Regional Innovation Strategy of the Free and Hanseatic City of Hamburg

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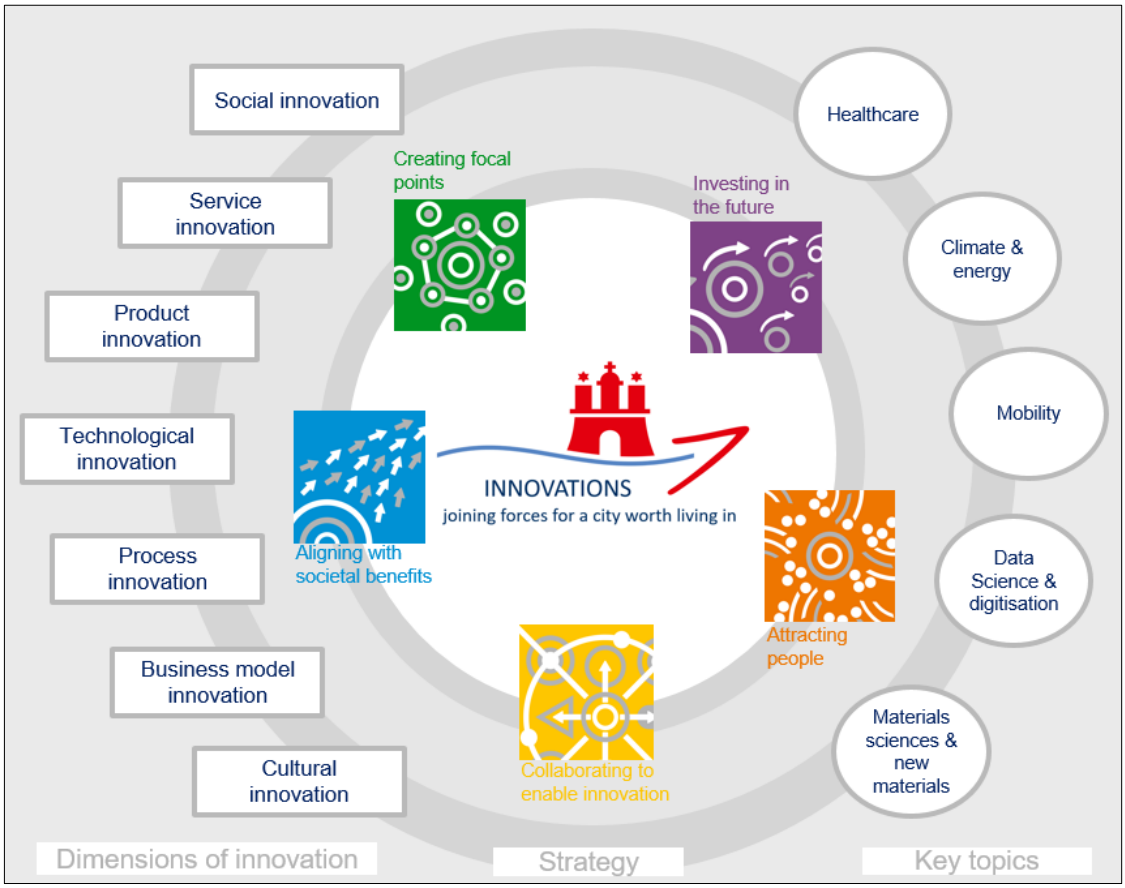

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1 Preamble

In the dynamic environment of a globalised, connected world and in light of the rapid pace of technological development, innovation has become a crucial factor in successfully shaping the future. In order to succeed in the international competition of regions and to create sustainable added value as well as future-proof jobs in Hamburg, the city's innovation system calls for an intelligent interplay of public and private funding. To achieve this, innovation policy must be aimed at strengthening networks, providing stakeholders with an attractive environment and sharpening the region's profile by focusing on topics relevant to the future. Most recently, the COVID-19 crisis has demonstrated how important it is to focus on forward-looking topics and, as a business and science location, to respond to unexpected changes in an agile manner rather than relying on past successes. Against this background, Hamburg's Regional Innovation Strategy aims to define the relevant conditions for promoting an innovation system that is aligned with global and regional societal benefits and is geared for coping with unexpected crises.

