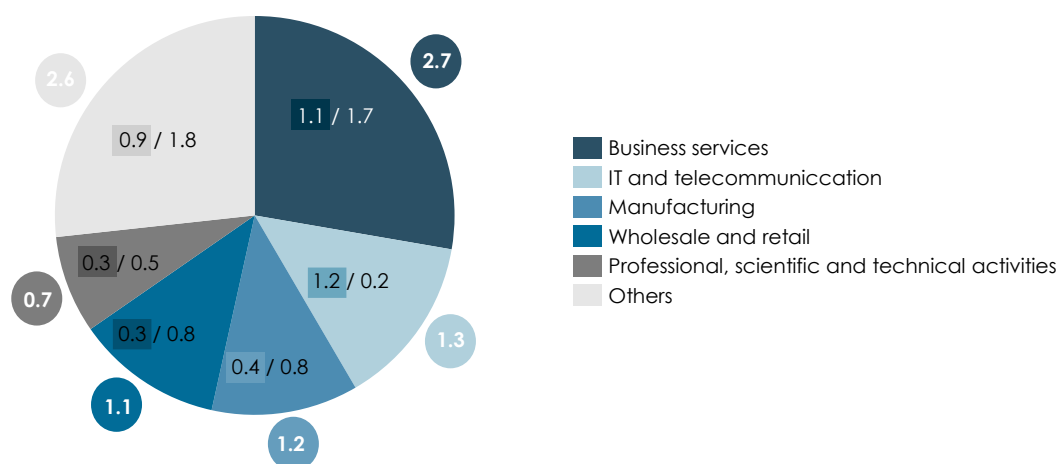
Source: Interview with Harry van den Bergh, Sales Director at SUSE, August 2022

¹³ Profits before interest, tax and depreciation. See appendix on how EBITDA is estimated in this study.

The *induced contribution* of EUR 5.7 bn from Huawei is the result of increased personal income caused by the direct and indirect contribution. When Huawei's employees and the employees of Huawei's suppliers and sub-suppliers in Europe spend their wages on goods and services in the wider economy, this increases general economic activity. Thus, the induced impact captures the economic contribution generated by the employees of Huawei as well as by the employees along the European supply chain supported by Huawei.¹⁴

The indirect and induced value added to the European economy from Huawei is centred around a few specific sectors in which Huawei's presence is especially vital. By breaking down Huawei's indirect and induced value added on sectors, we find that in 2021 Huawei's impact was largest in the business service sectors, which accounted for 28 per cent of the total indirect and induced value added. The second and third largest value added was created in the IT and telecommunication sectors (14 per cent of the total) and the manufacturing sector (12 per cent of the total); see Figure 2.

Figure 2
Value added by Huawei in key sectors, 2021
EUR bn



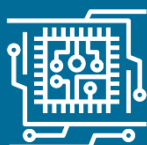
Note: Number to the left of the slash measures the indirect contribution and numbers to the right of the slash induced contribution. We are using OECD's sector classifications. *Business services* includes the following sectors: financial and insurance services; real estate activities; administrative and support services (sector codes 64-68 and 77-82). *Manufacturing* includes all subsectors of manufacturing (sector codes 10-33). *IT and telecom* includes: IT; telecommunication (sector codes 61-63). *Wholesale and retail* includes: wholesale; retail (sector codes 45-47). *Professional, scientific and technical activities* (sector code 69-75) The remaining sectors are included in *Other*. Differences are due to rounding.

Source: Copenhagen Economics based on financial numbers provided by Huawei and OECD input-output table 2021.

¹⁴ The amount of economic contribution from a firm naturally reflects the extent of activity of that firm during the analysed period. As a sensitivity test, we have compared our 2021 results for the total economic contribution, i.e., EUR 11.8 bn, with evidence in the literature for the year 2019 (see Oxford Economics (2020a)). We note a decrease in this indicator, which is broadly in line with Huawei's revenues for the EMEA region, which have decreased by 36 per cent during 2019-2021 (see Huawei (2019) and Huawei (2022a)). Note, EMEA differs from the European scope of analysis in this study.

BOX 2: Case Study

By adopting new solutions quickly, Huawei encourages European businesses to accelerate the development and introduction of new products



In addition to directly working together with European businesses, bundling knowledge and developing joint solutions (see case study in Box 1), Huawei also contributes to the European economy by procuring, for example, software, hardware and system solutions from European businesses.

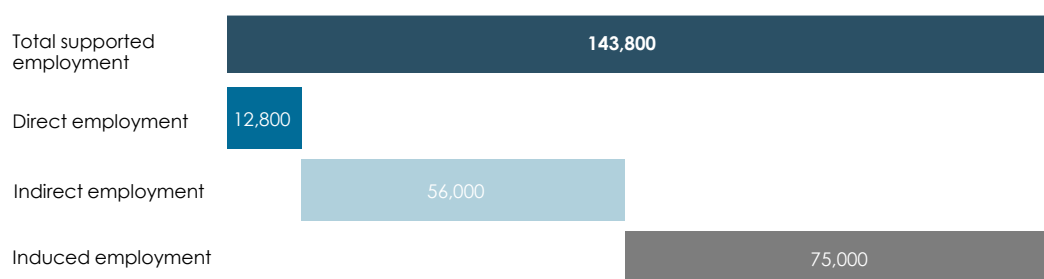
We interviewed a large German semiconductor manufacturer who supplies semiconductor solutions to Huawei for a variety of applications such as solar, server, and wireless infrastructure. The conversation made apparent that their business relationship with Huawei is characterised by a shared ambition to contribute to a smarter world. Huawei is one of the key players worldwide in telecommunication equipment and consumer electronics. Being a sought-after supplier to Huawei is valuable confirmation that the suppliers' products are a good fit for applications and end-use by the customers. It naturally also improves the scalability of the suppliers' business. Most notably, however, it is also mentioned that Huawei is particularly quick at adopting new solutions, which helps their suppliers to ramp up new products fast and manage new product introduction.

Source: Interview with Head of Key Accounts of a large German semiconductor manufacturer, August 2022

2.2 HUAWEI SUPPORTED AROUND 143,800 EUROPEAN JOBS IN 2021

Based on data provided by Huawei and OECD employment data, we find that Huawei supported in total some 143,800 European jobs in 2021 both directly and through its supply chain. Huawei employed directly 12,800 workers (i.e. employees and contractors)¹⁵ across Europe; see Figure 3. In addition, Huawei supported some 56,000 jobs indirectly via its supply chain, which measures jobs at Huawei's suppliers and sub-suppliers supported by Huawei's expenditures. An additional 75,000 jobs were supported through Huawei's induced economic contribution. The jobs created through Huawei's indirect and induced economic contribution are mainly within business service, manufacturing and wholesale and retail.

