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## MANAGING INNOVATIONS IN METROPOLITAN STOCKHOLM

### ZARZĄDZANIE INNOWACJAMI W METROPOLII SZTOKHOLMSKIEJ

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**ABSTRACT:** Metropolitan areas are hubs of productivity and innovation. Although innovation can happen anywhere, it is usually concentrated in heavily urbanised areas. Cities therefore play a key role in the expansion of productivity and are drivers of economic development. Benefits created by cities reach beyond their borders. The impact of such spreading from cities to smaller towns and their surrounding and neighbouring regions is considerable, as is their positive economic influence manifesting in a radius of up to 200-300 km (OECD 2015). It is therefore vital to support innovation in order to internationally promote the competitiveness of metropolitan areas, thus consequently advancing whole regions and countries. Such development necessitates inter-sectoral collaboration, first and foremost, according to the Triple Helix concept, the collaboration of business, science and public authorities. This depends upon forms of collaborative governance at a regional and local level, which can set agreed priorities and operationalise this approach.

This paper sets out to identify the forms of cooperation taken in Metropolitan Stockholm to generate innovation. The methodology applied in this research uses critical secondary data analysis, mainly the subject-matter literature and documents issued by public institutions. The paper starts with an introduction illustrating the meaning of innovation in the rise of competitiveness and development in metropolises. The next part of the paper elaborates on the concept of governance as the basis for cross-sectoral collaboration, to subsequently move to the core of the thesis, devoted to the analysis of good practice in innovation networks, particularly in ICT, life science and green economy. The summary indicates the main success factors.

**KEY WORDS:** governance, innovation, metropolitan area, Stockholm

**ABSTRAKT:** Obszary metropolitalne są ośrodkami produktywności i innowacji. Chociaż innowacje mogą mieć miejsce wszędzie, zwykle koncentrują się na obszarach silnie zurbanizowanych. Miasta odgrywają zatem kluczową rolę w zwiększaniu produktywności i są motorami rozwoju gospodarczego. Korzyści, jakie stwarzają miasta, wykraczają poza ich granice. Wpływ takiego rozprzestrzeniania się z miast do mniejszych miejscowości oraz okolicznych i sąsiednich regionów jest znaczny, podobnie jak ich pozytywny wpływ ekonomiczny przejawiający się w promieniu do 200–300 km (OECD 2015). Dlatego też niezbędne jest wspieranie innowacji w celu promowania na skalę międzynarodową konkurencyjności obszarów metropolitalnych, a w konsekwencji do rozwoju całych regionów i krajów. Taki rozwój wymaga współpracy międzysektorowej, przede wszystkim w myśl koncepcji Triple Helix, czyli współpracy biznesu, nauki i władz publicznych. Zależy to od form wspólnego zarządzania na szczeblu regionalnym i lokalnym, które mogą ustalać uzgodnione priorytety i operacjonalizować to podejście. Niniejszy artykuł ma na celu zidentyfikowanie form współpracy

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podjętej w Metropolii Sztokholmskiej w celu generowania innowacji. Metodologia zastosowana w badaniach wykorzystuje krytyczną analizę danych wtórnych, głównie literatury przedmiotu i dokumentów instytucji publicznych. Artykuł rozpoczyna się wstępem, ilustrującym znaczenie innowacyjności we wzroście konkurencyjności i rozwoju metropolii. W kolejnej części artykułu omówiono koncepcję rządzenia jako podstawy współpracy międzysektorowej, aby następnie przejść do sedna pracy, poświęconej analizie dobrych praktyk w sieciach innowacyjnych, szczególnie w ICT, *life science* i zielonej gospodarki. Podsumowanie wskazuje główne czynniki sukcesu.

