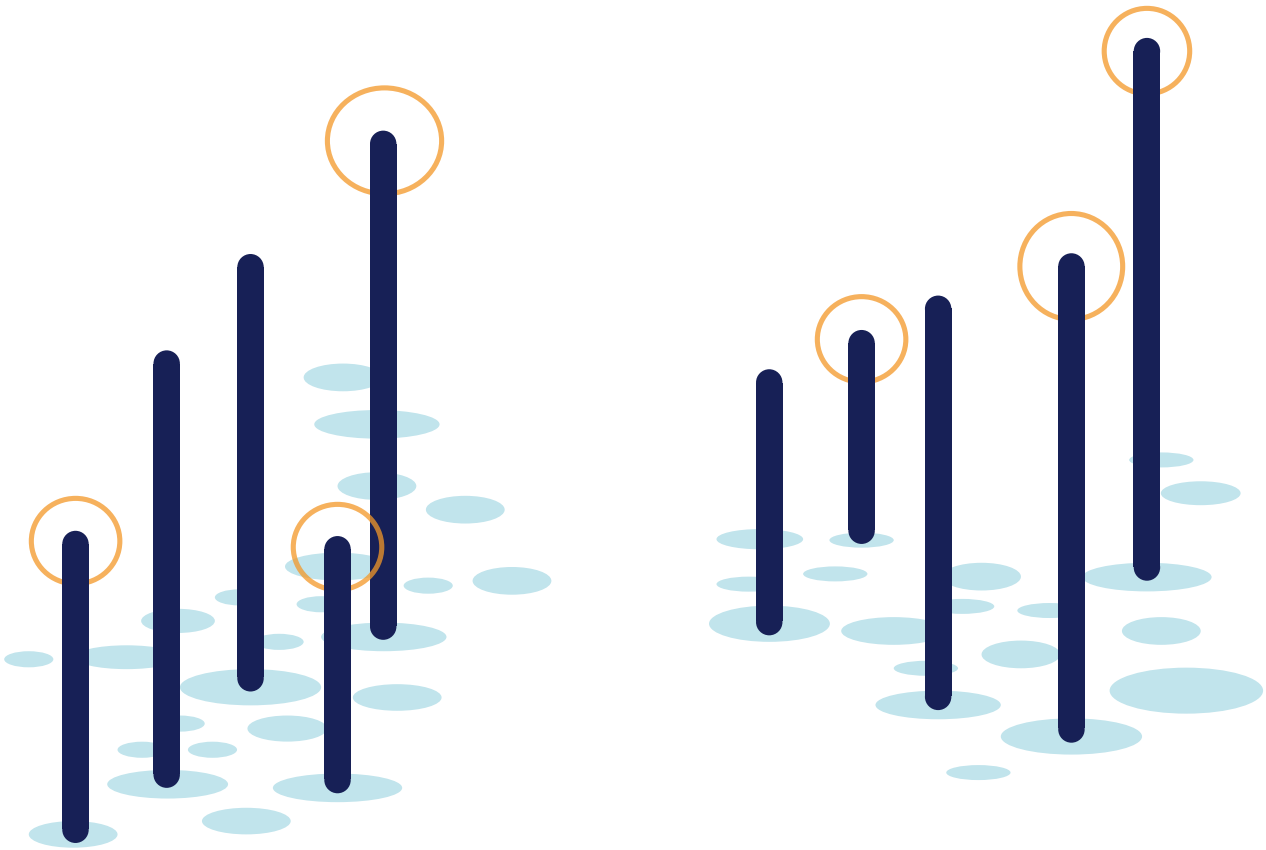
EU-China Regional Innovation Joint Study



Authors:
ROBERT HASSINK
LUN LIU
AMADEO JENSANA
GUILLERMO MARTÍNEZ-TABERNER

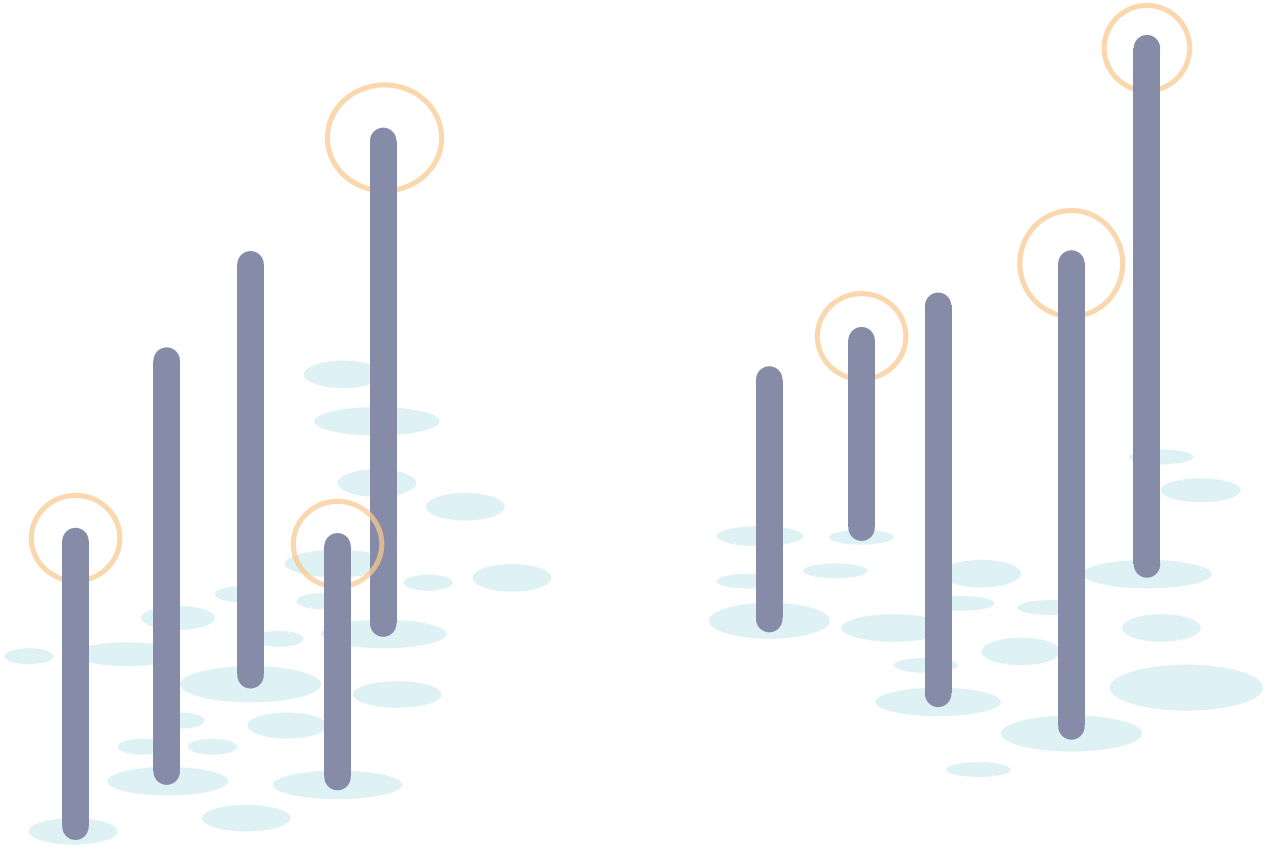
FOREWORD AND CREDITS

The aim of this study is to compare the European and Chinese approaches to regional innovation carrying out a comparative analysis at a general level and also analysing three best practices of regions/provinces in China and the EU. It seeks to explore ideas for future cooperation between the European Union and China on regional innovation systems. The study supports the European Union Cooperation on Regional Policy with China as established in the Memorandum of Understanding of 2006.

It has been prepared under the International Urban Cooperation (IUC) programme of the European Union, which is funded by the partnership instrument. IUC is managed by the Service for Foreign Policy Instruments (FPI) in cooperation with the Directorate General for Regional and Urban Policy (REGIO).

The study has been coordinated by Casa Asia. The authors would like to acknowledge Ronald Hall, Active Senior Advisor, European Commission, Directorate General for Regional and Urban Policy, Lambert van Nistelrooij, frm. Member of the European Parliament, Committee on Regional Development, Pablo Gándara, Team Leader, IUC Asia, and Oscar Prat van Thiel, Senior Expert, IUC Asia, for their valuable feedbacks and suggestions in the preparation of the study.

EU-China Regional Innovation Joint Study



Authors:
ROBERT HASSINK
LUN LIU
AMADEO JENSANA
GUILLERMO MARTÍNEZ-TABERNER

Table of contents

Executive Summary

EU-China differences and similarities in innovation policy

In general, it is difficult to overstate the importance of innovation in promoting economic progress and generating income and employment. For example, the Executive Chairman of the World Economic Forum, Klaus Schwab, has underlined the need for "economies to create new value-added products, processes, and business models through innovation" (Schwab, 2013, p. xiii). Rather starkly, he goes on to affirm that, "Going forward, this means that the traditional distinction between countries being 'developed' or 'developing' will become less relevant and we will instead differentiate among countries based on whether they are 'innovation rich' or 'innovation poor'".

In the **European Union**, and in its member states and regions, economic progress has been a comparatively long-term experience since the industrial revolution of the mid-19th century through to the digital revolution of today. Constant innovation, and the adoption of new innovative technologies have characterised this process, which, as well as leading to increased productivity and income growth, has also been disruptive, and creatively destructive, with uneven impacts on society and on regions. The challenge for policy-makers in the EU has been to harness this innovation in order to exploit the economic and social benefits, while attenuating the negative impacts of change, both socially and geographically.

Innovation in the EU today is seen as a process connecting, on the one hand, knowledge and technology with, on the other hand, the exploitation of market opportunities leading to new or significantly improved products (goods or services), or processes, new marketing methods, or new organisational methods in business practices, workplace organisation or external relations.

Innovation policy in the European Union has a strong geographical dimension. Today, the European Union's regions are key actors for delivering EU policy priorities, in general, and this applies in a very particular and resolute way when it

comes to the implementation of innovation policy. This regionally-based delivery system has support at the highest level in the EU, on the part of the Heads of State and of Government, who, over the past two decades, have ensured major financial support for regional policy in general, and for regional innovation systems, in particular. This political and financial support has unleashed a 20-year explosion in intellectual and policy development activities on the theme of regional innovation systems, later extended with Smart Specialisation Strategies.

In China, recent economic history, as well as the geography of development, are quite different than in Europe. Since the economic reform decisions taken by the central government in the 1970s, the country has experienced very rapid economic growth averaging 10% per year, with significant positive impacts on standards of living and poverty reduction. It has been accompanied by rapid urbanisation, and the new city administrations have been given an increasingly important role in delivering a range of policies, including innovation policy.

China has now, and in a much shorter time than the equivalent process in the EU, become an upper-middle-income country and the world's second largest economy. Similar in many ways to the European Union, the reflection over recent years in China has been concerned with ways to move to the next phase of economic development, reducing the dependence on traditional, resource-intensive manufacturing and exports, and developing a more dynamic enterprise culture based on innovation. This process has had a strong, central government impetus, notably, under the national Science and Technology Strategy for the period 2006 to 2020. The aim has been to use innovation for the upgrading of the manufacturing and IT industries to world standards, and achieving excellence in agricultural science and technology.

Today, both the European Union and China face complex development challenges including transitioning to a new greener and more inclusive growth model, rapid ageing, building a resilient and cost-effective health system against the background of a global pandemic, and addressing energy transition and fighting climate change. There is a shared conviction that addressing these challenges requires new thinking and new approaches, and as such there is considerable scope for cooperation on innovation policy that integrates these environmental and socially and geographically inclusive dimensions.

Key messages

It is clear from the analyses in this study that innovation lies at the centre of efforts in the EU and China to remain competitive and gain competitiveness in the era of globalisation.

While approaches to innovation differ in many respects in the EU and China, respectively, this study suggests that their differing experiences in relation to promoting innovation at the regional level provide a fruitful terrain for cooperation.

The smart specialisation methodology developed in the European Union is now recognised internationally as a suitable approach to promoting innovation and competitiveness, with the flexibility that enables it to adapt to different circumstances.

The European Union, through **the new International Urban and Regional Cooperation programme (IURC)**, to be implemented from 2021, provides an opportunity for decentralised cooperation between the EU and China. The resources of the IURC are an opportunity for a structured and durable cooperation between both sides.

Future cooperation should involve **the high-level partners** on both sides: the European Commission, on the one hand, and the National Development and Reform Commission of China, on the other hand. But it should also involve, notably, the key actors at the **sub-national level**, consistent with the principles of Smart Specialisation, supported by the resources and influence of the high-level partners.

This cooperation should have policy and project dimensions. At the policy level, this report has exposed the differences between the EU and China, both in general, and, through more detailed analysis of specific regional Case Studies on each side. Each side has specific experience to bring to bear to the cooperation. China, for example, has considerable experience in the regionalisation of national innovation policy, while the EU has considerable experience in the role of regions as independent actors developing an independent vision, and strategy, for innovation. **The articulation of central and decentralised innovation policy is clearly an area of mutual interest, including the role of science and technology parks, incubator centres and training facilities.**

At the project level, a key tenet of the smart specialisation methodology is that of knowledge sharing and overcoming information deficits. EU-China cooperation provides an opportunity to internationalise the process of knowledge sharing. Moreover, both the EU in its Smart Specialisation Strategies, and China, have identified the enterprise sector as a key actor in a decentralised approach to innovation. Future cooperation needs to maintain, if not reinforce, the involvement of **enterprises**, which should also provide new opportunities for joint-projects, trade and new employment. There are opportunities for mutual learning on how to support innovation in enterprises including start-ups, training and human resources, and talent development.

The key actors of international cooperation on decentralised innovation also include, notably, **universities and research centres,** which apart from their traditional role in promoting excellence, are also major players in new approaches to regional and urban development. It is equally important that cooperation brings together the enterprises, on the hand, and the universities and research centres, on the hand, since this is how the process of **bringing science and technology to the market** is achieved.

Both the EU and China recognize that **innovation policy needs to address complex modern challenges**. These include transitioning to a greener and more inclusive growth model, rapid ageing, building a resilient and cost-effective health system against the background of a global pandemic, and addressing energy transition and fighting climate change. Cooperation under IURC provides an opportunity to share innovative experience and best practice in the fields of the green economy and inclusion.

Regarding **greener growth**, both sides have much to share regarding the transition to a climate neutral economy; promoting business opportunities for green innovation; reconciling the long-term strategic dimensions of a climate neutral transition with short-term action.

Regarding a more **inclusive growth**, both sides have different experiences to share on how to strengthen social well-being in regions and cities against a background of the global pandemic; addressing the digital divide in the new information era; addressing geographical discrepancies and promoting territorial linkages; improving governance for inclusive growth including citizen participation in innovation policy and practice.

In sum, both the European Union and China use a variety of policies and implementation tools to support innovation and transition processes. The history of EU-China cooperation on regional policy, since the signing of the Memorandum of Understanding in 2006, demonstrates the willingness on both sides to promote knowledge sharing and mutual learning on such issues.

The actors and stakeholders on both sides have an opportunity to explore together paths to additional socio-economic progress using, notably, the opportunity afforded by the IURC, post 2021. The IURC begins from the principle that future progress will continue to have a strong territorial or regional dimension, and the differing experiences in this regard in the EU and China, respectively, provide a fruitful terrain for mutual learning.

References

Schwab, K. (2013). Preface to *The Global Competitiveness Report 2013-14*. World Economic Forum.

Introduction

While the development paths of the EU and China have been quite different, both are facing many common challenges in the 21st century. These require an extensive mobilisation of the available resources, including not just the engagement of actors at national or supra-national level but also those at sub-national, regional and urban level. Indeed, the conviction on the importance of the latter is implicit in the agreement reached between the EU and China in 2006, which took the form of a Memorandum of Understanding on Regional Policy.

In the **European Union**, there is an active, and mature, policy to promote economic development at the regional (and urban) level, which today is its second most important policy after the Common Agricultural Policy when measured in terms of its financial weight in the EU's seven-year budget, 2014-2020. The importance of regional development was recognized by EU leaders right from the beginning of what was to become the modern-day EU, in the 1950s, so that the preamble to the Treaty of Rome (1957) signed by the leaders of the six original member states confirmed the political necessity "to strengthen the unity of their economies and to ensure their harmonious development by reducing the differences existing between the various regions and the backwardness of the less favoured regions".

In other words, reducing economic gaps between member states was seen as having a clear sub-national, geographical dimension, rather than, for example, being set purely in social terms (for example, by seeking to reduce the income gap between rich and poor social groups or alleviating poverty). The Treaty implicitly recognized the "region" as a unit for policy, which was an important political decision given that all EU Treaties, legally speaking, are agreements between national governments without the involvement of the regional authorities. The recognition of the "region" at this level was the basis for the derived legislation (regulations), which provided the legal basis for EU policy for the development of the regions, leading among other things to the creation of the European Regional Development Fund (ERDF) in 1975, and the large increase in budgetary support for regional development after 1989.

For the EU today, regional policy is not just about addressing regional disparities, important as this remains (and reflected in the distribution of the ERDF in favour of the regions with lower levels of GDP per head). Rather, the regional level is now viewed as a key actor for delivering EU policy priorities in the global sense and this has been carried through to the implementation of innovation policy. Thus, in the year 2000, when the EU turned to a fundamental reflection on its declining competitive position in the world in the light of the unremitting competitive pressures arising from globalisation, the EU took the decision to place the emphasis, in investment terms, on delivering competitiveness and innovation through programmes that were targeted geographically. This decision unleased a 20-year explosion in intellectual and policy development activities on the theme of regional innovation systems, later Smart Specialisation Strategies.

The impact of this activity is also evidenced by the intense interest shown, and several reports published, by supra-national organisations referring to European regional innovation policy, such as the OECD (OECD, 2011) and the World Bank (World Bank, 2010).

In **China**, recent economic history and the geography of development are somewhat different. The priority since 1978 was to open up and reform the national economy, a successful policy in the sense that GDP growth since then has averaged around 10% per year, with significant positive impacts on standards of living and poverty reduction. China is now an upper-middle-income country and the world's second largest economy. The rapid growth was achieved initially through more resource-intensive manufacturing and exports, and relied on relatively low-paid labour.

In territorial terms, the striking feature of China's economic growth over the past 40 years has been the explosive rate of urbanisation of the population. Chinese census figures show that whereas, in 1953, the proportion of the population living in urban areas was 13%, by 2010 it had reached nearly 50% and over 60% by 2020. Just as elsewhere in the world, domestic migration has played a major role in urban growth. Urbanisation has allowed rapid national socioeconomic development, driving the increase in productivity and levels of GDP.

In China, urbanisation has been the effective policy for territorial development, creating nodal points across the country and counteracting the historical tendency for concentration of population and wealth in the coastal areas. Thus by 2015, according to UNPD estimates, China had more than a hundred million-plus cities, with a total of nearly 380 million inhabitants, seven times as many as resided in its 22 million-plus cities back in 1985, just three decades earlier, and over 25 times as many as in 1950.

The model of socioeconomic development based on low labour costs reached its limits in the 21st century which led the authorities to initiate efforts to restructure the economy from lower-end manufacturing to higher-end manufacturing and services, and from investment to consumption. This has led to policy developments in pursuit of new drivers of growth and new methods that, among other things, seek to harness the stakeholders at sub-national, regional and urban level. At the same time, China, like the EU, is seeking to address the social and environmental dimension thrown up by its development path based on rapid urbanisation.

The complex development challenges that China faces are clearly relevant to other countries, including transitioning to a new growth model, rapid ageing, building a resilient and cost-effective health system against the background of a global pandemic, and addressing energy transition and fighting climate change (World Bank

2020).
This situation provides fertile ground for EU-China cooperation, with an emphasis on innovative solutions. As discussed below, these innovative solutions include a reinforcement of EU-China cooperation on regional innovation systems, notably within the framework of the EU-China Memorandum of Understanding on Regional Policy (2006).

References

OECD (2011). *Regions and Innovation Policy, OECD Reviews of Regional Innovation*. Paris: OECD Publishing.

World Bank (2010). *Innovation Policy: A Guide for Developing Countries*. Washington, DC: World Bank.

World Bank (2020): China Overview. https://www.worldbank.org/en/country/china/overview

I

Regional Innovation in the EU and China

1 Regional innovation policy and practices in the EU

1.1 Introduction

Research and Innovation is a major priority of the European Union.[1] Since 1984, European Community research and technological development activities have been defined and implemented by a series of multi-annual Framework Programmes (FP), the current generation being more commonly known as Horizon 2020 (2014-2020).

The **Framework Programmes** have been the main financial tools through which the European Union supports research and development activities covering the key scientific disciplines. FPs are proposed by the European Commission and adopted by the Council of leaders of the member states and the European Parliament (Hall, 2014).

Horizon 2020 is the financial instrument implementing the "Innovation Union", a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness, and as a means to drive economic growth and create jobs. Horizon 2020 combines research and innovation, emphasising the pursuit of excellence in science, fostering industrial leadership and tackling societal challenges. The goal is to ensure that Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation. Under the three headings, Horizon 2020 seeks to develop capacities in key technologies (for example, nanotechnology, ICT, space); addressing societal challenges (for example, health, green technologies, freedom and security).[2] It includes a new Innovation Council to look at innovation from the bottom up, notably, by working with entrepreneurs (accompanying funds with mentoring, follow-up, material support such as data and information).

[1] This part draws from, among other sources, Hassink (2020) and Hassink and Gong (2019).
[2] European Commission (2020b). https://ec.europa.eu/programmes/horizon2020/en/h2020-sections

Horizon 2020 is therefore essentially a sectoral policy with a focus on excellence. It is, however, complemented by EU regional policy which today gives a major priority to ensuring that, among other things, as many regions as possible can achieve excellence and participate in the process of innovation.

Regional innovation policy has a long tradition in Europe dating back to the 1990s (Landabaso, 1997). The strong surge of regional innovation policy in Europe since the year 2000 has been accompanied by a wave of conceptual and empirical academic research on regional innovation systems, clusters and, today, Smart Specialisation.

Traditionally, innovation policy typically consisted of an array of measures such as: building science and technology parks and technopoles; funding applied research and technological development programmes, creating innovation support agencies, developing skills in university and colleges, supporting cluster policies. The central aim of these innovation policies was to support, and develop, endogenous potential including at the sub-national or regional level by encouraging the diffusion of new technologies both from universities and public research establishments to small and medium-sized enterprises (SMEs), between SMEs and large enterprises (vertical cooperation) and between SMEs themselves (horizontal cooperation). These measures can be regarded as sectoral measures (financial aid schemes, SME support, technology transfer), whereas measures that select promising activities in a non-neutral manner, such as cluster and smart specialisation policies, can be regarded as territorial measures.

More recently, these sectoral measures have been harnessed in an attempt to create integrated, internally coordinated, regional innovation strategies, known today as **Smart Specialisation Strategies**. This trend towards coordinated innovation strategies at the regional level has two possible explanations.

- First, as a general policy trend, the regional level has become more important for diffusion-oriented innovation support policies. This is perhaps especially true in successful regional economies such as Baden-Württemberg in Germany and Emilia-Romagna in Italy, and in many other regions in Europe, which have been setting up their own regional innovation policies. In addition, regional innovation policy has been supported by the EU, as explicitly reflected in the EU's Regulations governing the implementation of EU regional development programmes for the period 2007-2013, where Article 2 of the ERDF Regulation stated that "the ERDF shall give effect to the priorities of the Community, and in particular the need to strengthen competitiveness and innovation, create and safeguard sustainable jobs, and ensure sustainable development."[3]

- Second, the European Union has supported the regional level for political reasons, with the creation of what used to be called "the Europe of the Regions" as an explicit political goal, as well as to achieve cohesion goals, that is to reduce regional economic inequalities, partly to achieve European unity.

---

[3] Regulation (EC) No 1083/2006 laying down general provisions on the European Regional Development Fund, OJ L 210, 31.7.2006. Joint Research Centre, European Commission, June 2019.

More recently, political interest in developing more sustainable modes of production and consumption has changed the global agenda with an increasing emphasis in challenges such as climate change, ageing societies, migration and the refugee crisis, food and energy security, and now COVID-19. Therefore, regional innovation policies are now often linked to discussions on so-called "mission-oriented" innovation policy (Mazzucato, 2018). In contrast to previous generations of innovation policies, which contain a strong motivation to resolve all sorts of structural failures, as discussed below, the current generation of policy has an increasing emphasis on meeting societal needs, following among other things, the themes of the United Nation's Sustainable Development Goals.

