Remanufacturing Mission to China

Beijing and Shanghai, China

24-26 May 2016

Dr. Yan Wang, University of Brighton
MISSION TO CHINA .................................................................3
MISSION PARTICIPANTS.......................................................4
MISSION ITINERARY & DIARY.............................................5
FINDINGS.................................................................................8
  1. STATUS OF REMANUFACTURING IN CHINA..............8
  2. STRATEGIC FUTURE PLANS IN CHINA......................13
  3. OPPORTUNITIES.............................................................15
ACKNOWLEDGEMENTS....................................................... 20
MISSION TO CHINA

A mission to China took place between 24-26 May 2016 as part of a project sponsored by the British Foreign & Commonwealth Office.[1] The agenda included: a Sino-UK Remanufacturing workshop, presenting at the World Remanufacturing Summit 2016, a visit to an industry demonstration base in Shanghai, and meetings with senior Chinese Government officials. The purposes of the mission were to:

- Understand and appreciate the market size, the state-of-the-art in policy development and technologies used by the remanufacturing sector in China.
- Understand the UK’s position in the area in relation to the rest of the world.
- Present UK leadership in remanufacturing to a global audience.
- Initiate a dialogue between the UK and Chinese Governments to facilitate future cooperation and exchange on the issue.
- Identify the opportunities for commercial collaboration and the potential for knowledge exchange and development of standards in remanufacturing between organisations in China and the UK.

MISSION PARTICIPANTS

The mission was organised by the University of Brighton (Dr Yan Wang, UK Project Lead) and the National Key Lab for Remanufacturing in China (Prof. Wei Zhang, China Project Lead). Participants from the following organisations joined the mission: Department for Business, Energy & Industrial Strategy (Ms Clare Marett, Head of Manufacturing), The British Standards Institution (Prof. Brian Griffiths, Chair of BSI Committee TDW/4/7 - BS 8887 Design for MADE and Ms Sarah Kelly, Lead Programme Manager), Oakdene Hollins (David Fitzsimons, Managing Director), Zero Waste Scotland (Izzie Johnston, Manager), the Knowledge Transfer Network (Ben Peace, Sustainable Manufacturing Lead) and the High Speed Sustainable Manufacturing Institute (Dr David Stewart, Manager).

The National Key Laboratory for Remanufacturing was founded in 2003. Currently it has about 50 full time academics and researchers and over 100 PhD and MPhil students all working in the area of remanufacture. The lab has been granted 40 Chinese and international patents, and published around 900 papers - among which 400 were indexed by SCI - and 30 books and 18 national standards in remanufacture. The laboratory has about 300 various facilities, including most advanced remanufacturing facilities, surface analysis instruments, rapid forming systems, and surface coatings preparation facilities.

The University of Brighton (UoB) is the leading university for the professions, particularly medicine, nursing, engineering and pharmacy. The Advanced Engineering Centre at UoB has an international reputation and has recently invested £14m to advance the design and development of novel low-carbon technologies. UoB is involved in developing remanufacturing standards and has many years’ experience in remanufacturing, with case studies ranging from turbine blades and machine tools to moulds & dies etc.