Figure 3
Jobs supported by Huawei, 2021
Full-time equivalents, thousands



Source: Copenhagen Economics based on financial numbers provided by Huawei and OECD input-output table 2021 and table on employment from OECD; Employment by activities and status (ALFS).

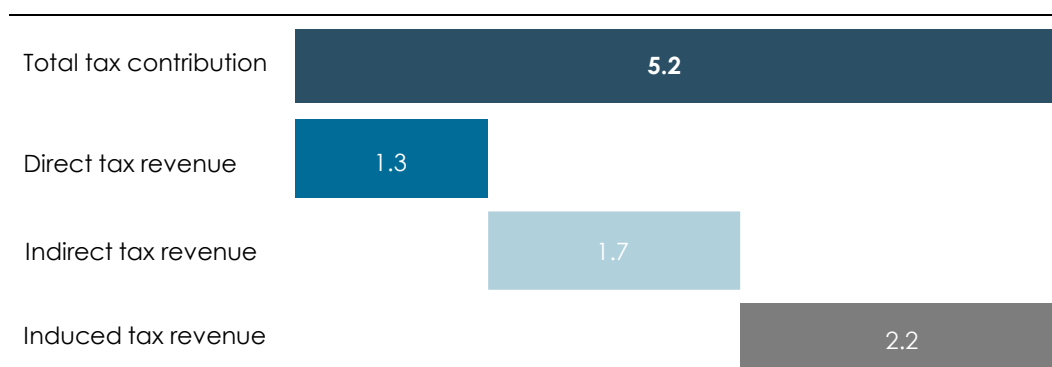
¹⁵ While direct employment is measured in full time employees, indirect and induced supported jobs are defined as number of jobs (and thus also include part-time jobs).

2.3 HUAWEI'S EUROPEAN BUSINESS ACTIVITIES CONTRIBUTED EUR 5.2 BN IN TAXES IN 2021

Huawei's economic activity generates a range of tax revenues for national authorities in Europe. We find that the total amount of tax revenues supported by Huawei in 2021 (consisting of direct, indirect, and induced contributions) amounted to EUR 5.2 bn. Governments use tax revenue, inter alia, to pay for necessary public services. To put the stated number in perspective, we note that the tax revenue supported by Huawei corresponds to the average salaries of 147,000 teachers in Europe.¹⁶

Huawei's direct tax contribution, as reported by Huawei, amounted to EUR 1.3 bn in 2021, and includes corporate taxes paid by Huawei and personal income taxes paid by Huawei's employees. We estimate that Huawei's indirect tax contribution amounted to EUR 1.7 bn in 2021, which captures revenue from corporate and product tax stemming from the indirect economic activity that Huawei supports along its value chain. Finally, we estimate that Huawei's induced economic activity supports additional induced tax revenues of EUR 2.2 bn, which capture the tax revenue generated by the economic activity that follows from employees (direct and indirectly supported) using their wages for consumption in the wider economy; see Figure 4.¹⁷

Figure 4
Taxes supported by Huawei, 2021
EUR bn



Source: Copenhagen Economics based on financial numbers provided by Huawei and OECD input-output table 2021.

¹⁶ Based on European Commission (2021b), we find an average annual wage of teachers of approximately EUR 35,500. Dividing the total tax contribution of EUR 5.1 bn by EUR 35,500 corresponds to 144,000 teachers.

¹⁷ Product taxes are also included in this measure.

CHAPTER 3

**HUAWEI IS A KEY CONTRIBUTOR TO
EUROPE'S LONG-TERM R&D OUTCOMES**

Investment in research and development (R&D) is a key driver of long-term economic growth as it facilitates innovation.¹⁸ Thus, R&D is often a cornerstone in strategies promoting such growth. This also holds for the EU, where programmes and agendas such as Horizon Europe¹⁹, the EU R&I Strategy Plan 2020-2024²⁰, and Europe's Digital Decade²¹ all aim at boosting R&D investments and hence stimulate long-term economic growth.

Huawei contributes to the EU policy ambitions by investing in R&D in Europe and thereby helps stimulate long-term economic growth in Europe. In this Chapter, we present Huawei's R&D investments and relate their size to that of other global companies. In Chapter 4, we will present the EU policy ambitions and show how Huawei can contribute to achieving these ambitions.

**3.1 HUAWEI IS ONE OF THE LARGEST R&D INVESTORS IN
EUROPE AND SUPPORTS A WIDE ARRAY OF
RESEARCH PROJECTS**

Huawei is one of the world's most prominent R&D investors and continues to build the future of digital equipment and applications

In 2021, Huawei invested EUR 18.7 bn in R&D globally, thereby reaching its highest level in the past ten years; see Figure 5. In 2020, Huawei's R&D investment amounted to EUR 17.6 bn, and in that year the company ranked second amongst the top 2,500 global investing companies in the Industrial R&D Investment Scoreboard published by the EU;²² see Figure 5. While the EU Industrial R&D Investment Scoreboard for 2021 has not been published at the time of writing, we would expect Huawei to achieve a similarly high ranking in 2021. In contrast to the overall trend amongst the top 2,500 R&D investors globally, Huawei increased its R&D investments in 2020 and 2021 despite the pandemic. Looking at the five-year period 2017-2021, Huawei increased its global R&D investment by 11 per cent per year on average; see Figure 5.

¹⁸ See for example Stokey (1995) and Bilbao-Osorio & Rodriguez-Pose (2004).

¹⁹ European Commission (2022a).