1.2 Innovation Policy Development in Europe: Smart Specialisation

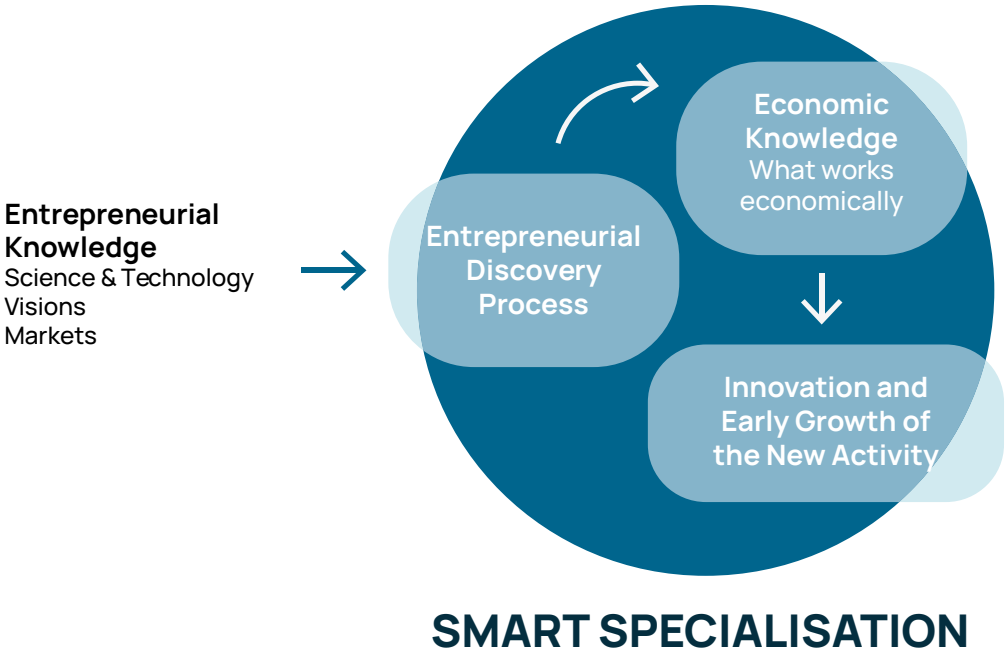
Currently the most influential European policy strategy for regional innovation is Smart Specialisation (Foray, 2015), which emerged out of thoughts developed by the Knowledge for Growth Expert Group on how to explain and reduce the productivity gap between the USA and the EU. Key characteristics of Smart Specialisation are, among others, the territorial dimension, which relates to a strong anchorage in the regions; the identification of investment priorities based on local assets and resources as a result of an Entrepreneurial Discovery Process; the bottom-up character nurtured by an inclusive dialogue among local authorities, academia, business spheres and the civil society (the so-called quadruple helix); flexibility in implementation allowing improvements, modifications or reassessments throughout the intervention process.

The traditional way in which sectors and the **territorial dimension** have been brought together has come to be known as "clusters" and these remain important building blocks of smart specialisation. In fact, many smart specialisation programmes are built on cluster strategies. Similar to cluster policies, Smart Specialisation Strategies focus on existing structures, on concentration and agglomeration economies. Moreover, the level of granularity is similar to cluster policies, which is neither the sectoral nor the individual level (so-called "mid-grained level of aggregation", Foray, 2015, p. 3), as well as its inclusive nature: each sector and each territory has a chance to be included. Accordingly, in a smart specialisation strategy, countries and regions seek to identify strategic 'domains' of existing or potential competitive advantage, where they can specialize and create capabilities in a different way compared to other countries and regions, and thus lead to structural change. Of course, an important influence results from the nature of political-administrative systems, so that in some member states, regions have more power to devise their own strategies, perhaps most notably in federal countries, such as Germany, Belgium and Spain than in other, more unitary member states, such as France and to some extent in Italy.

Structural change in regions is one of the key aims of a smart specialisation strategy. The transformative hope of smart specialisation, according to Foray (2015) (see Figure 1), lies in the potential of individualised, so-called **entrepreneurial discovery processes** to contribute to the rest of the regional economy with the help of knowledge spillovers. Entrepreneurial discovery is defined as a process in which entrepreneurial actors (both firms and non-firms actors, such as resear-

chers at universities and public research establishments) in a region explore and discover new and innovative activities, which is called a domain, which in turn leads to innovation and transformation of the regional economy. In some cases, this involves a strategic interaction between the government and the private sector. Regional actors involved in an entrepreneurial discovery process can stem from a certain cluster or industry, but not necessarily so.

Figure 1 : TYPES OF KNOWLEDGE AND THE ENTREPRENEURIAL DISCOVERY PROCESS

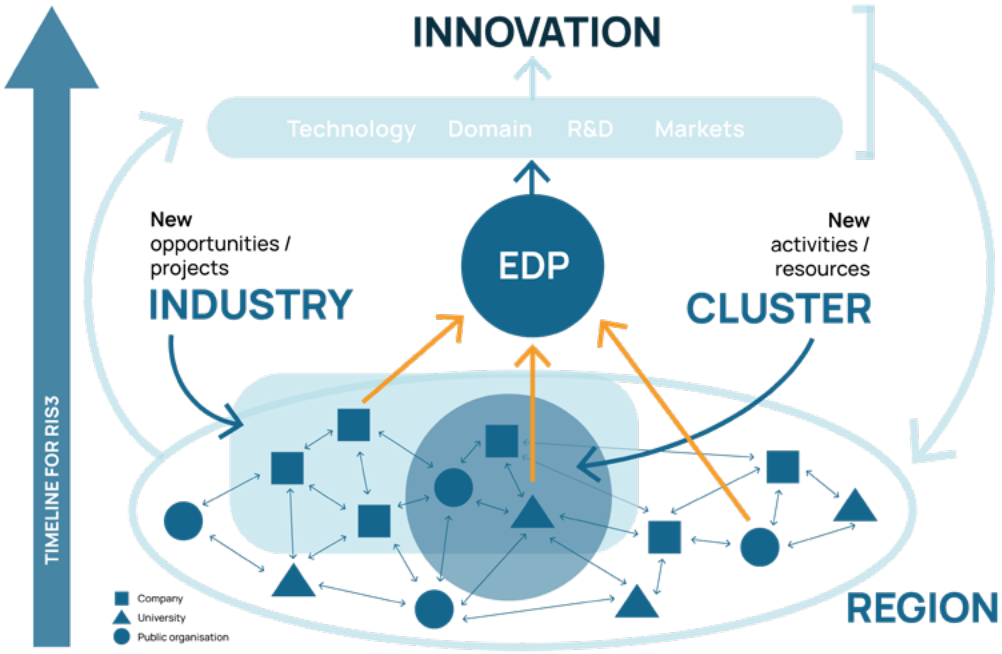


Source: Foray (2015)

If used properly, the entrepreneurial discovery process is a useful tool for identifying sectoral comparative advantages in regions. It is not a straightforward matter, however, and transformative expectations for a stronger economic structure tend to come against countervailing pressures such as the resistance of vested interests, where rent-seeking groups can dominate the selection of activities and the lack of genuine diversity (and opportunity) in entrepreneurship at regional level.

The **bottom-up character and inclusive dialogue** are the key features of Smart Specialisation, encouraging regional players, particularly regional governments to become more focused, leading to a concentration of resources in those areas or activities that are likely to effectively transform the existing economic structure through R&D and innovation. It encourages the participation of a large group of different regional actors (beyond just firms) in entrepreneurial discovery processes (Figure 2). This helps to generate knowledge-sharing and avoids a one-size-fits-all approach and encourages strategies that build on resources and potentials particular to each region. It also takes region-specific needs and resources into account. Moreover, it emphasizes local demand (needs and potentials) as a potential driver for innovation and expedites agglomerations processes by reducing double investments. Academic research has also been influential in favour of a bottom-up, non-one-size-fits-all, place-based approach towards regional development policy (Barca et al., 2012).

Figure 2: THE ENTREPRENEURIAL DISCOVERY PROCESS (EDP)



Source: Mäenpaa & Teras (2018), p.5

Strong multi-sector engagement, and consensus building, also creates the conditions for **flexible implementation**. This is important because it means that Smart Specialisation Strategies are less risk-averse and more comfortable with the idea of experimentation. It also allows strategies to be revised and improved throughout the implementation period.

In support of the implementation of these principles with the EU, the European Commission represents an external, supra-national actor with the capacity to bring to bear significant intellectual resources, including the specific Smart Specialisation Platform,[4] and importantly, the resources of the EU budget. The strengthening of the EU's role to implement Smart Specialisation Strategies in EU regional policy is reflected in tight pre-conditions before programmes can be approved. Before approval of the programme, a national or regional research and innovation strategy for Smart Specialisation had to be submitted in line with the EUR2020 strategy (EUR2020 representing the renamed smart, sustainable and inclusive growth strategy mentioned above). The submissions were also required to indicate how private research and innovation expenditure would be involved as well as presenting a SWOT analysis to concentrate resources on a limited set of research and innovation priorities; a description of measures to stimulate private investment; a monitoring and review system.

The results of this effort during the current regional development planning period, 2014-2020, has been the realization of a massive effort, in terms of financial input from the EU budget, for strategies which have been supported with more than EUR 67 billion available under the European Regional Development Fund (ERDF), together with national and regional authority funding. In the EU, over the past five years, more than 120 Smart Specialisation Strategies have been developed by Member States and regions.

[4] European Commission (2020c). https://s3platform.jrc.ec.europa.eu/

1.3 Emerging challenges

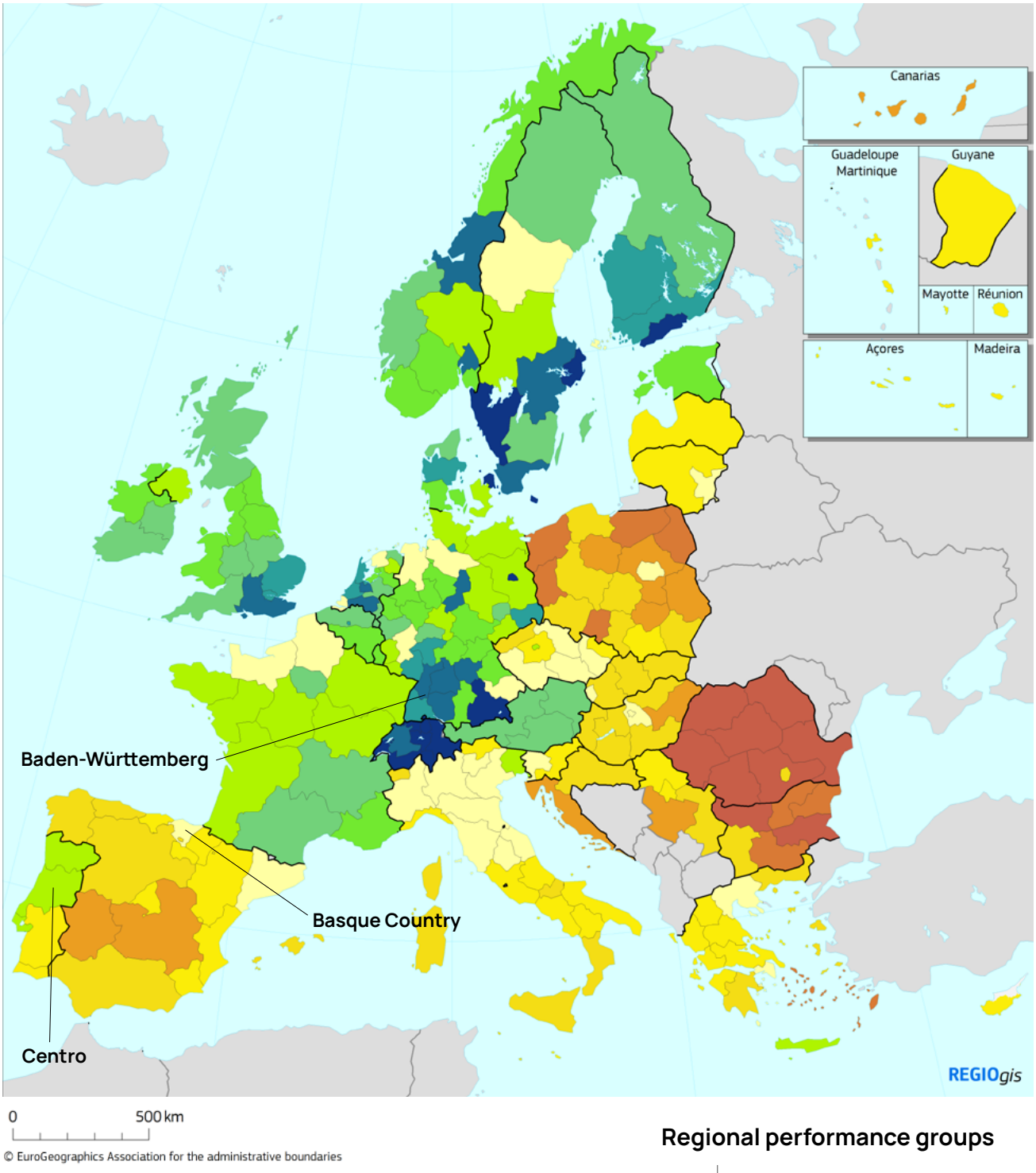
As a laboratory for regional innovation policy and Smart Specialisation, the EU has a diversity of experience. These experiences form a database for reflection and exchange of best practice on Smart Specialisation. A particular challenge has been to transfer the methodology to regions that are structurally weak. First, the social, economic and political structures on which Smart Specialisation builds might be too weak in structurally weak regions. There is evidence that the more successful cases presented in the literature are located in structurally strong regions (Foray, 2015). Secondly, the strategy puts high demands on the institutional capabilities in regions to select the right entrepreneurial discovery processes, and to guarantee its inclusive nature so that the vested interests do not predominate. Again, regional institutional capacity is influenced by national political-administrative systems, giving regions in federal systems more autonomy and often a stronger financial and executive capacity than regions in more centralised systems.

The European Commission pays particular attention to these aspects in the conception and implementation of regional development programmes, for example, through programmes that specifically target institutional capacity building. A major part of the effort is concerned with benchmarking the regions under what is known as the "Lisbon Scoreboard".[5] This provides a snapshot of innovation-related activities in the regions of the EU, and in certain neighbouring countries. The level of performance in the regions shows that the weaker areas are in the South and East of Europe (see Figure 3), and this distribution bears a strong resemblance to maps showing the relatively low levels of GDP per capita in these areas or their relatively greater financial allocations per capita from the EU under EU regional policy (see European Commission, 2017).

Foray (2015, p. 56) stresses the need for complementarity between regional Smart Specialisation Strategies and horizontal, or sectoral, instruments. Structurally weak regions often have only weakly developed sectoral measures, and accordingly find it more difficult to develop complementary Smart Specialisation Strategies. Indeed, in the EU there is a risk of a regional innovation paradox in the form of a mismatch between the need for more innovation in structurally weak regions and their low absorptive capacity to use innovation funds. This suggests that in a forward-looking perspective more emphasis should be placed on developing appropriate sectoral, horizontal measures. At the EU level, this would suggest that efforts should continue to build complementarities between regional policy and the sector-based research programme, currently, Horizon 2020.

[5] European Commission (2020a). https://ec.europa.eu/growth/industry/policy/innovation/regional_en

Figure 3:THE GEOGRAPHY OF INNOVATION IN THE EU: THE LISBON SCOREBOARD (2019)



Source: European Commission (2019)

Looking forward in the next generation of EU regional programmes, which will run from 2021 to 2027, and therefore coinciding with the EU's new International Urban and Regional Cooperation programme (as elaborated above), the ex-ante conditions regarding future investments in innovation will be replaced by a set of more specific fulfilment criteria (Benner, 2020). They will have a greater focus on "the green dimension of Smart Specialisation … in line with the European Green Deal" (Landabaso, 2020). Meanwhile, there is increasing pressure from the regions themselves for smart specialisation to incorporate the idea of social sustainability, an idea which has gathered ground in the light of the impact on communities arising from the COVID-19 pandemic. [6]

In sum, Smart Specialisation has become a central pillar of efforts to support, simultaneously, the development of the regions in Europe and to contribute to the EU's overall competitiveness position. The four key characteristics of EU Smart Specialisation due to considerable practical experience (both positive and negative), and which the EU can bring to the table in international cooperation are: the territorial dimension, which relates to a strong anchorage in the regions; the bottom-up character nurtured by an inclusive dialogue among local authorities, academia, business spheres and the civil society (the so-called quadruple helix); the identification of investment priorities based on local assets and resources as a result of an Entrepreneurial Discovery Process; and the flexibility of the mechanism allowing improvements, modifications or reassessments throughout the intervention process. As such, the successes and failures of the Smart Specialisation experience represent a rich fund of experience of use not only to the regions of the EU itself, but also to those in key international partner countries, such as China.

1.4 EU Support for International Cooperation on Regional Innovation

The relationship between the EU and countries outside the EU is expressed in structured "policy dialogues". These dialogues reflect widespread concern among mature and emerging economies to create more sustainable models of development in **economic** terms (diversified, innovative, competitive…), in **social** terms (inclusive…) and in **environmental** terms (energy efficient, climate change resistant…).

Regional and urban policy is increasingly included in the policy dialogue process, as reflected in political mandates deriving from summits with EU strategic partners. While the EU's external policy has increasingly concentrated its efforts, at least in financial terms, on classical development aid to the poorest parts of the world, relationships with other parts of the world are based on "cooperation". Exchanges of experience and best practices, as well as joint projects, in the field of regional and urban policy are now an increasingly standard element in this external cooperation. This approach has enjoyed strong European Parliament support, which has come with financial resources since 2009, and which has added to the intensity of the cooperation perhaps most notably with China and other Asian countries, as

[6] For example, Tomaney et al. (2020). What comes after the Pandemic: A Ten Point Plan for Foundational Renewal.

well as with Latin American countries. Since 2016, the role of the sub-national authorities in international cooperation, focusing on sustainable development policy and practice, was consolidated with the creation of the International Urban Cooperation programme (IUC) which will be followed from 2021 by the International Urban and Regional Cooperation programme (IURC).

In the case of China, the 7th China-EU Summit of December 2004 identified balanced development and regional policy as key areas on which both sides should share information and experience. On 15 May 2006, a Memorandum of Understanding (MoU) on regional policy cooperation was signed by the European Commission and the Chinese National Development and Reform Commission to exchange information and best practices on experiences in setting up and implementing cohesion policy. In the Joint Statement at the Eighth EU-China High-Level Dialogue held in Beijing on 21 November 2013, both sides identified "Cooperation between EU and Chinese regions to improve innovation capacity and to promote industrial clusters at regional level".

International cooperation more generally has tended to have had an increasing focus on regional innovation processes. Outside the EU, policy processes along similar lines to Regional Innovation Systems and Smart Specialisation are found in Australia, Brazil, Chile, Colombia, Mexico, Norway and Peru, where these countries have developed actions ranging from pilot activities to structured nation-wide approaches (Gómez Prieto et al., 2019). In other countries such as China, the United States of America, Canada and some countries of Africa, Smart Specialisation has attracted attention on the part of several types of stakeholders, including policy-makers and representatives from academia. The EU's first action in this field took the form of an action study on Regional Innovation Systems in the EU and Latin America which examined the innovation systems in the regions of Cordoba (Argentina) and Santa Caterina (Brazil) and introduced them to counterpart regions in the EU (Ismeri Europa, 2013). The study showed that cooperation on innovation was a subject of profound interest to both sides, leading to greater mutual understanding on the regional innovation process and to business opportunities for private sector participants. This was followed up by cooperation on regional innovation systems under the heading of "INNOVACT" and "INNOV-AL".

The IUC programme consolidated these exchange processes, and the Mid-Term Review of IUC underlined the importance of knowledge sharing platforms, networking and the added value of technical support to participant authorities from inside and outside the EU. It also identified strong support for regional innovation systems among participating cities and regions inside and outside the EU.

The appeal of this work outside the EU is partly because of the adaptability of the regional innovation systems and Smart Specialisation methodology to diverse realities. While there is considerable scope for customisation the method requires the **four basic elements** which have already been alluded to above: the geographical or territorial dimension; the prioritisation element; the Entrepreneurial Discovery Process; the multi-stakeholder involvement. These elements would form the common denominator or the DNA of a Smart Specialisation worldwide community.

As a result of the efforts of countries, regions and cities, and the structure brought to cooperation by IUC and other programmes and projects, it could be said that there are signs of an emerging Smart Specialisation community on a global scale. The first global workshop on Smart Specialisation took place in 2019, reflecting the interest in this cooperation.

An important player, both inside and outside the EU, has been the EU's **Smart Specialisation Platform** hosted by the European Commission's Joint Research Centre and run in collaboration with the Directorate-General for Regional and Urban Policy. Initially set up to offer technical support to EU regions, it now counts around 25 members outside the EU, including particularly Australia (Gippsland territory) and Thailand. Participants are kept up to date on innovation systems in the EU and other areas of the world, are involved in key events, receive methodological guidance and can access the different virtual tools for implementing Smart Specialisation Strategies.

Looking forward, the EU is preparing policies for the new financial planning period, 2021-2027. This includes plans for a second International Urban Cooperation Programme from 2021, including an extension of cooperation on regional innovation systems to include China and Japan, as well as the Latin American countries. This would therefore represent a very concrete implementation of the 2013 Joint Statement.

References

Barca, F., McCann, P., and Rodríguez-Pose, A. (2012). The case for regional development intervention: place-based versus place-neutral approaches. *Journal of Regional Science,* 52, 134–152.

Benner, M. (2020). Six additional questions about smart specialisation: Implications for regional innovation policy 4.0. *European Planning Studies,* 28, 1667-1684

European Commission (2017). S*eventh Report on Economic, Social and Territorial Cohesion*. https://ec.europa.eu/regional_policy/en/information/cohesion-report/

European Commission (2019). *European Innovation Scoreboard*. European Union. (https://ec.europa.eu/growth/sites/growth/files/ris2019.pdf)

European Commission (2020a). https://ec.europa.eu/growth/industry/policy/innovation/regional_en

European Commission (2020b). http://ec.europa.eu/programmes/horizon2020/en/h2020-sections

European Commission (2020c). https://s3platform.jrc.ec.europa.eu/

Foray, D. (2015). *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Abingdon: Routledge/ Regional Studies Association.

Gómez Prieto, J., Demblans, A., and Palazuelos Martínez, M. (2019). *Smart Specialisation in the world, an EU policy approach helping to discover innovation globally.* Joint Research Centre. Technical Report.

Hall, R. (2014). The Development of Regional Policy in the Process of European Integration: An Overview. In: Bischoff G (ed). *Regional Economic Development Compared: EU-Europe and the American South*, Innsbruck University Press.

Hassink, R. (2020). Advancing Place-Based Regional Innovation Policies. In: González-López, M. and B. T. Asheim (eds.), *Regions and Innovation Policies in Europe; Learning from the Margins*.,Cheltenham: Edward Elgar, 30-45.

Hassink, R., and Gong, H. (2019). Six critical questions about smart specialisation. *European Planning Studies*, 27(10), 2049-2065.

Ismeri Europa (2013). *EU-Latin America Cooperation of Regional Innovation Systems in the framework of Regional Policy.* Directorate-General for Regional and Urban Policy. Contract number – 2011CE160AT046.

Mäenpää, A. & Teräs, J. (2018). In Search of Domains in Smart Specialisation: Case Study of Three Nordic Regions. *European Journal of Spatial Development*, 68, 1-20.

Mazzucato, M. (2018). Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change*, 27(5), 803-815.

Landabaso, M. (1997). The promotion of innovation in regional policy: proposals for a regional innovation strategy. *Entrepreneurship & Regional Development*, 9, 1-24.

Landabaso, M. (2020). From S3 to S4: towards sustainable smart specialisation strategies. (unpublished manuscript).

2 Regional innovation policy and practices in China

2.1 Introduction

In China, the central government has given explicit recognition to the fundamental role of research and innovation in moving to a high-added value, high-productivity and high-income economy. Innovation has been essentially a sectoral policy, similar to the EU's Horizon 2020 programme discussed in Part I, and as such is less similar to the regional, sub-national innovation policies through which the EU delivers most of its innovation investment, under the heading of Smart Specialisation.

In China, innovation and innovation-related policies have therefore not been territorially focused in the first instance. Rather they have a sectoral focus with the broad aim of developing excellence in science and technology, and in transferring results to economic actors, enterprises and start-ups, in order to help improve their added-value and global competitiveness. The policy agenda is therefore set by central government, principally, the National Development and the Research Commission, the Ministry of Science and Technology, Ministry of Commerce and the Ministry of Economy, together with the Central Committee for the Comprehensively Deepening the Reform, an overarching decision-making body attached to the President.

