

# Quantifying and Qualifying the Benefits of R&I Cooperation with China

## Paper on Tangible Benefits for Europe from R&I Collaboration with China

EU Research and Innovation Knowledge Network on China

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## Preface

The EU-KNOC initiative was launched in July 2020, by the Directorate-General for Research and Innovation of the European Commission and the Strategic Forum for International Cooperation (SFIC) and is implemented by a consortium consisting of DLR Management Agency, Intrasoft, Teamwork, Technopolis and ZSI. EU-KNOC brings together representatives of the EU Member States' Ministries of Science, Technology and Innovation and other relevant ministries who constitute the Core China Group (CCG) and external experts to tackle thematic issues related to R&I policy towards China and to promote a common response.

As input and background information for EU-KNOC several studies are prepared by a research team. These studies aim to provide more in-depth knowledge regarding specific sub-topics within the wider area of STI collaboration with China.

This study aims to provide a state of play regarding benefits of R&I cooperation with China, in quantitative and qualitative terms from an EU perspective. It should be noted that this study does not seek to be an in-depth study but rather gives a snapshot and indicative elements of the overall situation between Europe and China. Furthermore, the geopolitical dimension which is intrinsically linked to the risk/benefit analysis in this area will not be addressed as evidently as possibly needed in this paper, due to its scope. Main sources used for drafting this paper are academic literature, policy literature, public statistics, expert interviews with experts from Europe, and online resources by EURAXESS<sup>1</sup>.

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<sup>1</sup> <https://euraxess.ec.europa.eu/>

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# 1. Introduction: Key Concepts and Definitions

## 1.1. Background of EU-China R&I Cooperation

The EU and China have formalised their R&I cooperation through the EU-China Science & Technology Cooperation Agreement of 1998, which was last renewed in 2018. It is established on the following principles: (i) mutual benefit based on an overall balance of advantages; (ii) reciprocal access to the activities of research and technological development undertaken by each party; (iii) timely exchange of information which may affect cooperative activities; (iv) appropriate protection of intellectual property rights<sup>2</sup>. Several documents guide the dialogue between Europe and China. The EU-China S&T cooperation agreement is implemented through a Joint Steering Committee. In 2012, the EU-China Joint Declaration on the Innovation Cooperation Dialogue (ICD) was signed to create a space for Europe and China to cooperate on innovation. This platform regularly brings together the European Commission and China to discuss at Commissioner/Minister level. In the same year of the last renewal of the S&T cooperation agreement, namely in 2018, the EU formulated a Roadmap for EU China S&T cooperation (now outdated). A new EU-China Joint Roadmap for the Future of Science, Technology and innovation cooperation is now being discussed between the EU and China as agreed during the Innovation Cooperation Dialogue of 2019. The aim of this document is to obtain clear commitments for a fair and non-distortive innovation ecosystem, defined by reciprocity and a level-playing field while respecting high ethical and science integrity standards.

Back in 2018, the EU also engaged in a series of studies to analyse challenges as well as positive and negative effects of EU-China R&I cooperation, notably the papers *“China: challenges and prospects from an industrial and innovation powerhouse”* from 2019 and issued a Joint Communication to the EU Parliament and the Council that guides the EU’s strategy towards China named *“EU-China – A strategic outlook”* from 2019. This document describes the EU relations with China, and presents the various roles China plays with regards to the EU: cooperation partner, negotiation partner, economic competitor or systemic rival. In addition to this, the Commission seeks to engage in an approach that promotes level-playing fields, rebalancing, openness, and reciprocity vis-a-vis relations with China, in line with the Strategic Outlook and the Global Approach to Research and Innovation communication of 2021<sup>3</sup>.

The EU-China R&I cooperation poses clear challenges to the EU. In a previous paper on *Upgrading knowledge on China: Ways forward for the European Union and Member States* which has been developed in the context of the EU-KNOC initiative, the risks of the R&I cooperation with China were detailed and discussed: China increasingly seeks to control the higher education, science and technology sectors and research linked to these sectors. This can lead to violations of academic and research freedom and agreements on international science cooperation<sup>27</sup>. China’s research ecosystem does not follow the Open Access approach, promoted by the EU, hence potential for benefits from R&I cooperation are coming through alternative routes<sup>4</sup>. This has led to discussions between the

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<sup>2</sup> Official Journal of the European Communities (1998) *Agreement for scientific and technological cooperation between the European Community and the Government of the People's Republic of China* available at:

<https://ec.europa.eu/research/iscp/pdf/policy/china-agreement.pdf#view=fit&pagemode=none>

<sup>3</sup> European Commission (2021). Europe’s global approach to cooperation in research and innovation: strategic, open and reciprocal. Available online at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_21\\_2465](https://ec.europa.eu/commission/presscorner/detail/en/ip_21_2465)

<sup>4</sup> European Commission. (2017). Roadmap for EU-China S&T cooperation. Available online: [https://ec.europa.eu/info/research-and-innovation\\_en](https://ec.europa.eu/info/research-and-innovation_en)

Chinese government (MOST) and Europe to improve the accessibility of their research to the whole research community<sup>5</sup>. Additionally, the Chinese market remain relatively closed for European companies for the valorisation of their innovation, while on the opposite side the EU welcomes Chinese companies to their market<sup>6</sup>.

Nevertheless, EU-China R&I cooperation does hold opportunities. Considering the overall lack of understanding of modern China, its academic system and goals<sup>7</sup>, the EU can eventually miss out on these potential benefits from EU-China R&I cooperation. However, the EU has to keep in mind that China's policy agenda and its highly strategic approach to R&I might imply risks related to engagement that ought to be effectively understood and managed. Some papers and reports have written about opportunities from EU-China cooperation, but not many have dived into what benefits various EU stakeholder might gain from EU-China cooperation. This paper seeks to qualify and quantify the various benefits that can arise from an EU-China cooperation in the field of research and innovation, building on the knowledge gathered in previous papers – notably the *Science & Innovation cooperation between Europe and China: How reciprocal are they?*<sup>8</sup>, which focused on the reciprocity of the cooperation.

## 1.2. Benefits from R&I cooperation: definitions

Benefits from R&I cooperation can have various dimensions and affect various stakeholders. This study distinguishes between benefits at five levels, as presented in Table 1: individual researchers, research institutes, companies, systems, and global goals.