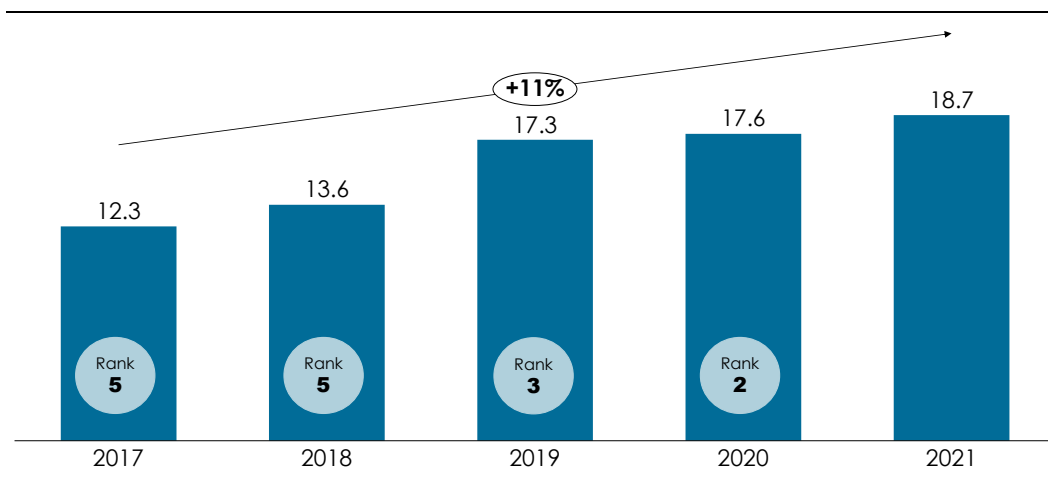
²⁰ European Commission (2020).

²¹ European Commission (2022c).

²² European Commission et al. (2022). The scoreboard is published by the EU, but the scoreboard ranks all companies globally.

Figure 5
Huawei's global investment in R&D, 2017-2021

EUR bn. (2021-prices) and rank amongst the 2,500 top R&D investors globally



Note: Investments are converted from nominal prices to 2021-prices using the CPI for China from the World Bank and the CPI for the OECD total from the OECD database. The circles show the rank of R&D spending amongst the top 2,500 R&D investors examined in the EU Industrial R&D Investment Scoreboard. The EU Industrial R&D Investment Scoreboard for the year 2021 is not available yet. The investment from 2021 stems from Huawei's Annual Report 2021 converted from CNY to EUR using the average exchange rate in 2021 from the European Central Bank.

Source: European Commission EU Industrial R&D Investment Scoreboard 2017-2021, Huawei Annual Report 2021, the World Bank World Development Indicators, OECD database, and the European Central Bank.

Huawei supports the overall R&D agenda in Europe by investing in many different R&D projects via their European research centres and participating in European funded research programmes

In 2021, Huawei ramped up investment in basic research into fundamental theories which took part largely in Huawei's **27 R&D facilities across Europe** headed by the Huawei European Research Institute (ERI) in Belgium which manages research centres in 13 countries. The ERI oversee fundamental and applied technology research as well as academic research cooperation projects and thereby drives many R&D activities in Europe.

As a large tech company, Huawei considers it a responsibility to explore the future and invest heavily in R&D to strengthen innovation and drive fundamental changes in three areas:²³

- **Rethinking fundamental theories:** The investments in rethinking fundamental theory are, for example, related to wireless AI and getting closer to theoretical telecommunication limits. The investments also aim to create new horizons for the development of the communications industry.
- **Reshaping architecture:** The investments in reshaping architecture are, for example, addressing core challenges like ultra-high-frequency, ultra-large-bandwidth, and ultra-high-speed data transfer in wireless communication.

²³ Huawei Investment & Holding Co., Ltd. (2022).

- **Reinventing software:** The investments in reinventing software are related to helping scientists and engineers improve the efficiency of AI development. See for example, Huawei's cooperation with external researchers in Ireland; see Box 3.

BOX 3: Case Study

Huawei and Lero embark upon multi-year "Trustworthy Responsible Engineering of Software" research programme



Lero (the Science Foundation Ireland Research Centre for Software) brings together experts from software teams at universities and institutes of technology across Ireland in a coordinated research centre with a strong industry focus. The centre is ranked second globally in terms of research excellence and citations, and its main areas of expertise are software engineering, open-source software, crowdsourcing, and AI techniques.

Since 2018, Lero collaborates with Huawei on the research programme TREES (Trustworthy Responsible Efficient Engineering of Software). Under this programme, Lero has conducted several joint research projects with Huawei to improve software development processes, e.g. in terms of the architecture of cybersecurity, traceability, memory, and optimisation of software applications.

The collaboration with Huawei has allowed Lero to test innovative software solutions at a large scale through end-point applications within Huawei, which has several positive effects:

- Research gets closer to real-life problems ensuring
 1. that the research has an impact in a business context
 2. that the developed solutions are useful for large companies with complex processes
- State-of-the-art research and learning contribute to publications in top-tier international journals which facilitates knowledge spillovers within academia and across businesses

Brian Fitzgerald (Professor and Director at Lero):

"Huawei is an advanced R&D company. They understand what research is all about and that it is a longer-term process. Together with Huawei, we identify and solve significant research topics which are of general interest and can be published in top-tier journals while also having relevant business applications".

Source: Interview with Brian Fitzgerald, Professor and Lero Centre Director, August 2022

In addition to running the European research centres, Huawei contributes to the R&D agenda in Europe by participating in the Horizon Europe programmes. Horizon Europe, the successor to the FP7 and Horizon 2020 programmes²⁴, is a cornerstone of the EU's research and innovation policy agenda to boost economic growth. The programme facilitates collaboration and strengthens the impact of research and innovation in developing, supporting, and implementing EU policies while tackling global challenges, for example climate change. Huawei has contributed to the EU R&I Strategy Plan by **participating in 32 FP7, Horizon 2020, and Horizon Europe projects**.²⁵

²⁴ FP7 was the first research programme within the EU. As part of the seventh framework programme, the abbreviation FP7 is used.

²⁵ 18 of these 32 programmes, representing 70 per cent of the net EU contribution from the projects, are within the pillar "Industrial Leadership" examining Information and Communication Technologies. The remaining 14 are within the pillars "SP1-Cooperation", "Societal Challenges", and "Excellent Science". European Commission (2022b).