China's overarching aim has been one of "building China into an innovative country" under the central government's National Medium-to-Long-Term Science and Technology Development Outline (2006-2020). The goals provided for innovative development included upgrading the manufacturing and IT industries to world standards, and improving agricultural science and technology to "world-excellence". The Outline also sets the goal of building an innovation system with enterprises as central players, guided by supportive policy tools. Thus, the authorities have continuously increased the investment in infrastructure to promote innovation, while developing an array of programmes to encourage enterprises to invest in R&D activities.

2.2 Innovation Policy Development in China

As indicated above, the national level is central to understanding innovation policy and practice in China. Between 2012 and 2018, a number of **Opinions and policy documents** from the central government were published. Key objectives were to consolidate the role of enterprises as drivers of innovation activities, while combining science and technological development with economic development, and encouraging collaboration in innovation.[6] Specific policy instruments were also put forward such as establishing a regular high-level dialogue and consultation platform on enterprises' technological innovation, piloting innovation-based transformation on leading enterprises, reducing tax, establishing enterprise-led industrial innovation alliances, etc. The aims also included the building of partnership, to accelerate national innovation, calling for efforts to integrate and share innovation resources among key actors: government, enterprises and society and speeding up the transformation of scientific and technological outputs into actual productive power.

In addition, **industry-specific policies** were included. For example, the National Development and Reform Commission (NDRC), which had been issuing the Guiding Catalogue for Industrial Structure Adjustment on a regular basis since 2005, in its 2019 edition took the step of allocating more than 1,000 industries into one of three categories: favoured, restricted or to be closed down.

Perhaps unsurprisingly, the innovation capacity of Chinese enterprises appears to have significantly improved in recent years. The number of industrial enterprises with R&D activities increased from 17,075 in 2004 to 102,218 in 2017 with the latter accounting for 27.4% of all industrial enterprises.[7] Similarly, the number of patents from such industrial enterprises increased from 0.2 million in 2011 to 1.2 million in 2017.

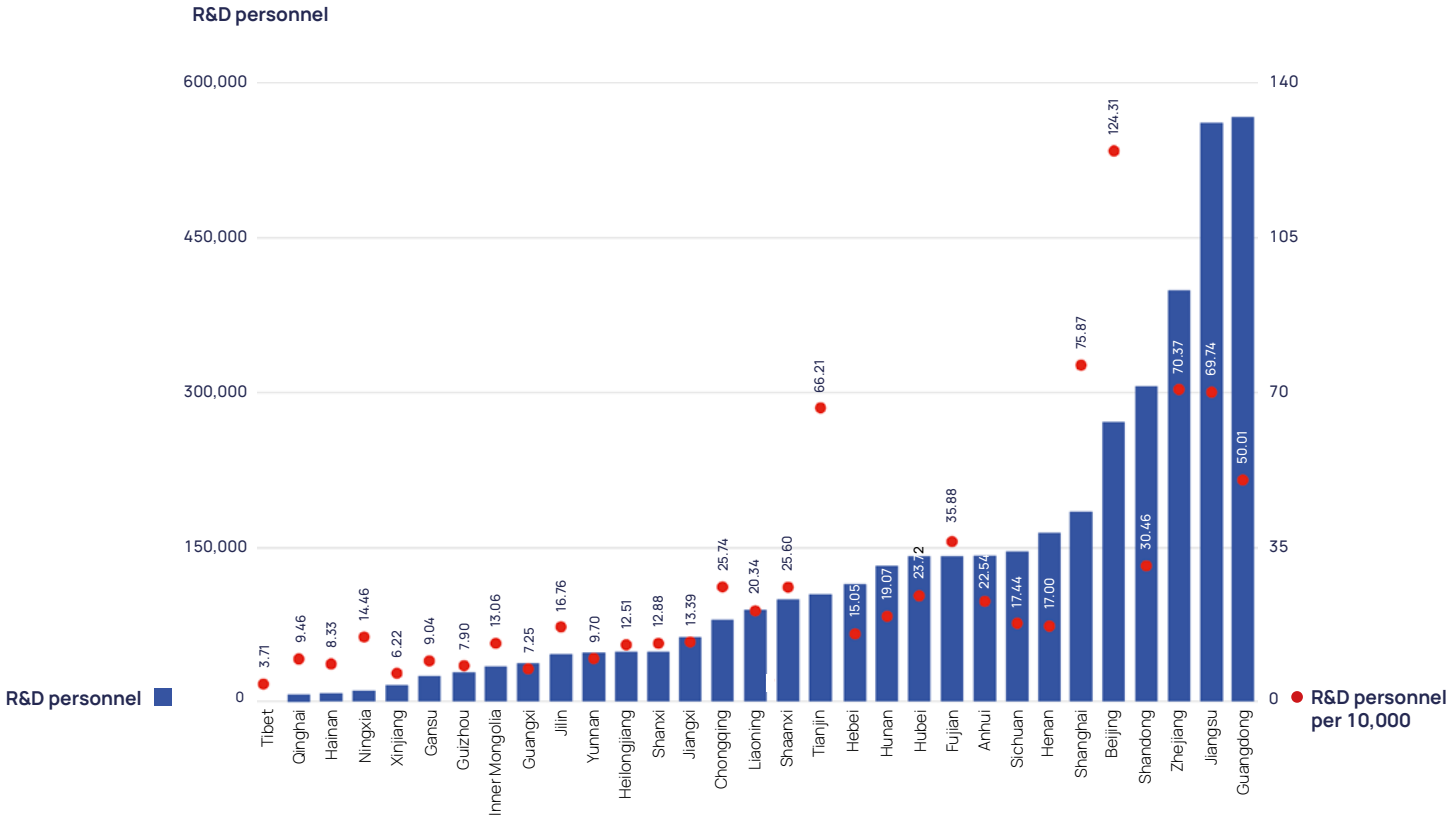
China's progress in increasing its innovation capability can be see in the the World Economic Forum's global country comparisons, and the country ranks 24th in the innovation capability country comparisons (World Economic Forum, 2019). This is an average figure for the country as a whole and, as discussed below, disguises important geographical differences across the territory (see Figure 4), with some areas probably ranking with the world leaders.

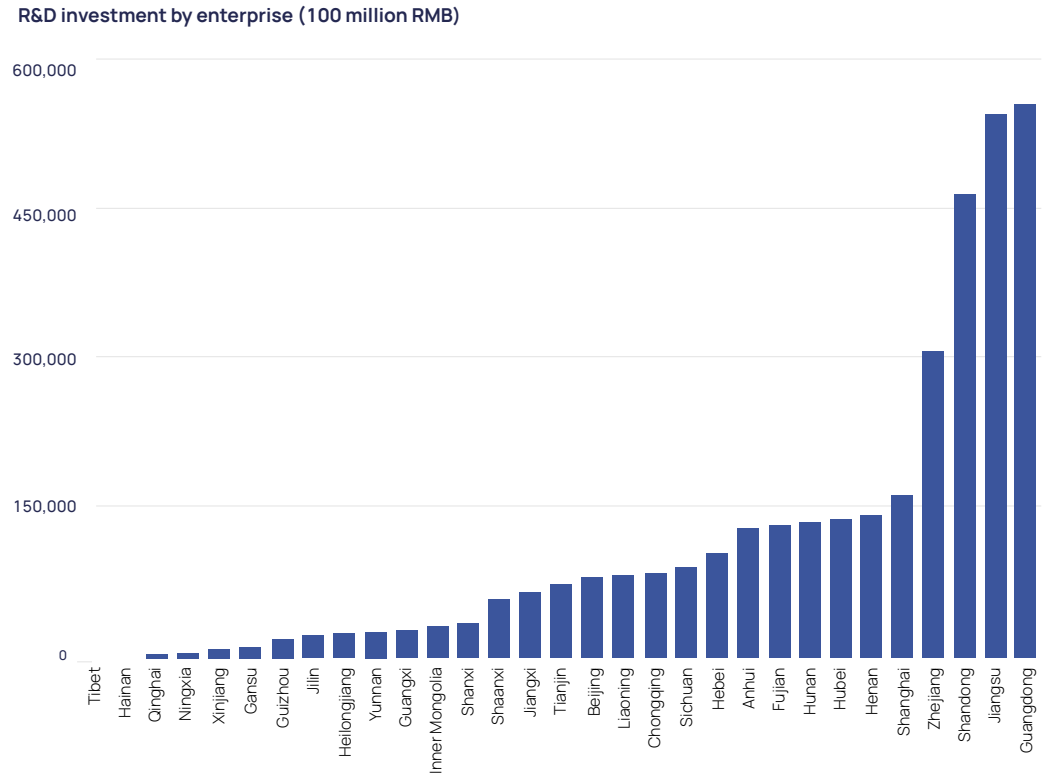
OPINIONS AND POLICY DOCUMENTS FROM THE CENTRAL GOVERNMENT

- Central Committee of the Communist Party of China and the State Council (2012). Opinions on Deepening the Reform of Science and Technology System and Accelerating the Development of National Innovation System.
- General Office of the State Council (2016). Opinions on Strengthening the Dominant Position of Enterprises in Technological Innovation and Comprehensively Improving the Innovation Capabilities of Enterprises.
- General Office of the State Council (2016). Implementation Plan for Deepening the Reform in the Science and Technology System.
- State Council (2015). Opinions on Several Measures to Push Forward Widespread Entrepreneurship and Innovation.
- State Council (2017). Opinions on Strengthening the Implementation of Innovation-driven Development Strategy and Further Deepening the Development of Widespread Entrepreneurship and Innovation
- State Council (2018). Opinions on Promoting High Quality Development of Innovation and Entrepreneurship and Creating an Upgraded Version of "Mass Entrepreneurship and Innovation".

[7] Above-scale enterprises refer to those with annual revenues of 20 million RMB or above.

Figure 4: INNOVATION CAPACITY OF CHINESE PROVINCES





Source: China Science and Technology Development Strategy Research Group & UCAS Research Center in China's Innovation and Entrepreneurship (2019)

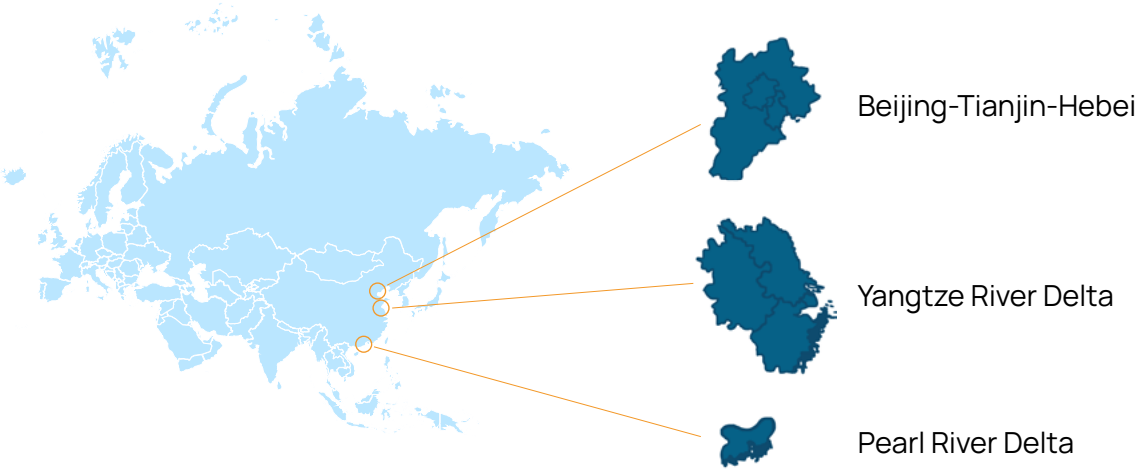
2.3 The territorial dimension

The territorial dimension is not absent, on the contrary, significant efforts have been made to seek to ensure that sub-national areas are equipped to benefit from innovation initiatives. In the Opinions outlined above, the territorial approach was also introduced, with the promotion of the idea of **regional innovation systems with local characteristics**.

As a large country, the capacity for innovation in China varies geographically. Figure 4 shows the distribution of four key indicators of innovation capacity in Chinese provinces (or province-level cities). Three regions can be considered as the cores of innovation in China, which are Beijing and surrounding areas, the Yangtze River Delta and the Pearl River Delta (see Figure 5). They together attract 30% of China's R&D investment and 43% of the nation's high-tech enterprises, and produce 38% of all patents.

The geographical pattern shown is the mixed outcome of both historical roots and latest trends (Kroll, 2010). The economy and innovation capacity of east China has long been stronger than the other parts of the country. However, China has attached great emphasis to promoting a more balanced development among regions in recent years, a strategy which has been led by new urbanisation. In order to achieve this, a series of regional development strategies have been put forward, including boosting the areas with relatively slow development such as the Grand Western Development Programme, Revitalizing Northeast China and the Rise of Central China, as well as leveraging the power of the most developed provinces and cities to drive the development in the surrounding areas, such as the Coordinated Development Plan of the Beijing-Tianjin-Hebei Region, the Regional Integration of the Yangtze River Delta, and the Yangtze River Economic Belt.

Figure 5: CHINESE KEY URBAN CLUSTERS



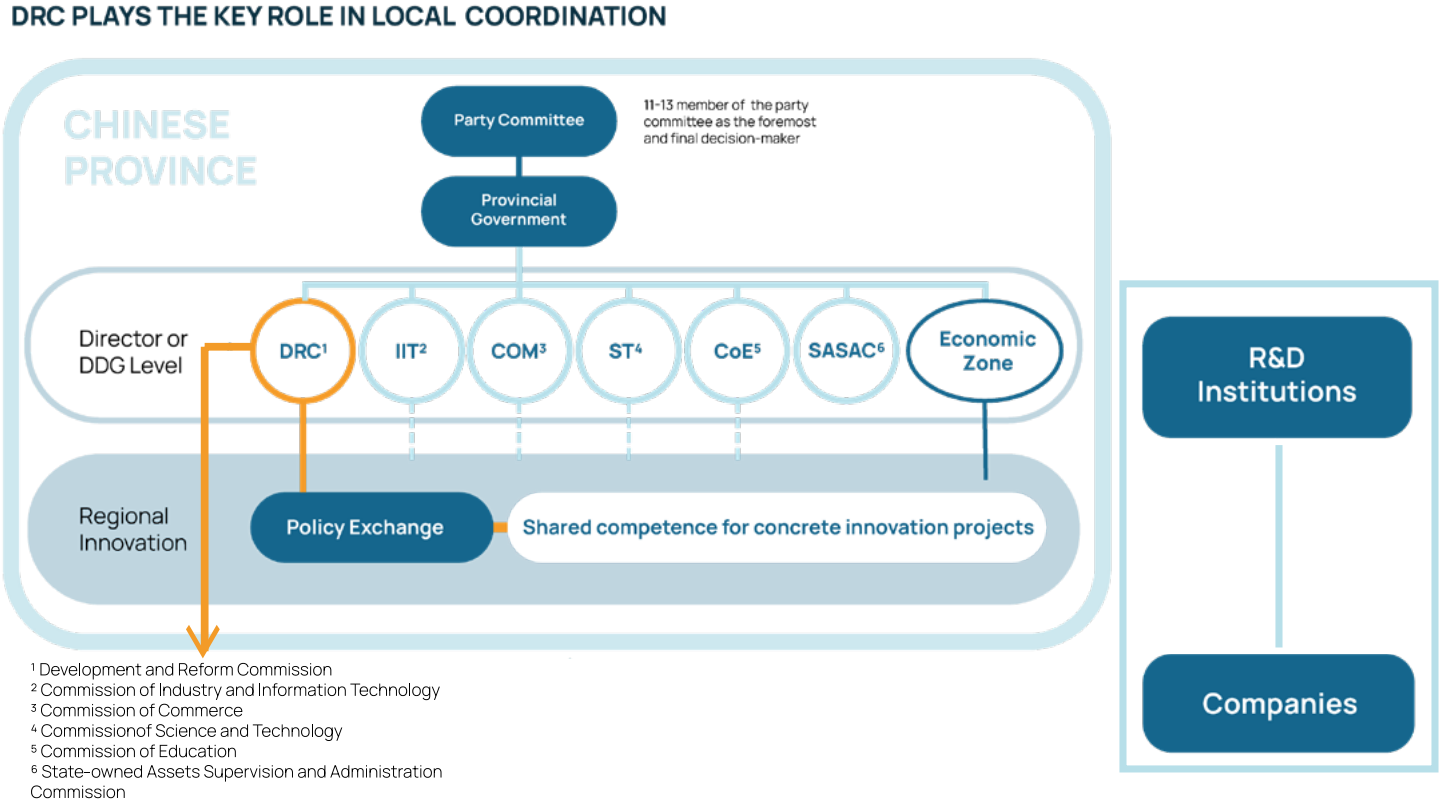
In spite of these efforts, China still faces clear challenges in inter-regional disparities in innovation. First, there is still a significant gap in innovation capacity between east and west China, which is basically a continuation of the long-standing developmental gap. Second, the enterprise-led innovation system is not completely formed yet, instead, a large proportion of innovative activities are conducted under the guidance of the government. Third, regional innovation systems themselves need to be strengthened.

Regional government is the level at which national strategies are translated into concrete actions and developments. It should be noted that the term "region" can refer to geographical areas varying a lot in size, especially in a large country as China, from a group of adjacent provinces to a cluster of cities or counties within a province (or across neighbouring provinces). In this study, the focus is on provincial regions since they are medium in size and there are relatively rich statistics and policy materials at this formal administrative level.

Considering the different endowments of regions, both the central government and provincial governments are aware of the importance of **tailoring strategies to contexts**, which bears resemblance to EU's Smart Specialisation. For instance, in the Catalogue of Encouraged Industries for Foreign Investment published by NDRC and MOC, there is a dedicated list for each of the 23 provinces (or equivalent) in west and middle China on top of a list of general, national applicability. The NDRC also published a Catalogue of Encouraged Industries in West China, which names 30-40 niche industries for development in each of the 12 provinces (or equivalent) in west China.

While the central government of China is a strong leader and their policies are echoed by regional governments, there is much room for regions to further tailor their innovation strategies based on their distinctive features. This room to manoeuvre at sub-national level is delivered through the counterparts to the key national departments referred to above which exist at the provincial and city levels, sometimes with slightly different names such as the Beijing Municipal Science and Technology Commission or the Department of Science and Technology in Jiangsu. Other major stakeholders in regional innovation include enterprises, universities, research institutes and various coordination platforms/agents (see Figure 6). Since deep field knowledge is needed in innovation policy-making, both the central and regional governments use a variety of channels to consult the stakeholders and experts such as expert committees or commissioned research on specific issues.

Figure 6: MULTI-LEVEL GOVERNANCE FOR REGIONAL INNOVATION POLICY



Source: IUC Implementation Team

For instance, Shandong Province, a case study in the next chapter, identified five emerging industries and another five existing industries as key areas to invest in future years. The former are a subset of the priorities set in the national strategy in Made in China 2025, while the latter are more based on the region's industrial base such as chemical industry. Instead of all top-down, the central government sometimes also strongly encourages regional governments to search for viable approaches to regional innovation. For example, Shandong is labelled to be the "experimental zone for shifting the new and old driving forces for development" since 2018 and President Xi colloquially asked Shandong to "find a way out to high quality development" (Gong, 2019).

Given the innovation disparities, the territorial approach to innovation in China has historically focused on **the growth pole** notably, the building of science and high-tech parks to accommodate and attract innovation activities within a designated urban area. A growth pole for innovation is then intended to disseminate outputs across surrounding areas and drive regional development. China has a functional typology of science parks which act as "an innovation demonstration zone", or, "a high-tech zone", or, "a developmental zone", or, "an experimental zone", in different contexts. For instance, China has launched more than twenty innovation demonstration zones since 2009, and more than 160 national high-tech industrial development zones since 1988. These are intended to drive economic development, and, for example, 43 high-tech zones contribute more than 20% of the GDPs of their host cities.

The territorial approach to innovation in China is also part of **spatial planning policies** which are mainly composed of the master plans of provinces and sub-provincial cities, as well as the spatial plans of key regions.[8] The former is part of the statutory planning system, and usually involves spatial arrangements for regional innovation such as determining the location of "growth poles". The latter is a type of plan for coordinated development within a certain region, which is usually made for key regions of the country, such as the Development Plan for the Urban Cluster in the Yangtze River Delta, the Regional Plan for the Chengdu-Chongqing Economic Zone and the Development Outline for the Guangdong-Hong Kong-Macao Greater Bay Area. In certain cases, the designation of key regions serves further purposes for the innovation-based development and, for example, there were eight Overall Innovation and Reform Pilot Zones launched by the central government in 2015. Besides the key regions, the central government also certifies a number of "innovative regions" at various geographical levels, including ten innovative provinces, and more than fifty innovative city prefectures and innovative counties, which are mainly distributed along the eastern coast and the Yangtze River Delta (see Figure 7).

[8] Sub-provincial cities are fifteen cities with higher administrative status.

Figure 7: INNOVATIVE COUNTIES PREFECTURES AND PROVINCES IN CHINA (2020)

Innovative Provinces

Jiangsu
Anhui
Zhejiang
Shaanxi
Hubei
Guangdong
Fujian
Shandong
Hunan
Sichuan

Innovative City Prefectures

Shenzhen
Hangzhou
Guangzhou
Nanjing
Wuhan
Suzhou
Xian
Changsha
Xiamen
Hefei
Wuxi
Qingdao
Chengdu
Dalian
Kunming
Changzhou
Jinan
Shenyang
Ningbo
Yantai
Zhenjiang
Harbin
Nanchang
Fuzhou
Guiyang
Zhengzhou
Taiyuan
Dongguan
Wuhu
Nantong
Changchun
Jiaxing
Yanghzou
Foshan
Chaozhou
Taizhou
Lanzhou
Shijiazhuang
Shapingba District (Chongqing)
Maanshan
Xuzhou
Nanning
Shaoxing
Weifang
Luoyang
Yancheng
Zhuzhou
Urumqi
Jinhua
Haikou
Hohhot
Xiangyang
Dongying
Quanzhou
Yichang
Jining
Lianyungang
Jingdezhen
Yinchuan
Baotou
Baoji
Qinhuangdao
Xining
Longyan
Tangshan
Hengyang
Lasa
Jilin
Pingxiang
Zunyi
Yuxi
Hanzhong
Nanyang
Changji
Shihezi
Haidian District (Beijing)
Binhai New District (Tianjin)
Yangpu District (Shanghai)

Innovative Counties

Zhengding (Hebei)
Guan (Hebei)
Jiaocheng (Shanxi)
Jungar (Inner Mongolia)
Left Keraqin (Liaoning)
Tonghua (Jilin)
Bin (Heilongjiang)
Kunshan (Jiangsu)
Jiangyin (Jiangsu)
Zhangjiagang (Jiangsu)
Changshu (Jiangsu)
Haian (Jiangsu)
Changxing (Zhejiang)
Xinchang (Zhejiang)
Cixi (Zhejiang)
Leqing (Zhejiang)
Anji (Zhejiang)
Jieshou (Anhui)
Ningguo (Anhui)
Chaohu (Anhui)
Jinjiang (Fujian)
Fuqing (Fujian)
Jinggangshan (Jiangxi)
Zoucheng (Shandong)
Rongcheng (Shandong)
Longkou (Shandong)
Xinzheng (Henan)
Daye (Hubei)
Yidu (Hubei)
Xiantao (Hubei)
Liuyang (Hunan)
Xiangyin (Hunan)
Zixing (Hunan)
Sihui (Guangdong)
Lianjiang (Guangdong)
Taishan (Guangdong)
Lipu (Guangxi)
Wuzhishan (Hainan)
Fengjie (Chongqing)
Jintang (Sichuan)
Longchang (Sichuan)
Shifang (Sichuan)
Meitan (Guizhou)
Kaili (Guizhou)
Tonghai (Yunnan)
Bailang (Tibet)
Zuoshui (Shaanxi)
Gaotai (Gansu)
Wulan (Qinghai)
Yanchi (Ningxia)
Korla (Xinjiang)
Shihezi (Xinjiang)

2.4 Emerging challenges

While there has been considerable progress in developing an innovation culture in China, there remain a number of challenges. These were summarized in a Research and Innovation Observatory Country Report on China by Huang et al. (2016). These reports are co-authored by JRC policy analysts and independent experts, and provide an update on the performance of the national research and innovation systems. Three main challenges were identified in the latest report published in 2016.