Table 1 Dimensions of international STI collaborations

Beneficiary	Key Benefits
Individual researchers	<ul style="list-style-type: none"> <li>• Access to research funding</li> <li>• Access to research infrastructure (including data)</li> <li>• Access to research exchanges (mobility)</li> <li>• Access to talented students</li> <li>• Valorisation opportunities</li> </ul>
Research institutes	<ul style="list-style-type: none"> <li>• Access to research funding and infrastructure</li> <li>• Improved research capacity through collaborative programs</li> <li>• Revenue generation from Chinese students</li> <li>• Investment from Chinese public research/HE sector</li> <li>• Investment from Chinese (owned) private sector</li> </ul>
Companies	<ul style="list-style-type: none"> <li>• Access to research &amp; innovation funding</li> <li>• Access to IP/technology through cooperation</li> <li>• Access to capital (via loans/equity) for key R&amp;I investments</li> </ul>
Systems	<ul style="list-style-type: none"> <li>• Higher efficiency in research (division of labour, economies of scale) by combining forces</li> <li>• Higher quality (excellence in research through large total funding base, diversity in viewpoints etc.) by combining forces</li> </ul>
Global goals	<ul style="list-style-type: none"> <li>• Faster and more impactful research &amp; innovation for global goals (e.g. energy transition)</li> <li>• Access to knowledge, technology and IP that will help Europe address its own national public goals (SDG-related)</li> </ul>

<sup>5</sup> Kelly, E. & Burke, F. (2020). Universities wrestle with question of how open to be with China. Available online: <https://sciencebusiness.net/technology-strategy-board/news/universities-wrestle-question-how-open-be-china>

<sup>6</sup> European Commission. (2019). European Commission and HR/VP contribution to the European Council: EU

<sup>7</sup> Yan, F.: Identity of China's modern academic system: A Chinese–Western interaction perspective. J Educ Change (2020). <https://doi.org/10.1007/s10833-020-09389-w>

<sup>8</sup> This confidential recommendation paper was developed in the context of the EU-KNOC initiative.

	<ul style="list-style-type: none"><li>• Access to knowledge, technology and IP that will help China address its own national public goals (SDG-related)</li><li>• Better diplomatic ties through scientific cooperation (science diplomacy)</li></ul>
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*Source:* Technopolis Group, 2021

The following chapters identify the benefits of R&I cooperation between EU and China at each of these levels.

## 2. Qualifying and Quantifying the Benefits of R&I Cooperation with China for Europe

### 2.1. Individual Researchers

#### 2.1.1. Benefit Mechanisms

There are various benefit mechanisms available for individual researchers, such as access to research funding, access to research infrastructure, exchanges, and access to students' networks which can share information on Chinese systems.

Regarding **research funding**, European researchers can apply for various Chinese funding programs<sup>9</sup>. For example the National High-end Foreign Expert Recruitment Plan was created in 2019 by the Ministry of Science and Technology (MOST), and merges several other programs such as the Thousand Talents Recruitment Plan created in 2008. This programme targets strategic high-level overseas scientists who can receive fundings to conduct research in China and participate to the country's scientific programmes. Top researchers in fields that are defined as strategic by the Chinese government, such as technology development, industrial technology innovation, social and ecological construction, agriculture and rural revitalization<sup>10</sup>, have an increased chance to find funding for their research in China, or even the possibility to set up their own research team in China. Obtention of research funding seems however much easier when researchers have previously studied in a Chinese university<sup>11</sup>, as mentioned by an interviewed researcher in July. Individual researchers can also benefit from funding provided to Chinese PhD students that can then work in the researchers' groups in Europe "for free", as they get fully paid by the Chinese authorities.

When individual researchers cooperate with Chinese partners, they also gain access to **research infrastructures** in China. Researchers can access data they would otherwise not have access to<sup>27</sup>. For example, in medical research, China can grant access to data of large cohorts of patients. Additionally, researchers might make use of (expensive) equipment which is not or only scarcely available at European institutes<sup>27</sup>. According to an interviewee who regularly engages in joint research projects, it is sometimes the case in these projects that a Chinese partner has the equipment but lacks the knowledge to make good use of it. Therefore, the European partner supplies the know-how, and is allowed to use the equipment for their research in return. Doing research in China also offers individual researchers unique valorisation opportunities, given the size of China's market<sup>27</sup>.

Individual researchers can also benefit from **research exchanges**, both from Europe to China and vice versa. These research exchanges to China can help researchers become more familiar with the Chinese culture and learn from the research that is being done in China, and thus increase future cooperation and synergies. The number of scholarships for individual researchers between China and Europe is growing very fast, increasing the opportunities for individual researchers to do part of their research in China<sup>12</sup>. However, an imbalance remains in the number of opportunities for European researchers to go to China compared to the opportunities offered to Chinese researchers to come to Europe. On another aspect, the number of internationally mobile tertiary students is increasing for China, both

<sup>9</sup> Source: <https://chinainnovationfunding.eu/thousand-talents-plan/>

<sup>10</sup> Those strategic fields are identified by the "High-end Foreign Experts Recruitment Plan", Source: <https://chinainnovationfunding.eu/project/2019-high-end-foreign-experts-recruitment-plan/>

<sup>11</sup> Source: Interviewee.

<sup>12</sup> EC Website, "Collaboration opportunities".Source: <https://euraxess.ec.europa.eu/worldwide/china/collaboration-opportunities>

outbound and inbound students. The number of outbound students from China was about a million in 2019, while 10 years before that it was approximately half a million. The number of inbound tertiary students has been lower, with around 200.000 students in 2019. However, in relative terms the number of inbound students has increased faster over the past 10 years, so it might catch up with the outbound students<sup>13</sup>.

The research exchange from China to Europe can also be beneficial for individual researchers since this provides **access to talented Chinese students**. Over the past years, China has provided funding programs to talented students to do their PhD abroad. Once in the EU, there is a high probability that Chinese students stay (according to a study done in the Netherlands)<sup>14,15,16</sup>.

Finally, collaborating with China on R&I can offer individual researchers benefits such as learning Mandarin and learning about Chinese culture and society. This can contribute to closing the existing knowledge gap on China within Europe.

### 2.1.2. Available Quantitative and Qualitative Evidence

Concerning **research funding**, the Research Fund for International Scientists<sup>17</sup> (RFIS) - funded by the National Natural Science Foundation of China (NSF), supports international scientists with the aim to contribute to long-term international academic collaboration and exchanges. Scientists can request up to 800.000 RMB (Approx. 105 428€) per year per project (for a maximum of two years). There are three types of beneficiaries: i) young scientists (who obtained their PhD within the past 6 years); ii) excellent young scientists (who obtained their PhD within the past 15 years and a senior academic title); iii) senior scientists (with a senior academic title and outstanding academic achievements).

Regarding **research exchanges**, one example is the Joint Research PhD Fellowship from the Confucius Institutes, which is accessible to PhD students in the EU, and which offers half a year to 2 years research in China funded by the Chinese government<sup>18</sup>, for example in the field of Sinology, China Studies or related humanity and social sciences. Other examples include the Thousand Talents Recruitment Plan and the NSFC. The latter funds Chinese scientists participating in joint research, academic meetings and personnel exchange and actively attracts overseas scientists to participate in domestic basic research.

Regarding **career development**, there are slightly more researchers active in China than in the EU in absolute terms, and almost double the number of R&D personnel, as shown in Table 2. However, in relative terms, there are 3 times more researchers per 1000 employed people in the EU-27 than in China, and 2.5 times more R&D personnel.