SŁOWA KLUCZOWE: zarządzanie, innowacje, obszar metropolitalny, Sztokholm

## Introduction

Over the last few decades we have witnessed a rapid progress in urbanisation. Over 50% of the world's population live in urban areas and it is forecast that by 2050 this indicator will have risen to 70% (World Urbanization... 2018). Half of the people in OECD countries live in one of the 300 metropolitan areas producing well over half of the gross domestic product (GDP). Located in individual countries and connected with both neighbouring and remote regions, these metropolitan areas are hubs of productivity and innovation, providers of goods and services for surrounding areas and also play a key role in sustainable development (OECD 2015). Metropolitan areas compete against each other and are aware that one of the key success factors is the promotion of innovative environment on their territories, i.e. creating conditions that stimulate various entities to foster innovation. Considering that growth-, efficiency- and profit-generating innovation is crucial to competitiveness in modern world, companies have to implement innovative solutions to survive (Beugelsdijk 2007). Innovation can, of course, happen anywhere, but it has a clear tendency to concentrate in heavily urbanised areas. The complexity characteristic of industrial environment necessitates not only collaboration between companies, but also utilisation of external knowledge in conjunction with internal expertise (Chesbourg 2003). Although external knowledge may be difficult to access, physical proximity of companies is conducive to mutual interaction, as are common, shared standards and values that enable the transfer and exchange of (tacit) knowledge. This tacit knowledge is tied to the concentration of companies and institutions in a given geographical area, i.e. to the benefits of agglomeration (Marshall 1920). Concentration of companies encourages networking and alliances. Their collaboration assumes various forms. For example, it may be a collaboration among non-competing companies orientated on complementary knowledge; a collaboration among competing companies orientated on creating mutually valuable knowledge; as well as a collaboration among companies and organisations interested in generating knowledge.

Stronger competitiveness that increases market share, attracts highly qualified workforce and expands the global chain of values, is dependent on benefits of agglomeration. These benefits result in economies of scale and increase along with spatial proximity and transfer of knowledge. The benefits of agglomeration rise proportionately to the

size of the city if the following conditions are fulfilled: access to employment, availability of a qualified workforce, research and innovation, and efficient governance solutions that implement public policies across the established administrative boundaries (OECD 2018).

Improving city competitiveness is a central issue. Indeed, it is essential to rise the welfare and prosperity of inhabitants and companies, generating employment. Therefore, it is imperative to increase the understanding of economic growth prospects in metropolises. In this regard, novel growth sectors such as biotechnology, ITC and environmental technology are becoming key elements in the academic context as well as for urban/metro managers (van den Berg et al. 2014).

However, several signals indicate competitiveness as emerging from successful collaboration among economic actors who form innovative facilities of companies and other organizations. Innovation has constantly been at the core of competitiveness. Investigation, exploration and an effort to exploit resources are as crucial for companies as they are for urban/metro regions (Denton 1999). In this view, the pursuit of competitiveness through innovation is a praiseworthy objective of local and national policy, since innovation is a key function in the current modern knowledge-driven economy, mainly for urban/metro areas that start behind and wish to catch up (Cantwell 2005). For innovation to be generated it is vital to create a network of connections among the various stakeholders. The dynamism of these social networks is supported by the development of collective governance which associates public and private actors (Lusso 2011). According to the Triple Helix concept (Etzkowitz, Leydersdorff 1997; Asheim, Gertler 2005; Etzkowitz 2008, Martin, Sunley 2003; Porter 2000) such networks should be created among: firms, training and R&D facilities, and public authorities. One of the most innovative regions in European Union is Stockholm Metropolitan Area which has been at the forefront of innovation rankings for years. The purpose of this paper is to make an analysis of the forms of cooperation taken up in Metropolitan Stockholm to generate innovation. The methodology applied in this research uses critical secondary data analysis, mainly the relevant literature on the subject and documents of public institutions.

## **Metropolitan governance**

The mismatch between functional boundaries and administrative boundaries in functional areas of metropolises is well known and policy makers have long been aware of the co-ordination problems it might cause. In response, a wide range of metropolitan governance arrangements has emerged. While some countries have chosen to shift administrative boundaries to match the new urban form (e.g. via municipal mergers), others are encouraging municipalities to build partnerships, within a more or less institutionalised framework.

Metropolitan regions develop policies to reorient management activity and build relations with economic and civil society actors that act in diverse ways, depending on

local governance cultures. The challenge to the actors to use the resources available, the way they integrate with the decision-making system, and how they rebuild their relations at the local level are the parameters used to denote the characteristics of this interface mechanism (Cars et al. 2002; Le Gales 2002). Metropolitan area governance is characterised by vertical and horizontal interactions of different actors that can take on many different forms (see Hooghe and Marks 2001).