The Department for Business, Energy and Industrial Strategy (BEIS) is a UK Government Department created as a result of a merger between the Department of Energy & Climate Change and the Department for Business, Innovation & Skills. BEIS will bring together responsibility for business, industrial strategy and science and innovation with energy and climate change policy. It is responsible for ensuring that the UK economy grows strongly in all parts of the country based on a robust industrial strategy, and that the UK has secure energy supplies that are reliable, affordable and clean. It will encourage investment and innovation that fully utilises the UK science base; and enable a whole-economy approach to deliver the UK Government’s climate change ambitions. The China Mission raised awareness of the role and opportunities that remanufacturing has in this innovative high tech sector as well as identifying areas for future collaboration between China and the UK.
<table>
<thead>
<tr>
<th><strong>Oakdene Hollins</strong> is a research and consulting company specialising in the circular economy. The firm is the lead partner in the European Remanufacturing Network (<a href="http://www.remanufacturing.eu">www.remanufacturing.eu</a>) and manages the UK-based Centre for Remanufacturing and Reuse (<a href="http://www.remanufacturing.org.uk">www.remanufacturing.org.uk</a>). During the mission, David Fitzsimons announced the inauguration of the business-led Conseil Européen de Remanufacture (<a href="http://www.remancouncil.eu">www.remancouncil.eu</a>) based in Brussels.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The <strong>British Standards Institute (BSI)</strong> is the UK's National Standards Body (NSB). It represents UK economic and social interests across all European and international standards organizations and in the development of business information solutions for British organizations of all sizes and sectors. A number of BSI Committees, including TDW/4/7 - BS 8887 Design for MADE, are involved in the development of standards around remanufacturing.</td>
</tr>
<tr>
<td>The <strong>Knowledge Transfer Network (KTN)</strong> is the UK’s innovation network. Its mission is to stimulate innovation for the benefit of the UK. It does this by transferring knowledge, setting up effective collaborative partnerships, and providing access to funding. Established by Innovate UK, its expertise in connecting sectors, disciplines and skills with the right collaborations and business approach is what helps unlock the tremendous hidden value in people and companies.</td>
</tr>
<tr>
<td><strong>Zero Waste Scotland</strong> exists to create a society where resources are valued and nothing is wasted. Its goal is to help Scotland realise the economic, environmental and social benefits of making best use of the world's limited natural resources. It is funded to support delivery of the Scottish Government's circular economy strategy and the EU’s 2020 growth strategy. <a href="http://www.zerowastescotland.org.uk">www.zerowastescotland.org.uk</a> @ZeroWasteScot.</td>
</tr>
<tr>
<td><strong>The High Speed Sustainable Manufacturing Institute (HSSMI)</strong> is a not-for-profit research institute based in East London. The Institute brings together universities, large multi-national manufacturers and their supply chain partners to create a multi-industry collaboration for the implementation of high value, high volume manufacturing systems. HSSMI's work focuses both on commercial engineering contracts and on publicly-funded applied research projects. Its members include Ford, Jaguar Land Rover, Nissan, and London Taxi Corporation.</td>
</tr>
</tbody>
</table>
MISSION ITINERARY & AGENDA

Day 1 (24 May 2016): FCO Remanufacturing Workshop, Beijing

The UK delegates attended an invitation-only meeting of senior representatives from Government, industry and professional organisations. Sponsored by the Foreign & Commonwealth Office (FCO), the workshop was chaired by Professor and Academician Binshi Xu. A figure of great renown in China, Xu is considered to be the “father of remanufacturing in China”. The UK delegates interacted with the Chinese participants through presentations and Q&A sessions, coming to a common understanding of their respective interests and positions. David Fitzsimons from Oakdene Hollins, manager of the Centre for Remanufacture and Reuse (CRR), presented a certificate to Academician Xu on behalf of the Europe Remanufacturing Network [2] in recognition of Xu’s contributions to global remanufacturing.

Day 2 (25 May): The World Remanufacturing Summit, Beijing

The UK delegates attended the 2016 World Remanufacturing Summit, the premier global forum for discussing the state-of-the-art in remanufacturing, in which around 260 delegates from several countries participated. Presenters included companies involved with earth-moving equipment, medical devices, automotive components, machine tools, bearings and motors. From the UK delegation Ben Peace, Sustainability Lead of the Knowledge Transfer Network (KTN), and David Fitzsimons from Oakdene Hollins also addressed the summit. Ben outlined cutting-edge developments in remanufacturing technology and business models from the UK, whilst David announced the inception of the new European Remanufacturing Council[3], the objective of which is to be a focal point for remanufacturing policy dialogue in Europe.

Day 3 (26 May): Remanufacturing Industrial Demonstration Park, Shanghai

The UK delegates travelled to Shanghai to see the national remanufacturing industrial demonstration base there.[4] The 2 km$^2$ remanufacturing base is located in the Shanghai Lingang industry park which is adjacent to Yangshan Bonded Port Area with a planning area of 247 km$^2$, and has international public ports. Visits were made to Caterpillar Remanufacturing Services (Shanghai) and Lin Shi Laser, a laser technology business developed by alumni of Manchester University. This was followed by a formal meeting at the Lingang Group head office, and with dinner, during which cultural gifts were exchanged. The UK delegation presented red pencils to mark 400 years since the death of Shakespeare in exchange for models of Chinese operatic characters.