<sup>13</sup> UNESCO Institute for Statistics. (2021). Number and rates of international mobile students (inbound and outbound). Available online: <http://data.uis.unesco.org/#>

<sup>14</sup> Bijwaard, G. E. 2010. "Immigrant Migrant Dynamics Model for the Netherlands." *Journal of Population Economics* 23 (4): 1213–1247

<sup>15</sup> Li, S. 2013. "China's Brain Drain Worst in the World." Accessed August 2021. [http://www.china.org.cn/china/2013-10/28/content\\_30424275.htm](http://www.china.org.cn/china/2013-10/28/content_30424275.htm)

<sup>16</sup> Rui Yang (2019): Benefits and challenges of the international mobility of researchers: the Chinese experience, *Globalisation, Societies and Education*, DOI:10.1080/14767724.2019.1690730

<sup>17</sup> NSFC. (2021). Research Fund for International Scientists Call for Proposals FY 2021. Available online: [http://www.nsf.gov.cn/english/site\\_1/international/D5/2021/04-02/231.html](http://www.nsf.gov.cn/english/site_1/international/D5/2021/04-02/231.html)

<sup>18</sup> Confucius institute. (2021). PhD fellowship. Available online: <https://www.confuciusgroningen.nl/projects/funding-projects/china-studies-program/phd-fellowship>



Table 2 Overview of number of researchers in China and in the EU-27.

Indicator	China	EU-27	Source
Total researchers in Full Time Equivalent (FTE)	2109k (2019)	1855k (2019)	OECD <sup>19</sup>
Number of researchers in FTE per 1000 employed	2.4 (2018)	8.7 (2018)	OCED
Total R&D personnel in FTE	4.8m (2019)	2.9m (2019)	OECD
Total R&D personnel in FTE per 1000 employed	5.6 (2019)	13.7 (2018)	OECD

### 2.1.3 Example case

The opportunity to access large and state of the art research infrastructures is one of the key incentives for European researchers to collaborate within the Chinese research ecosystem. One good example is in the disciplines of astronomy and space research<sup>20</sup>. In these disciplines, the number of infrastructure and installations is higher in China than in Europe. Hence, on one hand, while in Europe some instruments are difficult to access as they are already widely used by numerous researchers<sup>21</sup>, instruments may be more accessible in China, with more observational time available for research. On the other hand, China has some outstanding equipment that can greatly contribute to scientific discoveries. Notably, in 2016 China built the five-hundred-meter aperture spherical radio telescope called “FAST”, which is the world’s largest filled-aperture radio telescope.<sup>22</sup> FAST’s mission is to survey large scale neutral hydrogen, detect pulsars and interstellar molecules, and search for interstellar communication signals. The National Astronomical Observatories of China (NAOC) of the Chinese Academy of Sciences, which operates the telescope, issued a communication about the opening of the access to this infrastructure to foreign scientists. The application for foreign researchers opened in April 2021 and a timetable with access right was planned to be published in August. In the long run, about 10% of the observation time of this telescope is planned to be allocated to global scientists<sup>23, 24</sup>.

However, challenges arise regarding the translation of the voluminous documentation that guides the use of the infrastructures. Hence, a sustained interest of foreign researchers and the underlining of the importance of a global open sky policy will help in sustaining the Chinese effort to make their infrastructures available, both in term of observation time and in the language accessibility of their installations. This problematic also applies in social science fields, where data translation and access is key to cooperation.

<sup>19</sup> OECD. (2021). OECD Statistics. Available online: <https://stats.oecd.org/>

<sup>20</sup> Zastrow, M. (2018). China's place among the stars. *Nature*, 564(7735), S64-S64. Available online: <https://www.nature.com/articles/d41586-018-07690-6>

<sup>21</sup> ESFRI (2020). Making Science Happen, A new ambition for Research Infrastructures in the European Research Area. Available online: [https://www.esfri.eu/sites/default/files/White\\_paper\\_ESFRI-final.pdf](https://www.esfri.eu/sites/default/files/White_paper_ESFRI-final.pdf)

<sup>22</sup> Zastrow, M. (2018). China's place among the stars. *Nature*, 564(7735), S64-S64. Available online: <https://www.nature.com/articles/d41586-018-07690-6>

<sup>23</sup> (2021) China’s FAST telescope will be available to foreign scientist. Xinhua. Available online: [http://www.xinhuanet.com/english/2021-01/04/c\\_139640756.htm](http://www.xinhuanet.com/english/2021-01/04/c_139640756.htm)

<sup>24</sup> On European-side, the Commission ensures that European research infrastructures are “open and accessible to all researchers in Europe and beyond”, [https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures_en)

#### 2.1.4 Barriers and Drivers to Access Benefits

In general, for individual researchers, collaboration with China is a self-enforcing process. Scientists who go study or perform research in China acquire expertise and knowledge about Chinese culture and politics, which in turn helps to foster links and better access to collaboration benefits. The same holds true for Chinese researchers who study or perform research in the EU.

For a long time, a driver of increased collaboration between the EU and China was the appeal of the EU to Chinese students. However, this appeal seems to be decreasing according to an interviewee (see the Interviewee list in **Fehler! Verweisquelle konnte nicht gefunden werden.**). In 2001, just 14% of all Chinese students that went abroad went back to their home country. From 2013 until now at least 80% have returned annually<sup>25</sup>.

Among the barriers for R&I collaboration with China, the biggest is, unsurprisingly, the language barrier. Still, many Chinese do not speak English, although this is increasing among the Chinese youth. EU researchers, meanwhile, often do not speak Mandarin, which makes it hard for them to move to China to perform research there. Another barrier, according to some interviewees, is the political stigma from both sides.

## 2.2. Research Institutes

### 2.2.1 Benefit mechanisms

Benefit mechanisms for research institutes include improved research capacity through collaborative programs, investments from the Chinese public research, higher education, and private sectors, and access to revenues from incoming Chinese students.

On the front of **collaborative research**, there are several local programs and funds available to Chinese entities (being researchers, enterprises, research institutes and universities) to team up with European partners and participate in projects under Horizon2020 and currently Horizon Europe<sup>26</sup>. This means that there are several opportunities for European research institutes to collaborate with diverse Chinese entities that (partially) get their funding from China.

Research institutes also experience benefits from collaborating with China on R&I through **generating revenues from incoming Chinese (PhD) students**. Fee-paying Chinese students add to the financial stability of research institutes<sup>27</sup>. The sheer size of China's academic system ensures the attractiveness of collaboration. 8 million Chinese students graduate annually, which makes for a great pool of academic talent<sup>27</sup>. It is very beneficial for European universities to receive foreign-funded PhD candidates to sustain their research. Some researchers argue that there is an overreliance of Western

<sup>25</sup> Ministry of Education of China (2021)

<sup>26</sup> EC (2019). People's republic of China – Country page. Available online:

[https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020\\_localsupp\\_china\\_en.pdf](https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020_localsupp_china_en.pdf)

<sup>27</sup> D'Hooghe, I., Montulet, A., de Wolff, M. & Pieke, F. N. (2018). *Assessing Europe-China Collaboration in Higher Education and Research*. Leiden Asia Centre, Leiden. Available online: <https://leidenasiacentre.nl/wp-content/uploads/2018/11/LeidenAsiaCentre-Report-Assessing-Europe-China-Collaboration-in-Higher-Education-and-Research.pdf>

universities on Chinese students<sup>28</sup>, which became especially clear when the number of Chinese students studying abroad dwindled during the corona pandemic<sup>29</sup>.