First, the science and technology (S&T) **financing system** was described as too fragmented, overlapping and lacking in efficiency. The S&T system reform programme launched in 2015, referred to above, specifically included a reform plan of the S&T funding system. Before this reform, there were nearly one hundred funding programmes managed by approximately forty departments at the central government level (Wan, 2015). These have now been streamlined into five funding lines. The reform also called for new executive capacities, with professional S&T project management agencies assigned to process funding applications and monitor the progress of funded projects, so that the government could focus on strategy. For example, the National Key R&D Programme, one of the five funding lines, is administered by seven professional agencies in different research fields, which were selected from twenty-four candidates (The State Council Information Office of PRC, 2017).

Secondly, gaps were identified in converting universities-level, **basic R&D research and industry's commercial applications**. Among the explanations were a flawed regulatory system in terms of incentives, ownership, and other policy impediments. The reforms undertaken in this area aimed to 'untie' the researchers in universities and institutes and to encourage the industrial application of academic research. These include a number of changes in the legal framework policies in order to deregulate the transfer of research outputs from public universities and institutes to the private sector and clarify the intellectual property rights of researchers[9]. There is evidence of improvement in this field with, for example, the marketisation rate of invention patents by universities increasing from 2.2% in 2015 to 3.7% in 2019 (China National Intellectual Property Administration, 2019).

Thirdly, the report concluded that Chinese **scientists and companies** were not yet at leading edge or high added value level in many S&T fields. The Medium-and-Long-term National Plan for S&T Development (2006–2020) set the target of upgrading the country's annual growth in patent grants and paper citations to the top five in the world. Accordingly, much emphasis has been placed on producing internationally competitive research outputs and publications in recent years. According to Thomson Reuters' data, China has progressed up to second in the world both in terms of total paper citations in 2019 and the number of highly cited papers published between 2009 and 2019 (was the third in 2018).

[9] These included amending the Law on Promoting the Transfer of S&T Outputs in 2015, the Notice on Further Increasing the Authorization and Promoting the Transfer of S&T Outputs by the Ministry of Finance in 2019, and Opinions on Enhancing the Quality of Patents by Colleges and Universities and Promoting the Transfer and Application of Patents jointly by the Ministry of Education, the National Intellectual Property Administration and the Ministry of Science and Technology in 2020.

Particularly, China even ranks the top in paper citations in certain fields including material sciences, chemistry and engineering (Zhang, 2019). Meanwhile, China has also numbered the top in equivalent patent grants in 2018 according to the World Intellectual Property Organization. Despite of these achievements, China has begun to reflect on the effectiveness of using these metrics to guide and monitor S&T development, and has now shifted more focus to the qualitative assessment of research outputs, according to the latest Measures on Stopping the Harmful "Paper-Only" Trend in Scientific and Technological Evaluation by the Ministry of Science and Technology.[10]

More recently, additional policies related to regional innovation have been issued by the central government and sample regional governments. These policies can be categorized into the following types (see Figure 8):

Figure 8: PRINCIPAL ACTIONS IN INNOVATIVE AREAS

Terciary Education	Including making long-term and comprehensive plans for the training and absorption of professional personnel according to demands of industrial development, improving the education and training system at all levels, and providing training programs on starting-up for young entrepreneurs such as coaching, business operation courses and legislation courses.
Technology Development Support	Including providing technical support and consultation to assist enterprises in technological innovation, directly funding technology diffusion and transfer or support the innovative transition of leading enterprises.
Funding	Providing direct financial support for the innovation activities of enterprises.
Financial Support	Including helping with financing and venture capital, providing subsidies, special permissions, loan guarantee, export credit, etc.
Tax incentives	Including tax exemption, accelerated depreciation, and tax credit for enterprises and individuals involved in innovation activities.
Extended Services	Providing extended public services for innovation activities, including launching associations and discussion platforms, organizing exhibitions, building science parks or incubator, etc.
Procurement / Outsourcing	Providing a clear and stable market through bulk purchase of new products, so as to reduce the uncertainty confronted by enterprises in the early stage of innovation, also including the outsourcing of R&D demands of the government.
Regulation	Making regulations on fair trade, intellectual property right, monopoly behavior as well as environmental and health standards, so as to provide favorable environment for innovation.
Encouragement and Advocacy	Proposing a series of encouraged activities in favor of industrial innovation such as encouraging enterprises to cooperate or form alliances, encouraging technology import, etc. However, such policy items often do not indicate detailed implementation measures, hence more concrete follow-up measures are still needed.

Sources: Liu et al. (2019); Huo (2015); Sheng and Sun (2013).

[10] Highly cited papers refer to the papers ranking in the top 1% by citations by research field and publication year as indexed in the Web of Science.

The WEF report referred to above suggests that the country's innovation ecosystem would benefit for market reforms to allow for more intense competition and better allocation of resources. The report also points to inefficiencies in the labour market with, for example, rigidities in wage determination and redundancy, problems in industrial relations, low participation of women, high tax on labour, and lack of internal mobility. Meanwhile, the education and training system is seen as struggling to keep up with evolving skills needs of the economy, in particular, with regard to the adoption of new technologies and the growing efforts in the field of innovation in general.

Of course, like the EU, China's most immediate challenge in 2020 is related to the economic, social and public health impacts of the COVID-19 pandemic. While China's economy has started to rebound from the COVID-19 induced shock, the recovery remains partial. The World Bank points to weaknesses in domestic demand and especially private consumption, reflecting ongoing impacts of the pandemic, labour dislocation and slower growth in household incomes.

The policy reset resulting from the pandemic in both the EU and China creates the opportunity in the medium-term for rebalancing to a more sustainable and inclusive economy. It provides a fertile ground for cooperation on innovative actions in fields such as resilience against similar health shocks, enhanced food safety, health surveillance and response systems.

In the 2019, NDRC published the Opinions on Establishing and Improving the Process of Involving Entrepreneurs in Enterprise-Related Policy Making, which requires the hearing of entrepreneurs' opinions in agenda setting and regulation making. The State Council also published a Notice on Fulling Listening to the Opinions of Enterprises and Industrial Associations in Formulating Administrative Regulations and Standards, which emphasizes the hearing from SMEs as well as staffs at various levels. This new policy direction has been echoed by many regional governments with implementation plans, such as Jiangsu, Shandong, Henan, etc. Therefore, we should expect more contributions from enterprises in regional innovation policy-making in the future.

China is currently making the 14th Five-Year Plan. The official plan is still under discussion, yet speeches of senior officials can reveal some key ideas for future policy making in S&T and innovation. The minister of MOST put forward "three focuses" for future S&T development, which are focusing on the frontiers of global S&T development, focusing on the key strategic needs of the country, and focusing on the key areas of economic and social development. Besides, the minister emphasized that institutional and managerial innovations should be carried forward together with S&T innovation (Zhao, 2020).

References

China National Intellectual Property Administration (2019). 年中国专利调查报告 [China Patent Investigation Report 2019].

China Science and Technology Development Strategy Research Group & UCAS Research Center in China's Innovation and Entrepreneurship (2019)

Gong, Z. (2019). 山东：奋力趟出一条高质量发展路子 [Shandong: Striving to Find a Way Out to High Quality Development]. *Qiushi Theory*, October 3, 2020. http://www.qstheory.cn/dukan/qs/2019-10/03/c_1125069249.htm

Huang, C.; Jin, X., and Liu, L. (2016). *RIO Country Report 2015: China*. JRC Science for Policy Report, Joint Research Centre.

Huo, H. (2015). 京鄂皖苏等地创新驱动政策分析——基于内容分析法的探讨 [A Summary and Analysis of Innovation Policies of Beijing, Hubei, Anhui and Jiangsu]. *Science Technology Progress and Policy,* 32 (12), 114-118.

Kroll, H.(2010). Indicator-based reporting on the Chinese innovation system 2010: The regional dimension of science and innovation in China. *Fraunhofer ISI Discussion Papers - Innovation Systems and Policy Analysis*, No. 25, Fraunhofer ISI, Karlsruhe. http://nbn-resolving.de/urn:nbn:de:0011-n-1622750

Liu, X.; Xie, F., and Wang, H. (2019). 政策组合视角下的区域创新政策分析_以东北地区为例 [Regional Innovation Development Policy from the Perspective of the Central Government: Based on Content Analysis]. *Forum on Science and Technology in China,* 05, 87-122.

Sheng, Y. and Sun, Y. (2013). 我国区域创新政策比较——基于浙 、 粤、苏、京、沪5省、市的研究 [Comparison of China's Regional Innovation Policies Based on the Research of Zhejiang, Guangdong, Jiangsu, Beijing and Shanghai]. *Science Technology Progress and Policy*, 30 (06), 93-97.

The State Council Information Office of PRC (2017). 科技部举行中央财政科技计划管理改革情况发布会 [The Ministry of Science and Technology Held a Press Conference on Reforming the Science and Technology Programs Supported by the Central Government. February 23, 2017]. http://www.scio.gov.cn/xwfbh/gbwxwfbh/xwfbh/kjb/Document/1543131/1543131.htm

Wan, G. (2015). 万钢：中央财政科技项目由近40个部门管理 影响效率 [The Science and Technology Projects Supported by the Central Budget are Managed by Nearly 40 Departments, Which Affect the Efficiency]. *Chinanews*, March 11, 2015. http://www.chinanews.com/gn/2015/03-11/7119802.shtml

World Economic Forum (2019). *The Global Competitiveness Report 2019*. World Economic Forum.

Zhang, L. (2019). 中国科技论文统计结果发布：从求数量到重质量 评价指标变化显著 [Statistics of China's S&T Papers Published in 2019: Significant Changes in Evaluation Indicators]. *Guangming Daily*, November 20, 2019. http://www.gov.cn/shuju/2019-11/20/content_5453698.htm.

Zhao, Z. (2020). 科技部：正在组织编制面向未来15年的科技发展规划和“十四五”科技创新规划 [The Ministry of Science and Technology is organizing the drafting of the science and technology development plan for the next 15 years and the Science and Technology Innovation Plan for the 14th Five Year]. *People*, May 19, 2020. http://scitech.people.com.cn/n1/2020/0519/c1007-31715278.html

3 EU-China Regional Innovation Cooperation

3.1 Introduction

Cooperation on innovation between the EU and China has had both sectoral and territorial dimensions. **In sectoral terms**, EU-China cooperation on innovation takes the form of joint research activities framed within the EU-China High Level Innovation Cooperation Dialogue between the European Commission (represented by the Directorate General for Research and Innovation) and the Chinese Ministry of Science and Technology (MOST). Within the Co-funding Mechanism (CFM), several European and Chinese innovation partners cooperate in projects funded within the Horizon 2020 programme, including flagship projects such as ENRICH China. Here, European research, technology and business organisations are connected to Chinese partners through R&D intelligence, training and enabling events. Also, European research and innovation partners participate in China's "Inter-governmental Science and Technology Innovation (STI) Cooperation Special Programme".[1]

As regards **the territorial dimension**, EU-China cooperation on regional innovation has assumed growing importance over the past decade. Following the signing of the Memorandum of Understanding on regional policy cooperation in 2006, EU-China cooperation intensified after 2009, following the decision of the European Parliament to vote financial support for cooperation as a pilot action. This provided resources that enabled the bringing together of representatives from EU regions and those from outside the EU, notably China, to exchange experience and best practice on regional innovation.

For example, already in October 2011, within the "CETREGIO" programme, 20 Chinese government officials from 15 provinces and from Beijing engaged in exchanges of experience and best practice with regional innovation experts from France, Germany, Latvia, the Netherlands and Sweden. The aim was to promote deeper understanding of innovation strategies, instruments and programmes, with an emphasis on the regional level. It also emphasised the importance for Europe of the multi-stakeholder approach with representatives from government

[1] See EU DG RTD website: https://ec.europa.eu/research/iscp/index.cfm?pg=china.

at different levels, the research community and European business involved in the entrepreneurial discovery process (EDP) for developing regional innovation strategies. Discussions also covered the concept of cluster policies in the light of efforts in China to develop coordinated regional innovation strategies.

Between 2013 and 2016, within the EU's ongoing CETREGIO project and its new "World Cities" project, European experts visited regional innovation hubs in China, including the Beijing E-Town, the Tianjin Economic Development Area (TEDA), the Wuhan East Lake High-Tech Industrial Park, the Guangzhou Development District (GDD), Chengdu's Tianfu Area and the Chengdu High-Tech Zone. These exchanges led to formalised agreements for bilateral innovation cooperation, for example between Guangzhou and Upper Austria (Austria), as well as between Tianjin with Lazio (Italy) and Lower Silesia (Poland).

In June 2019, the IUC programme, the City of Mannheim and the ZEW–Leibniz Centre for European Economic Research organised the first European-Chinese Regional Innovation Forum.[2] The event –which was attended by more than 120 representatives from politics, business and research– provided valuable insights into the role of cities and regions in supporting European-Chinese relations as well as trends, challenges and opportunities for the bilateral cooperation. At the event, the EU-China cooperation through Smart Specialisation Strategies was discussed by high level representatives of the European Commission's DG REGIO, research and business.

The actions supported by the EU build on bilateral cooperation which has existed historically between individual EU regions and city actors (not necessarily the authorities) and their counterparts in China, and which often focused on innovation. An interesting example is that of cooperation between Jiangsu and Baden-Württemberg (Germany). This has been conducted primarily at a stakeholder level, involving universities, research institutes, companies and business incubators. In 2019, on the 30th anniversary of their cooperation, Baden-Württemberg's Minister of Economy led a delegation to Jiangsu of 100 senior business representatives mostly from innovation-research in large and medium sized companies. Start-ups from Baden-Württemberg were invited to participate at Nanjing Techweek, and key innovation partners from Germany such as Karlsruhe University PionierGarage or BWconnect have implemented activities in Jiangsu. The main coordination body for the Baden-Württemberg-Jiangsu partnership is the China office of Baden-Württemberg International (bw-i) located in Nanjing.

Highly innovative projects have been implemented between R&D partners from Baden-Württemberg and Jiangsu, including the Advanced Manufacturing Institute (GAMI) run by the Karlsruhe Institute of Technology in Suzhou. As mentioned, most of these arrangements are carried out directly by these universities and research institutes with local authorities without direct involvement of the regional governments of Baden-Württemberg or Jiangsu. The corporate sector also has well established operations in Jiangsu and increasing research and development activities including research centres.

---

[2] See IUC Asia website: https://www.iuc-asia.eu/2019/06/iuc-regional-event-in-mannheim/

Also engaged in cooperation with Jiangsu is the region of North Brabant (Netherlands) where innovation cooperation is channelled through individual companies, with the support of agencies such as the Brainport Industries Campus. Innovation exchange between North Brabant and Jiangsu is therefore essentially triggered by company interest, covering sectors such as semiconductors, food and agricultural technologies. The approach is very much bottom up, driven by the regional actors themselves. North Brabant has established a representative bureau in Nanjing, which maintains contact with these companies and other commercially oriented entities such as cooperatives and associations. Its function is to provide support and guidance on demand and provide guidance and suggestions to businesses and the public authorities in North Brabant. When patterns or specific areas of interested are identified by either the representative office or companies, then officially organized delegations will be organized with possible financial support from Jiangsu and North Brabant.

While the involvement of North Brabant has been driven from the grassroots, on the Chinese side there is more involvement of national entities. These include the Jiangsu Development and Reform Commission as well as with the Jiangsu Science and Technology Office. North Brabant can also call on the Belgian Shanghai Consulate, Science and Technology section also supports the cooperation. Included in this cooperation are start-up and technology delegations to Jiangsu, including matchmaking missions.

The evidence suggests that an important feature to develop and sustain cooperation with China is the interest and engagement of the political leadership in European regions. North Brabant, for example, marked the 25th anniversary of region-to-region relations in 2019 by sending a delegation to China led by the Governor accompanied by 7 mayors including the Mayor of the major city of Eindhoven.

In sum, while there has been an acceleration of EU-China diplomacy in the field of regional policy over more than a decade, it is important to remember that the regions and regional actors themselves, on each side, have shown a considerable capacity to carry out actions independently. At the same time, the leadership provided, respectively, by the EU, through the European Commission, and China, through the National Development and Reform Commission has helped the regional actors on each side, by opening doors, providing structure including some financial support and encouraging the durability of cooperation over time.

3.2 The Process of Cooperation on Regional Innovation Systems: Emerging Challenges

Based on the EU-China regional cooperation experience,[1] it is suggested that cooperation on regional innovation systems should have a number of key elements:

[1] Casa Asia (2020). Interview with members of the EU-China implementation teams for regional cooperation 2011-2020.

Select the regions with the best prospects for successful cooperation outcomes

This process should seek to provide as much information as possible to allow a kind of ***ex ante*** **evaluation** to take place in terms of the recommendations outlined above, drawing inspiration from the selection process used to identify participants regions under the first IUC programme for regional cooperation with Latin America. Regions should be selected through an **effective matching mechanism** based on four **criteria**[2], namely Potential, Opportunity, Similarity and Commitment to cooperating on regional innovation.

Identifying a strong partner for each participant region

Relevant "**pro-active innovation managers**" must be identified within key institutions – both from government and non-government stakeholders – at regional level. These individuals will be crucial to deliver concrete, **sustainable results**. This should be preferably someone in a senior position, who will lead the regional cooperation team and guide the process through to the end and ensure continuity. The expert should ideally represent the single, or main, point of contact for the technical support teams working under the IURC. Effective and continuous **stakeholder mapping** and **engagement** greatly facilitates the connections necessary to achieve project success. This will allow **gathering** information from the regions through sourcing ideas, best practice, case studies, policy and project templates to support the prioritisation element referred to above.

Turn this information into proposals for Regional Cooperation Action Plans

In order to avoid a mismatch and motivate the regions, a bold, impact-based **start-up cooperation plan** is needed. The establishment of a concrete **working structure** through which regions will be able to get technical support, new contacts and - where possible - travel to participate in matchmaking events without incurring cost to region's budgets are the minimum conditions needed for the success of cross-regional cooperation. Regions will then be enabled to develop road maps and identify the working groups needed to implement plans in a concrete way. Small-scale **pilot projects** should be initiated right from the beginning of the partnerships in order to establish a working dynamic. The EU or Chinese cooperation programmes should foresee a **seed-fund** for the financing of initial actions that can lead to other sources of funding.

Create an intra-regional innovation system based on an open pairing approach

Regions should be allowed to benefit from **cross-regional** cooperation based on an **"open pairing"** approach that facilitates the formation of thematic clusters and communities for regional innovation cooperation. These thematic clusters should be driven by experienced thematic managers (experts) able to capitalise from international experiences on regional innovation and achieve high-quality action plans.

---

[2] Adapted from the Matching Mechanism developed by Eurocities within the Urban EU-China Project (H2020).

The **bottom line** is to adopt as much as possible a **"cluster approach"**, involving several regions from both sides at the same time and not focusing on one-to-one pairings, which – due to exogenous factors - may lose dynamic in the course of implementation. However, since the clustering approach should be open in nature, regions that - in the light of justified reasons and in the perspective of clear synergies and opportunities - wish to develop a more intensive cooperation with only one partner regions, should be supported as well. This could be inspired in the **variable geometry** nature of EU regional integration.

Triple-helix Approach

The project cannot base cooperation and pilot project development on government dialogue alone. A **multi-stakeholder** involvement is essential to limit the risk of a one-sided approach and to ensure **sustainability** and **replicability**. For this reason, public authorities, academia, research and business must be involved where appropriate in order generate balanced solutions at various levels. Given the importance of institutions like embassies, cultural institutes, research institutes, higher-education organisations and business associations in the global diplomacy system, it is crucial that cross-regional cooperation is communicated to these and further **stakeholders**.

Governance and Vertical Integration

In order to achieve results that are **scalable** at national or European level, coordination among the local, regional and **national government** levels should be envisaged. Coordination with relevant national ministries in the European **Member States** as well as with China's National Development and Reform Commission **(NDRC)** will be crucial to validate the partnerships outcomes. The governance of the regional innovation cooperation has to be both, **bottom-up** and **top-down**. Operationally, bottom-up **validation** and application must be carried out for effective buy-in. Regions' stakeholders must inform officially to national counterparts for the projects to be approved so that funds and authorisations can be released.

Communicate the process and the results

Strong **visibility and communication** is of crucial importance to keep partners engaged and to showcase the cooperation results. In order to engage the stakeholders and to reach a broader audience including civil society, the EU-China regional partnerships should include innovative solutions. The elaboration of short bilingual **videos** and **newsletters** as well as the participation in relevant international **events** on regional innovation should be envisaged.

In order to facilitate cooperation among the project partners, it is crucial to launch a bilingual, user-friendly **web platform** linked to the most used **social media** channels in Europe and China. This platform should feature regular online meetings through a web-based videoconferencing system that is used both in China and the EU. Also, regions should be showcased in international social-media portals for **business exchange**.

4 EU-China Regional Innovation Systems Compared

The following points are intended as references in order to indicate the main differences and similarities between the EU and China in various elements related to regional innovation, which in turn, suggest potential areas of collaboration.

4.1 Approaches to Innovation in the EU and China

Both Europe and China have given a major priority to the process of innovation. In Europe, the concern has been one of seeking to maintain competitiveness, and restructure the economy, against a decades-long process of restructuring of, and job losses in, key industries. In China, the concern has also been to restructure industry but the underlying aim is to move to a different stage in the process of economic development, moving up the value-chain and achieving a high-productivity, high-income economy. As discussed above, in both cases, the innovation process relies on a **mix of sectoral and territorially based policies and programmes**.

In Europe, a major sectoral effort in research and innovation is pursued by national governments and by the EU, currently through its Horizon 2020 programme. But the interesting feature in Europe has been the explosive growth of the territorially-based approach, known today as Smart Specialisation which as a starting point, focuses on specific strengths, competitive advantages and the performance potential of the region. Thus, each region should "identify transformation priorities that reflect and amplify existing local structures and competences, and thus produce original and unique competitive advantages" (Foray, 2015, p.2).

In China, national innovation strategies play a leading role in innovation policy, setting priority sectors, investing in innovation infrastructure and determining where this infrastructure is located. The territorial dimension enters mostly as a second order issue, in the sense that investments associated with the national

policy, for example, science and technology parks have to be located somewhere, and as such can bring advantages to particular areas. At the same time, the national strategies in China are complemented by local strategies at the province and city levels. Therefore, even if the design of the strategy could be considered as sectoral and top-down, it is complemented by regional innovation systems with local characteristics. These innovation strategies with local characteristics are not a new feature in China, and it can be said that there have always been local strategies. In addition to central governments' five-year plans and policies, the governments of provinces, municipalities, counties, districts, and towns, have made their own development plans based on their relevant local characteristics, although these tend to be more broad-ranging in scope than the EU's essentially economy-centred Smart Specialisation Strategies.

In this regard, as can be seen below in the analysis of the case studies, moving up the value chain and cultivating new sectors and revitalizing traditional industries are the major approaches of the regional innovation policies in China. In that sense the EU's experience in these two areas through the Smart Specialisation Strategies developed in several European regions is potentially valuable for provincial and local governments in China, and one in which they have shown great interest. Indeed, this conviction underpins the priorities established for the EU's new International Urban and Regional Cooperation programme beginning in 2021.

Regional inequalities

In the European Union, regional policy has the dual function of seeking to address the geographical inequalities across its territory, reflected principally in differences in GDP per head, while using the resources of the policy to deliver the priorities of the EU set by its institutions. **Regional innovation policy is central to the delivery of the dual objectives of cohesion and competitiveness**. When it comes to innovative capacity, there are many differences between 'leader' and 'follower regions', and a corresponding mismatch between the need for innovation in structurally weak regions and their low capacity to use innovation funds (Eastern and Southern Europe).

Although there are wide gaps across the European Union, in the case of China, they are substantially wider, especially between eastern and western provinces. Recently (May 2020), China announced a new "Go West Plan" for developing central and western provinces, obtaining a more balanced regional development through important investments in infrastructure (transport, energy, etc.).

The EU's experience with Smart Specialisation Strategies simultaneously attempting to promote a more innovative region, while reducing inequalities across its territory is known to be of great interest to China, particularly in the less developed provinces.

4.2 Territorial dimension

What is a "region" for innovation policy?