1. STATUS OF REMANUFACTURING IN CHINA

Remanufacturing, arguably the gold standard in circular economy strategies, retains the embedded value in products by returning them to full working order, rather than allowing them to become waste at their end-of-life. This represents a significant business opportunity, and can have a major impact on reducing waste and lowering net CO₂ emissions. It can also create good quality jobs. China, due to its massive industrial sector and population, is experiencing one of the fastest rates of growth in remanufacturing in the world. China aims to establish the world's largest remanufacturing sector. The Chinese government is promoting this aim with legislation such as Circular Economy Promotion Law, Product Return Incentives and labelling and certification systems as well as direct investment in supporting infrastructure. The wider context of this effort is to exploit the business opportunity and create high quality jobs, whilst reducing environmental pollution, increasing resource security and thereby improving environmental sustainability. Moreover, remanufacturing is seen as a means of making China’s manufacturing more broadly resilient - and part of a move away from competing on cost alone, towards value added – in the face of competition from other emerging economies. Total output value of the remanufacturing sector in China was estimated to be ¥150 billion (£15 billion) in 2015.\(^{[5]}\)

Even the most conservative estimates indicate the value of remanufacturing in the UK to be £5.6 billion (¥48.5 billion).\(^{[6]}\)

The sector is regulated and controlled by two governmental ministries: the National Development and Reform Commission (NDRC), and the Ministry of Industry and Information Technology (MIIT) via two pilot programs: Remanufacturing Pilot Enterprises (RPEs) and MIIT Remanufactured Product List (RPL). To be listed as an RPE, a company must satisfy strict requirements relating to such matters as production scale, management systems and operator skills. The

---


As of August 2016, there are 153 Remanufacturing Pilot Enterprises (RPEs), the total output from which is approximately £5 billion. There are over 1,000 remanufactured products that have been approved by and published by, the Ministry of Industry and Information Technology (MIIT).

28 national remanufacturing standards have been published, with another 20 under development.[8] A labelling and certification system for automotive remanufactured products has been created.

RPL is focused on the quality of remanufactured products to ensure the products meet at least the same specifications as those for new products.

As of August 2016, there are 153 RPEs mainly consisting of Original Equipment Manufacturers (OEMs), larger independent remanufacturers, international well known sole-owned enterprises and joint ventures. Very few small or medium enterprises have been listed as RPEs in China. The total output of the RPEs is approximately £5 billion.[7] More than 1,000 remanufactured product models from various sources, including both RPEs and non RPEs, have been formally approved by MIIT and published on its website which is accessible to the general public.

China has invested in the development of numerous standards and certification systems to support remanufacturing. 28 national remanufacturing standards have been published; another 20 are under development.[8] For automotive components, a labelling and certification system has been created. Furthermore, a third-party national inspection centre has been formed at one of the industrial remanufacturing demonstration parks and, recently, a proposal to form a new ISO Technology Committee has been submitted to the International Standards Organisation by the Standardization Administration of China (SAC). The aim of this is to transfer a number of the most successful Chinese remanufacturing standards into international (ISO) standards.

[7] Data from the National Key Lab for Remanufacturing, China
Industrial demonstration parks represent the next stage of development by which the government plans to support remanufacturing in China. Four remanufacturing industrial demonstration parks have been approved so far. International enterprises that have taken up space at these facilities include Caterpillar and Daimler-Benz.

The parks are usually located within existing industrial zones so as to: (1) make use of existing industrial clusters and infrastructure; (2) benefit from cost sharing with public services; and (3) offer very large scale facilities to enable reverse logistic systems for core collection, disassembly and cleaning at significantly lower unit costs and higher efficiency. The parks have only recently been constructed and offer superb, global-scale facilities to domestic and foreign investors along with incentives and support packages.

There are several policy barriers hindering the development of remanufacturing in China. By law, end-of-life automotive components such as engines, steering parts, gearboxes and front and rear axles must be treated as waste and sent for recycling rather than being remanufactured. Remanufactured auto components are not allowed to be used to service in-warranty vehicles, thus the market for remanufactured auto components is limited to the after-sale market. This has restricted the availability of ‘core’ (used or end-of-life products for remanufacturing). It is expected this law will be changed in the near future. China currently prohibits the import and export of ‘core’ and remanufactured products, which has undermined the development of the remanufacturing sector. A second issue has been the over-production of similar components which are sold at very low prices. As a testing ground for reform, these restrictions are lifted, with conditions, inside the seven Free-Trade Zones (FTZs) in China.
The “Remanufactured for Used Products” scheme, in which customers can get 10% of the purchase price or up to £200 from Government, has increased public awareness of remanufactured products.