Compared with previous regional and industrial policies, today's governments are focusing on innovation policy, which no longer views the individual firm as the single key to economic growth (Nelson 1993). The innovation process occurs over time and involves interactions of a wide range of 'organizations that gain, develop, and exchange various kinds of knowledge, information, and other resources' (Edquist 1997: 2). Interactions are thus the most important determinant of technological innovation, since it facilitates learning and accumulation of knowledge (Morisson, Doussineau 2019). According to Cooke and Morgan (1998), the associational economy is dominant, meaning that there must exist an ensemble of relations in which firms, states and systems interact (Cooke, Morgan, 1998). It also emphasizes trilateral initiatives involving the public sector, strategic alliances and university-industry-government development initiatives, frequently referred to as triple helix initiatives. The ability to establish inter-institutional relations is a key resource in competition between metropolitan areas (Crespo, Cabral 2010). The governance approach allows analysing diverse but interdependent arenas in which members are developing, negotiating and deciding public and private innovation policies (Bercovitz, Feldmann 2006; Cooke, Leydesdorff, 2005).

## **Cooperation on Innovation in Metropolitan Stockholm**

Metropolitan Stockholm encompasses 26 communes inhabited by 2.1 million people and it overlaps with the administrative boundaries of Stockholm County<sup>1</sup> (<http://www.sll.se/om-landstinget/Information-in-English1>). The Stockholm region is ranked as the most knowledge intensive region outside the US (EC 2019). The achievement of such a position could be explained by the existence of 19 higher education institutions (among them the three leading universities) and a number of strong research institutions and internationally competitive clusters in the region. Innovation is closely linked to research and development. In the region, there operate research-intensive companies, particularly in the sectors of ICT (Ericsson, IBM Svenska and Telia-Sonera) and life sciences (AstraZeneca and Pfizer). The Stockholm region accounts for a considerable part of Swedish research – one third of the total R&D-expenditure in Sweden and every third start-up company comes from the region. The gross domestic expenditure

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<sup>1</sup> Swedish counties constitute the second echelon of local government and may be considered equivalent to Polish voivodships.

on research and development of Stockholm County amounts to 3.91% of the regional GDP and the majority of investments in research and development (R&D) are made by industry (Ligenzowska 2016). There is also a high density of many small research-based companies in the Stockholm region that play a crucial role when attracting international talent, investments and capital to the region.

Despite the strong position of Stockholm in many international innovation rankings, the participation of small and medium-sized companies in innovation collaborative initiatives has been relatively low.

## Governance in Stockholm Region

The key stakeholders involved in the domain of regional innovation policy are rather diverse (Figure 1).

| Public sector   | Science sector                    |
|---|-----------------------------------|
| County Administrative Board of Stockholm (Länsstyrelsen)    | Karolinska Institute              |
| Region Stockholm Assembly (Landstinget)                     | Royal Institute of Technology     |
| Stockholm County Association of Local Authorities           | Stockholm University              |
| Municipalities  | Stockholm School of Economics     |
| Vinnova, the Swedish National Agency for Innovation Systems | Karolinska University Hospital    |
| Swedish transport administration                            | RISE ICT                          |
|   | Science for Life Laboratory       |
|   | Stockholm Science City Foundation |
| Business sector   | Other stakeholders                |
| AstraZeneca   | Stockholm Business Region         |
| Pfizer  | Stockholm Chamber of Commerce     |
| Ericsson  | Electrum Foundation               |
| IBM Svenska   | Knowledge Foundation              |
| Telia-Sonera  | Labour unions                     |
| SMEs  |                                   |

Fig. 1. Key stakeholders in the Stockholm Region in the domain of innovation policy

Source: own elaboration.

As a capital region, Stockholm is characterized by a complex institutional setting, with a large number of rather independent actors. The responsibility for the regional development in Stockholm is shared between the County Administrative Board of Stockholm and the Region Stockholm Assembly. The County Administrative Board is the central government body, responsible for developing a Regional Development Program (RUP). Their level of funding for the regional development is low. The Assembly is a politically elected regional organization, responsible for developing the Regional Development Plan for the County of Stockholm (RUFS), focusing on planning, spatial development and health care. During recent years, the two regional authorities have cooperated in the development of RUFS, integrating the Regional (business) Development

Program (RUP). The process initiated a broad dialogue among many agents, including public as well as private stakeholders at the local and regional level (Danielewicz 2018).