An interviewed researcher stated that some institutes – particularly those in the technical, natural, and medical sciences – even state that cooperating with China has become a necessity to maintain or strengthen research excellence. The reason for this is that China is already the world leader in these fields due to its **large investments in the fields over the past years**. Another, parallel, process mentioned by multiple interviewees is that the numbers of domestic students in these fields have been decreasing, especially in applied research. Social sciences and humanities on the other hand are more EU and US, and less China focused.

### 2.2.2 Available Quantitative and Qualitative Evidence

The sheer size of China's investment in R&I and the number of outbound students are summarized in Table 3, including a comparison with the EU-27. China has, in absolute terms, invested more in R&D than the EU-27, but less when measured relative to the GDP. In China, the business enterprise sector is responsible for more of the investment in R&I than in the EU-27. It has to be noted that some of these businesses might be state-owned enterprises. There were almost five times more outbound Chinese students than inbound in 2018, while the EU received almost five times more students than there were students outbound.

Table 3 Quantitative evidence of benefits of R&I Collaboration with China

Indicator	China	EU-27	Source
Gross Research and Development expenditure in million dollars	\$515 billion (2018)	\$391 billion (2018)	OECD <sup>19</sup>
Gross Research and Development expenditure as a proportion of GDP (GERD)	2.06% (2019)	2.18% (2018)	Eurostat <sup>30</sup>
Business-financed GERD as a percentage of GDP	1.64% (2018)	1.21% (2018)	OECD
Government-financed GERD as a percentage of GDP	0.43% (2018)	0.62% (2018)	OECD
Percentage of GERD financed by business enterprise sector	77% (2018)	59% (2018)	OECD
Percentage of GERD financed by government	20% (2018)	30% (2018)	OECD
Percentage of GERD financed by rest of the world	0.4% (2018)	7.2% (2018)	OECD
Enrolment in tertiary education (at 18-year-old)	84.7% (2019)	85.9% (2018)	China statistical yearbook <sup>31</sup> , Eurostat

<sup>28</sup> See e.g. Adams, R. (2020). UK Universities accused of overreliance on fees from Chinese students. Available online: <https://www.theguardian.com/education/2020/jul/23/uk-universities-accused-overreliance-fees-chinese-students>

<sup>29</sup> Smyth, J., Woodhouse, A., Pong, J. & Jack, A. (2020). Coronavirus exposes western universities' reliance on China. Available online: <https://www.ft.com/content/b3429de6-4dec-11ea-95a0-43d18ec715f5>

<sup>30</sup> Eurostat. (2021). Eurostat: your key to European statistics. Available online: <https://ec.europa.eu/eurostat/data/database>

<sup>31</sup> National Bureau of Statistics of China. (2021). China Statistical Yearbook. Available online: <http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm>

Outbound students	993k (2018)	302k (2018)	UIS <sup>32</sup>
Inbound students	201k (2018)	1300k (2018)	UIS

The main possibilities for European research institutes to collaborate with diverse Chinese entities that (partially) get their funding from China include:

- The main project of importance is the EU-China co-funding mechanism in collaboration with China's Ministry of Science and Technology (MOST). Launched in 2015, and renewed in 2018, it is aimed at supporting joint projects between European and Chinese entities in specific areas that have been mutually agreed. MOST provides financial support on a competitive basis to China-based entities that participate in H2020 projects. For the period of 2018-2020, the annual budget was 200m RMB (26m EUR). The co-funding mechanism will likely be renewed for Horizon Europe.
  - China's National Science Foundation of China (NSFC) also provides co-funding for the Food, Agriculture, and Biotechnology flagship initiative through the EU-China co-funding mechanism described above. The ceiling of fund scale per project does not exceed 15m RMB (2m EUR).<sup>33</sup>
- For individual researchers, the European Research Council (ERC) and the NSFC agreed on the so-called Implementing Arrangement to facilitate high-calibre Chinese researchers who are active holders of NSFC competitive grants to come to Europe to join ERC-funded research teams<sup>34</sup>. Fehler! Textmarke nicht definiert.

### 2.2.3 Example case

An example of a research institute benefiting from R&I cooperation with China is Nottingham University – the collaboration started when the UK was still part of the EU. Nottingham University has successfully started a campus abroad in the city of Ningbo, which is located South of Shanghai<sup>35</sup>. The university received funding from the Chinese government to establish a research facility there. It is an example of a success case notably while other universities have tried to do the same but failed at setting up a campus. According to an interviewee, the main success factor here was that Nottingham University successfully navigated the challenges brought about by cultural differences.

Two other examples are the University of Maastricht with the Chinese Scholarship Council, and the University of Amsterdam and Free University with HuaWei. Maastricht university has received 60 Chinese PhD students annually for 4 years. The PhD students are funded by China in terms of housing, payment, and travels to the Netherlands. This way, the university has access to many funded young researchers working for them. According to an interviewee, the main driver for the collaboration of the University of Amsterdam and the Free University with HuaWei is the financial benefits. The interviewee assumed that the initiative was initiated by HuaWei, and not necessarily from the universities themselves.

<sup>32</sup> Unesco Institute of Statistics. (2021). Data UIS. Available online: <http://data.uis.unesco.org/>

<sup>33</sup> China Innovation Funding, "Chinese national innovation funding programmes". Available online: <https://chinainnovationfunding.eu/chinese-national-innovation-funding-programmes/>

<sup>34</sup> European Research Council (2015). New initiative launched to encourage Chinese top researchers to join ERC teams in Europe. Available online at: [https://erc.europa.eu/sites/default/files/press\\_release/files/erc\\_pr\\_2015\\_China\\_agreement.pdf](https://erc.europa.eu/sites/default/files/press_release/files/erc_pr_2015_China_agreement.pdf)

<sup>35</sup> Nottingham University (2021). An international university in China. Available online: <https://www.nottingham.edu.cn/en/About/Who-we-are.aspx>

### 2.2.4 Barriers and Drivers for Benefits

The main driver for European institutions as well as for individual researchers to collaborate with China is the potential access to research funding, and access to many young talented researchers. In Europe, the number of students willing to pursue a PhD and consider an academic career has been dwindling. This means that it gets harder for research institutes to fill their PhD positions. International students, and especially Chinese students are an attractive alternative for domestic students. Although it is relatively easy to attract young researchers from China, it is harder to attract established researchers from China according to an interviewee.

The main barrier for research institutes to benefit from R&I cooperation with China is the differences in culture and language. These differences make it harder for European research institutes to establish and keep communications and good relations with Chinese institutes.

Another barrier is that Chinese funding procedures are not very transparent for Europeans, with many unwritten rules that benefit local applicants or politically favoured stakeholders rather than Europeans<sup>36</sup>.

## 2.3. Companies

### 2.3.1 Benefit mechanisms

For companies, the main benefits of R&I cooperation with China include access to China's market, access to R&I funding, access to IP and technology through cooperation, and access to capital for R&I investments.

The first benefit mentioned by interviewees is the sheer size of China's economy. Cooperation opens doors to **valorisation in new marketplaces**, and to the possibility of developing new markets and business opportunities, and hence a greater revenue.