At the FTZs, imported core from abroad can be remanufactured on condition that it must be exported and never sold in the Chinese domestic market.

Regardless of these restrictions, government incentives have been in place to stimulate the development of remanufacturing. In addition to financial support such as government loans and preferential policies at the industrial parks, the most influential incentive programme introduced by the government is the “Remanufactured for Used Products” scheme[10] in which customers can get 10% of the purchase price or up to £200 from government.

Remanufacturing can be approximately 3-5 times more labour-intensive than manufacturing the same product.[11] Due to the large-scale of remanufacturing in China and relative lower labour cost, the price of remanufactured products is also lower in China than that of comparable products in the UK. For instance, remanufactured automotive engines are often priced around 50% of new products in China, but can be approximately 80% of the new product price in the UK.

In summary, the remanufacturing sector in China is only around 20 years old but is receiving vigorous support from the Chinese Government. This is allowing it to develop rapidly almost from scratch to become currently the world’s third largest remanufacturing region after the USA and the EU. Comprehensive legislation, incentive policies, certification systems and standards have already been established. Yet there are many barriers facing the sector in China, which include:

(1) Poor perception of remanufactured products by customers, leading to lack of market pull for remanufactured products.

(2) Legislation barriers and government restrictions which have limited the supply of core for remanufacturing and the market for the remanufactured products.

(3) Over-production of new parts.

(4) Lack of new business models and supply chain management to facilitate development.
2. STRATEGIC FUTURE PLANS IN CHINA

According to national strategic plans, e.g. Made in China 2025 and the 13th Five Year Plan, remanufacturing will become more market-driven. Legislation will continue to be used to drive remanufacturing and encourage the use of technologies such as embedded sensors within a broad range of products. More in-depth international collaboration and investment are to be encouraged.

Remanufacturing is considered to be an emerging strategic industry in both the 13th Five Year Plan (2016-2020) and Made in China 2025 (an industrial strategy similar to the German Government’s Industry 4.0). In the recently approved but as yet unpublished “Remanufacturing Promotion Plan for 13th Five Year Plan” MIIT stated:

- **Market driven remanufacturing:** Remanufacturing will continue to be supported by government, but the focus will be toward development of industry parks with less involvement from government.
- **Modernised remanufacturing:** The remanufacturing process should not simply return the end-of-life products to their original specification; it shall be fused with technologies such as intelligent technology, online monitoring, robots, big data and information technology with upgraded functions and specifications. Key remanufacturing processing technologies for efficient non-destructive inspection and disassembly, green cleaning, restoration etc. will be developed and promoted to industry.
- **Legislation as the main driver for remanufacturing:** Extended producer responsibility (EPR) is to be implemented and the legal restrictions imposed on end-of-life vehicles will be removed. The EPR will encourage OEMs to be more engaged in remanufacturing.
- **Increased variety:** The range of remanufactured products shall be extended from the existing nine categories including automotive, mining, machine tools, household appliances, information technology, office equipment, tunnel digging equipment, power...
the petrochemical sector, to include aero engines, gas turbines, copier machines, medical equipment etc.

- **Significantly increased market size**: There is little official data with which to estimate the current market size of remanufacturing. Current, conservative, estimates of the market are approximately £15 billion in 2015. The market size by end of the 13th Five Year Plan is projected by government officials to be US$60 billion.

- **More in-depth international collaboration and investment**: Internationalisation of remanufacturing is encouraged in the 13th Five Year Plan, promoting more in-depth international collaboration and investment.

- **More innovation and working more with universities**: More research funds will be provided to accelerate the innovation and knowledge transfer from universities to industry.
3. OPPORTUNITIES

Remanufacturing - which has been recognised as an important element of the circular economy by several countries - has gained increasing attention in the UK, and several independent reports have been released\[^5,12,13,14\] urging the UK to seize the huge social, economic and environmental opportunities presented by remanufacturing. With the right infrastructure and policy in place, remanufacturing in the UK has the potential to be increased by a factor of 10, therefore increasing its percentage of total manufacturing turnover from 1% currently to 10%.\[^15\] However, globally, remanufacturing is still embryonic. The current ratio of remanufacturing to new manufacturing in EU is only around 1.9%.\[^14\] The biggest challenges to the global remanufacturing are poor perception of remanufactured products, lack of global standards for remanufacturing, and management of the global supply chain of core for remanufacturing. The diversity and uncertainty of the supply of core also lead to many problems facing the remanufacturing industry, such as the inability to remanufacture at costs similar to those in mass production and concerns over the service safety of remanufactured products. These issues could be tackled at a global level.