Since Stockholm was performing well, there were many strong independent actors and no public agency or authority with a mandate to coordinate innovation activities, the understanding for the need of public policy measures fostering innovation was limited. The turning point was 2007, when the national strategy for competitiveness, entrepreneurship and employment 2007-2013 was developed by the government to coordinate various policy areas and increase cooperation between the local, regional and national levels. The opportunity for implementing publicly coordinated regional development initiatives emerged through funding from the European Structural Funds. Particularly the European Regional Development Fund has had an important impact on the development policy in Stockholm Metropolitan Area since the regional partnership decided to prioritise a limited number of strategic projects. Six of the 16 larger projects might be characterized as cluster development projects. Focus has been on supporting strategic platforms (projects, science parks, business collaborations, etc.) in research intensive, technology based sectors, such as the life sciences, ICT and environmental technologies, but activities have also been directed towards less research dependent sectors, such as the creative sectors.

The partnership was made up of policy makers from local and regional levels, civil servants from the County Administrative Board of Stockholm, the Employment Agency and the Social Insurance Office, as well as representatives of the labour unions, Stockholm Chamber of Commerce and a non-profit organization for the social economy in Stockholm. Through this partnership, local and regional stakeholders from different sectors have increased cooperation on the regional development in Stockholm (RIM 2011). There have also been several interesting regional initiatives providing advisory services or early stage funding to entrepreneurs, innovators and small companies, like: Innovation Stockholm, Entrepreneur Sthlm and ALMI Invest. These initiatives have contributed to strengthening the partnerships among actors and building a more structured way of working with advisory services in the region. They have also provided a basis for developing a regional innovation strategy.

In 2010, the County Administration Board was commissioned by the government to develop a competence platform (Competitive Stockholm) to make sure that the Stockholm region attracted and retained people with higher-level skills, knowledge and competences. In the same year, the Region Assembly, Karolinska Institute (KI), County Administrative Board, Stockholm County Association of Local Authorities, Royal Institute of Technology (KTH), Stockholm Business Region, Stockholm Chamber of Commerce, City of Stockholm and Stockholm University (SU) started a broad collaboration to improve the innovative ability of the Stockholm region. The aim was to collect and coordinate initiatives that influence the innovative ability of the region, and to bring together the central actors in the region under a common innovation strategy. As a result, in 2012, the regional authorities adopted the Strategy for Smart Specialisation in Region Stockholm. The goal of the strategy is to transform Stockholm into the

most innovative economy in the world by the year 2025. Regional and city authorities would like to increase international availability of the region, but first and foremost its innovation. At the same time, they realise that the innovation process is broad, complex and includes a number of factors, whose interactions bring about success (or failure). Consequently, five action plans for the key areas of the region were created:

- infrastructure for research and innovation,
- innovation procurement,
- capital supply,
- intersectoral approach,
- region attractive on the global scale (County of... 2014).

One of the plans concentrates on the broadly understood attractiveness of the region both for businesses and individuals. Among the challenges faced due to the growing number of population are the following:

- satisfying housing demand,
- creation of efficient, highly reliable infrastructure with sufficient capacity.

These measures are to create a high quality living environment, which will attract highly qualified professionals from all over the world, as required by businesses. People with expert knowledge and experience expect to live in a place that offers a wide range of public services, including international schools, clean natural environment, good transport options, friendly public areas, etc. (LSE... 2013). According to the goals of the Strategy, opportunities for simultaneous employment at academia and in business or public administration offered here will be the best in the world (County of... 2014).

The implementation of the strategy is illustrated by measures taken in Hagastaden. It is an area of 96 ha (around triple of the area of the old town) on the border of Stockholm and Solna. Since 2009 it has been the scene of an ongoing project to develop the area into a life science research and business centre. The project is funded by the Stockholm Science City Foundation (SSC)<sup>2</sup> in cooperation with the City of Solna, Stockholm City Council, Stockholm universities, Swedish transport administration, construction companies and property owners (City of Stockholm). Geographical proximity of Karolinska University Hospital, Karolinska Institute (KI) and Science for Life Laboratory provides companies with a rare opportunity to establish close ties with exceptional research teams. By the year 2017 a hundred life science companies had been created in Hagastaden. Large concentration of universities, health sector entities and companies has offered a unique innovation environment that drives growth in the Swedish life science sector (<https://ssci.se/en/activities/hagastadense>). The Foundation attempts

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<sup>2</sup> The founders of Stockholm Science City Foundation are Karolinska Institutet (KI), KTH Royal Institute of Technology, Stockholm University (SU), Stockholm School of Economics (SSE), City of Stockholm and private foundations: Göran Gustafsson Foundation, Axel and Margaret Ax:son Johnson Foundation and Kjell & Märta Beijer Foundation. In 1995 they were joined by Region Stockholm Assembly (SLL) and City of Solna in 2009 as financial shareholders. The foundation is financed by KI, KTH, SU, City of Stockholm, City of Solna and SLL.

to attract new companies to the area through information campaigns, workshops and consultations. The measures taken by the foundation have created widespread international interest in the project. It gave rise to a large number of businesses and increased activity of global firms, but also SMEs, universities and authorities.