Related to this point is the **access to funding**. As discussed in the previous section, China outspends the EU in R&D expenditure as a share of GDP (GERD). Innovation is a cross border process, and China has highly innovative companies in house. Opportunities to tap into Chinese talent pool and high-tech industrial clusters exists.<sup>37</sup> Funding from Chinese investment into European companies can come from Chinese foreign direct investment (FDI). However, traditional equity investments is currently decreasing. This type of equity investment (FDI) are reduced but other types of non-equity investment develop instead: joint Research and Development (R&D) is a new axis of Chinese cooperation with OECD countries. These funding can bring benefits to European companies involved in technologies, products, and services<sup>38</sup>.

Another possible benefit for R&I cooperation with China could be to reap the benefits of China's Belt and Road initiative. With the Belt and Road Initiative, China aims to invest and/or construct infrastructure projects on various routes between China and Europe, Africa and the rest of Asia. The Initiative can enhance the market access on both sides and help to address infrastructure bottlenecks

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<sup>36</sup> Bergmann F., Herrmann, E. (2018). Understanding the Chinese STI landscape in the context of EU-China innovation cooperation, ENRICH – European Network of Research and Innovation Centres and Hubs, China. Available online: <https://china.enrichcentres.eu/UserFiles/File/Repositorio/37/report-steinbeis.pdf>

<sup>37</sup> Kratz, A., Huotari, M., Hanemann, T., & Arcesati, R. (2020). Chinese FDI in Europe: 2019 update. Mercator Institute for China Studies, 8

<sup>38</sup> Kratz, A., Huotari, M., Hanemann, T., & Arcesati, R. (2020). Chinese FDI in Europe: 2019 update. Mercator Institute for China Studies, p. 15

for companies<sup>39</sup>. Especially for companies it can thus increase opportunities for valorisation in the more easily accessible market, and due to the better connectivity there could be more opportunities for joint Research and Innovation projects with China. However, the Belt and Road initiative is still in development. Chinese contractors are often used for the development of the infrastructure projects. Hence, the initiative is more interesting in terms of better connectivity once the infrastructure is there, rather than potential for business activity through contributing to the Belt and Road.

### 2.3.2 Available Quantitative and Qualitative Evidence

In China, companies contribute to a relatively high percentage to R&D activities compared to the EU, both in relative and in absolute terms, as shown in Table 4. The percentage of GERD performed by the business sector, as well as the total R&D expenditure that is performed by the business sector is higher in China than in the EU. The same is true for R&D by the government sector. The higher education sector, on the other hand, performs both in relative and absolute terms more of the R&D in the EU than in China.

Table 4 Quantitative evidence of companies' R&D activity in China and the EU.

Indicator	China	EU-27	Source
Percentage of GERD performed by business sector	76.4% (2019)	66.1% (2019)	OECD <sup>19</sup>
Percentage of GERD performed by higher education sector	8.1% (2019)	21.8% (2019)	OECD
Percentage of GERD performed by government sector	15.5% (2019)	11.5% (2019)	OECD
R&D expenditure performed by business sector	\$393 billion (2018)	\$258 billion (2018)	OECD
R&D expenditure performed by higher education sector	\$41 billion (2018)	\$85 billion (2018)	OECD
R&D expenditure performed by government sector	\$80 billion (2018)	\$45 billion (2018)	OECD

### 2.3.3 Example case

An example case of a firm reaping benefits from cooperating with China is the cooperation between the German Firm BioNTech and Shanghai Fosun Pharmaceutical. Together, the companies tested an experimental Covid 19 vaccine. The benefit here was that the Chinese Shanghai Fosun Pharmaceutical invested 135 million USD in the vaccine<sup>40</sup>.

Another example is that France and China started collaborating in 2016 on an *intern and students exchange programme* that increased the possibilities for companies to find interns from abroad. For

<sup>39</sup> García-Herrero, A., Kwok, K. C., Xiangdong, L., Summers, T., & Yansheng, Z. (2017). EU–China Economic Relations to 2025. *Building a Common Future. Books*.

<sup>40</sup> Burger, Ludwig (2020). "BioNTech in China Alliance with Fosun over Potential Coronavirus Vaccine." Reuters. March 16. <https://www.reuters.com/article/us-biontech-fosunpharma-vaccine-collabor/biontech-in-china-alliance-with-fosun-over-potential-coronavirus-vaccine-idUSKBN213005> . Accessed: July 26, 2021

this program, students from both countries with three years of study or who had held their diploma for less than one year could apply for internships at enterprises based in the other country<sup>41, 42</sup>.

### 2.3.4 Barriers and Drivers for Benefits

One main barrier to Chinese investment in European companies is the rather strict regulation around Chinese FDI in Europe<sup>43</sup>, with the development of the EU's Investment Screening<sup>44</sup>. There is a broad discussion on whether it is preferable to let Chinese investors own European companies. National security is most often mentioned as the reason for tightening legislation on this topic<sup>45</sup>.

Within China, a barrier for companies to operate freely are internet restrictions imposed by the Chinese government through the cyber security law of 2016<sup>46</sup>. These internet restrictions impose limitations on innovations by companies, and they limit business efficiency<sup>47</sup>. Also, in November 2021, new data privacy laws will be introduced in China that impact how tech companies can operate in the country: modelled after the EU's GDPR, the Personal Information Protection Law of the People's Republic of China imposes protections and restrictions on data collection and transfer by companies within and outside of China<sup>48, 49</sup>

Other barriers to companies operating in China are related to business and competition aspects. There are concerns that there is insufficient intellectual property rights (IPR) enforcement in China. This makes it less attractive for companies to innovate in China, since it brings the risk that companies are not able to profit from their innovations. Also, there is the risk of technology leakages through state owned companies (SOEs). Business communities that rely on their technological prowess, which may be based on domestic (European) government investment, might be concerned that Chinese SOEs gain access to their technology and knowledge through collaboration<sup>50</sup>.

<sup>41</sup> State council of the People's Republic of China (2021). China, France debut intern exchange program. Available online:

[http://english.www.gov.cn/news/international\\_exchanges/2016/04/04/content\\_281475320714246.htm](http://english.www.gov.cn/news/international_exchanges/2016/04/04/content_281475320714246.htm)

<sup>42</sup> Chan, Z. T., & Meunier, S. (2021). Behind the screen: Understanding national support for a foreign investment screening mechanism in the European Union. *The Review of International Organizations*, 1-29

<sup>43</sup> This regulation does not specifically target China.