With a tradition of innovation, world leading universities and a skilled workforce, the UK has established its leading position in many sectors and industries. However, the UK producers face significant challenges in breaking into global supply chains for remanufacturing. The current economic downturn has provided a short ‘breathing space’ in which manufacturing companies are able to focus on profitability through resource reuse and efficiency improvements rather than concentrating purely on output. The ‘Brexit’ could mean a new strategic relationship between China and the UK. Collaborating with China in remanufacturing in all levels including universities, industry and governments will certainly present great potential for the UK remanufacturing community. The following opportunities were identified for Sino-UK co-operation in remanufacturing: technical development of product and process standards, joint university-led research, joint funding of innovation development, improved trading arrangements, joint promotion of investment.

**Technical development of standards**

China has published 28 remanufacturing standards and aspires to have a number of them adopted as international (ISO) standards so as to enable wider global recognition of quality requirements for remanufactured products. This recognition is considered to be vital for small-to-medium sized enterprises (SMEs) that represent the backbone of the independent specialists in the UK remanufacturing sector, few of which can rely on customer perception of their brand names.\[^12\] The UK offers particular expertise and a history of leadership in the development of standards.

\[^5\] APSRG report, 2015, “Triple Win - The Social, Economic and Environmental case for Remanufacturing”
\[^14\] ERN 2015, “Remanufacturing market study”,
\[^15\] Conservative 2020 ‘Sweating our Assets - Productivity and Efficiency Across the UK Economy
China values both the longevity and depth of this expertise, acknowledging that standards are thought to contribute approximately 28.4% of annual UK GDP growth, equivalent to £8.2 billion in 2013.\textsuperscript{[16]} The discussion on this issue during the Mission suggests that both countries could benefit from funding a formal process of co-operation on the development and adoption of standards to support remanufacturing. The BSI is best placed UK organization to be involved in this work with China.

- **Joint university-led research**

  There is already vibrant cooperation between universities in China and the UK. The UK is the second largest partner of China in joint publications.\textsuperscript{[17]} China currently has more than 100 academics working on aspects of remanufacturing with a special strength in restoration of defective components for remanufacturing. They have established international relationships, especially with German institutions; less so with UK universities. However, academics working at institutions including Strathclyde, Birmingham, Bath, Imperial, Cranfield, Cambridge, Surrey, Cardiff Business School, Bradford and Brighton Universities are working on a variety of relevant issues such as design for remanufacturing, robotic technology for disassembly, additive engineering, laser guided cleansing and residual life assessment. To date, there has been no concerted effort to focus attention on developing better university-led research links based on this issue, yet there appears to be considerable potential to do so. There is already some evidence of collaboration between China and the UK in university-led research and technology transfer. For instance, Lin Shi Laser - a start-up company based at the Shanghai Remanufacturing demonstration park - was established to exploiting laser technology developed at University of Manchester. A network for remanufacturing composed of academics, industry, policy makers and standards development agencies should be established between China and the UK to facilitate joint collaboration, identify key areas of focus, exploit potential opportunities, and systematically tackle the common issues facing global remanufacturing. This could be linked to the Europe Remanufacturing Network. The Scottish Institute for Remanufacture\textsuperscript{[18]} and the UoB could be in a position to lead this due to their leading position in remanufacturing and approved track record in collaboration with China.