Regions in Europe are the administrative tier of governance directly below the nation-state level. They vary greatly across the member states in terms of their degree of autonomy, for example, in generating their own tax resources and de-

termining spending priorities. This means that there is corresponding variation in regions' degree of autonomy in the elaboration, implementation and allocation of resources to Smart Specialisation Strategies, which is inevitably much higher in decentralised states than in centralised states of Europe. The regional system in Europe for the purposes of policy and data collection is defined by the "NUTS" classification (Nomenclature des Unités Statistiques) which, starting from the sub-national administrative boundaries of the member states, seeks to create as high a degree of comparability between them with reference to population or surface area. It was not possible, however, to find a single definition of region given the sheer variety of administrative systems, and the solution adopted under the NUTS systems was to assimilate national administrative regional areas to one of three principle levels in a multi-level, hierarchical system. The medium-sized NUTS II level is the one used for EU regional policy, but it is important to note that in some member states a corresponding administrative unit simply does not exist, and so NUTS II regions have been constructed by combining smaller units, for the purpose of gathering statistics and for the purpose of implementing EU regional policy, and by implication, for Smart Specialisation Strategies.

The term "region" in China can refer to geographical areas which vary considerably in size, from a group of adjacent provinces to clusters of cities or counties. As such there are ad hoc characteristics, in the positive sense, in regional definition as in the EU. Since China is one country, the administration system is similar across the country and, for instance, the degree of autonomy of the different provinces is more homogenous than in Europe. The flexible nature of territorial prioritisation for development and innovation purpose can be seen in the fact that the central government has created 3 major urban clusters (Tianjin-Beijing-Hebei, Yangtze River Delta and Pearl River Delta), 10 innovative provinces, and more than fifty innovative city prefectures and innovative counties.

Despite these differences between European regions and Chinese provincial regions, they are comparable from the point of view of regional innovation strategies and policies. For instance, most of the reports about regional innovation in China also focus on Chinese provincial regions as the most significant actor, since they are medium in size and their statistics and policy materials are available. In Europe, there are many differences in terms of regional innovation strategies depending on the political and administrative system. For instance, there is more scope for regional innovation policy in federal political systems than in centralised political systems. The key role of the state in China does not imply that the management of innovation strategies is always in the hands of the Chinese central government, since provincial and municipal authorities have wide room to manoeuvre, which means that they can offer interesting opportunities for direct collaboration with European regions.

In Europe, **interregional cooperation** is one of the key elements of the Smart Specialisation strategy and the implementation of the strategies includes opportunities for peer review, supported by the Smart Specialisation Platform. Also, innovation is now a major priority for the EU's programmes to promote cross-border cooperation between member states. These activities promote the exchange of experience and best practice in innovation and help to raise quality.

In China, the City Cluster plan aims to develop 19 super-regions to drive regional economic development. Three of these clusters (Pearl River Delta, Yangze River Delta and Beijing-Tianjin-Hebei) have made significant progress in their integration, but as seen in the case study of Chengdu and Chongqing presented in Part II,

there are still significant challenges in creating efficient collaboration between cities that often have the same objective priorities, so the search for complementarity is not easy. There is scope for the potential cooperation between these interregional initiatives in the EU and China, respectively.

4.3 Multi-stakeholder Involvement and Participation

Role of the public authorities

In terms of leadership, there are clear differences between the pre-eminently bottom-up approach characteristic of Smart Specialisation in Europe and the national driven, sectoral approach in China. This should not be exaggerated, however, and **there are elements of the bottom-up and top-down in both areas**.

In Europe, the European Commission and its Directorate-General for Regional and Urban policy, under the EU's regional innovation policies and programmes, has provided much of the impulse for the diffusion of Smart Specialisation Strategies in EU regions. This leadership role encompasses obligations through the legislative framework, funding through the European Structural and Investment Funds and intellectual and practical support through the Smart Specialisation Platform. But, at the same time, there has been also a reinforcement of the territorial dimension. The regional level, therefore, has become more important for diffusion-oriented innovation support policies. Regions across Europe have adopted different kinds of participatory models and evidence-based practices to implement the regional innovation and identify potential domains of specialisation, partly explained by differences in the decentralisation of responsibilities on the spectrum from unitary to federal states. But, in general, Smart Specialisation has proven to be adaptable to wide differences in the multi-level governance systems.

In China, the central government plays a predominant role in the definition of regional innovation policies and strategies, but regions are increasingly relevant for innovation policy-making. For instance, there is a rising number of local and regional departments and institutions dealing with innovation. The central government plays a strong role in setting agendas and strategies through relevant departments and institutions, that include NDRC, MOST, MOC, MOE, etc., plus the Central Committee for Comprehensively Deepening the Reform. But all of these institutions have their counterparts at the provincial and city levels to implement the policies and strategies, and additionally more detailed and operational regional strategies are made by the regions themselves. The general trend is that regional strategies mirror these national strategic orientations, objectives, and priorities, but also include priorities based on the region's characteristics.

Universities and the research community

In the EU, universities, research centres, science parks, and incubators play a pivotal role in regional innovation. Science Parks and Incubator Centres are used to encourage entrepreneurial discovery and, notably in the case of Science Parks, to import and diffuse international best practices. These facilities are often pro-

vided through national policies and emphasize the need for effective multi-level governance. However, there are gaps between universities' basic R&D research on one hand and industry's commercial application on the other, especially in the less innovative regions. This is due to various factors, such as the different perception of the market, the differences between the objectives of companies and researchers, the use of models for technology transfer that are not suitable, etc.

In China, the central and local governments assign a crucial role to universities as key players in innovation. Universities and scholars have been given roles in advising policy-making. In terms of innovation activities, Chinese governments at different levels also promote the role of science parks and incubators in addition to universities and research institutes. In spite of improvements made during recent years, there remains room to improve the technology transfer mechanisms and the relationship between basic R&D research and industry's commercial applications.

Since in Europe and China there are challenges related to the transfer of technological developments from universities and R&D centres to industry, there is clear scope for more exchanges of experiences between Chinese and European regions on **the models used to facilitate technology transfer** (including on the role of non-profit intermediaries, technology transfer offices, incubators), in order to identify good practices that would allow a higher rate of technology transfer and research results to industry at the regional level.

Civil Society

In the EU, civil society organisations are often underrepresented in regional innovation strategies, at least in part because of capacity issues.

In China, the degree of participation by civil society in regional innovation strategies is also very low. This is another area where collaboration between China and the EU on the ways to integrate civil society into regional innovation plans could be of great interest to both parties.

4.4 Entrepreneurial Discovery Process

In Europe, **the Entrepreneurial Discovery Process' importance is widely recognize**d as one of the critical elements for the development of a successful Smart Specialisation strategy. As discussed above, the Entrepreneurial Discovery Process is the procedure in which entrepreneurial actors and other stakeholders in a region explore and discover new innovative activities. At the same time, policy-makers assess outcomes and ways to facilitate the realization of this potential.

In China, the central and regional governments use different channels to consult different stakeholders, including entrepreneurs and experts (expert committees for constant consultancy, consultation meetings on specific issues, field visits by government officials, commissioned research, etc.). More recently, new approaches adopted in many parts of the country have sought to strengthen the role of enterprises in innovation activities. This new policy direction involves greater priority for the opinions of entrepreneurs in agenda-setting and regulation-making, including SMEs and staff at various levels.

The results and experiences obtained by different regions in Europe through the Entrepreneurial Discovery Process is of great potential use for the Chinese provinces that are seeking to incorporate a higher weight of industry and entrepreneurs in the formulation of their regional innovation policy.

4.5 Flexibility and Adjustment

In Europe, monitoring and evaluation systems are an integral part of the Smart Specialisation Strategies, as they allow relevant information to be obtained on the degree of compliance with established objectives, the adequacy of economic resources in the most relevant sectors, and the changes that have taken place in the local economy. The evaluations are usually external and internal.

There is a growing trend for Chinese governments to outsource evaluation (both fiscal and performance) of innovation funding projects to third-parties, such as accounting firms in the case of fiscal matters, or, universities and research institutes with regard to performance aspects. This is undoubtedly one of the great outstanding challenges for regional innovation strategies, and therefore the exchange of experiences and good practices in terms of **monitoring and evaluation could be one of the key elements of regional cooperation**.

While approaches to innovation differ in many respects in the EU and China (see Table 1), their differing experiences in relation to promoting innovation at the regional level provide a fruitful terrain for cooperation.

4.6 Challenges and Outlook

As discussed above, the EU and China are facing a number of challenges, and opportunities which will require imaginative and innovative solutions. Indeed, what is needed is probably nothing less than a new economic model, which should be greener, more sustainable and address resolutely the issues of climate change, while taking on board the lessons learned in the management of the COVID-19 global pandemic in 2020.

In the EU, **the** "**Green Deal**" is the new strategy to promote recovery and transition following the COVID-19 induced crisis. The EU intends to reinforce the green dimension of Smart Specialisation, which will be further enhanced in line with the European priority of adapting sustainable development to digital transformation. In China, local governments already integrate environmental protection objectives into local economic and social development plans and report on implementation in the evaluations by local government officials. The recent history of cooperation between the EU and China at the regional level shows that high priority is already being given to issues such as renewable energy, clean technologies, sustainable transport, energy efficiency and transition.

There is a global framework for cooperation in these areas, since the EU and China are signatories to the **Sustainable Development Goals (SDGs)** and the New Urban Agenda of the United Nations. The OECD estimates that no less than 105 of the 169 SDG targets will not be reached without proper engagement of sub-national governments. Therefore, a territorial approach to the Sustainable Development Goals is needed both in Europe and China.

China also released its national plan for implementing SDGs with an action plan for each goal. Pilot projects have been carried out in China to monitor the implementation of the SDGs at the local level. In the EU, Smart Specialisation has already presented opportunities for achieving the SDGs, and the links between Smart Specialisation and the SDGs are being increasingly acknowledged at international level. The implementation of the SDGs is an interesting field for EU-China cooperation, for example, in aspects such as the selection of indicators, resource mobilisation, impact and monitoring.

The COVID-19 pandemic has led to a number of changes and for widespread recognition of the urgency to generate new models of development that are more sustainable and inclusive. In Europe, the pandemic will spur efforts to promote a greener economic model, for example, accelerating energy and digital transition and changing in mobility systems. In China, the 14th 5-year plan will probably focus on technological independence and will pay particular attention to aspects such as sustainable development, energy transition or innovation in the health sector.

In addressing the challenges, regions and cities in EU and non-EU countries have new opportunities not only for cooperation to enhance policy development and promote innovative solutions on each side, but also to promote trade, business development, new market opportunities, innovative projects, international value chains and thematic clusters. The pandemic itself has already provided an important occasion for cooperation on innovations in areas such as health.

TABLE 1: EU-CHINA REGIONAL INNOVATION SYSTEMS: COMPARATIVE TABLE

	SMART SPECIALISATION IN THE EU	REGIONAL INNOVATION POLICY IN CHINA
THE TERRITORIAL DIMENSION	There are now more than 120 Smart Specialisation Strategies at the regional level in the EU. The approach is resolutely placed-based and place-sensitive based on the principle of an independent, bottom-up regional innovation policy strategy. The degree to which this principle is converted into practice depends, however, on how multi-level governance systems function in the different member states, and the degree of political and financial autonomy available to the regions.	There is a leading role for national innovation strategies, complemented by other local strategies at the province and city administration levels, exploiting "local characteristics". The term region in China can refer to geographical areas varying considerably in size, from the creation of "macro-regions" in the form of a group of adjacent provinces to a cluster of cities or counties. In terms of regional innovation, there are 3 key macro-regions (Yangtze River Delta, Beijing-Tianjin-Hebei, and Pearl River Delta), 10 innovative provinces, and over 50 innovative city prefectures and innovative counties.
PRIORITISATION	Smart specialization strategies focus on endogenous potential and are founded on existing assets and endowments regarding sectors and concentration and agglomeration economies. New domains with potential are identified from these assets with a view to generating promising, new activities. Such priorities tend to arise not at the level of the sector, but in subsectors and in process innovation.	Central government plays a major role in identifying both industries of the future and those that are outmoded, and this in turn governs the system of public support. The city administrations review their own industrial structures in the light of national priorities and draw up their own priorities for investment according to perceived strengths and weaknesses.
ENTREPRENEURIAL DISCOVERY PROCESS	The Entrepreneurial Discovery Process (EDP) in the EU is key to the success of Smart Specialisation Strategies by helping to overcome the information deficits experienced by the key actors. It involves knowledge-sharing among entrepreneurs and the research community as a means to generate new opportunities for product and process innovation. Challenges are often present in weaker EU regions, where there may be fewer enterprises and a less developed research community, requiring greater support at national and supra-national level.	The central government has attached particular importance to increasing the role of enterprises in the innovation process. A recent development has been to develop direct relationships between individual officials and specific enterprises. The enterprises are increasingly consulted on policy.
STAKE-HOLDERS: The authorities	Regions across Europe have adopted different kinds of participatory models practices to implement regional innovation strategies. The degree of autonomy depends on the extent of financial and policy autonomy accorded to the region in the national constitution. The articulation of the national and regional levels is therefore very different. The, the supra-national level, the EU, has provided much of the impulse for the diffusion of these regional innovation strategies in EU regions.	The central government plays a strong role in setting the innovation agenda, and this is transmitted to the sub-national level, to macro-regions and city administrations. This includes designating sub-national areas into specific functional categories in order to generate critical mass and specialisation. Thus areas are designated, for example, as "Demonstration Zones" or "High-Tech Zones". The city administrations are responsible for more detailed strategies.
STAKE-HOLDERS: Universities and research centres	Universities and research centres are regarded as key actors in a Smart Specialisation Strategy. Regional differences in the strength and density of the research community are considerable, with a direct bearing on the quality of inputs to, notably, the EDP. History has also created a legacy of sub-optimal knowledge and technology transfer between universities and industry, especially in less innovative regions. Science Parks and Incubator Centres are used to encourage entrepreneurial discovery, by diffusing international best practice.	The central government assigns a crucial role to universities as a key player in innovation and has developed extensive national policies and programmes to foster university-industry technology transfer. There are major differences in the success of these policies and programmes, where deficits in human capital and talent have been identified as an explanatory factor.
STAKE-HOLDERS: Civil society	EU Smart Strategies are evolving, albeit slowly, towards a more inclusive approach. Citizens, as the main beneficiaries and users of innovations, are increasingly present as a way of building consensus in regions where relatively far-reaching change is occurring. This means that strategies are increasingly moving from a "triple-helix" model (based on interaction between research and innovation stakeholders, the public administrations and companies) to a "quadruple-helix" to encourage the participation of citizens, using ICT as a way of outreaching to citizens.	The degree of participation by civil society in regional innovation strategies is characterised as very low, although social media is providing new opportunities for citizen involvement. Both China and the EU need to consider new ways to integrate civil society into regional innovation plans.

	SMART SPECIALISATION IN THE EU	REGIONAL INNOVATION POLICY IN CHINA
GREEN DIMENSION	The "Green Deal" is at the centre of EU policies for the coming period, with a view to promoting transition to a more sustainable model of development and to create the basis for recovery following the global COVID-19 crisis. Smart Specialisation Strategies will remain an EU priority in regional policy with increasing emphasis on green innovation, energy transition and digital transformation.	Regional and local governments in China increasingly integrate environmental protection objectives into local economic and social development plans and report on implementation in the evaluation of local government officials.
INCORPORATION OF SDGs	Smart Specialisation is seen as an opportunity for achieving the SDGs. The links between Smart Specialisation and the SDGs are being increasingly acknowledged at international level.	China has a national plan for implementing SDGs with a specific action plan for each SDG.
PUBLIC FINANCIAL SUPPORT	European Structural and Investment Funds (ESIF) are strongly geared to promoting regional innovation strategies. The EU effectively uses the ESIF, notably the European Regional Development Fund, as an "innovation booster". Conditioning the availability of EU funding to the existence of a Smart Specialisation Strategy has been a major driver for the widespread adoption of this approach.	Innovation actors at the provincial level compete for funds from the main national programmes. These funds have been streamlined to promote focus, with a new emphasis on professional management to increase efficiency. There are also funding programmes at the provincial and local levels, Within the provinces, city administrations have different priorities depending on their strengths.
MONITORING AND EVALUATION SYSTEM	In Europe, monitoring and evaluation systems are an integral part of the Smart Specialisation Strategies, although at this relatively early stage in the process, evaluation results are limited.	There is a growing emphasis on evaluation of innovation programmes, covering financial and performance aspects. There is a tendency to outsource this activity to suitably qualified third parties, such as accounting firms or universities, institutes, and research centres.
INTERREGIONAL COOPERATION	Innovation is now a major priority under the cross-border cooperation development programmes supported by EU regional policy. Inter-regional cooperation, in the form of peer review, is also one of the key elements of Smart Specialisation Strategy implementation.	Three key innovation regions and city cluster plan (19 city clusters) are examples of interregional cooperation, but rivalries between independent authorities and other factors mean that there remain significant challenges in creating efficient collaboration.
INTERNATIONAL COOPERATION	Smart Specialisation has attracted attention on the part of international partner countries, policy makers and representatives from academia. The IUC programme, 2016-20, included cooperation with Latin American countries on regional innovation systems and this will be extended to include China and Japan in the new IURC programme.	China supports international cooperation in this field, as reflected in the conclusions of the High-Level Dialogues n Regional Policy that have been conducted with the European Commission since 2006. Province and city administrations have been heavily engaged with EU counterparts and this creates the conditions for the success of decentralised cooperation under IURC.
CHALLENGES AHEAD	For the EU side there are new challenges bearing on cooperation: (a) the successful delivery of the new IURC programme, notably supporting the regions in trade development, business promotion, opening up of market opportunities, showcasing European innovation, developing international value chains and thematic clusters; (b) adaptation of innovation strategies to the post COVID-19 recovery and transition;(c) further greening of the innovation model.	China shares many of the challenges facing Europe and its regions. The 14th Five Year Plan provides the next major political framework which will probably seek to boost science and technology and their industrial application, perhaps with more autonomy and self-reliance.

References

Foray, D. (2015). *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Abingdon: Routledge/ Regional Studies Association.

II Case Studies

Europe case study

5. Basque Country

5.1 Introduction*

The Basque Country is a relatively small region located in the north of Spain, with a population of 2.2 million inhabitants and a GDP per capita of 33,200 euros. It has a relatively high degree of devolved competences and autonomy in most areas, including in innovation. Industry accounts for 24% of GDP which makes the region one of the two most industrialised regions in Spain alongside Catalonia. As such, its economic structure provides a solid base for implementing a strategy based on innovation.

Although since the 1990s an industrial policy has been applied that was specifically aimed at enhancing industrial competitiveness, it was not until the beginning of the 20th century that the first innovation strategies were developed, culminating in the implementation of the regional Science, Technology and Innovation Plan (PCTI) in 2004. A second edition of the PCTI was approved in 2005 (PCTI 2006-2010) which emphasized a greater orientation of science and technology policy towards obtaining results. A third edition of the PCTI was launched in 2015 (Basque Government, 2015), incorporating new features to ensure the implementation of the European Union's innovation strategies for Smart Specialisation (RIS3). In 2020, a new generation of the PCTI is entering into force (Basque Government, 2019). In the Basque region, the PCTI has a transversal or cross-cutting role in the sense that it conditions all other government plans, which means that innovation can be said to be at the core of the Basque region's future socio-economic development at all levels.

Within the EU's Regional Innovation Scoreboard, the Basque Country scores as "Moderate +", which means that it has an above average position compared to other EU regions (See Table 2). Within Spain, it is considered as one of the most innovative regions, as well as standing out for the increase in innovation activity over the last few years.

Due to its industrial fabric based on sectors such as machinery, energy, the automobile industry and aeronautics, it has a high concentration of its population

* Casa Asia (2020). Interviews with members of the Basque Government. We are pleased to acknowledge their contribution.

working in medium to high added value technology sectors. The ratio of scientific publications is somewhat higher than the European average with universities accounting for almost 60% of scientific output, the remainder coming from technology centres. The Scoreboard identifies an area of weakness concerning a relatively low level of activity in the field of patents.

Table 2: REGIONAL INNOVATION SCOREBOARD FOR THE BASQUE COUNTRY

INDICATOR	Score	Relative to the EU(=100)
Tertiary education	55	159
Scientific publications	1.089	103
R&D Expenditures public sector	0.47	80
R&D Expenditures private sector	1.42	104
PCI Patent applications	2.56	58
Employment Medium-Hi Tech/KIS	18	122

Source: Regional Innovation Scoreboard (2019)

5.2 Stakeholders

The innovation strategy is driven by the Basque government which is the main promoter and coordinator of the PCTI programme. The Basque government is advised by the Basque Council for Science, Technology and Innovation which is composed of a wide range of actors in the public and private sectors, including the President of the Basque Government, representatives from government departments, the Basque Provinces of Alava, Guipúzcoa and Vizcaya, representatives from universities, the Tecnalia and IK4 technology corporations, four companies representing the private sector, the Basque Foundation for Science (Ikerbasque), the Basque Agency for Innovation (Innobasque) and the Basque Academy of Sciences, Arts and Letters (Jakiunde).

The innovation strategy also draws specifically on the main actors in science and technology in the Basque Science and Technology Network. This includes representatives of universities, research centres, technology centres, science and technology dissemination agents, business R&D units and supply-demand match-making agents. The innovation strategy is also influenced by private companies more generally, representatives of the clusters, and representatives of social organisations.

While the leadership of the regional innovation strategy is in the hands of the Basque government, its implementation is a participatory process, so that part of the effort is devolved to other key actors. A series of priority sectors and territories of opportunity have been established, and a dedicated steering group is placed in charge of implementing the strategy agreed for each case. In the steering groups, the government departments involved in the area in question are represented, as well as members of the Basque Science and Technology Network, , as well as any companies or individuals who are considered able to enrich the knowledge base.

While inclusiveness and consensus are key to the implementation system, it has been observed that the mix of participants from the various sectors in the different steering groups has been somewhat unbalanced. Thus, in the case of sectors with an important industrial character, the leadership of the steering groups has tended

to be dominated by business associations or private sector clusters. In the case of sectors with less entrepreneurial capacity, the leadership tended to fall to government and other public institutions.

5.3 The Regional Innovation Strategy

The regional innovation strategy has focused on three main sectors: advanced manufacturing; energy; health and biosciences.

Regarding advanced manufacturing, the strategy focuses on research and development in support of the automotive, aeronautical, railway, naval, capital goods, machine tools, and metal sectors. Indeed, advanced manufacturing is the Basque government's main priority in innovation, and the main strategic lines of action are established in the Basque Plan for promoting the new technologies under the heading of "Industry 4.0". Business clusters have so far assumed the leadership of the group, but there are observable trends towards a more horizontal strategy with the participation of other actors.

Regarding the energy sector, this is already one of the region's established strengths, especially in the field of alternative energies such as wind power, solar thermal power, as well as in other areas such as energy storage or intelligent networks. The development of the sector has always been based on partnership, which has continued under the innovative strategy to involve government, the business sector and other actors.

Regarding health and biosciences, this is an area in which the Basque Country does not have a significant tradition, but the government has considered it as a promising new area in a forward-looking perspective. The leadership in developing the sector was assumed by several departments of the Basque government together with public body, "Bioef", the Basque foundation for health, innovation and research. The participation of the health research institutes, cooperative research centres, technology centres and industry representatives (Basque Health Cluster) is also essential.

Prioritisation is considered in a dynamic framework, and together with the above sectors, other areas of opportunity have been identified for the future including food; urban habitat; environment ecosystems; creative and cultural industries.

5.4 Implementation

The Basque government leads in relation to implementation, allocating the budget by organising public calls for tender (R&D&i support programmes in the form of grants). The budget allocation is approximately 200 million euros per year. Consistent with the ideas of entrepreneurial discovery, cooperation between companies is seen as essential, and the rules require that three or more companies must cooperate in each project. The publication of calls for tender are transparent and in an open competition.

A key component of the implementation system is evaluation. On average, some 2000 projects are submitted and evaluated annually. This requires a well-equipped, digitalised public management system and a competent team of evalua-

tors. All programmes follow a series of stages in their evaluation process, from the first evaluation to the adjustment and review phase and finally the project closure phase.

Once the administrative phase has been completed, a "merit-based" evaluation phase begins focusing on quality, including aspects such as the scientific and technical relevance of the project, the previous experience of the candidates and the economic impact of the project in the region.

A second key moment of the process in the Basque Country, consistent with the need for flexible implementation, is the adjustment phase. The idea is to review previous phases to verify that the established criteria for support were met, and to have the opportunity to impose changes in an effort to ensure the adequacy of the project in the light of the strategic objectives. The experience gained in this phase provides information that can help to improve, and better target, subsequent public calls for project support.