<sup>44</sup> Duchatel M. (2020). China Trends #5: Living with the EU's Investment Screening, Institut Montaigne. Available online: <https://www.institutmontaigne.org/en/blog/china-trends-5-living-eus-investment-screening>

<sup>45</sup> The Economist. (2020). The law on foreign takeovers is being tightened. It's not about China, honest. Available online: <https://www.economist.com/britain/2020/11/12/the-law-on-foreign-takeovers-is-being-tightened>

<sup>46</sup> Wong, S. L., & Martina, M. (2016). China Adopts Cyber Security Law in Face of Overseas Opposition. Reuters

<sup>47</sup> Bergmann F., Herrmann, E. (2018). Understanding the Chinese STI landscape in the context of EU-China innovation cooperation, ENRICH – European Network of Research and Innovation Centres and Hubs, China [https://www.steinbeis-europa.de/files/198092\\_enrich\\_web.pdf](https://www.steinbeis-europa.de/files/198092_enrich_web.pdf)

<sup>48</sup> E.g., South China Morning Post. (2021). What China's new data laws are and their impact on Big Tech. Available online: <https://www.scmp.com/tech/policy/article/3147040/what-chinas-new-data-laws-are-and-their-impact-big-tech>

<sup>49</sup> For more information on key elements of China's regulatory framework on data management (including key laws and regulations) see the study on *China's specific regulatory framework on data and how it impacts EU-China R&I collaboration* developed under the framework of EU-KNOC. Available online:

<https://www.kooperation-international.de/dokumente/berichte-und-studien/detail/info/chinas-specific-regulatory-framework-on-data-and-how-it-impacts-eu-china-ri-collaboration/>

<sup>50</sup> Meyer, E. K., Ding, Y., Li, Jing & Zhang, H.. (2014). Overcoming distrust: How State-Owned Enterprises adapt their foreign entries to institutional pressures abroad. *Journal of International Business Studies*, 45(8), 1105-1028. Available online: <https://www.jstor.org/stable/43654628>

Finally, another barrier to more collaboration is that currently, there is a lack of reciprocity in market access and access to financing. While Chinese companies are often allowed on the European market, it is not always the case for European companies on the Chinese market, especially in the area of high-tech, and European companies also have difficulties accessing Chinese financing and other fiscal benefits.

## 2.4. Systems of Research and Innovation

### 2.4.1 Benefit mechanisms

There are various benefits to R&I cooperation with China also at the systemic level. Benefits include higher quality and higher efficiency in research by combining forces.

Higher quality of research is possible through a larger total funding base, and diversity in viewpoints. China and the EU individually have a large R&I budget available, but the combined funding base is even bigger. The total funding base of China and the EU is also expected to grow since China sets out to invest increasingly in R&I<sup>51</sup>. This larger funding base, and the combined work of excellent scientists enables scientists to be at the forefront of scientific discovery.

**Higher efficiency of research** is possible through division of labour and economies of scale of the collaborative research. Especially research that requires global knowledge and large population benefit from the R&I collaboration. The size of the Chinese population is an asset for large scale research, particularly in the field of health research, because the volume makes it easier to run randomized experiments. However, ethical standards regarding these types of experiments remain at stake. In the health field, there are a number of consortia of European and Chinese researchers active: in rare diseases (international rare diseases consortium), cancer (international cancer genome consortium), and chronic diseases (global alliance for chronic diseases)<sup>52</sup>.

Collaborating on R&I with China could also strengthen the EU soft power. The EU can train and build capacity amongst Chinese scientists and officials, expose them to European societies and the European values, and promote good governance. According to some interviewees from research or public servant background met during July and August 2021, this tremendously helps China understand the European ecosystems and markets and it could also result in a larger promotion of SDG's in Chinese policies. Due to its leadership role in environmental governance, the EU, at a macro-level, aims to exert its influence on international negotiation and the agenda-setting of environmental issues. Meanwhile, at a micro-level, the EU strives to implement the EU's and international agreements and treaties, either by protecting, preserving and improving the environment inside the EU or by cooperating with third countries outside of Europe. Both help the EU diffuse environmental governance related norms including rule of law<sup>53</sup>.

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<sup>51</sup> Jitaru, L., & Popescu, L. F. (2017, September). The Eu–China Cooperation In The Field Of Research, Development, And Innovation. In CBU International Conference Proceedings (Vol. 5, pp. 537-540)

<sup>52</sup> EC, Roadmap for EU-China S&T cooperation (2018),

[https://ec.europa.eu/info/sites/default/files/research\\_and\\_innovation/strategy\\_on\\_research\\_and\\_innovation/documents/cn\\_roadmap\\_2018.pdf](https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/cn_roadmap_2018.pdf)

<sup>53</sup> Yang, Y. (2017). How do EU norms diffuse? Rule of law promotion in EU-China cooperation on environmental governance. *Journal of European Integration*, 39(1), 63-78



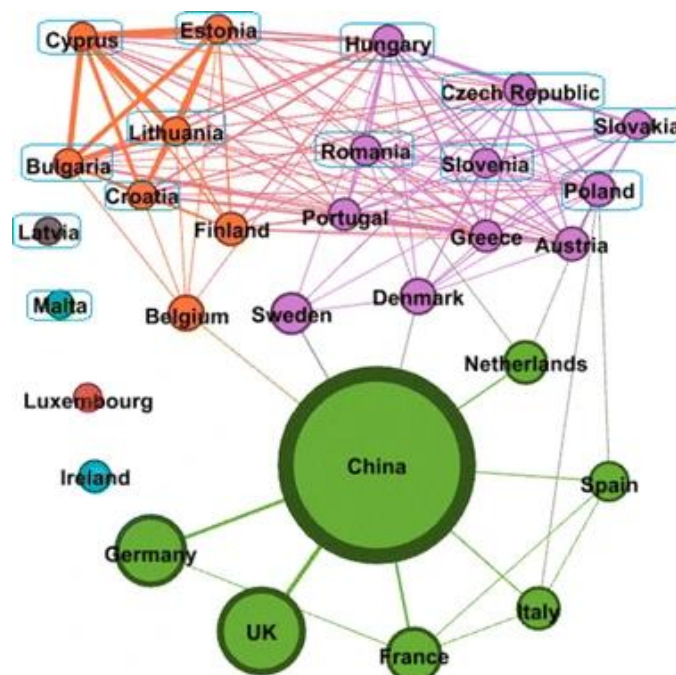
#### 2.4.2 Available Quantitative and Qualitative Evidence

During the period of 2000 and 2014<sup>54</sup>, there were a total of 132,800 joint publication between the EU 28 and China. However, European countries have research capacities that vary and various capacities to collaborate at the international level. The leading countries in term of collaboration with the Chinese research system were the UK, Germany and France. When adding the Netherlands, Italy and Sweden, these countries account for 87% of the joint publications between China and the EU 28<sup>55</sup> (of course, these figures are now different due to Brexit, however, were the latest figures available). Collaboration between research system is hard to quantify, but the benefits of system openness are numerous. For example, it can help researchers from both sides widen their practices and worldview, which in turn will improve the communication and the work efficiency.

According to the *OECD STI Outlook 2021: Time of Crisis and opportunity*<sup>56</sup>, China, together with the US, is the largest contributor to COVID-19 publications, with an increased collaborative approach during the pandemic. Examples for this approach were the exchange of data and genetic or viral material, from China to other research centers, as in the case of the sequencing of the coronaviruses that took less than 24 hours to be processed by the Chinese public health laboratories to being published on the Global Initiative on Sharing Avian Influenza Data<sup>57</sup> database.

Figure 1 presents the network of collaboration between EU-28 and China between 2010 and 2014. It shows that older EU member states remain at the heart of the collaboration with China in terms of joint publications. Newer member states are indirectly cooperating with China, but they cooperate with an intermediary country that operates as the interface with Chinese researchers.

Figure 1 The structure of China-EU28 collaboration network (2010–2014), in terms of joint publications volume



<sup>54</sup> This is the latest period in which such an analysis was made available.