The Innovation Strategy shall serve as a basis for designing innovation promotion policies and supplies the different innovation stakeholders with a reliable framework for aligning their activities in the medium and long term. Moreover, it aims to provide valuable guidance for the planned North German innovation strategy, facilitate supra-regional collaborations in the Hamburg Metropolitan Region and connect national and international stakeholders.

The Regional Innovation Strategy of the Free and Hanseatic City of Hamburg represents the Smart Specialisation Strategy for the European Regional Development Fund (ERDF). To be eligible for structural funding from the ERDF, applicants are required to submit a strategy. The Regional Innovation Strategy sees itself as the successor to the previous strategy of 2010 and its updated version of 2014. In designing this Innovation Strategy, particular emphasis was placed on incorporating the experiences from the previous strategy as well as factoring in today's changing conditions.

With its new vision, the Innovation Strategy goes well beyond the traditional idea of linking up science and research with the business sector. Societal relevance has now become a crucial factor in assessing the success of innovation measures. Hamburg's key topics for the future provide innovation stakeholders with subject-specific orientation for engaging in worthwhile projects. With this Innovation Strategy, the city itself is more than a location where innovation takes place. Rather, the Free and Hanseatic City of Hamburg is taking an active and formative role in promoting innovation. Thus, innovation becomes an integral part of urban and regional development in a global context.

The Innovation Strategy was jointly developed by Hamburg's Ministry of Economy and Innovation (BWI) and Hamburg's Ministry of Science, Research, Equality and Districts (BWFGB) under the auspices of the InnovationsAllianz Hamburg initiative. Furthermore, Hamburg's Ministry of Culture and Media (BKM) and Hamburg's Ministry of Education and Vocational Training (BSB) have contributed to broadening our understanding of innovation by taking part in the process.

Involving the relevant stakeholders, the process was carried out with the participation of 300 individuals from business, science, research, education, culture and society. The process was established and supported throughout by the interdisciplinary Supervisory Group. The basic idea of the new Innovation Strategy was developed in the course of various working group sessions and was subsequently discussed at a large kick-off event with 140 participants. The strategy was elaborated further as part of specialist workshops and was evaluated and specified by the Delegation Groups incorporating different perspectives.

The collaborative mindset and the pioneering spirit of the stakeholders involved have been immense and have contributed to creating a coherent overall concept.

The SWOT analysis revealed that Hamburg’s strengths are its competencies in key topics for the future that are relevant for the region as well as internationally. Moreover, it was found that the location is characterised by a dense network of stakeholders and infrastructure as well as favourable cluster, transfer and funding structures. These findings provided the basics for developing the forward-looking rationale of Hamburg’s new Innovation Strategy. From a matrix perspective, Hamburg's key topics for the future are closely interlinked with the strategy and its strategic fields. This makes it possible to focus equally on the strategic elements and on the subject-related implementation opportunities in Hamburg’s key topics for the future. This combination is new in its approach and, with its implementation-oriented rationale, is meant to strengthen Hamburg as a location for innovation, while at the same time enhancing visibility and public involvement. Some of the individual measures outlined have already been developed. As a next step, these measures will be specified for implementation as well as complemented by and integrated with other measures of the strategy.

2 Initial situation

Hamburg is home to numerous innovation-related initiatives and networks. As well as providing the basis for a new common identity that consolidates resources and strengthens networks internally, the city's multifaceted innovation system has the capacity to create a clear and attractive external profile for the Free and Hanseatic City of Hamburg. The new Innovation Strategy is targeted at innovation stakeholders in business, science and research as well as investors, educational establishments, social, cultural and political institutions alongside other interested parties from Hamburg, the Hamburg Metropolitan Region, Germany and abroad.