3.2 HUAWEI IS AMONGST THE TOP PATENT APPLICANTS IN EUROPE

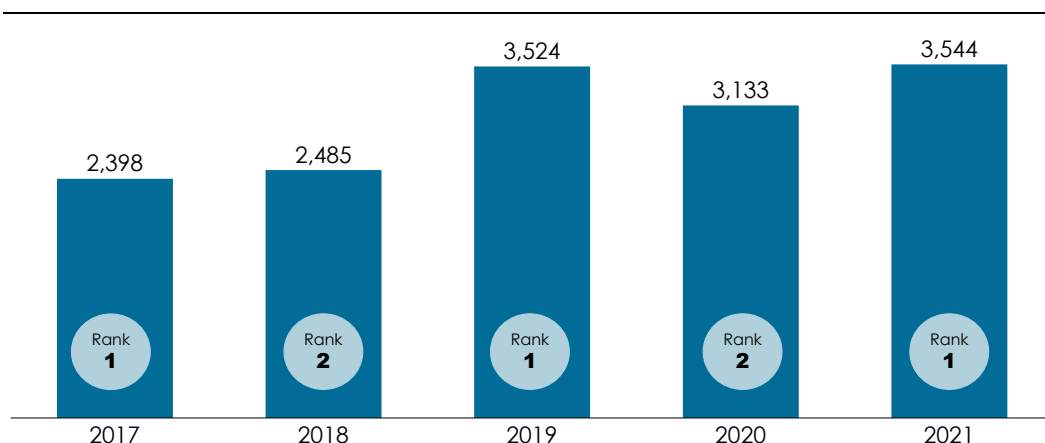
While the exact impact of R&D investments is hard to measure due to the lag between the R&D investment itself and the observed economic growth, the number of patent applications from the investor provides a good indication of the impact of R&D investments. This is because successful, ground-breaking research can lead to a patent application to protect the outcome of the research.

In 2021, Huawei was the largest patent applicant in Europe, with more than 3,500 applications registered at the European Patent Office; see Figure 6. Despite a varying number of patent applications, Huawei has ranked second or first amongst all applications since 2017. This suggests that Huawei's R&D presence is strong not only globally, but also in Europe. It also indicates that Huawei's research is ground-breaking and important for the digital transition in Europe.

Figure 6

Huawei's patent applications to the European Patent Office

Number of applications and rank amongst all applicants



Source: European Patent Office

Huawei's strong and strategic R&D presence in Europe in terms of R&D investments, patent applications, and participation in EU-funded research programmes shows that the company is contributing to Europe's R&D outcomes and opportunities for long-term growth in Europe. In the next Chapter, we will highlight how specific contributions by Huawei affect and relate to EU policy ambitions in three areas: EU's R&I Strategy Plan, EU's Digital Compass, and the European Green Deal.

CHAPTER 4

HUAWEI'S ACTIVITIES SUPPORT EUROPEAN POLICY AMBITIONS AROUND INNOVATION, DIGITALISATION, AND THE GREEN TRANSITION

Research and innovation (R&I) policy is an engine of the green and digital transition in Europe, and R&I remains at the forefront of the common European response to the health, social, and economic challenges in Europe.²⁶ With its R&D investments in Europe, Huawei supports not only EU's research and innovation ambitions as outlined in the EU R&I Strategy Plan 2020-2024 (see Section 4.1), but also the EU's ambitions regarding the digital transition as outlined in the EU Digital Decade (see Section 4.2), and the green transition as outlined in the European Green Deal (see Section 4.3); see Figure 7.

Figure 7
Huawei contributes significantly to European policy ambitions

EU POLICY AGENDA		
	EU AMBITION	HUAWEI CONTRIBUTION
 EU RESEARCH & INNOVATION (R&I) STRATEGY PLAN	• Increase R&D investments • Increase R&D intensity to ensure long-term growth and recovery after covid-19 • Increase research through Horizon Europe	• Increased R&D investments and participation in EU-funded research programmes • Increasing R&D Intensity in Europe through funding for research projects • Knowledge exchange via research collaborations
 EU DIGITAL COMPASS	• Secure & sustainable digital infrastructure • Proficiency in digital technology • Digital transformation of businesses • Digitisation of public services	• Building digital infrastructure (5G) • Supporting digital skills through e.g. Seeds for the Future programme • Building young women's digital skills and encouraging participation in STEM
 EUROPEAN GREEN DEAL	• Net GHG emissions reduced by at least 55 per cent by 2030 and no net GHG emissions by 2050 • Decoupling economic growth from resource use • Biodiversity Strategy	• Reducing travel-related emissions • Moving networks from 4G to 5G and making networks and data centres more energy efficient • Employing digital technologies to protect wildlife and ensure sustainability

Source: Copenhagen Economics based on European Commission (2020), European Commission (2022c) and European Commission (2022e).

4.1 HUAWEI ADVANCES THE EU RESEARCH & INNOVATION STRATEGY PLAN

R&D investments are a cornerstone of the EU strategy for long-term growth, and the European Commission has identified Research & Innovation (R&I) as an important part of the European recovery plan needed after the covid-19 pandemic. With the EU R&I Strategy Plan 2020-2024, the European Commission aims to increase the share of gross domestic expenditure on R&D, the so-called R&D intensity, to ensure continued R&D investments to deliver on the vision of a sustainable,

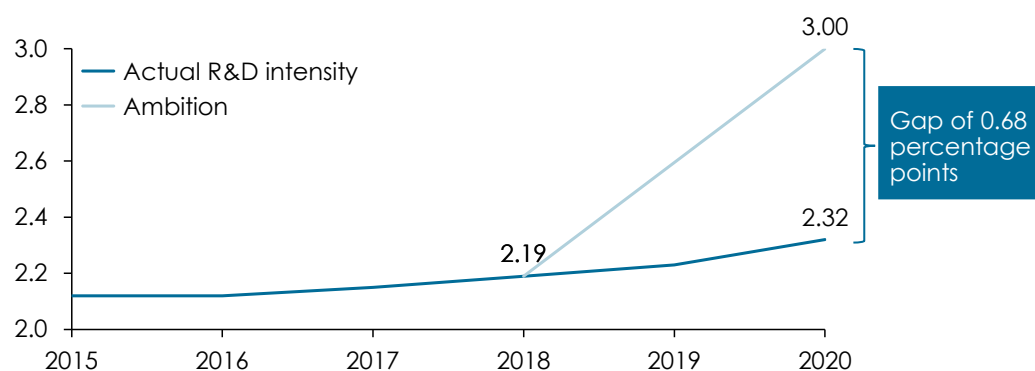
²⁶ European Commission (2020).

safe, fair, and prosperous future for the people and the planet.²⁷ With the EU R&I Strategy Plan, specifically, the European Commission aims at increasing R&D intensity in EU27 from 2.19 per cent in 2018 to 3 per cent in 2020 and further in 2024. Data show that EU27 did not reach this goal by 2020, when the R&D intensity “only” increased by 0.13 percentage points to 2.32 per cent, leaving a gap of 0.68 percentage points to the ambition level; see Figure 8.

Figure 8

Actual gross domestic expenditure on R&D by sector in EU27 and ambition

Share of GDP



Note: 2020 is the most recent year.

Source: Eurostat table SDG_09_10.