5.5 International cooperation

International cooperation is maintained notably through the participation in European projects by entities belonging to the Basque Science and Technology Network, such as Tecnalia (an applied research and technological development centre), UPV/EHU (the University of the Basque Country) or Vicomtech (a technological centre specialising in Artificial Intelligence). The Basque region also participates in European strategic initiatives such as EIT manufacturing, EIT Food, Vanguard and S3 platform, as well as in some EU cross-border development projects, notably the INTERREG programme which promotes exchanges of experience, the transfer of good practices and the development of joint initiatives among the different regions in the EU. INTERREG has increasing sought to promote innovation.

The Basque Government also has a network of strategic partners formed by regions with similar interests with which they have signed multi-sectoral agreements, to promote innovation in different areas.

5.6 Concluding Remarks

As far as the application of the principles of regional innovation strategies, or smart specialisation, the Basque Country has identified challenges emerging from PCTI (2015) which have been addressed in different ways (Aranguren et altri, 2019). The challenges concern the difficulty in achieving a genuine multi-stakeholder approach in order to involve SMEs, participation, technology parks and universities, and the citizens.

Regarding SME participation, one of the main challenges has been to try to boost innovation as widely as possible across the 1,600 SMEs in the Basque region. For this purpose, a network of "intermediary agents" was created made up of some 100 actors, which, in collaboration with the regional and local development agencies and the professional training centres, seeks to outreach to SMEs

and bring them into the strategy. Thus, the Innobasque innovation agency and the regional and local development agencies were able, during 2017-18, to facilitate contacts between 1,600 companies, on the one hand, and vocational training centres on the other, for the implementation of some 400 innovation projects.

Regarding the participation of technology parks and universities, securing their involvement in the innovation ecosystem was a particular priority. However, a significant challenge was to align universities with the priorities of the PCTI and to promote cooperation between industry and universities. Thus, the creation of the 4GUNE network as an instrument of cooperation between university and business, targeting challenges presented by developing Industry 4.0, made a substantial contribution to the incorporation of the regional innovation strategy into university plans.

Regarding citizen participation, as in many other European regions, the limited participation of civil society in the innovation ecosystem is an ongoing challenge. Although different programmes have been set up to develop new talent and raise awareness among the public of the importance of innovation, it is felt that there is still a long way to go in this area.

One of the main new elements introduced by the Basque region through the PCTI is the incorporation of social challenges aligned with the Sustainable Development Goals, notably, those concerning climate change, health, gender equality, decent work and reduced inequalities. The new generation PCTI 2020 will emphasise cross-cutting principles such as internationalisation, new business and entrepreneurship models as themes that unite different areas of the ecosystem.

The current Covid-19 pandemic has meant the acceleration of three global transitions that pose a challenge for the future of the Basque region: digitalisation, energy and climate change and inclusion, the former including challenges related to health, migration, gender equality and healthy ageing as well. These transitions will undoubtedly transform the future of countries, companies, society and people. These transitions are contemplated in the new PCTI as they mean a great opportunity for growth and job creation that the Basque region should take advantage of.

The Basque Country, looking forward also wishes to deepen and widen the innovation effort, effectively, using innovation as the driving force of the economy. This will require budgetary commitments, with public resources for innovation increasing by 6% every year until 2030. It is intended that this will be accompanied by a change approach to encourage new instruments and financing mechanisms that include public-private formulas.

The Basque Country also intends to develop interregional and international cooperation to become a more influential actor in networks across the European Union and on a global scale.

References

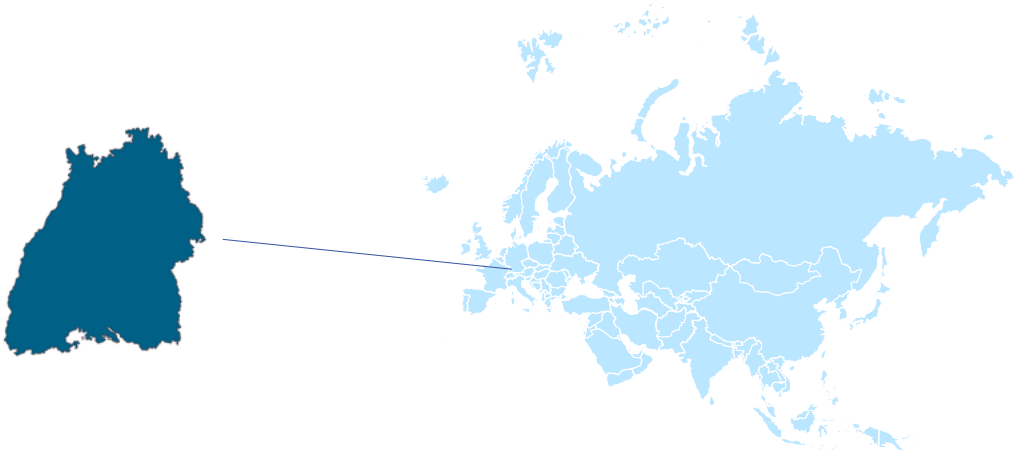
Aranguren, M. J., Magro, E., Morgan, K., Navarro, M., and Wilson, J. (2019). Playing the long game: Experimenting Smart Specialisation in the Basque Country 2016-2019. *Cuadernos Orkestra*, Orkestra - Basque Institute of Competitiveness.

Basque Government (2015). *PCTI EUSKADI 2020. A Smart Specialisation Strategy.* Basque Country.

Basque Government (2019). *PCTI EUSKADI 2030. Líneas Estratégicas y Economías Básicas*. Basque Country.

Europe case study

6. Baden-Württemberg



6.1 Introduction

Baden-Württemberg has a population of some 11 million inhabitants, making it the largest reference EU Case Study for the purpose of this report. As a major exporting region and with a large research and development sector, the annual GDP per capita of the region is commensurately high at 47,290 euros (2019).

Interestingly, it used to be one of the poorest regions in Germany and a source of migrant labour for the rest of the country and beyond. Public policy is accredited with helping to secure an important economic transformation, including a technology programme put in place already in 1976 (Schütte 1985). This early development in technology-based transformation resided on four pillars: supporting the public research infrastructure, technology transfer, technological aid schemes focused on individual firms and technology centres and business start-up support.

The regional economy has four key industries: automotive; mechanical engineering; electrical engineering; ICT. Baden-Württemberg hosts some major global players in these industries, such as Daimler and Porsche in automotive, Bosch in electrical engineering, Trumpf in mechanical engineering and SAP in software. In addition to these global players, Baden-Württemberg has, at the same time, a high density of SMEs in these industries and traditionally strong inter-firm networks and clusters.

According to the Regional Innovation Scoreboard 2019, Baden-Württemberg is an "Innovation Leader". Three of the four regions that make up Baden-Württemberg rank among the top-25 Regional Innovation Leaders: Karlsruhe; Tübingen and Stuttgart (see Table 3). Regarding patent applications, for example, Baden-Württemberg is well ahead of the European average, due to a high degree of input from the above-mentioned global players.

Table 3: REGIONAL INNOVATION SCOREBOARD FOR BADEN-WÜRTTEMBERG

INDICATOR	Score	Relative to the EU(=100)
Tertiary education	37.7	94
Scientific publications	1,551.5	123
R&D Expenditures public sector	0.98	122
R&D Expenditures private sector	3,245	161
PCI Patent applications	9.08	178
Employment Medium-Hi Tech/KIS	23.05	163

Source: Regional Innovation Scoreboard (2019)

However, although it currently still has a strong innovation position, Baden-Württemberg does not score well concerning innovation dynamics, which indicates that other regions in Europe are catching up (WM BW 2020). Moreover, SMEs have a small share and therefore are the key focus of current innovation policies (WM BW 2020).

6.2 Stakeholders

The most important Baden-Württemberg ministries conducting technology policy in Baden-Württemberg are, on the one hand, the Ministry of Economics, Labour and Housing, and on the other hand the Ministry of Science, Research and the Arts, and to a lesser extent three other ministries, dealing with, among others, rural development, environmental and energy issues and digitalisation (WM BW 2020). To emphasize the importance of technology transfer in state policy, it appointed a so-called "technology commissioner" for the state of Baden-Württemberg (a post typically occupied by a highly regarded individual, often a professor in technology, who advises the government on issues around technology transfer and supporting innovation in SMEs).

Due to its federal political system, many government tasks in Germany are performed by the regional states (Länder). Higher education and technology policy are areas in which these states have their own responsibilities. Over the years, innovation policy in Baden-Württemberg has increased the number of actors and agencies considerably (Stahlecker & Zenker 2017), and it therefore can be seen as one of the regions in Europe with the highest institutional 'thickness' concerning innovation policy. Concerning technology transfer, it has a dense network of innovation-oriented intermediaries, such as innovation consultants at the Chambers of Commerce, as well as technology transfer centres at polytechnics, universities, and the dense network of transfer centres of the Steinbeis Foundation. The latter was founded in 1971, as one of the core institutions for technology transfer. In general, the dialogue- and consensus-oriented innovation policy puts a high value on participatory structures of stakeholders, but also citizens.

There are several commissions, intermediary organisations and dialogue-platforms in the individual future areas, such as Alliance Industry 4.0, who are in constant dialogue with the state government and relevant ministries to develop and adjust policies. Moreover, in order to provide a creative room for discussion and debate about innovation policy beyond the individual priority areas and ministries, the state is planning to set up a so-called Innovation laboratory (InnoLab_bw) (WM BW 2020).

6.3 The Regional Innovation strategy

Baden-Württemberg is generally accredited with having a well-functioning regional innovation system (Cooke & Morgan 1998; Stahlecker & Zenker 2017; Hassink & Berg 2014). Due to its size, economic weight and historical legacy, innovation policy in the region is a much broader effort than that of regional innovation strategies.

The region's current innovation policy is based on a recently published innovation strategy paper (WM BW 2020). This identifies five priority areas, for which the Smart Specialisation strategy is expected to act in support: digitalisation; artificial intelligence and industry 4.0; sustainable mobility; health economy; resource efficiency and energy transition; sustainable bio economy. In order to make the five priority areas nationally and internationally more visible, the region of Baden-Württemberg recently developed a new programme of innovation campuses which will be rolled out over five sectors. The first one, Cyber Valley, was recently established in Tübingen, focusing on artificial intelligence. The campus aims to be an attractive place for AI-related start-ups, for developing disruptive innovation and for attracting young, talented scholars and entrepreneurs in this area. The innovation strategy is intended to function as a living strategy, which means that it should involve a stable, ongoing dialogue with key stakeholders and able to be accordingly updated and adjusted (WM BW 2020).

The public budget for innovation policy in Baden-Württemberg was about 5 billion euros in 2019, the second highest in Germany in absolute terms. As a percentage of overall R&D expenditures in Baden-Württemberg, however, it is relatively low, which reflects the enormous importance of private R&D expenditures. Innovation is a key area of Baden-Württemberg's overall state policy, as is emphasised in the political Coalition Agreement (Landesregierung Baden-Württemberg 2016).

Given the traditionally dense networks in the key industries between global players and local SMEs, cluster policy has been figuring prominently in Baden-Württemberg during the last twenty years. Since 2015, a cluster agency oversees the coordination of cluster initiatives and policies in Baden-Württemberg. Since innovation deficits have been identified among SMEs, several specific measures have been developed to boost their innovativeness, such as innovation vouchers, digitalisation bonus, innovation awards, and start-up support. Moreover, recent SME policies have been put in place aiming at supporting SMEs in rural areas, as well as supporting creative laboratories and makerspaces. All state support measures for SMEs have been developed in addition to SME support measures from the federal (national) government and the European Commission.

In addition to the global innovation strategy for the region, Baden-Württemberg has embraced the EU's efforts to promote Smart Specialisation. In Baden-Württemberg, tailor-made Smart Specialisation Strategies for functional, rather than administrative, areas of the region have been drawn up with funding being secured as a result of competition between areas. The Baden-Württemberg government invested 30% of its ERDF allocation from the EU in this competition, under the heading of "RegioWIN" and "RegioWIN 2030" (WM BW 2020).

6.4 Implementation

Monitoring and evaluation of innovation policy takes place regularly, supported by the State Statistical Office, as well as several highly reputable economic research institutes based in Baden-Württemberg. The latter carry out studies for the state government, not only to advise on future innovation policies, but also to evaluate and monitor specific measures and programmes (for some reference to recent reports, see WM BW 2020). Finally, the state government puts strong emphasis on dialogue and consensus to develop and adjust its policies.

6.5 International cooperation

Baden-Württemberg has a long tradition of collaborating with other regions in Europe concerning regional technology and innovation policies. It is arguably one of the earliest and most active regions, setting up partnerships with other European regions. It was, for instance, part of the "four motors of Europe" initiative in the 1980s, together with Lombardy (Italy), Rhône-Alpes (France) and Catalonia (Spain). In September 1988, the memorandum was signed in Stuttgart (Borras 1993, p.166, 167), and the partnership is active until today.

Moreover, is has been very active in building partnerships with Chinese provinces, in partnerships that go beyond the innovation scope. It has partnerships with Liaoning since 1982 and with Jiangsu since 1986, and is one of the few states in Germany with two Chinese partner regions. Finally, Baden-Württemberg participates in nine partnerships on "industrial modernization", and is hence one of the most active regions when it comes to regional partnerships in the Smart Specialisation platform.[1]

6.6 Concluding remarks

Overall, Baden-Württemberg is one of the most innovative regions in Germany and Europe and also one of the archetypes of regional innovation systems and policies in Europe. Due to both the federal political system in Germany, as well as high tax revenues from its powerful global players, it has much room to manoeuvre, and the resources, to support policy and intermediary organisations. Over the years, innovation policy has become more differentiated with an increasing number of institutions and intermediary organizations. The dialogue- and consensus-oriented innovation policy puts a high value on participatory structures of stakeholders, but also citizens.

Given the maturing of some of its industries and the overall innovation system, as well as its weakening innovation dynamics, the future challenge will be to adjust policies and the innovation system fast enough to international technology trends.

---

[1] See: https://s3platform. jrc.ec.europa.eu/thematic-platforms-map)

References

Borras, S. (1993). The 'Four Motors for Europe' and its promotion of R&D linkages: beyond geographical contiguity in interregional agreements. *Regional & Federal Studies, 3, 163-176.*

Cooke, P. & Morgan, K. (1998). *The Associational Economy; Firms, Regions, and Innovation*. Oxford: Oxford University Press.

Hassink, R. & S-H. Berg (2014). Regional innovation support systems and technopoles. In: D.S. Oh and F.Y. Phillips (eds.) *Technopolis: Best Practices for Science & Technology Cities*. London: Springer, 43-65.

Landesregierung Baden-Württemberg (2016). Koalitionsvertrag: Baden-Württemberg gestalten: Verlässlich. Nachhaltig. Innovativ. Stuttgart: Bündnis 90 Die Grünen, CDU.

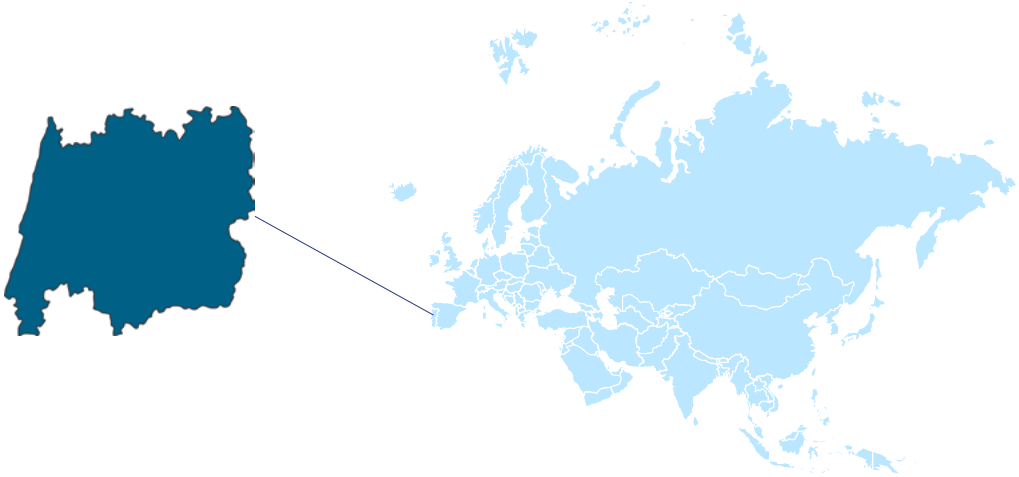
Schütte, G. (1985). Regionale Technologieforderung in der Bundesrepublik Deutschland. *Zeitschrift für Wirtschaftsgeographie,* 29(1), 145-165.

Stahlecker, T., & Zenker, A. (2017). Das baden-württembergische Innovationssystem im Wandel. *Standort,* 41(3), 180-185.

WM BW (2020). Innovationsstrategie Baden-Württemberg (Fortschreibung 2020). Stuttgart: Ministerium für Wirtschaft, Arbeit und Wohnungsbau.

Europe case study

7. Centro Portugal



7.1 Introduction*

Portugal is divided into five administrative regions (Centro, Norte, Alentejo, Lisbon and Algarve) and two autonomous island regions detached from continental Portugal (Azores and Madeira).

Centro is located between the two main metropolitan areas of the country (Lisbon, the capital, and Porto), having a territory of 28,000 km^2 with a population of 2.2 million inhabitants and a per capita income of 17,196 euros, slightly below the national average. The main city in the region is Coimbra.

Regarding the business structure of Centro, the central role of SMEs should be highlighted, as they account for 99% of the total number of companies and 89 % of all company employment. Centro is one of the more industrialised regions in Portugal, with the secondary sector accounting for 29.6% of the regional Gross Added Value. Within the secondary sector, the following figure among the most important activities: traditional industries such as ceramics, glass and cement and metallurgy; exploitation and transformation of natural resources such as water, forestry and wind resources; telecommunications and ITC; health-related services.

Centro also has an established university sector (the University of Coimbra is one of the oldest in the world) as well as research labs, incubators and other technological infrastructures distributed throughout the territory.

---

* Casa Asia (2020). Interview with members of the Comissão de Coordenação e Desenvolvimento Regional do Centro (CCDCR). We are pleased to acknowledge their contribution.

Table 4: REGIONAL INNOVATION SCOREBOARD FOR CENTRO

INDICATOR	Score	Relative to the EU(=100)
Tertiary education	36.3	86
Scientific publications	1053	101
R&D Expenditures public sector	0.60	92
R&D Expenditures private sector	0.66	68
PCI Patent applications	1.76	35
Employment Medium-Hi Tech/KIS	8.7	46

Source: Regional Innovation Scoreboard (2019)

In the 2019 Regional Innovation Scoreboard (see Table 4), Centro was classified as a "strong innovator", standing out in aspects such as non-R&D innovation expenditures; SMEs innovating in-house; SMEs introducing product/process innovations; and marketing/organisational innovations. As an administrative region in a centralised country, however, Centro does not have an elected political authority in charge of regional finances and actions in the way that exists in regions such as the Basque region or Baden-Württemberg which belong to decentralised countries. This leads to less autonomy in carrying out the implementation of their Smart Specialisation Strategy.

7.2 Stakeholders

Apart from the autonomous island regions of Azores and Madeira, Portugal does not have political regions, only administrative ones. Organisations and bodies of central government are responsible for the administration of regional development policy in the five mainland regions. This means that, in the absence of decentralised, regionalised structures, regions such as Centro do not possess an independent regional budget, which reduces the level of flexibility and the range of initiatives that may be promoted, implemented and funded at the regional level. Regional development policy is implemented through the "Regional Operational Programme of Centro" (or "Centro 2020") which is managed at the regional level, and supported by the EU under the European Structural and Investment Funds (ESIF).

The National Development and Cohesion Agency (AD&C) is the entity in charge of coordinating the "Partnership Agreement" through which EU support to Portugal and its regions under the ESIF is delivered, and has responsibility for the monitoring and evaluation of all the Portuguese programmes funded in this way. Within the management of the Partnership Agreement, there are two national networks namely the Science Network and the Incentives Scheme Networks. These oversee the coordination of the calls for projects launched within Thematic Objecives 1 (Strengthening reseach, technological development and innovation) and 3 (Enhancing the competitiveness of Small and medium-sized enterprises) and, thus, guarantee the establishment of a coordinated system for the whole country.

At the regional level, Smart Specialisation Strategy development is the responsibility of the Centro Regional Coordination and Development Commission (CCDR-CY)

an agency of the Portuguese central government. The strategy is subsequently approved by the regional innovation governance bodies. Similar commissions exist for the other mainland regions of Portugal.

The RIS3 governance model in Centro is made up of eight different entities. On the one hand, there is an enlarged regional council, a coordinating council, a strategic advisory group, and a management team. On the other hand, there are four thematic working groups, one for each of the four "Innovation Hubs" established in Centro's Smart Specialisation Strategy. The involvement of non-government stakeholders is bound up with the priorities of the regional innovation strategy, of which more in the next section.

The results of a 2020 revision of the regional innovation strategy in Centro are currently awaited, which is expected to lead to improved coordination and to incorporate the new challenges arising from the current situation into the strategy. The review process is subject to multiple stakeholder consultations.

7.3 The Regional Innovation Strategy

The Smart Specialisation Strategy for Centro has three main elements: thematic domains; cross-cutting priorities; specific objectives. The thematic domains are based on areas in which Centro has competitive advantages or in which there is significant capacity for future development. They include forestry, sea, tourism, agroindustry, materials, health, ICT and biotechnology. The cross-cutting priorities apply to all and include resources sustainability, qualification of human resources, territorial cohesion and internationalisation. The specific objectives focus on the adoption of sustainable industrial solutions, valorisation of natural endogenous resources, mobilisation of technologies for quality of life, and promotion of territorial innovation.

For each of the specific objectives a working group has been established, open to different stakeholders, which defines lines of action in a participatory process coordinated by external experts. It is interesting to note that, in Centro, special emphasis is placed on coordination and integration. When evaluating applications, the first criterion analysed is the contribution of the project to at least one of the Centro RIS3 specific objectives. If the project complies with this first criterion the alignment of the application with one of the thematic domains or cross-cutting priorities is then assessed.

7.4 Implementation

The implementation of Centro's Smart Specialisation Strategy is highly dependent on EU financial support under the ESIF. These funds are delivered nationally under the global "Portugal 2020" strategy agreed for the country as a whole with the European Union, and then to the regional level. This means that, at the regional level, the public funds available to support innovation are essentially those deriving from the programmes supported by the EU. The Centro region also bids for support under the sectoral Horizon 2020 programme, having so far participated in 447 projects.

The regional development programme for Centro (the Regional Operational Programme), has a total budget of 2,155 million euros for the 7-year planning period, 2014-20. These resources are used principally to support investment to help dynamise Centro's regional innovation ecosystem, notably through investment in strengthening research, technological development and innovation, enhancing the competitiveness of SMEs, promoting sustainable and quality employment and supporting labour mobility and investing in education, training and vocational training for skills and lifelong learning. Some of the overall EU support to Portugal 2020 is delivered through national programmes, and, apart from the Regional Operational Programme, projects in Centro can be supported under the different national programmes.

The National Development and Cohesion Agency (AD&C) has the responsibility for monitoring and evaluating Portugal 2020. AD&C regularly publishes the results of this work. One evaluation carried out by AD&C specifically concerned the implementation of Smart Specialisation Strategies in Portugal. An important conclusion was that, although some regional innovation ecosystems were quite mature, there was a strong dependence on EU funding. A diversification of the funding streams was recommended to reduce this dependence.

7.5 International Cooperation

Centro is involved in innovation-related cooperation with regions in other countries. For example, Centro is part of the Euroregion "Euroace", which also includes the regions of Alentejo (Portugal) and Extremadura (Spain). Centro also participates in the "Improve" project, supported by the EU's INTERREG programme, which includes eight regions from different member states working together to improve the implementation of Structural Funds Programmes to ensure a better and more efficient delivery of R&D&i policies, with a particular focus on improving the quality of Smart Specialisation Strategies. Centro also participates in the "REPLACE" project, also under the INTERREG programme. REPLACE aims at improving management, implementation and monitoring of regional policy instruments targeted at facilitating the transition towards the development of the circular economy.

7.6 Concluding remarks

In Portugal, the implementation of both the national and regional Smart Specialisation Strategies is highly dependent on EU financial support under the Structural and Investment Funds. Without the ESIF contribution, Portuguese Smart Specialisation Strategies would tend to have a more limited scope, and the authorities in the regions are concerned to draw in other sources of finance in the future in order to make these efforts more resilient and more durable.

Challenges have also arisen from the fact that Centro is an administrative region, and not a political entity, and as such does not have a political authority with its own regional budget. The other European Case Studies in this report, as well as the academic evidence, tend to underline the importance of a political authority, elected by the population, which can provide the leadership, independent strategic vision and consensus-building for a genuinely regional innovation system.