In 2006, the Foundation, in conjunction with Stockholm universities, created an internet platform called “Tools of Science”. At the beginning, the universities based here offered access to their advanced equipment. Then the platform evolved to include companies and healthcare entities offering their services and the use of their devices to scientists and academic firms. Toolsofscience.se currently provides complex services with easily accessible information on the region and the rest of Sweden. Here, one can quickly find the expertise and services missing in a given entity. The site also offers information about courses, events and new initiatives proffered by the leading entities. The platform contributes to increased interaction among various actors in the life science sector and to the expansion of knowledge about accessible equipment and services in the region (<https://ssci.se/en/activities/tools-science>).

Since 2014 SSC has regularly organised Health Hack Academy – a competition aimed at finding solutions to challenges in the healthcare sector. The Foundation provides the winning teams with support in prototype production and the opportunity to present their product concepts in an appropriate context (<https://ssci.se/en/activities/health-hack-academy>).

The other result of the Foundation’s activities is the 2016 opening of the co-working H2 Health Hub. It is an office and meeting space for start-ups interested in healthcare technologies. The H2 Health Hub concentrates on skills available in the digital healthcare sector in Stockholm in order to strengthen competitiveness of companies and the region. Since 2017 the Hub has functioned independently of the Foundation, which however remains its strategic partner and participates in the construction of a digital healthcare network. Region Stockholm Assembly is its other strategic partner, which contributes to stronger ties with healthcare. The H2 Health Hub has a number of partners in the medical technologies sector and promotes creative relationships between established companies and new up-and-coming businesses. One of the H2 Health Hub shareholders is Sting, a business incubator, which gives their member firms the opportunity to participate in acceleration programmes to boost their development (<https://www.h2healthhub.com>).

One of the recent initiatives proposed by the Foundation is a photo contest “My Area”. It set out to promote and increase the awareness of talents, curiosity and creativity among working class youth and to introduce variety into higher education institutions. The contest was organised together with Kista Science City, Stockholm University, KTH, KI, The Global Village, My Dream Now, Canon, Fryshuset Husby and Vinnova (<https://ssci.se/en/activities/minakvarter>). The background of this project is twofold: on the one hand, research shows that twice the number of young people with educated parents go to university compared with the number of children whose parents lack academic education; on the other hand, there is the demand for well-educated employees.



To strengthen competitiveness in Sweden it is necessary to choose talented, often “undiscovered”, people in the poorer areas of the metropolitan area.

These examples show that managing innovations and competition in the region is multi-faceted and involves many actors. It is worth noting that the collaboration is not focused on producing innovative businesses but rather on promoting a friendly environment conducive to innovative development, and especially friendly to people who create innovation. Construction in Hagastaden is due to finish in 2025. In the pipeline there is a brand new district with 6,000 apartments and 25,000 jobs, including cultural institutions, green areas, leading research centres and highly specialised healthcare centres. The development will be connected to the metropolis by modern means of transport. There will be a tunnel with an extended fast city railway line and a new stretch of motorway, a new underground line will also be built to accommodate transportation needs of the future residents of the area (<https://vaxer.stockholm/omraden/normalm-hagastaden/in-english-hagastaden/>).