One factor hampering the ambition of a 3 per cent R&D intensity was the covid-19 pandemic, when many governments had to reallocate budgets from e.g. R&D to healthcare. However, **despite the pandemic, Huawei increased its global R&D investment in 2020 and 2021** and, as outlined in Chapter 3, Huawei invests heavily in R&D (EUR 18.7 bn globally in 2021) and contributes to innovation (3,544 patents in Europe in 2021). The R&D intensity in Europe is linked to cooperate funding; indeed, for many academic researchers, receiving support via corporate funding is often a requisite to sustain their research programme and projects. Thus, through its significant R&D investments and collaborations with research institutions, Huawei continues to stimulate R&D intensity in the EU.

Besides increasing R&D investments and R&D intensity, another important ambition mentioned in the EU R&I Strategy Plan is to increase research through the Horizon Europe programme. The primary aim of Horizon Europe is to accelerate the achievement of the EU's climate and digital goals, and with a budget of EUR 90.95 bn the programme is the largest of its kind to date. As described in Chapter 3, **Huawei has participated in several EU-funded research programmes**. Thereby, in collaboration with many partners, Huawei has contributed to paving the way for new research and technology to support the EU in reaching its goal in multiple fields such as technology and digital infrastructure.

Huawei also leads several initiatives that accelerate innovation in Europe. For example, in cooperation with REInA (Rural European Innovation Area), Huawei funds start-up villages in

²⁷ European Commission (2020).

rural areas across Europe to create, inter alia, new opportunities to attract innovative business and to promote new and improved skills; see Box 4.

BOX 4: Case Study

Together with Rural European Innovation Area (REInA), Huawei creates opportunities to support innovation in rural areas



REInA is a pan-European open platform which aims to gather innovative initiatives to support the creation of a new Rural European Innovation Area. Together with Huawei, REInA pledged to develop rural European innovation and start-up villages.

Huawei and REInA award start-up villages EUR 10,000 – 20,000 to cover the salary of one employee to run the coworking space of the start-up village

A start-up village is defined as a village willing to execute activities helping it to become stronger, connected, resilient and prosperous. To do so, the village should be orientated to create new opportunities to attract innovative business, provide access to quality jobs, promote new and improved skills, ensure better infrastructure and services, and leverage the role of sustainable agriculture and diversified economic activity. Also, the village must have a population equal to or lower than 15,000 inhabitants.

Source: REInA (2022)

In addition to projects that Huawei is directly involved in, **Huawei also creates positive spillover effects via collaborations with universities**. Positive spillover effects imply not only that those involved in a specific research programme gain new knowledge, but also that other individuals and companies can reap the benefits of the research. One specific type of R&D spillover stems from collaborations between universities and industries. In contrast to other types of R&D spillovers, university-industry R&D spillovers are not geographically limited – especially when the collaboration exists over longer distances.²⁸

Huawei recognises and contributes to the positive spillover effects between universities and industry by e.g. participating in networks like Cambridge Wireless (CW), a membership organisation for companies involved in research, development, and application of wireless and associated technologies. Through CW, Huawei seeks to partner with universities to create breakthrough technologies.²⁹ Additionally, Huawei also holds technological competitions for universities. In 2021, Huawei held a series of competitions with 100+ universities across 9 European countries. More than 1,000

²⁸ See for example Ponds et al. (2009).

²⁹ Cambridge Wireless (2022).

European students participated in the competitions to explore cutting-edge research topics.³⁰ In doing so, students pursued advanced knowledge of cutting-edge research topics which are going to be of importance for European economic growth, such as AI infrastructure and several communications engineering advances (indoor positioning, HMS core innovation, real-time schedulers).

A further example of spillover effects from research at universities is the collaboration between Politecnico di Milano and Huawei, which leads to both publications in the public domain as well as patenting of new technologies. Therefore, this collaboration allows not just Huawei and the involved academic researchers to grow, but also other companies and society at large to benefit from the outcomes of the collaboration; see Box 5.

BOX 5: Case Study

Long-term project collaborations between Politecnico di Milano and Huawei push the research frontier and lead to patentable research outcomes



Politecnico di Milano is the largest technical university in Italy, and trains engineers, architects, and industrial designers. Some of the key areas of research within telecommunication are connectivity, for example, advanced radar systems, 5G/6G technology, meta-materials (fabricated materials with arbitrarily complex micro/nano-architectures), and communication for self-driving cars. Politecnico di Milano and Huawei have created a joint lab in which more than 40 researchers from Politecnico di Milano have been working on joint research projects together with Huawei since 2014. Their collaboration is a prime example of bridging the gap between academia and industry players by facilitating research and development related to technologies that have real-life applications in an industry context.

Huawei is an R&D company accustomed to engaging with researchers with a practical mindset. As described by Professor Spagnolini: "Huawei offers researchers like us the possibility to make true research and to bet on new ideas". Beyond simply providing funding, the joint research lab ensures an exchange of ideas – in terms of problems to be solved and solutions proposed – and mutual learning between Huawei and the researchers. For the researchers, the collaboration facilitates learning about the application of technologies, while for Huawei, the collaboration provides valuable insights into the more abstract theoretical aspects of developing new technologies.

The research conducted in the joint lab between Huawei and the researchers of Politecnico di Milano in the last eight years has resulted in many patents of new technologies as well as numerous publications in peer-reviewed journals, ensuring spillover effects of innovation to other research institutes, businesses and the wider society.

Source: Interview with Umberto Spagnolini, Professor and Chair of Politecnico di Milano, August 2022

4.2 HUAWEI BOOSTS THE USE OF DIGITAL TECHNOLOGIES AND THEREBY CONTRIBUTES TO ACHIEVING THE EU DIGITAL DECADE

In addition to the more general R&I ambition of the EU covering a wide variety of research and innovation topics relevant to sustaining long-term economic growth, the EU also has the specific ambition of achieving the digital and green transition. The EU has formulated its ambitions for a

³⁰ Information shared by Huawei.

digital transition with clear, concrete targets in “The European Way for the Digital Decade”. The targets are summed up in the Digital Compass, which covers four points – skills, infrastructures, business, and public services – to identify the main goals to reach by 2030.³¹

Huawei is **at the forefront of building and investing in secure and sustainable digital infrastructures**. Huawei has long researched 5G and is today known as an industry leader in the field.³²

Additionally, Huawei contributes to the EU digital transition by **offering programmes to up-skill students and especially young women and actively participating in networks and collaborations with other companies and universities**. By 2021, Huawei had established more than 150 ICT Academies in European countries and provided training for more than 14,000 partners, students, and others.³³

In France and Portugal, for example, Huawei supports programmes to up-skill the population and, in Portugal, supports reemployment of the students; see Box 6.