In Centro, the region has noted that even though much has been done to involve the key local actors, dependence on national structures and finance have had the effect of reducing the level of flexibility over the range of initiatives that the region can promote and fund at the regional level. As a constitutional matter, the need for political decentralisation is not something that can be controlled by the Centro region itself, nor can it be implemented in the short-term in any case. Ongoing efforts and experimentation in multi-stakeholder approaches therefore remain a priority for the region in a forward-looking perspective.

China case study

8. Jiangsu

8.1 Introduction

Jiangsu is one of the most developed provinces in China, with a population of 80 million and a per-capita GDP of 123,600 RMB in 2019 (approximately 15,800 euros at today's exchange rates) (Jiangsu Provincial Bureau of Statistics and National Bureau of Statistics Jiangsu Team, 2020). The strength of the economy of Jiangsu derives from a solid industrial base, which contributes 11% of the added value of national added value in industry (Table 5).

The industry of Jiangsu is specialised in equipment manufacturing, electronics, petrochemical, metallurgy and textiles. Although the province has a leading position in the country, it faces a number of challenges, such as: lack of global competitiveness of enterprises; a concentration of many sectors at the lower end of the global value chain; inadequacies in the innovation capacity of enterprises; too few leading enterprises possessing key technologies; lack of environmental sustainability in some dominant industries, such as metallurgy and petrochemical; over-production in relation to market demand in some sectors.

Faced with these challenges, Jiangsu began to promote innovation from 2010 under different policy initiatives such as, among others: "upgrading traditional industries"; "phasing out inefficient industries"; "innovation-driven development"; "building an innovative province".

8.2 Stakeholders

There are a number of key stakeholders from the public and private sectors involved in designing and implementing regional innovation strategies in Jiangsu. At the level of the public authorities, a leading role is occupied by the provincial government, followed by city governments.

The provincial government has the key responsibilities of providing province-wide strategies, as well as distributing funds and other resources from the provincial budget. At the lower geographical level, the city governments make city-specific strategies and provide financial support and other resources from city-level budgets.

Other key stakeholder groups beyond the public authorities are the enterprises, the research community and the development agencies. Enterprises are increasingly regarded as key agents in innovation. Policy documents from the central authorities increasingly stress the key role of enterprises in implementing regional innovation, but, on the evidence, their role in the related policy-making function seems to be more limited. This has been addressed in latest reform of early 2020 which requires a more adequate involvement of enterprises in business-related policy-making. Jiangsu is one of the first provinces to echo the reform and it is to be expected that Jiangsu enterprises will have a more intensive engagement in policy in the future.

Regarding the research community, universities and research institutes are key players in innovation, and Jiangsu is in the position of having the largest number of universities of any province across China. The central government attaches much weight to promoting knowledge transfer between universities and enterprises, but it is considered that this still should be improved. The universities and institutes are also major sources of expertise and consultancy for innovation policies, through seminars and meetings, public calls for policy research projects, etc.

The agencies for innovation activities are emerging actors in regional innovation, and can facilitate the process of patent transfer, innovation fund application, etc.

8.3 The Regional Innovation Strategy

In Jiangsu, innovation policy is conducted at the level of the province itself and at the sub-provincial level, notably through the thirteen administrative cities.

At the level of the province, given the strong basis in manufacturing, the provincial authorities are seeking to project the area as globally competitive in advanced manufacturing and a leading province in implementing the national "Made in China 2025" policy (Jiangsu Provincial People's Government, 2017). In concrete terms, the aim is to develop a number of large enterprises with international reach supported by a cohort of SMEs specialised in niche markets, both using key technologies.

As an echo of the Made in China 2025 policy, Jiangsu devised its own Jiangsu "Action Plan for Made in China 2025" (2015), which identified 15 priority sectors based on the national strategy and its own conditions (Jiangsu Provincial Peo-

ple's Government, 2015). Three major considerations were involved in selecting the priorities: support for advanced manufacturing; strategically important sectors; existing globally competitiveness in the respective areas. The result is a focus on electronics (hardware and software), engineering, energy and bioscience. Specifically, the 15 priorities are: integrated circuit and special equipment; network communication equipment; operating system and industrial software; cloud computing and the internet of things; intelligent manufacturing equipment; advanced rail transportation equipment; marine engineering equipment and high-end ships; new generation electric equipment; aerospace equipment; engineering and agricultural machinery; energy-saving and environmental-protection equipment; energy-saving and renewable energy vehicle; renewable energy; new materials; biomedicine and medical instruments.

Partly overlapping with these priorities, Jiangsu also aims at upgrading its traditional industrial base such as machinery, petrochemicals, metallurgy, and textiles, with a view to making these activities greener and with more advanced technologies (Jiangsu Provincial People's Government, 2017). In addition, Jiangsu has created a short-list of "future" sectors, in which the province currently may have limited capacity but which are considered to be important for future economic success. These are nanomaterials, quantum communication, robotics, portable devices, autonomous vehicles, and new healthcare technology.

In European terms, Jiangsu Province is very large for innovation (and other) policy purposes. The province therefore has important administrative units below the provincial level, notably, the thirteen administrative cities mentioned above. The thirteen cities are grouped into three sub-provincial regions by geographical location and economic strength, namely North Jiangsu (Xuzhou, Lianyungang, Suqian, Huaian, Yancheng), Middle Jiangsu (Yangzhou, Taizhou, Nantong) and South Jiangsu (Nanjing, Wuxi, Changzhou, Suzhou, Zhenjiang). South Jiangsu, as part of the Jiangnan region (meaning: south of Yangtze River), has long been one of the most developed areas in China and has been granted by the central government the status of National Innovation Demonstration Zone. Compared with South Jiangsu, Middle Jiangsu is less developed and North Jiangsu is the least developed part of Jiangsu province.

While the three regions are conceptually important, and indicative of the broad geographical distribution of economic activity across the province, the absence of formal administrative authorities at this level means that local innovation policies are mainly formulated by the city governments. The city governments combine the agenda of central and provincial governments and adapt them according to their own conditions when selecting priorities. Inevitably, given the smaller size of cities, city governments tend to devise more detailed innovation or upgrading plans, which also try to differentiate from, or form a production chain with, neighbouring cities.

For example, Huaian, a North Jiangsu city, selected four already dominant industries and two future industries as their priorities ("4+2 system" in the government's own terminology).

One of the six industries is that of salt-based chemicals. While this is not listed as a provincial priority, the city is rich in rock salt deposits and thus has a strong

basis in this sector. However, the salt-based chemical industry in Huaian is a traditional one, and does not produce high added value products, but focuses on the lower end. Huaian therefore aims to move the industry up the value chain through new chloralkali processes and products and through integration with the petrochemical industry in neighbouring cities (Huaian Municipal Government, 2016).

The remaining industries of the 4+2 plan are: special steel and equipment manufacturing; electronics and related software; the food industry; renewable energy vehicle and components (a "future industry"); Biotechnology and medicine (a "future industry").

As another example, the priorities selected by Suzhou, the South Jiangsu city with the highest GDP in the province, are more knowledge-intensive and overlap with the provincial priorities (Suzhou Municipal Government, 2016). They are: electronics, such as large display panels, components of flat-panel display, OLED, chips for smart terminals, high-speed network equipment; advanced equipment manufacturing; new materials; software and integrated circuits; renewable energy and energy-saving technologies; medical instrument and biomedicine.

8.4 Implementation

Jiangsu spent 2.7% of its GDP on R&D in 2018, or 250 billion RMB, which ranked among the highest levels in China.[1] Ten percent of this expenditure came from various levels of government (central, provincial, city, etc.) while the rest came from contributions by the enterprises concerned. Among the government expenditures in the province, 9% was from the provincial government and 91% was from the city governments.[2] In addition, the provincial and city governments themselves as well as enterprises and research bodies also drew innovation funds from the central government through various schemes. For example, the province was awarded the central government's Special Fund for Local S&T Development (100 million RMB), and the National Natural Science Fund won by the research bodies in Jiangsu summed up to 2 billion RMB in 2018.[3]

More specifically, Jiangsu provides three major funds for innovation, namely a Special S&T Fund (multi-year total: 23 billion RMB), Manufacturing and Information Industry Upgrade Fund (multi-year total: 13 billion RMB), and Special Fund for Emerging Strategic Industries (multi-year total: 3 billion RMB)[4]. These funds are distributed through public calls and have so far supported thousands of projects, selected mainly after an appraisal by experts. The fund usage and innovation performance are monitored (at least once in the funding period) and evaluated by the Department of Finance and the Department of Industry and Information Technology of the province and relevant cities. Another major incentive policy in Jiangsu is to reimburse 5-10% of enterprise investment in R&D, which was claimed by more than 6000 enterprises.[5]

---

[1] Data in 2018 is the latest statistics available when the report is drafted.
[2] The data are from the government budgets,which use S&T activities instead of R&D as the budget item. S&T activities include R&D, application of research outputs, and S&T related services.
[3] See: https://www.cingta.com/detail/9934
[4] See: https://www.cingta.com/detail/1620
[5] Jiangsu launched a generous policy on rewarding enterprise investment in R&D. See Ministry of Science and Technology of the People's Republic of China. http://www.most.gov.cn/zypzygls/gzdt/201711/t20171101_135927.htm

Both provincial and city-level plans in Jiangsu involve clear and quantitative goals. For example, the 13th Five-Year Plan of Jiangsu sets the target of increasing the percentage of R&D expenditure to 2.8% of its GDP by 2020, as well as increasing the output of high-tech industries to 45% of all above-scale industries and raising the number of invention patents per 10,000 capita to 20 (Jiangsu Provincial People's Government, 2017). Other indicators used by the province and cities include the number of high-tech companies, the patents granted per 10 billion RMB GDP, the percentage of R&D expenditure in above-scale enterprises' income, the contribution of emerging strategic industries to GDP and so on. These indicators are monitored continuously and will be comprehensively reviewed when devising the next five-year plan. The evaluation will be included in the documentation of the next five-year plan itself.

8.5 International cooperation

Since Jiangsu aims to achieve international competitiveness, international cooperation is accorded much importance, especially the exchange with central and eastern Europe. Jiangsu has close S&T collaboration with Israel, Finland, Russia, Czechia, Ontario (Canada), Victoria (Australia), Baden-Württemberg (Germany), etc. In addition, Jiangsu also houses several international institutes with European countries, such as the China Centre of Czech Technology (Suzhou), the Sino-Finland Nanotechnology Centre, the International Technology Transfer Centre of Oxford University (Suzhou, Changzhou).[6]

8.6 Concluding remarks

Through the various instruments on boosting innovation, Jiangsu has made clear progress in relevant fields. Thus high-tech industries contributed 44.4% to the total output of above-scale enterprises in 2019 (Jiangsu Provincial Bureau of Statistics and National Bureau of Statistics Jiangsu Team, 2020) and the percentage of R&D expenditure in GDP increased to 2.7%,[7] which are close to the targets set by the 13th Five-Year Plan. However, Jiangsu still considers its innovation capacity to be insufficient, which is complicated by the downward pressures on the economy linked to the global COVID-19 pandemic. While quantitative indicators are important measures of success, the central government has begun to place more emphasis on the quality of innovation outputs, and their true contribution to industrial competitiveness.

From the perspective of stakeholder involvement, the role of civil society as a stakeholder in innovation is less important when compared with that of industry and the research community. Although this is the case in regional innovation policies, it is complemented by a broader stream of policy in 'mass entrepreneurship and innovation'. Arising from the grass roots, and in the light of an explosive growth in social media, there is a growing number of teams running social media accounts in S&T dissemination, increasing the public's exposure to relevant information.

---

[6] See The State Office of Information of the People's Republic of China. http://www.scio.gov.cn/xwfbh/gssxwfbh/xwfbh/jiangsu/Document/1519515/1519515.htm

[7] 2017 data from http://www.jsrd.gov.cn/zyfb/hygb/1303/201807/t20180724_501766.shtml

Another major issue to be addressed is that of the knowledge transfer between the universities and industry. Though Jiangsu has a large number of universities, the transfer rate is still lower compared to that in the world's advanced economies, which is also identified as a key area for improvement in recent S&T reforms.

Table 5: INNOVATION INDICATORS COMPARED (JIANGSU)

Education		China 2018	Jiangsu 2018
	College and above educated population (samples). (China Statistical Yearbook)	182,163,414	11,318,300
	Ratio of college and above educated population to the sample population(%) (Data analysis)	14.00 %	14.90 %
	Growth rate of college and above educated population(%) The growth compared with last year. (Data analysis)	1.70 %	-13.16 %
R&D expenditure in the public sector			
	Investment in R&D (Total) ***public	¥397,864,100,000	¥25,392,890,000
	Investment in R&D (Total) ***public+private	¥1,967,792,940,000	¥250,442,930,000
	Investment in R&D (% GDP) ***public+private	2.14 %	2.70 %
	Investment in R&D (Public/private in %)	25.34 %	11.28 %
	R&D Personnel (per 10.000 persons)	47.09	69.59
R&D expenditure in the business sector			
	Corporate funds for the internal R&D expenditure of universities and institutes (10,000 Yuan) Measure the cooperation between enterprises and universities / institutes (China Statistical Yearbook)	¥48,979,980,000	¥4,835,520,000
	Ratio of corporate funds for the internal R&D expenditure of universities and institutes(%)	11.78 %	26.60 %
	Growth rate of corporate funds for the internal R&D expenditure of universities and institutes(%). The growth compared with last year. (Data analysis)	8.31 %	11.99 %
China's domestic patent			
	The Number of Invention Patent Granted	345,959	42,019
	Average Amount of Invention Patent Granted Per 10,000 R&D personnel	526.46	749.99
	Average patent application amount of large industrial companies per 10,000 R&D personnel ***all types	2,246.56	2,648.13
	Growth rate of patent application amount of large industrial companies(%)	17.17 %	32.10 %
	Granted patent amount of large industrial companies	N/A	N/A
	Average granted patent amount of large industrial companies per 100,000 people	N/A	N/A
	Patent applications per 10.000 R&D personnel ***all types	6,310.36	10,714.72
	Patents granted per 10.000 per R&D personnel ***all types	3,553.92	5,479.50
High-tech employments			
	Ratio of high-tech employments to the total employments(%) ***2017	3.52 %	6.48 %
	High-tech employments ***2017	27,354,815	3,084,630
	Growth rate of high-tech employments(%) The growth compared with last year ***2017	15.88 %	5.16 %
	Number of high-tech companies	33,573	4,870

Source: National Bureau of Statistics of China (2019)

References

Huaian Municipal Government (2016). 市政府办公室关于印发淮安市“十三五”工业发展规划的通知 [Huaian City's Industrial Development Plan for the 13th Five-Year Plan]. http://www.huaian.gov.cn/col/16699_756587/art/20181130095831_kxrhNKoA.html

Jiangsu Provincial Bureau of Statistics and National Bureau of Statistics Jiangsu Team (2020). 2019年江苏省国民经济和社会发展统计公报. http://stats.jiangsu.gov.cn/art/2020/3/4/art_4576_8995203.html

Jiangsu Provincial People's Government (2017). 江苏省政府办公厅关于印发江苏省“十三五”现代产业体系发展规划的通知 [13th Five-Year Plan for the Development of Modern Industrial System]. http://www. jiangsu.gov.cn/art/2017/1/13/art_46450_2557726.html

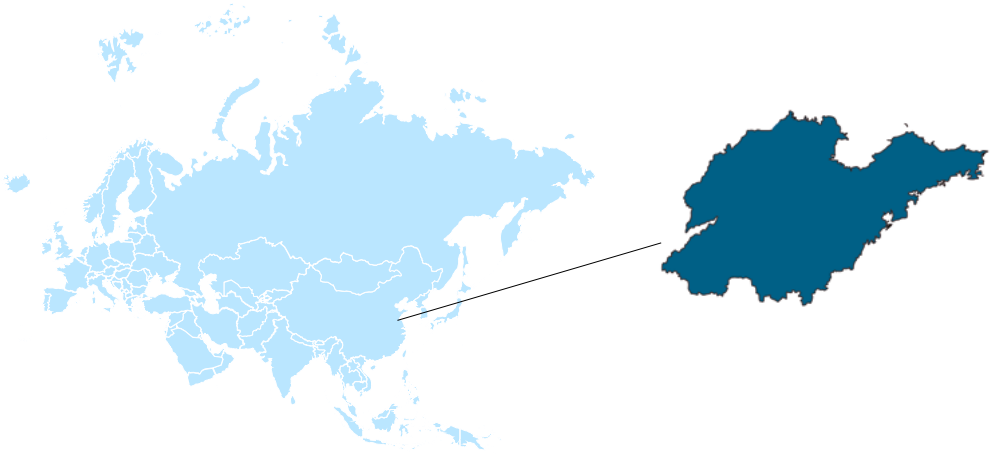
Jiangsu Provincial People's Government (2015). 《中国制造2025江苏行动纲要》的解读 [Jiangsu Action Plan for Made in China 2025]. http://gxt. jiangsu.gov.cn/art/2015/4/21/art_6197_4175021.html

National Bureau of Statistics of China (2019). China Statistical Yearbook. Beijing: China Statistic Press.

Suzhou Municipal Government (2016). 苏州市“十三五”工业发展规划 [Suzhou City's Industrial Development Plan for the 13th Five-Year].

China case study

9. Shandong



9.1 Introduction

Shandong is a coastal province in east China, with a population of 100.7 million and a per-capita GDP of 70,653 RMB in 2019 (or 9,180 euros at current exchange rates) (Shandong Provincial Bureau of Statistics and National Bureau of Statistics Shandong Team, 2020). Although the province is coastal and geographically belongs to the east, it is considered to be second tier when compared with the most developed provinces with higher per capita GDP such as Jiangsu, Zhejiang and Guangdong. The largest industrial sectors of Shandong are the processing of oil and coal and chemical products, which each contribute 10% to the province's industrial output, followed by metal processing, food processing, automobiles, machinery, medicine and electronics. Regarding innovation, expenditure on R&D was 2.27% of the GDP and the number of patents granted was 20,338 in 2018 (Shandong Provincial Bureau of Statistics and Nation, 2020) (see Table 6).

A large proportion of Shandong's industry is heavy, less environmentally-friendly and comparatively non-innovative. Consequently, many of the products belong to the medium- to lower-end in the global market, which is not only a dilemma for Shandong but not uncommon in the rest of China. In the light of this situation, the central government put forward a strategy named 'transforming the driving force of development' in 2015, advocating the nurturing of innovation activities and knowledge-intensive businesses to replace low-end and less efficient production, for which Shandong was chosen as the experimental and demonstration zone.

9.2 Stakeholders

The main stakeholders of regional innovation in Shandong are generally similar to those in Jiangsu. Contrary to its conventional image as public sector or government-oriented when it comes to policy, Shandong in reality has attached much emphasis on involving its own entrepreneurs. For example, Shandong set up a training programme specifically for entrepreneurs, which sent around 200 entrepreneurs to study in overseas universities on the Global 500 list. The province also involves entrepreneurs in policy-making as government consultants, and invites them to attend provincial government meetings on issues related to the economy or business development. The province seeks to promote links between actors in the public and private sector through pairing up between key provincial officials and two enterprises each, requiring that the official should visit the enterprise at least twice per year.

9.3 The Regional Innovation Strategy

The approach of Shandong at provincial level is a combination of upgrading traditional industry and promoting more knowledge-intensive industries. More specifically, Shandong identified five emerging industries and five traditional industries to-be-upgraded. The five emerging industries are: information technology; advanced equipment; renewable energy; new materials; modern marine industry; health industry. The five identified for upgrading are: chemicals; agriculture; cultural industry; tourism; finance.

The five priorities in emerging sectors were also selected according to the central government's strategies and therefore resemble those of Jiangsu. However, the precise areas of specialisation reflect the different innovative capacities, respectively, of the two provinces. For example, in terms of integrated circuitry in information technology, Jiangsu focuses on the areas of chip design and production, packaging and testing technologies. In contrast, Shandong focuses on less cutting-edge technologies within the same sector, which are tools for electric design automation, video and audio processing chips, and materials for IC packaging. As another example, in terms of internet and communication technology, Jiangsu aims at the core technologies of 5G, while Shandong looks at more application-based activities (Shandong Provincial People's Government, 2017)

Below the provincial level, Shandong Province is composed of seventeen administrative cities, which have adopted different development strategies according to their perceived strengths and weaknesses. Among them, Qingdao, Jinan and Yantai are comparatively stronger than the others which is reflected in their efforts to specialise in more knowledge-intensive sectors. For example, Qingdao is developing machinery manufacturing, electrical appliance manufacturing, petrochemicals, rubber products and three further sectors in order to generate more income, expected to run into several billion RMB (Qingdao Municipal People's Government, 2016). Meanwhile the city of Binzhou focuses on a smaller number of sectors including aluminium materials and aluminium machine components, chemicals, food processing, textiles and wheel hub production (Binzhou Municipal People's Government, 2016).

9.4 Implementation

Since Shandong possesses the status of "demonstration province" for the 'transforming the driving force of development' programme accorded by the central government, the provincial government is active in launching new policies to realise this goal. R&D investment in Shandong was around 164 billion RMB in 2018, 8.3% of which was from the public sector and the remainder financed by enterprises or from foreign investors (Shandong Provincial Bureau of Statistics and Nation, 2020). It is a little surprising that enterprises in Shandong play an even larger role in financing R&D than in Jiangsu given that the latter is considered to have the stronger market economy. This could be related to new financial instruments in the funding of innovation activities which will be explained now.

This new funding instrument is known as the Government Guide Fund, which is based on a partnership between the government and private entities and aims to use public investment to leverage more private investment into innovation-related sectors. It is motivated by the desire for greater efficiency compared to funding based on conventional, direct public subsidies since it has a market orientation, that is, it is run by professional fund management agencies (with less risk of irregularities and rent-seeking behaviour).

Also, enterprises supported by the fund are under greater pressure to provide returns to shareholders, which is more demanding than reporting to government. Although this kind of fund has been in existence in China from the beginning of the 2000s, it is only since 2015 that the Government Guide Fund becomes a significant instrument in Shandong. For the purpose of 'transforming the driving force of development', the provincial and city governments have provided 40 billion RMB and the subscribed private capital is 600 billion RMB, from which 150 billion RMB had been invested into 1,600 projects by the end of 2019. This so-called 'Driving Force Transition Fund' now ranks second among all Government Guide Funds in China, evaluated by the size and performance.[1] There are also other innovative instruments such as allowing for loaning on patents.

Shandong also employs more conventional funding and subsidy instruments. There are several innovation funding programmes, such as the programme for industrial upgrade (c.a. 1 billion RMB a year), the innovation award for SMEs (c.a. 100 million a year), and the patent-related award (c.a. 90 million a year). The use of the funds is evaluated by the Department of Finance in terms of management quality, fulfilment of targets and the satisfaction of stakeholders. In terms of subsidy, Shandong launched a major R&D subsidy programme in 2017, which subsidises enterprise R&D expenditure up to 10 million RMB, as long as an enterprise's R&D expenditure is larger than 3-5% of the annual revenue. The budget is shared 50-50 between the provincial government and corresponding city governments. More than 2,000 enterprises receive the subsidy annually. The subsidy is required to be rolled forward into further rounds of R&D investment and to be audited independently, by a commissioned third party. Other instruments include tax breaks for innovation activities, free or discounted land provision, entrepreneur training programs, etc.

[1] See: https://www.pedata.cn/RANKING/2019/fund_list.html

9.5 International cooperation

Shandong has fostered R&D and other innovation cooperation with multiple international partners, for example, with Kazakhstan in potato production technology, with Israel in agricultural technology, with Ukraine in linen growing and processing. The province also maintains a long friendship and contact with Bavaria in Germany, which has facilitated the cooperation between local enterprises and Airbus (helicopter assembly), Siemens (in an R&D park), Bosch (hydrogen fuel cell), among many others.

9.6 Concluding remarks

The major indicators for innovation set by Shandong in the 13th Five-Year Plan include raising the percentage R&D expenditure in GDP to 2.6%, the output of high-tech industries to 38% of all above-scale industries and the ownership of invention patents to 14 per 10,000 capita by 2020 (Shandong Provincial People's Government, 2017). The progress in these three indicators by far is 2.27% (2018), 40.1% (2019) and 10 (2019) (Shandong Provincial Bureau of Statistics and National Bureau of Statistics Shandong Team, 2020). The provincial government believes that the province is faced with severe challenges in building an innovation-driven economy, notably, that the innovative sectors are small and the innovation capacity is relatively weak (Shandong Provincial People's Government, 2020).