2.1 Project course

The strategy process was guided by InnovationsAllianz Hamburg. In addition to the Ministry of Economy and Innovation (BWI) and the Ministry of Science, Research, Equality and Districts (BWFGB), representatives of the following institutions have been involved: the Hamburg Investment and Development Bank (IFB), the Hamburg Chamber of Commerce (HK), Hamburg Innovation GmbH (HI), Innovations Kontakt Stelle Hamburg (IKS) as well as Hamburg Invest Wirtschaftsförderungsgesellschaft mbH (HIW). To support the process, InnovationsAllianz Hamburg was extended to include the Hamburg Ministry of Education and Vocational Training (BSB) and the Hamburg Ministry of Culture and Media (BKM). The Senate Chancellery of the Free and Hanseatic City of Hamburg was also represented. The integration of additional institutions is reflected in the strategy's new understanding of innovation. Together, these stakeholders form the Supervisory Group of the strategy process.

In the course of the process, the parameters relevant to innovation were taken into account. These include the existence and development of strong innovation stakeholders (e.g. universities, research institutions, start-ups, companies, cluster initiatives, educational establishments, cultural and creative institutions), ensuring access to the innovation system (e.g. via thematic focus, transparency, networking activities, marketing activities) as well as sufficient support mechanisms (e.g. needs-based funding system, infrastructure, innovation culture).

Figure 2-1: An effective innovation strategy through public participation formats and data analysis
Source: Da Vinci team.