BOX 6: Case Study

Improving digital skills
and supporting
reemployment for
European citizens



Huawei wishes to improve the digital skills of European citizens to help in the digital transition. Through local programmes, Huawei supports the up-skilling of the national labour force and, in Portugal, the reemployment of people.

DigiTruck Programme¹

Improving digital skills and reducing digital exclusion is a core objective of the French National Plan for Digital Inclusion. Specifically, the plan aims at promoting training and reskilling to raise basic digital skills and expand the use of digital technology for everyone. To help reach this goal, Huawei collaborates with Simplon and Close the Gap in the French Digi-Truck programme. The programme offers free training in basic digital skills in priority districts according to urban policy. The programme is for everyone who is looking to improve their digital skills.

DigiTruck is located in chosen areas in a converted, environment-friendly, shipping container that is fully solar-powered. The classroom accommodates 20 workstations equipped with Huawei computers, tablets, smartphones, and an internet connection. As of November 2021, 1,500 students had received training through the programme, corresponding to 700 hours of training.

42 Lisboa²

Since 2013, programme 42 has helped more than 15,000 students in 25 countries to up-skill and gain coding experience. Studying at 42 is free and it does not require any academic degree or coding experience. With its pioneering teaching philosophy, 42 was named one of the world's 10 most innovative colleges.

Since 2020, Huawei has been a partner of 42 colleges located in Lisboa. The programme is very successful, and in 2021 42 Lisboa attracted more than 16,000 local applications. After level-by-level screening, Huawei supported the retraining and reemployment of 155 students. The skills acquired at 42 Lisboa allow the students to enter the local job market as ICT talent with professional skills.

Source: 1) Huawei (2021f) / 2) 42 Lisboa (2022) and information shared by Huawei

³¹ European Commission (2022c).

³² MWC Barcelona (2022).

³³ Information shared by Huawei.

In general, Huawei is committed to developing digital skills in every country where it operates. This has led to several talent development programmes and training. In total, Huawei has invested EUR 130 million into these programmes, benefitting more than 1.5 million people from over 150 countries.³⁴

Huawei is supporting both children and adults in the development of digital skills. To help children, Huawei for example offers training to help them identify cyberbullying and donating books to children; see Box 7.

BOX 7: Case Study

Huawei supports children and teenagers with digital tools



To support children in Europe, Huawei has built and delivered programmes to improve ICT Education and provide the children with skills to grow and be safe and active in the digital age – as well as to use education and digital tools as a way to recover from personal challenges.

1,000 Dreams¹

In 2019, Huawei announced the launch of its "1,000 Dreams" social contribution programme. With this programme, Huawei aims at training 1,000 ICT talents in total across 16 Central and Eastern European Countries, donating 1,000 books to university libraries, and 1,000 toys to children's hospitals in each of the 16 countries over the period 2019-2023.

With this programme in CEE, Huawei aims to provide a long-term sustainable platform for the youth in the region and to encourage them to work in the ICT sector, helping their countries to build an intelligent society in the future.

SmartBus²

In Europe, children are growing up with the internet as a central part of their lives, therefore it is necessary that they know how to navigate the online world. To help children aged 11 to 15 develop their understanding of what constitutes online well-being, Huawei has developed Smart-Bus. SmartBus is a fully accessible, mobile interactive classroom, which travels on-site to schools throughout Europe. The bus offers training on cyberbullying, online safety and data privacy.

Source: 1) Huawei (2019) / 2) Huawei (2021e)

To empower women to lead the digital future, Huawei supports several initiatives. For example, Huawei's *Seeds for the Future* programme launched in 2008 offers top STEM (Science, Technology, Engineering, and Maths) students learnings and hands-on experience in China.³⁵ As of December 2020, 2,591 European students had participated in the programme, which is part of a broader global initiative reaching nearly 9,000 students.³⁶

³⁴ Huawei Investment & Holding Co., Ltd. (2022a).

³⁵ In 2020, the *Seeds for the Future* program was held online; see Huawei (2021a).

³⁶ Information shared by Huawei.

Other examples are Huawei's *European Leadership Academy (ELA)*, the *Club Tech Huawei Inspiring Girls* in Spain and the *TECH4HER* scholarships in Ireland, all aimed at supporting young females in their digital skills development; see Box 8.

BOX 8: Case Study

Developing digital
skills in girls and
young women



Huawei supports young women worldwide through several scholarships and programmes, demonstrating Huawei's commitment to decreasing the gender gap in the technology sector. Two examples of programmes supporting the development and encouragement of young European women are the following.

European Leadership Academy (ELA)¹

As part of Huawei's initiative Seeds for the Future, the company has also founded the Schools for Female Leadership in the Digital Age as a continued commitment to digital inclusion. With this initiative, Huawei wants to help close the gender gap and create a world where women are empowered to lead us into the digital future. In the programme, 29 female candidates, one from each of the 27 EU Member States, one from Ukraine, and one from the Western Balkans, are chosen to complete a combination of workshops, debates, and cultural and networking activities over a week to learn the skills needed to thrive in a world defined by the digital transition. The candidates are selected by an expert Jury based on their academic performance, their non-academic achievement and commitments, and their interest in learning more about the role of technology. It is not a requirement that the women have a technical degree – all they need is a strong interest in technology and innovation. The female candidates gain a network, receive a Certificate of Completion from Huawei EU, and get a chance to get strong, female role models to learn from through this programme.

Club Tech Huawei Inspiring Girls in Spain²

Club Tech IG is an online e-learning platform designed to learn and allow the participants to become familiar with different technological tools and categories, including app development, web, 3D animation, social networks, graphic design and communications. This initiative was developed by Huawei in collaboration with the Spanish "Inspiring Girls Foundation" aiming at promoting STEM careers among young female audiences and democratising digital education among women by promoting equal opportunities. The programme lasted from October to December 2021; it was divided into five modules and based on the Learning by Doing methodology. This methodology tests the knowledge required in a practical way and guides efforts to solve problems in the technological, social, economic, and environmental fields.