Another area of innovative solutions in Stockholm is green development. Special support for green technologies is based mainly on seed funds for the development of the city ICT sector and clean technologies, distributed by the Electrum Foundation. On the board of the foundation there are representatives of business (Ericsson, IBM Developers), science (KTH, Stockholm University and RISE ICT<sup>3</sup>) and the public sector (City of Stockholm, Region Assembly and Region Administration<sup>4</sup>) which makes it a clear example of collaboration among the public sector, businesses and academia in the Triple Helix structure. It focuses on stimulating partnership and development through research provided by innovative ICT companies. The foundation offers grants, loans and opportunities to share knowledge for research and development companies in Kista Science City – the ICT cluster on the outskirts of Stockholm (LSE 2013). It is the third largest ICT cluster in the world (<http://www.kista.com/electrum-foundation/>). The foundation created two subsidiaries:

- Kista Science City AB (KSCAB) was created in 1999 and is fully dependent on the Electrum Foundation. It is a non-profit organisation that encourages close collaboration among businesses, academia and the public sector in order to promote steady growth in Kista Science City (<http://www.kista.com/kista-science-city-ab/13.02.2019>).

- Stockholm Innovation and Growth AB (STING) incubator was created in 2002 to enable talented people to transform their ideas into businesses. It offers business development coaching, access to angel investors, venture capital, recruitment services, international investor network, business contacts and experts. STING supports promising Stockholm-based start-ups, mainly in the ICT, internet/media, clean technologies and natural sciences sectors. So far it has helped over a hundred start-ups (<https://sting.co/en/>). As mentioned earlier, it is a shareholder in H2 Health Hub.

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<sup>3</sup> State research institute.

<sup>4</sup> The County Administrative Board of Stockholm.

As a result of such a consistently implemented innovation strategy, Metropolitan Stockholm is one of the largest life science clusters in Europe. It also has the highest level of employment in the knowledge-based services in OECD metropolitan regions and prides itself on the largest number of start-ups per capita compared with any other European city. In 2015, the Financial Times dubbed it “a unicorn factor”; producing start-ups that had achieved the mark of USD 1 billion capitalisation. In the 2016 PwC “Cities of Opportunity” ranking, Stockholm came the seventh out of 30 global cities, mainly due to its large intellectual capital, innovation, sustainable development, demographics, living conditions, health and safety (PricewaterhouseCoopers 2017). In 2017, Stockholm was voted the most innovative of all EU regions (Regional Innovation Scoreboard EU).

It is worth remembering that one of the key instruments that provide stimuli and support for innovation is public spending on research and development. In the years 2011-2016, Sweden spent on average 3.25% GDP on research and development in comparison with other OECD countries that average 2.33% (OECD 2019, <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>).

## Conclusions

Metropolitan areas with their concentration of wealth, knowledge and innovation are the key factors in economic growth and future prosperity of European nations (Crespo, Cabral 2010). Stimulating the innovative performance of the metropolitan area should call the attention of policy makers in bringing solid and shared partnership among all the urban/metro players involved in spillover and innovative processes. Improvement in competitiveness of cities is the essential function of the local government and the local industry system, which should act more as facilitators in the exchange of knowledge and technology, by means of planning joint strategic actions to build a common and unique innovative network with the purpose of increasing urban/metro competitiveness.

The example of cooperation in Stockholm Region certainly does not mean that all its solutions can be grafted into other regions to increase their innovation. To be effective, regional innovation policies must be tailored to specific regional institutional arrangements. All regions have their own idiosyncrasies and the circumstances that shape them are different. It is, however, worth following the inspiring good practise. In the case of Metropolitan Stockholm, the main success factor in innovation is the holistic approach, focused on variety and interdisciplinary collaboration as well as the introduction of research, technical and social infrastructure. This strong innovation infrastructure is based largely on academic and scientific research. Stakeholders involved in the implementation of the strategy work within the classic Triple Helix model and represent all the three of its constituent sectors. The stronger the collaboration management, the stronger the specialisation of the region, as is apparent in Stockholm’s focus on life science and ICT innovation.

The Strategy for Smart Specialisation in Stockholm Region is a coherent vision of the development of the metropolis and of the whole region, which makes implementation of its goals a lot easier. The emphasis on creating an innovation-friendly environment is also crucial for its ultimate success. It is important to stress that without ample financial support for research and development from the state budget it is very difficult for a city to become an innovative metropolis. The world's most innovative metropolitan areas benefit from the largest percentage of allocated GDP (<https://www.businessinsider.com/most-innovative-cities-in-the-world-in-2018-2018-11?IR=T#7-boston-massachusetts-44>). In 2017, Sweden channelled the highest percentage of its resources into research and development out of all EU countries – 3.33% of the state's GDP compared to the EU average of barely 2% GDP. Poland's spending on R&D in the same period equalled only 1.035% GDP (<https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>).

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