<sup>55</sup> Wang, L., Wang, X., & Philipsen, N. J. (2017). Network structure of scientific collaborations between China and the EU member states. *Scientometrics*, 113(2), 765-781. Available online: <https://link.springer.com/article/10.1007/s11192-017-2488-6>

<sup>56</sup> OCDE (2021), *OECD Science, Technology and Innovation Outlook 2021 : Times of Crisis and Opportunity*, Éditions OCDE, Paris, <https://doi.org/10.1787/75f79015-en>.

<sup>57</sup> Website of the database: <https://www.gisaid.org/>

Source: Wang, L., Wang, X., & Philipsen, N. J. (2017). *Network structure of scientific collaborations between China and the EU member states*. *Scientometrics*, 113(2), 765-781. Note: (1) The size of the circle represents the volume of joint publications with China between 2010 and 2014 (2) The thickness of the lines represents the connection strength between countries. (3) Network filter is used in order to have a clear map. (4) Different node colours indicate different clusters. (5) Thirteen new EU members are in light blue squares.

Even though an interviewee mentioned the potential for cooperation on COVID-19, no quantitative evidence was identified on a global increase of researchers working together from EU and China, besides few examples restricted to research in direct connection to COVID-19, conducted with a commercial purpose. Additionally, it was not possible to quantify benefits such as young researchers broadening their experiences and worldviews.

### 2.4.3 Example case

An example on the clear benefits from R&I cooperation with China is the Horizon 2020 project EXCITING that ran from 2016 to 2019. It was a collaborative research project on 5G and the Internet of Things (IoT)<sup>58</sup>. China is the world leader in both technologies. Concerning 5G, China has ensured this position through policies such as the Made in China 2025 initiative and the ambitions laid out in its previous 5-Year Plan<sup>59</sup>. Concerning IoT, China has fostered a vibrant start-up ecosystem with support by the government and specific incentives. During the EXCITING project, the aim was to increase bilateral exchanges and harmonization through active participation of research, development and business activities.

### 2.4.4 Barriers and Drivers for Benefits

A main driver of EU-China R&I collaboration is the common drive for increasing knowledge and science in general. Scientists tend to view themselves as rather a-political and to practice science to understand more of the world. Collaboration can put the most brilliant minds of the EU and China together, which can lead to breakthroughs in their respective fields.

Cultural differences in general can be barriers as well as drivers to the benefits of R&I collaboration. On the one hand, cultural differences could lead to varying insights in research problems and therefore to novel solutions. On the other hand, cultural and language differences could be barriers for collaboration. For example, according to several interviewees who (have) live(d) in China, fluent English speakers are still relatively rare in China, even among the research community and especially in Chinese cities other than Shanghai. Chinese speakers among European researchers are even harder to find. Also, cultural differences such as a different research culture or risk apprehension could be barriers for collaboration.

One of the main barriers for reaping benefits from R&I cooperation is a fear of strategically targeted partnerships in fields such as emerging technologies. In the current geopolitical context, China is seeking to achieve self-reliance in key emerging technologies. The policies that it adopts to do so could have detrimental effects on Europe's competitive edge. In these fields, China could take advantage to create firms that could become global leaders and replace existing technologies that EU is currently a leader in. This is specifically the case in the China to EU direction, due to dyssymmetrical market laws and state support.

<sup>58</sup> EXCITING (2019). EU-CHINA Study on IoT and 5G. Available online: <https://www.euchina-iot5g.eu/index.html>

<sup>59</sup> EXCITING (2016). Recommendations for EU-China cooperation in IoT and 5G. Available online: <https://euchina-iot5g.eu/wp-content/uploads/sites/27/2019/01/D5.2-%E2%80%93-Recommendations-for-EU-China-co-operation-in-IoT-and-5G.pdf>

Another barrier is that the technological knowledge could be used to support actions that do not align with European values. For example, there is the risk of technology transfer to the military industrial complex of China, especially due to China's focus on Civil-Military Fusion. If technology is (solely) owned by the Chinese state and/or military, this could reinforce state ability for mass control on the population<sup>60</sup>.

## 2.5. Global Goals

### 2.5.1 Benefit mechanisms

Global goals are goals set by the global community, including both China and the EU. Examples of global goals are the Sustainable Development Goals (SDGs)<sup>61</sup>, and the goals ratified in the Paris Agreement<sup>62</sup>. Benefit mechanisms from R&I collaboration with China regarding global goals include: faster and more impactful research, access to knowledge, technology and IP that will help both EU and China to address their SDG-related challenges, and better diplomatic ties through scientific cooperation.

R&I would be done in a more efficient, faster way if China and the EU work towards the same global goals. China is an academic powerhouse, with many researchers available. According to Leiden Asia Centre think tank<sup>63</sup> it is imperative to work together with them if one is to find solutions to global challenges.

Both parties could learn from each other, and gain access to new knowledge, technology and IP. Since there is a common goal to the collaboration, scientists could be (even) more inclined to share their knowledge to advance the knowledge of all parties involved.

There is also a soft power side to collaborating with China. By working together on global goals, the EU might push forward their priorities. Also, scientific cooperation might lead to better diplomatic ties through science diplomacy activities.

### 2.5.2 Available Quantitative and Qualitative Evidence

China is active in implementing the SDGs both domestically and abroad. China's government has integrated its SDG implementation efforts with the country's 13<sup>th</sup> and 14<sup>th</sup> Five-Year Plan and other medium-to-long-term development strategies. For example, China has declared to have met its domestic poverty reduction goal (SDG 1) 10 years ahead of schedule<sup>64</sup>. The UN Global Geospatial Knowledge and Innovation Center and a UNHRD hub are both to be established in China by the UN. Also, an International Research Center of Big Data for Sustainable Development Goals is to be

<sup>60</sup> Kratz, A., Huotari, M., Hanemann, T., & Arcesati, R. (2020). Chinese FDI in Europe: 2019 update. Mercator Institute for China Studies, 8

<sup>61</sup> United Nations (2021). The 17 Sustainable Development Goals. Available online: <https://sdgs.un.org/goals>

<sup>62</sup> United Nations Framework Convention on Climate Change (2021). The Paris Agreement. Available online: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

<sup>63</sup> D'Hooghe, I., Montulet, A., de Wolff, M. & Pieke, F. N. (2018). Assessing Europe-China Collaboration in Higher Education and Research. Leiden Asia Centre, Leiden. Available online: <https://leidenasiacentre.nl/wp-content/uploads/2018/11/LeidenAsiaCentre-Report-Assessing-Europe-China-Collaboration-in-Higher-Education-and-Research.pdf>

<sup>64</sup> Ministry of Foreign Affairs of the People's Republic of China. (2021). China's VNR Report on Implementation of the 2030 Agenda for Sustainable Development. Available online: [https://sustainabledevelopment.un.org/content/documents/280812021\\_VNR\\_Report\\_China\\_English.pdf](https://sustainabledevelopment.un.org/content/documents/280812021_VNR_Report_China_English.pdf)

established in China. Abroad, China has invested in the sustainable development in other countries through providing Official Development Aid (ODA) to these other countries, see Table 5.

Table 5. Overview of numbers on Official Development Aid (ODA) for sustainable development by China and Europe, as reported in the SDG database<sup>65</sup>.