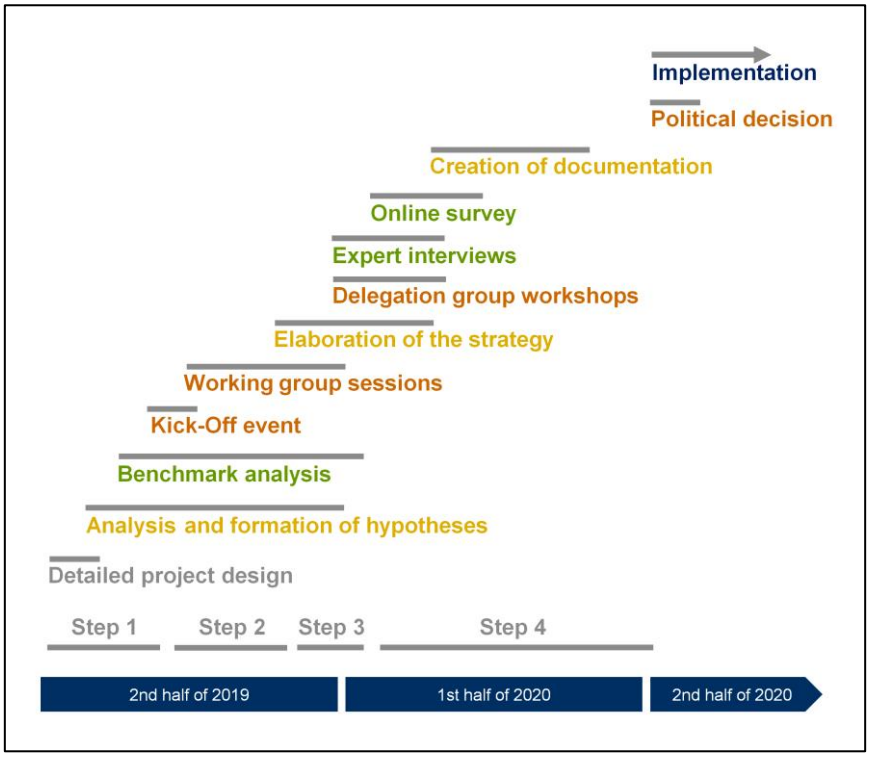


Figure 2-2: Project course

As part of the first step, the relevance of the selected mega-trends was elaborated, and so were the core questions for four dedicated work packages. The *Education, Research and Science* work package addressed ways of optimising the following aspects: excellent research as a breeding ground for innovation; vivid teaching as a foundation for research and education; encouraging education as a space for curiosity, exploring, failure and enthusiasm. The *Founding, Funding and Infrastructure* work package included the following aspects: knowledge-based founding and entrepreneurial innovation; sustainable innovation promotion; innovation-oriented infrastructure. The *Marketing and Transparency* work package examined questions such as “What is our powerful goal for marketing the region as a

location for innovation?"; "What are Hamburg's most inspiring stories?", and "Which concrete marketing instruments will be needed in the future?". Finally, the *Science Clusters, Economic Clusters and Transfer* work package dealt with questions of how economic clusters can be optimised in the wake of global challenges; how science clusters can be established; how these can be interlinked with existing economic clusters; and how innovative transfer tools could be expanded.

Moreover, to contribute to hypothesis formation, the data analysis setting was created as part of this step. In addition to analysing statistical data for the benchmarking analysis, empirical analysis formats were also used.

The kick-off event was attended by more than 140 stakeholders from business, science, society and administration. At the event, the hypotheses were discussed and participants provided their input from different perspectives. The findings were used to develop an initial strategy hypothesis, which already comprised the five strategic fields as well as a vision with a clear focus on local residents within a liveable city. In the course of several reflective sessions, the strategy was refined further. For this purpose, participants made use of a dedicated "innovation room" – a workshop space that served as a hub for the strategy process and was also used to display any findings, from the first ideas to concrete interim results. The room also made it easy for the participants of the more than twenty expert interviews to dive into the topic quickly. In addition to university presidents, a number of leaders from Hamburg-based companies and initiatives had agreed to take part, thus adding extra impetus to the strategy.

The Delegation Group workshops – with participants from industry and small and medium-sized enterprises (SMEs), research, science and education as well as start-ups, social entrepreneurs and stakeholders from society – also benefitted from this as sessions could be conducted most efficiently, while at the same time allowing participants to identify the Innovation Strategy's main sticking points. Especially their practice-based approach to innovation in Hamburg provided valuable insights, not only with regard to the hypotheses that had been developed up to that point, but also with a view to designing concrete measures.

Through the attendance and involvement of all participating individuals alone, the project has made a valuable contribution to strengthening the network of Hamburg's innovation community. While the feedback from the online survey[1] confirmed the hypotheses about the strategy and its key topics, it was not possible to conduct the survey to its full extent due to the Corona pandemic. However, the limited feedback gathered was used as a reservoir of ideas.

As well as verifying the findings of the benchmarking analysis, the empirical analysis clearly pointed to the need for a strong innovation culture. This was taken up in the mission statement, which argues that

[1] The online survey was conducted in the final third of the project. The aim was to test the hypotheses developed so far on a broad basis. Due to the Corona pandemic, the sample size was significantly smaller than originally planned, with almost 200 participants from business, science, society and administration taking part in the survey.

a broad base of agile, open and courageous innovation stakeholders is indeed vital for the success of the Innovation Strategy.

Figure 2-3: Impressions from the kick-off event

Figure 2-4: Impressions from the “innovation room”

2.2 Understanding of innovation

By expressly including the aspect of social relevance, the Innovation Strategy gains special significance for Hamburg's future. Innovation is no longer confined to technological inventions and their implementation in products or processes; the dimensions of innovation have now been extended considerably.

"Innovation spans the entire process of value creation, from developing an idea to implementing it and exploiting it in the marketplace. It encompasses the traditional perspective of technological innovation as well as process, service, organisational and business model innovation. In light of today's societal challenges, the concept of innovation has become more comprehensive, and social innovations as well as innovations from the cultural and creative industries have been given special emphasis. Thus, when assessing innovations, it is also being considered whether they succeed in addressing societal challenges and being a benefit for the people of a liveable city."