TECH4HER scholarship in Ireland³

Huawei Ireland is sponsoring the TECH4HER Scholarship Programme which in 2021 offered a total of EUR 90,000 in financial awards broken down across three prestigious universities to eligible female students studying STEM subjects. Through the scholarship programmes, the female students can not only avail themselves of financial awards but also of masterclasses and some other opportunities of engaging with outstanding female ambassadors offered by Huawei Ireland. Aimed at inspiring ambitious female STEM students who want to make a real contribution to Irish society, the application process involves candidates providing a personal statement on their passion for STEM, future career hopes, and barriers faced as a woman in this field, as well as an interview with an esteemed university panel. Through this programme, Huawei hopes to close the gender gap in STEM and help attract more young women into the Information and Communications Technology industry to drive sustainable and inclusive growth.

Source: 1) European Leadership Academy 2) Club Tech IG (2021) 3) Huawei (2021b)

4.3 A KEY DIGITALISATION SPILLOVER: REINFORCING THE GREEN TRANSITION

The EU has formulated the ambitious European Green Deal to address one of the biggest societal challenges: climate change. As highlighted by the European Commission recently, Europe's green transition goes hand in hand with the digital transition. The two might seem like two distinct issues, but they should be considered twin challenges as neither can succeed without the other.³⁷ Through Huawei's presence in Europe fostering digital technologies and their use, Huawei also contributes to the green transition, as for example the French Digital InPulse contest shows, which was centred around GreenTech in 2021; see Box 9.

BOX 9: Case Study

The Digital InPulse contest supports innovative French start-ups



Since 2014, Huawei has organised the Digital InPulse start-up contest in France with the aim to support innovative French start-ups in their development. The contest gives the participants an opportunity to create a new network and become more visible to other businesses. It also awards a monetary prize and a business trip to South China (in non-pandemic times) to the first and second place. Throughout the years, Huawei has supported 80 start-ups through the Digital InPulse contest.

Each year, the contest is dedicated to a specific theme. In 2021, the contest was dedicated to #GreenTech, i.e. technologies and innovations that contribute to the protection of the environment and the creation of a sustainable future and took place in six large French cities in cooperation with regional partners. The first and second place winners in each of the six cities offered a variety of innovative, green solutions ranging from apps analysing the users' spending on global warming, biological filters allowing for filtering of air pollution, quick re-chargeable micro-batteries, and coating formulas for paper that provides it with the properties of plastic. The winners, therefore, show how start-ups can contribute to the protection of the environment as well as how digital tools can help achieve the green agenda.

Source: Information shared by Huawei

The European Green Deal is focused on measures to reach carbon neutrality by 2050 and to ensure that economic growth is decoupled from resource use. The main role of the European Commission in this transition is to ensure that the right policies are in place. The European Green Deal will improve the well-being and health of citizens and future generations by e.g. providing fresh air, biodiversity, and cleaner energy.³⁸

³⁷ European Commission (2022d).

³⁸ European Commission (2020).

Digital technology can help achieve the goal of carbon neutrality. For example, mobile network equipment and connectivity used to access the internet (common not only on the move but also in many peripheral areas) or workers joining videoconferences instead of travelling to meetings results in removing emissions related to travelling. However, while increasing the role of digital technologies, the European Commission points out that digital technologies should not consume more energy than they save.³⁹ The European Commission notes that one way to reduce energy consumption is to switch from 4G to 5G networks which all things equal can reduce energy consumption by up to 90 per cent.⁴⁰

Telecom operators and companies like Huawei play a key role in reaching carbon neutrality not only by accelerating the transition from 4G to 5G networks, but also by deploying fibre networks, improving existing networks and the energy efficiency of data centres, and increasing the share of energy produced from renewables. The role of telecom operators in the green transition has also been highlighted by the European Telecommunications Network Operators' Association (ETNO).⁴¹ Huawei promotes the use of renewable energy to achieve a greener and more sustainable digital world. In 2021, Huawei for example shipped 52 GW of PV (photovoltaic) inverters globally.⁴²

In addition, the European Green Deal aims at bringing back biodiversity and supporting a green recovery following the covid-19 pandemic. This is also a core focus of the European Commission's Biodiversity Strategy for 2030. With the Biodiversity Strategy, the European Commission presents a long-term plan to protect and restore nature and put Europe's biodiversity on the path to recovery by 2030.⁴³ Digital companies can help to protect nature as digital technologies can be used to protect wildlife and ensure sustainability. Huawei has also contributed to this policy agenda in Europe. For example, in cooperation with other companies, Huawei uses acoustic technology to help monitor and protect the chamois habitat in Greece and cetaceans in Ireland, thereby protecting the wildlife in Europe; see Box 10.

³⁹ European Commission (2022d).

⁴⁰ European Commission (2022d).

⁴¹ ETNO (2020).

⁴² PV Magazine (May 2022).

⁴³ European Commission (2021a).

BOX 10: Case Study

Protecting European wildlife



As a global company, Huawei is dedicated to sustainable socioeconomic development and strives to build a more sustainable Europe as shown by these initiatives.

TECH4ALL Guardian¹

To monitor the chamois habitat in Greece, Rainforest Connection (RFCx), wildlife researchers from the Forest Research Institute (FRI), and Huawei Greece teamed up in January 2021 to deploy the TECH4ALL Guardian project. The project uses acoustic technology 24/7 to pick up sounds, and based on these data algorithms can identify gunshots by poach-ers and chainsaws by illegal loggers. If a threat is identified, an alarm will be sent to park rangers. Nova-Wind participates in this project as a sponsor by providing the necessary data transfer services (sim cards) and covers the consequent annual cost of their use. As of April 2021, the technology had identified five gunshots. While no arrests had been made, news of the new "acoustic shield" for the chamois has now reached local communities and might serve in a preventive manner. The Deputy General Director of Forestry of the Ministry of Environment and Energy in Greece, Mr. Evangelos Goudoufas stated: "This TECH4ALL project can help protect endangered wildlife species in real time – the first project of its kind in our country".

TECH4ALL Smart Whale Sounds²

The Smart Whale Sounds Project in Ireland also uses acoustics to protect wildlife, more specifically cetaceans. Rainforest Connection (RFCx) and Huawei Ireland teamed up for this project that uses bioacoustics to detect vocalisations in the ocean in real time. AI and deep learning models can automatically detect and identify cetacean species in Ireland based on acoustics. The technology is designed to assist decision-makers with marine spatial planning, including the development and monitoring of a network of Marine Protected Areas around Ireland and to create an early warning system alerting large ships of the presence of whales in an area, preventing ship strike and limiting noise pollution in important habitats.