The actions of Shandong in recent years reflect an effort to boost entrepreneurship and encourage innovation against a background of a more traditional society than those in the more developed and market-oriented provinces of China.

The Shandong provincial government attaches growing importance to incentivising entrepreneurs and developing a more market driven approach to achieve transition. However, cultural change is a challenging mission, at least in the short-term, and efforts could be hampered in the absence of improvements to the institutional culture and to oversight and monitoring. For example, the free-of-charge or price-discounted land and offices sometimes provided for innovators, risks to be taken by rent seekers. While Shandong appears to have developed an approach which is, in general, on a positive track towards the development of a modern economy based on innovation, this process could take more time and effort than foreseen at present by the authorities.

Table 6: INNOVATION INDICATORS COMPARED (SHANDONG)

Education		China 2018	Shandong 2018
	College and above educated population (samples). (China Statistical Yearbook)	182,163,414	11,829,300
	Ratio of college and above educated population to the sample population(%) (Data analysis)	14.00 %	12.80 %
	Growth rate of college and above educated population(%) The growth compared with last year. (Data analysis)	1.70 %	-3.34 %
R&D expenditure in the public sector			
	Investment in R&D (Total) ***public	¥397,864,100,000	¥13,665,550,000
	Investment in R&D (Total) ***public+private	¥1,967,792,940,000	¥164,333,00,000
	Investment in R&D (% GDP) ***public+private	2.14 %	2.14 %
	Investment in R&D (Public/private in %)	25.34 %	9.06 %
	R&D Personnel (per 10.000 persons)	47.09	30.69
R&D expenditure in the business sector			
	Corporate funds for the internal R&D expenditure of universities and institutes (10,000 Yuan) Measure the cooperation between enterprises and universities / institutes (China Statistical Yearbook)	¥48,979,980,000	¥1,521,040,000
	Ratio of corporate funds for the internal R&D expenditure of universities and institutes(%)	11.78 %	13.07 %
	Growth rate of corporate funds for the internal R&D expenditure of universities and institutes(%). The growth compared with last year. (Data analysis)	8.31 %	7.02 %
China's domestic patent			
	The Number of Invention Patent Granted	345,959	20,338
	Average Amount of Invention Patent Granted Per 10,000 R&D personnel	526.46	659.60
	Average patent application amount of large industrial companies per 10,000 R&D personnel ***all types	2,246.56	1,568.68
	Growth rate of patent application amount of large industrial companies(%)	17.17 %	9.03 %
	Granted patent amount of large industrial companies	N/A	N/A
	Average granted patent amount of large industrial companies per 100,000 people	N/A	N/A
	Patent applications per 10.000 R&D personnel ***all types	6,310.36	7,510.73
	Patents granted per 10.000 per R&D personnel ***all types	3,553.92	4,293.39
High-tech employments			
	Ratio of high-tech employments to the total employments(%) ***2017	3.52 %	2.37 %
	High-tech employments ***2017	27,354,815	1,557,680
	Growth rate of high-tech employments(%) The growth compared with last year ***2017	15.88 %	15.24 %
	Number of high-tech companies	33,573	1,978

Source: National Bureau of Statistics of China (2019)

References

Binzhou Municipal People's Government (2016). 滨州市国民经济和社会发展第十三个五年规划纲要 [The 13th Five-Year Plan of Binzhou]. http://www.binzhou.gov.cn/zwgk/news/detail?code={8bfd9309-8ce3-4fae-bbe4-65c2ae71db50}

National Bureau of Statistics of China (2019). *China Statistical Yearbook*. Beijing: China Statistic Press.

Qingdao Municipal People's Government (2016). 青岛市国民经济和社会发展第十三个五年规划纲要 [The 13th Five-Year Plan of Qingdao]. http:// www. qingdao .gov .cn/ n172/ upload/160425114635906756/160425140835035454.pdf

Shandong Provincial People's Government (2017). 山东省制造业“十三五”发展规划 [Shandong 13th Five-Year Plan in Manufacturing].

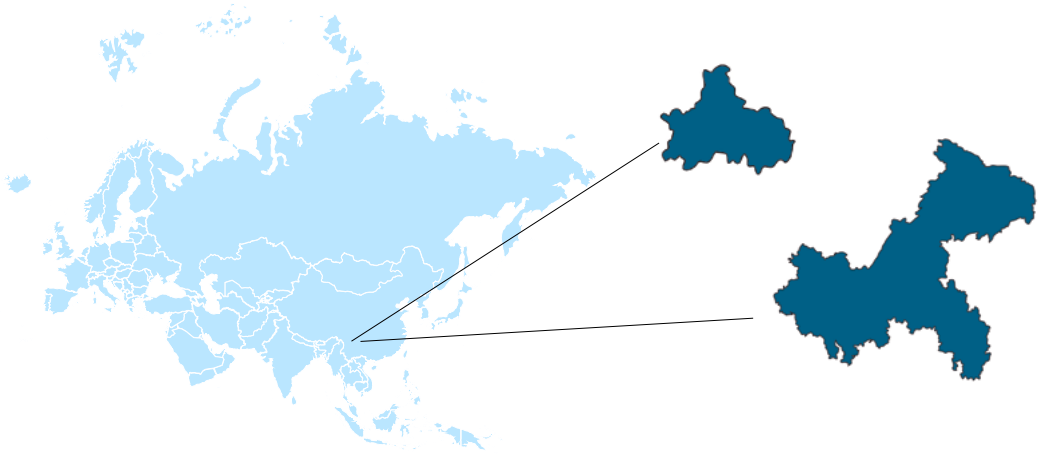
Shandong Provincial People's Government (2020). 2020年政府工作报告 [Report on the work of the government 2020]. http://www.shandong.gov.cn/art/2020/2/21/art_114892_8830765.html

Shandong Provincial Bureau of Statistics and Nation (2020). 山东统计年鉴2019 [Shandong Statistics Yearbook 2019]. China Statistics Press.

Shandong Provincial Bureau of Statistics and National Bureau of Statistics Shandong Team (2020). 2019年山东省国民经济和社会发展统计公报 [Economic and Social Development of Shandong Province]. Shandong Provincial People's Government. http://tjj.shandong.gov.cn/art/2020/2/29/art_6196_8865096.html

China case study

10. Chengdu-Chongqing



10.1 Introduction

This case study is of interest at least in part because it concerns a kind of "macro-region" formed by two, neighbouring cities belonging to two different provincial governments. It is therefore different from the two regions above which are individual administrative provinces. Chengdu is the capital city of Sichuan Province and Chongqing is one of the four province-level municipalities in China. The population of Chengdu is 16.58 million, larger than in most member states of the EU. GDP in Chengdu was 1.7 trillion RMB in 2019 and the GDP per capita was 103,386 RMB (or 13,400 euros at current exchange rates). The major industries of Chengdu are electronic manufacturing, automobiles and machinery. The expenditure on R&D is 2.56% of the GDP (Chengdu Bureau of Statistics, 2019) and the number of invention patents granted was 9,179 in 2019 (Chengdu Municipal Bureau of Statistics, 2020).

The population of Chongqing is with 31.24 million even larger than in Chengdu. In Chongqing, total GDP was 2.36 trillion RMB in 2019, averaged to 75,828 RMB per capita (or 9,900 euros at current exchange rates). The major industries of Chongqing overlap with Chengdu, and include electronic manufacturing, automobiles, non-metallic mineral products, and, on a smaller scale, the sectors of chemicals and machinery, making the city among the top producers of automobile, laptop and mobile phones in China. In terms of innovation, Chongqing spends 1.95% of its GDP on R&D and the number of newly granted invention patents is 7,000 in 2019 (Chongqing Municipal Bureau of Statistics and National Bureau of Statistics Chongqing Team, 2020).

These two neighbouring cities are among the few large cities in relatively less-developed, western China and, as such, represent what can be considered to be growth poles in the effort to promote economic growth in this part of China. Chengdu and Chongqing were first considered together as a single region of economic importance in the 2000s, named by the central government as the "Cheng-Yu economic zone" (Yu is the abbreviation of Chongqing). The terminology was revised in January 2020 to 'Cheng-Yu twin city economic circle' by central government (the idea of 'circle' in Chinese refers to an area surrounding a core), which reflects the importance attached to the twin cities by the central government.

Just as elsewhere, it is challenging to create efficient collaboration between large, independent, administrative areas, and this also applies to the two cities. Given the overlap in their respective industrial bases and geographical proximity, the challenge is to avoid duplication and unnecessary competition by encouraging specialisation. At the same time, the administrative obstacles need to be overcome given that the two cities belong to different provincial governments, which in normal circumstances would be responsible for devising their own development plans according to their own priorities. On top of this, western China tends to be less attractive to enterprises in innovative sectors than eastern China.

10.2 Stakeholders

Once again, the importance of national frameworks means that the same types of stakeholder are involved in regional innovation as in the previous case studies discussed above. What is particular here, however, is the involvement of two province-level governments with separate responsibilities, administrative systems, as well as having their own budgets. Competition did exist historically between the two governments in efforts to attract investments and talent. Now that the central government strongly emphasizes the coordination between the two cities, the two provincial governments are trying out new institutional arrangements to realize this goal. For example, a committee composed of the heads of Sichuan and Chongqing has been established, which meets regularly to discuss cooperation. Joint committees on more specific areas are also formed such as the committee for human resource coordination.

10.3 The Regional Innovation Strategy

Given its industrial base, Chengdu has identified ten sectors as the key areas for innovation. These are: electronics manufacturing (where Chengdu already has attracted major global companies such as Intel, Dell and BOE); automobiles (where, again, Chengdu has attracted major players such as Volvo, Volkswagen, Toyota, Bosch); rail vehicles; aerospace equipment; high-precision machinery and intelligent manufacturing machinery; petrochemicals; biomedicine; energy saving and environmentally-protective technologies; new materials; renewable energy (Chengdu Municipal People's Government, 2016).

Given the overlapping nature of their respective industrial bases, the priorities of Chongqing share some similarities with those of Chengdu, although possibilities for differentiation can be identified. For instance, Chongqing has more automo-

bile component suppliers than Chengdu to form an integrated production chain, while Chengdu enjoys a larger talent pool in electronics and aerospace due to a number of universities and research institutes located in the city. The major areas of innovation planned by Chongqing are: electronics manufacturing (notably, integrated circuitry); automobiles, agricultural machinery and motorcycles (renewable energy vehicles and intelligent systems for automobiles); intelligent machinery, including CNC machinery, robotics, 3D printing); transport machinery, (including aircrafts and components, special types of ships, rail vehicles and components); Internet of Things; electricity generation equipment, shale gas equipment and pollution treatment equipment; chemicals, metallurgy and building materials; new materials; biomedicine and medical instruments (Chongqing Municipal People's Government, 2016).

10.4 Implementation

In Chongqing, the share of the private sector in R&D expenditure (80%) is relatively low (see Table 7) (equivalent data are unavailable for Chengdu). A number of instruments have been applied in Chengdu and Chongqing to promote regional innovation, many of which are also observed in the other case studies. The instruments include encouraging cooperation between universities/research institutes and enterprises, facilitating the trading of patents and other research outputs, providing innovation funds, subsidies and tax reduction, establishing the Government Guide Fund, and so on.

Given that western China is generally less endowed with R&D talent and with internationally, competitive R&D teams, emphasis has been placed on attracting and retaining highly qualified human resources. For example, Chongqing municipal government provides 10 million RMB per year for new local research institutes supported by top universities or Global 500 enterprises (Chongqing Municipal People's Government, 2019). Human resource is also a key field of collaboration between the two cities. According to a recent agreement, those recognized by either Chengdu or Chongqing as 'talent' are recognised as having the same status in the other city.

10.5 International cooperation

Due to their western location, Chengdu and Chongqing has formed a number of international cooperation relationships with many countries. For example, Chongqing is cooperating with Singapore in aerospace and internet infrastructure and has signed an agreement with Italy in R&D exchanges. Chengdu is directly cooperating with EU and houses an EU Project Innovation Center.[1] There is also a China-Germany Innovation Park and China-Germany SME Cooperation Park.

[1] See: http://www.eupic.org.cn

10.6 Concluding remarks

The challenge of Chengdu-Chongqing in promoting innovation and innovation-driven development is on the one hand the relatively weak base in innovation resources, and on the other hand the efficient cooperation between the two local governments. Not only incentive instruments but also innovative institutional arrangements need to be involved in realizing the goal of jointly boosting the development of west China. New arrangements are being initiated, the effect of which is yet to be observed.

Table 7: INNOVATION INDICATORS COMPARED (CHONGQING)

Education		China 2018	Chongqing 2018
	College and above educated population (samples). (China Statistical Yearbook)	182,163,414	4,382,900
	Ratio of college and above educated population to the sample population(%) (Data analysis)	14.00 %	15.20 %
	Growth rate of college and above educated population(%) The growth compared with last year. (Data analysis)	1.70 %	11.64 %
R&D expenditure in the public sector			
	Investment in R&D (Total) ***public	¥397,864,100,000	¥6,973,120,000
	Investment in R&D (Total) ***public+private	¥1,967,792,940,000	¥41,020,940,000
	Investment in R&D (% GDP) ***public+private	2.14 %	2.01 %
	Investment in R&D (Public/private in %)	25.34 %	20.48 %
	R&D Personnel (per 10.000 persons)	47.09	29.65
R&D expenditure in the business sector			
	Corporate funds for the internal R&D expenditure of universities and institutes (10,000 Yuan) Measure the cooperation between enterprises and universities / institutes (China Statistical Yearbook)	¥48,979,980,000	¥1,213,100,000
	Ratio of corporate funds for the internal R&D expenditure of universities and institutes(%)	11.78 %	17.26 %
	Growth rate of corporate funds for the internal R&D expenditure of universities and institutes(%). The growth compared with last year. (Data analysis)	8.31 %	12.03 %
China's domestic patent			
	The Number of Invention Patent Granted	345,959	6,570
	Average Amount of Invention Patent Granted Per 10,000 R&D personnel	526.46	714.34
	Average patent application amount of large industrial companies per 10,000 R&D personnel ***all types	2,246.56	1,861.68
	Growth rate of patent application amount of large industrial companies(%)	17.17 %	4.52 %
	Granted patent amount of large industrial companies	N/A	14,642
	Average granted patent amount of large industrial companies per 100,000 people	N/A	N/A
	Patent applications per 10.000 R&D personnel ***all types	6,310.36	7,841.54
	Patents granted per 10.000 per R&D personnel ***all types	3,553.92	4,967.54
High-tech employments			
	Ratio of high-tech employments to the total employments(%) ***2017	3.52 %	3.49 %
	High-tech employments ***2017	27,354,815	598,603
	Growth rate of high-tech employments(%) The growth compared with last year ***2017	15.88 %	18.01 %
	Number of high-tech companies	33,573	696

Source: National Bureau of Statistics of China (2019)

References

Chengdu Bureau of Statistics (2019). 2018年成都市科技经费投入统计公报 [Statistics Commune of Chengdu on R&D Expenditure]. Chengdu Municipal People's Government. http://www.cdstats.chengdu.gov.cn/htm/detail_177684.html

Chengdu Municipal Bureau of Statistics (2020). 2019年成都市国民经济和社会发展统计公报 [Statistical Communique of Chengdu on 2019. Economic and Social Development]. Chengdu Municipal People's Government. http://www.cdstats.chengdu.gov.cn/htm/detail_180953.html

Chengdu Municipal People's Government (2016). 成都市国民经济和社会发展第十三个五年规划纲要 [The 13th Five-Year Plan of Chengdu]. http://www.chengdu.gov.cn/chengdu/qy fw/2017-05/03/content_90f452a1e3304a-b2b6054cbbdcb67ffa.shtml?y7bRbP=Ka3sqar-cA9xcA9xcA7MQOArH0jL-Hh-Vynt0C7aJqtXxGqqlE

Chongqing Municipal Bureau of Statistics and National Bureau of Statistics Chongqing Team (2020). 2019年重庆市国民经济和社会发展统计公报 [Statistical Communique of Chongqing on 2019 Economic and Social Development]. http://www.cq.gov.cn/zqfz/gmjj/tjgb/202004/t20200402_6963113.htm

Chongqing Municipal People's Government (2019). 重庆市引进科技创新资源行动计划（2019—2022年） [Chongqing Action Plan for Attracting Innovation Resources (2019-2022)]. http://sz.cq.gov.cn/zfxx/show/?id=10727

Chongqing Municipal People's Government (2016). 成都市国民经济和社会发展第十三个五年规划纲要 [The 13th Five Year Plan of Chongqing].

National Bureau of Statistics of China (2019). China Statistical Yearbook. Beijing: China Statistic Press.

Statistical Communique of Chongqing (2019). 年重庆市国民经济和社会发展统计公报 [Economic and Social Development. Chongqing Municipal People's Government]. http://www.cq.gov.cn/zqfz/gmjj/tjgb/202004/t20200402_6963113.html

Conclusions

It is clear from the analyses in this study that innovation lies at the centre of efforts in the EU and China to remain competitive in the era of globalisation. While approaches to innovation differ in many respects in the EU and China, respectively, this study suggests that their differing experiences in relation to promoting innovation at the regional level provide a fruitful terrain for cooperation. The EU's new International Urban and Regional Cooperation programme (IURC) provides, under its Component 2, an opportunity for a deeper and more systematic approach for cooperation between regions in the EU and in China (as well as other countries) on this theme.

Accordingly, this study's recommendations particularly focus on how best to exploit the opportunity created by IURC, although it is intended that the same recommendations could equally apply to bilateral cooperation organized by EU regions themselves with external partners. The objectives of cooperation under IURC, as far as cooperation on regional innovation systems is concerned, is to help regional economic actors (industry, research, training providers, etc.) in regions in China and in the EU to find missing competences, access research and innovation infrastructure and discover new business opportunities.

In taking this forward, the cooperation between the EU and non-EU partners on regional innovation systems under IURC will have a substantial dimension as well as a process dimension.

The Substance of Regional Innovation Systems Development

As identified in this study, there are four substantial elements to the regional innovation systems methodology which are key to its success and serve as useful points of reference for the cooperation between EU and China and non-EU partners.

The importance of the geographical or territorial dimension

A key element of regional innovation systems cooperation should be to empower the actors at the sub-national territorial level. The EU has shown that decentralized involvement is possible even with widely different constitutional arrangements

between the Member States, from unitary to the federal states. Accordingly, it is recommended that future cooperation on regional innovation systems should seek to give a leading role to partners at the sub-national level. This should not be to the exclusion of the national actors, on the contrary, national research and development policy, nationally-sponsored science and technology parks, etc. can bring resources, highly qualified actors and additional executive capacities to bear on regional innovation systems cooperation. Examples in Europe include the renowned Finnish Centre for Technological Research (VTT), a public company attached to the national Ministry of Economic Affairs.

Attention is often drawn to the wide differences in scale between EU regions, on the one hand, and their counterparts in China on the other. The average population size of an EU region is 1.8 million ("NUTS 2"), with wide variation around the average, which would be considered as the population of a relatively small city in China. Experience has demonstrated the importance of breaking down these larger geographical areas in China to achieve greater comparability with EU counterparts, for example, as was the case in past cooperation with Guangzhou, where the Development District within the city was the geographical unit used for cooperation with European regions. Accordingly, it may be necessary to find cooperation partners within some of the larger innovation areas in China, rather than seeking to work with the area as a whole.

A related element is the pairing or cluster methodology. Interest in regional clusters and their role in economic development has grown substantially, as means to enhancing competitiveness in the context of globalisation and international competition. One result has been an increased focus on cluster-based economic development policies. In the examination, identification and prioritisation of sectors and sub-sectors for cooperation, the cluster dimension, how they are created and how they are sustained should be of central interest.

The prioritisation element

Here, there is clear scope for learning from each other, with the EU regions historically seeking to develop new added value activities, while China has had a focus on restructuring traditional industries. Both of these aspects are clearly important for the development of regional economies.

While EU regional innovation strategies also often have a focus on traditional industries, the orientation is one of seeking to add value. For example, with regard to traditional agricultural products, as seen in the Centro case study above, this can be reflected in efforts to promote the internalisation of the processing sector into the regional economy, or seeking to integrate production into international value chains, etc. This has been very much the approach in relations between EU regions and counterparts in Latin America under the EU's INNOV-Al and INOVACT projects. Latin American regions are seeking to reduce dependence on primary products for export, and to develop new, high added value activities.

Under IURC, the time period for prioritisation for bringing cooperation to fruition is limited to a maximum of 18 months. This means that it is necessary for both sides to advance rapidly to identify sectors or rather subsectors, bearing in mind that concrete cooperation takes place at this level. Thus, regions may elect to cooperate on the automotive sector, but the cooperation needs to be defined more specifically, for example, longer-life batteries for electric cars. Or, as ano-

ther example, cooperation may take place in the textile and clothing sector, but the specific sub-sector could examine ways to avoid large quantities of clothing going into landfill. This latter example underlines the character of IURC which privileges innovation in sustainable development, as a cross-cutting theme, which is consistent with the Fourteenth 5-year Plan in China and the commitments to both sides under the Sustainable Development Goals. Additionally, it should be recalled that cooperation can concern product or process innovation, or possibly both.

It is recommended that in the identification of the regional partners for the participation in IURC, applicants should already provide at the outset an indication of potential fields for cooperation at the sectoral and sub-sectoral level.

The Entrepreneurial Discovery Process

Entrepreneurial discovery is defined as a process in which entrepreneurial actors (both firms and non-firms actors, such as researchers at universities and public research establishments) in a region explore and discover new and innovative activities, which is called a domain, which in turn leads to innovation and transformation of the regional economy. In some cases, this involves a strategic interaction between the government and the private sector. Regional actors involved in an entrepreneurial discovery process can stem from a certain cluster or industry, but not necessarily so.

If used properly, an entrepreneurial discovery process is a useful tool for identifying sectoral comparative advantages in regions. In reality, however, such a transformative hope towards a better economic structure is most often turned into a delusion if one considers that: 1) vested interest, rent-seeking groups often dominate the selection of activities, and 2) that there is strong geographical diversity of entrepreneurship in many countries and regions.

There appears to be considerable scope for cooperation in this field, where EU regions could learn from Chinese counterparts on the transformation of new ideas into market opportunities, a traditional weakness in Europe, and one where China appears to have made considerable advances over the past decade. On the Chinese side, there appears to be interest in how the stakeholders, notably business, can play a leading role in the innovative process, drawing on, while not being dependent on, national science, technology and innovation ministries.

The multi-stakeholder involvement

The key to understanding EU Smart Specialisation is that it seeks, at its heart, to promote change in order to improve the competitiveness of regional economies and their capacity to generate incomes and new job opportunities. Change in modern societies requires a high degree of consensus in order to be successful, which is why Regional Innovation Systems have placed so much emphasis on a widely-drawn partnership involving the key stakeholders who can act together as a prevailing force for change. The regional innovation system is essentially about process with a view to changing habits, bringing together actors who have not traditionally engaged with each other.

Under European Smart Specialisation, the key actors are diverse. The emphasis is on the actors on the ground such as, notably, regional governments where these exist and who can have the necessary authority to concentrate resources, finan-

cial or other, in those areas or activities that are likely to effectively transform the existing economic structure through R&D and innovation. As discussed above, a strong leader in the regional innovation team can play an important role. As illustrated in the case of Baden-Württemberg, this can be an appointee, although strong leaders also emerge spontaneously.

The landscape, as this study has shown, tends to be quite different in China, and this presents challenges for cooperation. In particular, and while recognizing that policy in China is undergoing change, innovation tends to be driven by central-level policies, programmes and initiatives.

As regards international cooperation on regional innovation systems in general, and the implementation of IURC in particular, the experience suggests that careful thought has to be given to the selection of partners. Among the considerations to be kept in mind are: do the partners represent the prioritized sub-sectors?; do the partners have sufficient access to executive capacities to carry the cooperation process through to regional action plans and concrete projects?; can the partners make themselves available at the right moments in the cooperation process so that decisions can be taken, allowing the process to move forward in a timely manner. These considerations lead towards an open and reasonably flexible approach, so that unsuitable partners can be replaced by others if they cannot represent the prioritized sub-sector, or if deadlines are being systematically missed, or if engagement is lacking, etc. This would also mean that the partners on each side should be empowered to act with the authority and confidence of senior leaders in the region, so that resources can be allocated and re-allocated where necessary.

It is worth noting that particularly successful cooperation between the EU and China has often occurred in the past when representatives of the universities are involved.

LIST OF FIGURES

LIST OF TABLES