This broadened perspective already surfaced in the joint analysis of trends as not only technology, jobs and a successful economy played a role here. While research and science can provide technologies for new solutions, they also require a certain degree of public support to be implemented. Today, the science and business sectors are competing to attract the best talent and the most innovative companies. This competitive effort has many dimensions and includes e.g. a welcoming culture and relocation incentives, engaging, relevant topics and appealing projects, systematic training and support in the area of innovation skills as well as the creation of an attractive, all-embracing innovation environment.

Innovations are made by people. It also became clear in the expert interviews that the focus on topics for the future can only bear fruit if a broad basis of local residents is closely involved via networks and through tangible opportunities to engage locally.

2.3 Benchmarking analysis

To place the project on a solid foundation and to gather as many specific suggestions as possible for the Innovation Strategy, a comprehensive benchmarking analysis was conducted, comparing Hamburg with other innovative locations in Germany and beyond. In this context, the pre-selection of over 100 locations revealed that even at this stage Hamburg belongs to the top 20 percent.

From the more than 100 locations, Copenhagen, Munich, Dublin, Rotterdam and, as a non-European location, Toronto were chosen as reference locations. These cities where analysed according to nine dimensions as well as three cross-cutting themes. For each of the nine dimensions, a further location was selected to represent a top location for the respective dimension.

The dimensions of the benchmarking analysis are as follows: research and development, transfer, education and training, economic structure/economic strength, start-ups, infrastructure, digitisation, sustainability and diversity. The three cross-cutting themes are funding, support, and innovation marketing.

The following figure shows the innovation score derived from this:

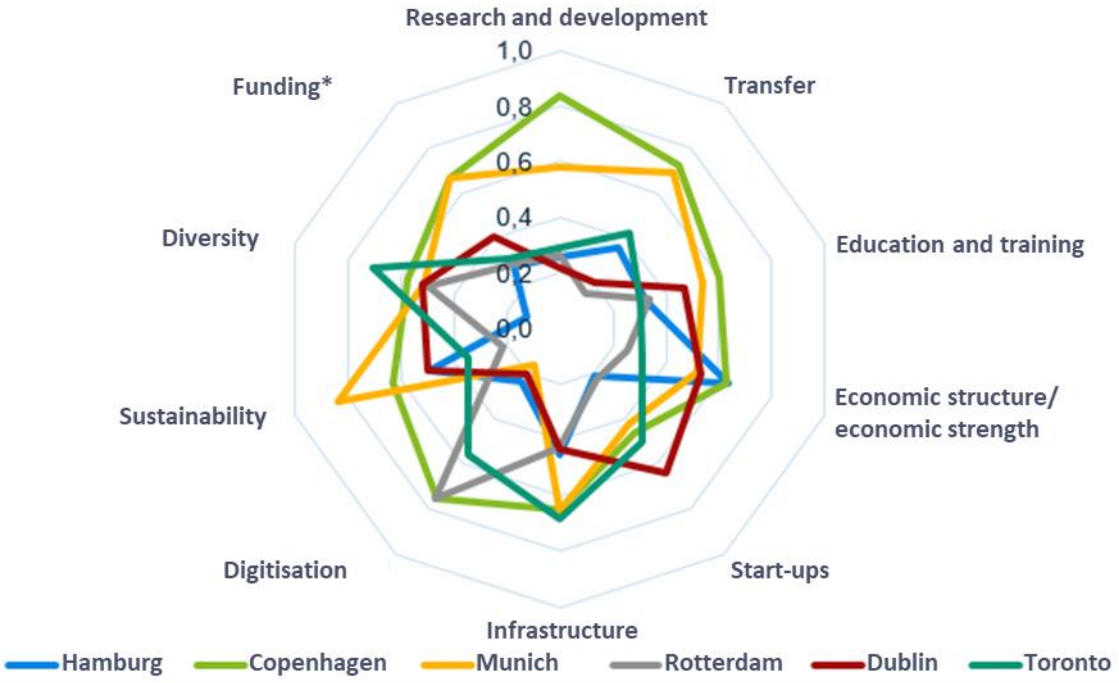


Figure 2-5: Innovation score – results of the subdimensions (Hamburg vs. all other cities)

Source: Statista analysis based on various sources, *aggregation of partial results of the other dimensions.