Sources: 1) Huawei (2021c) / 2) ORCA Ireland (2022) / 3) Huawei (2022)

4.4 OPPORTUNITIES AHEAD

In this study, we have shown that businesses such as Huawei, even if born outside Europe, contribute significantly to the European economy in terms of value added as well as jobs and taxes within Europe. Furthermore, when focusing on the bigger picture, it is apparent that R&D-focused businesses such as Huawei have an even wider role to play in Europe and are helpful for Europe to achieve its long-term policy ambitions.

The digital and green transition is a pressing issue for Europe (and beyond) and calls for new and innovative solutions. While policymakers cannot achieve all these important societal changes on their own, this can succeed thanks to the contribution of in primis tech- and R&D-oriented businesses, which have a key role to play in supporting the realisation of these vital policy goals. With its strong focus on fostering R&D and innovation in Europe and as a facilitator of research collaboration and knowledge sharing, Huawei provides a clear and positive case and contributes to the digital transformation in Europe.

While it is up to policymakers to create the right framework conditions to ensure that businesses such as Huawei can further advance R&D in Europe alongside other stakeholders, it is also imperative that the industry plays its part. The evidence that we have gathered and reviewed suggests that industry leaders such as Huawei are contributing to European R&D and digital transformation, which is a further opportunity for Europe to look ahead.

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APPENDIX A

METHODOLOGY

In Chapter 2 of this study, we assess Huawei's contribution to the European economy in 2021 in terms of value added throughout the economy, jobs supported, and tax revenue generated for European governments due to Huawei's operations. We thereby analyse three contributions: direct, indirect, and induced contribution.

The **direct contribution** measures the economic activity generated directly at Huawei's local European offices in terms of value added, employment or taxes paid. To estimate the direct effects, we rely on data provided by Huawei.

- We calculate (direct) value added from Huawei in Europe, as a proxy for economic activity, by summing Huawei's profits and salary. We use total salary numbers provided by Huawei and an estimation of Huawei's EBITDA in the countries included in this report. We approximate Huawei's European EBITDA for 2021 based on 2021 revenue and the observed ratio of EBITDA and revenue per country between 2015-2019, based on Huawei data.
- We calculate (direct) jobs supported based on direct employment numbers (full time equivalents) provided by Huawei, which includes both internal workforce and leased workforce.
- We base (direct) taxes paid on tax revenue data provided by Huawei, which includes both corporate taxes paid by Huawei and personal income taxes paid by Huawei's employees.

In addition to the direct contribution, the **indirect contribution** measures the contribution arising from money spent by Huawei on its European suppliers and the **induced contribution** captures consumer spending on the European market funded by wages paid to Huawei's employees and those employed along its supply chain.

To estimate indirect and induced effects of Huawei's European activities, we use an **input-output model** based on OECD's global input-output table.⁴⁴ The input-output table is built around industries and contain information on inter- and intra-industry purchases. The model thus captures the flow of purchases throughout the value chains in the economy – i.e., who buys from who, and what are the wider downstream effects of this. It thereby makes it possible to estimate i) the economic effect of purchases made by Huawei on other firms in the economy (i.e. the indirect effect) and ii) the economic effect of salaries paid out by Huawei and other firms in Huawei's value chain when used by employees in the wider economy (i.e. the induced effect). We follow standard input-output model assumptions⁴⁵ with several additional assumptions, as described below.

The **indirect effects related to value added** arise through Huawei's purchases from European suppliers, i.e. it measures the economic activities generated in other companies that stems from Huawei's economic activity. Thus, the engine of the input-output model is the purchases made by

⁴⁴ See OECD's inter-country input-output (ICIO) tables: <https://www.oecd.org/sti/ind/inter-country-input-output-tables.htm>

⁴⁵ Standard assumptions of an input-output model are that it is a static model implying no constraints on capital or labour, and that the model does not clear. In addition, an input-output model uses average sector numbers (in each country) for interregional purchases, number of jobs, etc. As a result, we assume, as is standard in these types of models, that Huawei acts as an average representative of the chosen sector.

Huawei in Europe. We base our model on purchase data for 2021 provided by Huawei, covering all European countries and sectors.

- To split purchases by country (necessary for the input-output model), we rely on actual, country specific purchase data from 2015-2019, provided by Huawei.
- To split purchases by sector (necessary for the input-output model), we assume that Huawei's purchases are distributed by sector comparable to the average telecommunication company. We use telecommunication⁴⁶, as Huawei's European headquarter in Düsseldorf is placed in the telecommunication sector.⁴⁷

In addition to a standard input-output modelling approach, we also consider the link between Huawei's purchases and the rest of the world, which is two-fold: i) Huawei in Europe purchases something in a non-European company, and ii) the same company buys something again in Europe. While the first link is *not* included in our analysis, the second link is and captures an additional economic effect supported by Huawei's original purchase.

Induced effects related to value added capture the spending capacity of employees in a given country and sector. Since the OECD input-output tables do not include salary numbers per country and sector, we estimate salary based on household consumption from the input-output tables and saving rates from Eurostat⁴⁸. We assume that salary equals household consumption divided by (1-saving rate), under the restriction that household consumption cannot be higher than salary.

To estimate **indirect and induced employment effects**, we rely on employment numbers per country and sector from OECD.⁴⁹ These numbers indicate how employment intensive a given sector is, and thus allow us to estimate how many jobs are supported by e.g. purchases from the sector. For countries with no OECD numbers available, we use Eurostat numbers instead.⁵⁰ To achieve a sector split in the employment figures that match the input-output tables, we split the OECD employment numbers based on Eurostat data.

To estimate the **indirect and induced tax contribution**, we multiply the indirect and induced value added per country with the average tax rate, i.e. tax revenues divided by GDP, per country.⁵¹

⁴⁶ Sector code 61 according to NACE definition.

⁴⁷ According to Huawei Deutschland LinkedIn page and <https://www.developmentaid.org/organizations/view/190929/huawei-technologies-duesseldorf-gmbh>

⁴⁸ See Eurostat, household saving rate: https://ec.europa.eu/eurostat/databrowser/view/NASA_10_KI/default/table?lang=en

⁴⁹ See OECD table Employment by activities and status (ALFS): https://stats.oecd.org/Index.aspx?DataSetCode=ALFS_EMP

⁵⁰ See Eurostat, table nama_10_a64_e: https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_A64_custom_1252979/default/table?lang=en

⁵¹ Based on Eurostat, see table GOV_10A_TAXAG\$DEFAULTVIEW: https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_A64_custom_1252979/default/table?lang=en



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