- **Joint funding for innovation**

  Most businesses operating in the remanufacturing sector in the UK are SMEs. Because of their size, these companies rarely manage research budgets yet many have common problems and improvement opportunities. The UK can offer experience of many of these shared challenges through the KTN, the CRR and Zero

\textsuperscript{[16]} https://www.cebr.com/reports/standards-contribute-8-2-billion-to-uk-economy/
\textsuperscript{[18]} http://www.scot-reman.ac.uk/
Waste Scotland. Adopting an ‘Innovate UK’ model for funding innovation around these shared challenges could build new bridges between companies and researchers with the aim of creating intellectual property and cross-sectoral investment. This could also be exploited through the Newton Fund\(^{[19]}\), and the KTN and others (such as the Department for International Trade and the China-Britain Business Council) could perhaps could act as brokers on behalf of UK business. The UK-China science and innovation relationship is going from strength to strength, as demonstrated by the fact that there are currently £47 million of jointly-funded UK-China research programmes.\(^{[20]}\) **Potential collaboration and partnership between the UK and Chinese research funding agencies could be established to tackle common problems facing by both the UK and Chinese remanufacturing industry.**

- **Improved trading arrangements**

  China is proposing to make further changes to trade policies in order to balance the domestic contradictions of over-production whilst promoting a resource efficient policy on remanufacturing. Chinese officials are keen to place the following issues on this agenda:

  1. The adoption of a standardised certification mark for internationally traded remanufactured products.
  2. Regulations governing the import and export of core through FTZs as well as sale within the Chinese domestic market.
  3. The development of trade in low carbon technologies (including remanufactured products). Both the UK and China excel in some aspects of this market and each could gain by liberalising this trade.

China is the second largest UK trade partner outside of EU countries, just after the USA.\(^{[17]}\) Establishing a trading partnership with China after ‘Brexit’ is essential to the UK. If the UK can get involved in policy development in trade with China at an early stage, the potential benefits for the UK are huge:

- The free and open trade of core will promote the mass remanufacturing market in China, and create huge demands for remanufacturing technology and services.
- By getting involved in policy-making in FTZs at the planning stage, the UK could influence the policy to facilitate trade in remanufacturing between the UK and China, having positive impacts on the subsequent trade policies at the national level.
- The UK may gain from any move toward a more liberalised remanufacturing market in China.

\(^{[19]}\) The Newton Fund promotes the economic development and welfare in partnering countries, through science and innovation partnerships and is part of the UK’s ODA.

\(^{[20]}\) [http://www.rcuk.ac.uk/media/news/131021/](http://www.rcuk.ac.uk/media/news/131021/)
These opportunities shall be assessed fully with the aim of stimulating international trade and investment in both China and the UK. A dialogue between governments of China and the UK could be established to exploit the opportunities. Chatham House[21] is well placed to facilitate Sino-UK discussions aimed at improving trade policies for the circular economy.

- Joint promotion of investment

During the Mission, without making an organised effort to do so, we were contacted by companies investigating remanufacturing investments in the UK and in China. Pico[22], an automotive specialist, approached us to investigate importing core. As the management of supply of core is a key aspect of successful remanufacturing, such investigations often end with a search for inward investment opportunities in the UK market. On return to the UK we were approached by an international company with remanufacturing operations in Europe. It aims to build capacity in China, exporting core it controls for onward sale in other markets. Furthermore, there have been recent visits of Chinese remanufacturer delegates to the UK and EU during June 2016 led by the Chinese Automotive Remanufacturing Association. Besides the potential to the UK of investment by Chinese remanufacturers, the UK remanufacturers are also exploiting opportunities in China; for example, ATP[23] has set up a China subsidiary in Zhuhai near Hong Kong to repair local transmissions. Those industrial remanufacturing demonstration parks in China which are at their early stage of development, offering preferential policies and infrastructure, could be a potential for investment in China. **Although anecdotal at this stage, further investigation should quantify the scale of this joint opportunity to increase the flow of investment in both directions. The Department for International Trade and the China-Britain Business Council could help with this.**

**Acknowledgements**

The financial support of the Foreign & Commonwealth Office for the Mission is gratefully acknowledged. The contribution of Ben Peace from the KTN is greatly appreciated. Ben provided support throughout the project including helping to shape the proposal; disseminating the outputs, introducing the participants for the China Mission and commenting on drafts of the final report. Special thanks go to the National Key Laboratory for Remanufacturing in Beijing for its support of the China Mission and Oakdene Hollins for its contributions to this report. Furthermore, I would also like to acknowledge with much appreciation the enthusiastic contribution made by the Mission participants.

**Contact:** Dr. Yan Wang, University of Brighton, y.wang5@brighton.ac.uk

[21] https://www.chathamhouse.org/