Indicator	China	Europe
Total net ODA as donor	N/A	\$20 billion (2020)
Total ODA to medical research and basic health sectors, gross disbursement (SDG 3.b.2)	\$89 million (2019)	\$118 million (2019)
International flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems (SDG 7.a.1)	\$325 million (2018)	N/A
Total ODA for technical cooperation	\$791 million (2019)	\$1012 million (2019)

According to the UNDP and PwC, Chinese enterprises are quite knowledgeable regarding the SDGs, with two in three companies mentioning the SDGs publicly, see Table 6. The following SDGs receive the most attention from Chinese enterprises: 1) SDG 3 Good Health and Well-Being, 2) SDG 4 Quality Education, 3) SDG 12 Responsible Production and Consumption. This is different from the global prioritization: 1) SDG 8 Decent Work and Economic Growth, 2) Climate Action and 3) SDG 12 Responsible Production and Consumption. This difference illustrates the sometimes divergent priorities between China and Europe, making it harder to cooperate efficiently. It is expected that SDG 9 Industry, Innovation and Infrastructure will increase in importance over coming years. This anticipates the growing interest in innovation in products, technologies and business models that developed in the recent years. The main internal driving force for companies to promote the SDGs is that implementing the SDGs can increase their brand value. The main role for achieving the SDGs is perceived by enterprises to be the government, with a second place for enterprises and then the UN<sup>64</sup>.

Table 6. Overview of indicators on Chinese enterprises' attitudes towards SDGs, as reported by the UNDP and PwC<sup>66</sup>.

Indicator	Value
Chinese enterprises that know about the SDGs and know that the Chinese government has signed a commitment to implement them	89% (2020)
Chinese enterprises that publicly mention the SDGs	69% (2020)
Chinese enterprises that know about the SDGs and have taken clear actions	10.1% (2020)
Chinese enterprises that publicly disclose their sustainable development practices	55% (2020)

Source: UNDP and PwC, 2020<sup>66</sup>

### 2.5.3 Example case

An example of benefits of R&I collaboration is the research conducted on clean technology, especially in the context of the energy transition<sup>67</sup>. Extensive research by China and the EU has already resulted in a fast scale up of clean technology, faster than expected beforehand according to an interviewee. Collaborating with China is beneficial in this regard since it is the region that has the capability to scale

<sup>65</sup> UN Department of Economic and Social Affairs. (2021). Sustainable Development Goals Indicators. Available online: <https://unstats.un.org/sdgs/indicators/database/>

<sup>66</sup> UNDP & PwC (2020). The Sustainable Development Goals – UNDP in China. Private Sector Awareness of the Sustainable Development Goals, a Survey Report on Business and Sustainability in China. Available online: <https://www.cn.undp.org/content/dam/china/docs/Publications/UNDP-PwC%20SDG%20Report%20EN.pdf>

<sup>67</sup> European Commission. (2017). Roadmap for EU-China S&T cooperation. Available online: [https://ec.europa.eu/info/research-and-innovation\\_en](https://ec.europa.eu/info/research-and-innovation_en)

up these technologies the fastest. Currently, debates arise on photovoltaics and on wind technologies, as the Chinese government encourages technology transfers and subsidies for this type of technologies. These developments could potentially harm the EU's own capacity to produce certain technologies and lead in this area. The take-up of Chinese technologies and innovations in this field is regarded as important, however remains controversial in Europe.

#### 2.5.4 Barriers and Drivers for Benefits

A big driver for benefits of R&I collaboration with China is the realization that global challenges cannot be solved by one country or one region. By nature, the challenges are global, and therefore the solution needs to be global as well. Climate change mitigation through decarbonization, for example, cannot be done by the EU or China alone, since each of the two parties only represent part of the global emissions.

Also, both parties have their own specializations in specific technologies needed to solve global challenges. On the one hand, this works as a driver because collaboration can bring multidisciplinary research about and could inspire innovative solutions for global goals. On the other hand, increased funding in the areas where China already has a competitive advantage, also means that China could become and/or remain the world leader in specific sensitive technological areas. This leads to the EU and European scientists possibly seeing more risks to cooperating with China in these areas.

### 3. Synthesis

The main added values for EU in R&I cooperation with China are access to the Chinese market, access to funding and opportunities for excellent science, but also the pursuit to achieve global development goals. The sheer size of the Chinese market is one of the biggest advantages for both researchers and companies to collaborate with China on R&I. The market size provides many valorisation opportunities, and data on large population samples which means that better research results can be obtained. And last but not least, global goals must be tackled by and with the main global players.

- **What are the main challenges in realising the benefits of cooperation?**

The main challenges in realising the benefits of cooperation are related to differences in culture and language, specific regulations in both the EU and in China, differences in values and norms, and the consequences brought about by China possibly becoming a leader and achieve self-reliance in many R&I strategic fields.

The culture barrier means that partners from both regions, even if there might be a desire to work together, can encounter difficulties in practice. The language barrier simply makes it hard for researchers to collaborate. Although there is an increasing number of English speakers in China, it is (still) not standard. Mandarin speakers among EU researchers are even more rare. This barrier is even more pronounced since most of the research published in China is written in Mandarin, while most of the research in the EU is in English. The language also makes application for China's research funds harder.

Regulations can create a barrier for collaboration especially for companies. In the EU, FDI is regulated strictly, which creates a barrier for reaping benefits from Chinese investments in European companies. In China, restrictions on companies – and especially foreign companies – as well as the tendency to favour Chinese (state-owned) enterprises create barriers for companies.

Values and norms can also create a barrier in the collaboration. In essence, there is a general fear that the differences in values and norms can lead to China using outcomes of R&I in other ways than were foreseen or preferred by the EU, which could create risks for the EU.

Finally, there is a general fear – grounded in concrete cases – that China could become a self-reliant global leader in certain strategic sectors, while the EU might lag behind and/or increase its dependency on China, which would have repercussions on market leadership and shares, as well as on the geopolitical relation between the two actors. This is especially true for strategic emerging technologies.

- **What are policy options to improve the benefits?**

First and foremost, EU-China collaboration in a short term shall always consider carefully the long-term consequences. EU has somehow to learn how to play the “go game” to engage in EU-China cooperation with better mastering of the pros and cons of such collaboration. Careful agenda setting by the EU regarding the direction and topics of R&I is key.

What could be done in terms of policy options to improve the benefits is that European companies in China could be supported more strongly by their respective national governments as well as by the EC in their efforts on the Chinese market. For example, information or even courses could be offered by experienced companies on how to engage with China.

Concerns about differences in values and norms, and the consequences of China possibly becoming a global leader could be confronted partially through more research on China and its progression in R&I

in emerging technologies. According to the interviews, it is important here to perform research for various research fields since potential benefits, drivers and barriers for R&I collaboration vary per field. Also, more agenda setting by the EU regarding the direction and topics of R&I could make the EU an even stronger global (co-)leader in strategic areas.

The challenges related to differences in culture and language can be tackled through actively providing opportunities for R&I collaboration in order for European researchers to get used to the culture and learn the language. Policy options are the provision of (more) grants for European students and researchers to study and work in China. It would also be advised to keep building China expertise within Europe.

## 4. ANNEX

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