Despite the fact that even today Hamburg is one of the top innovation locations, it will be necessary to leverage its potential to a greater degree to ensure that Hamburg continues to stand its ground in international competition. To further strengthen Hamburg's position in future, the following fields, which have been identified in the detailed analysis as having development potential, are especially relevant:

- **Research and development:** third-party funding, R&D expenditure of the private sector, number of scientists involved in research
- **Transfer:** number of spin-offs from universities, network of contract research for industry
- **Education and training:** dropout rates of schools, training companies and higher education institutions; share of population with tertiary qualifications, STEM focus, lifelong learning, international layout of system
- **Economic structure and economic power:** number of innovative large enterprises, cross-border cooperation, interconnectedness of economic clusters and science clusters

- **Start-ups:** funding and venture capital volumes, start-up ecosystem and competition for talent, infrastructure and networking opportunities
- **Infrastructure:** further expansion of intelligent traffic control and local public transport system
- **Digitisation:** availability of fibre optic internet, use of e-government services, internet speed
- **Sustainability:** carbon footprint, air quality, cycling infrastructure
- **Diversity:** share of international students, employment rate among non-native population
- **Funding:** third-party funding, research and development expenditure, venture capital provided for start-ups, financial resources provided by the public sector, distribution to focus areas.

Based on these findings, the following suggestions for Hamburg as a location for innovation have been identified:

Focus: One of the strengths of Hamburg's innovation system is the growing number and range of organisations, initiatives, measures and projects. At the same time, this very diversity poses a challenge when it comes to setting thematic and financial priorities. The benchmarking analysis shows that international locations succeed in consolidating their innovation activities and identifying focal topics, thus creating a distinguishable profile for the location. Focusing on a limited number of thematic fields allows a location to consolidate resources systematically, facilitates the formation of clusters across science and industry and is a prerequisite for straightforward, consistent communications.

Sufficient funding: In the area of financing, there is clear potential for supporting Hamburg's innovation system further. This applies to third-party funding as well as to expenditure on research and development. Sufficient volumes of private capital have to be made available as venture capital to strengthen investments and to compensate for the disadvantages of being a city-state and a location with relatively few large companies.

Market orientation: Efforts to align innovation activities with the needs of the market and global trends should be increased in the early phases of research and development. An even stronger exchange between science and industry, providing incentives for researchers and including them in commercial successes resulting from their research are approaches that other top international locations are pursuing more consistently than Hamburg.

Pilot projects and lighthouse projects: As a city-state, Hamburg offers an ideal environment for experimenting with innovations not only in laboratories but also in practical settings under real conditions. Initiating pilot projects in the city's regulatory sandbox also enables stakeholders to market these as beacons of sustainable progress and thus enhance Hamburg's supra-regional and global attractiveness as a location for innovation.

Aspiring goals and measuring progress: For innovative projects to gain public approval and enthusiasm it is important to provide transparency. Only by defining tangible goals and by measuring progress towards them, confidence can be created that innovations are advancing successfully for the benefit of society. Communicating the status of goal achievement openly includes sharing not only the

joy of successes, but also the failure to achieve certain goals. Especially the latter demonstrates whether failure, which is an integral part of the innovation process, actually represents an element of the joint learning process.

Networking: The traditional links between science and industry no longer suffice to ensure an innovation strategy's broad-based approval. More than ever, the societal relevance of progress is crucial for gaining the necessary political support. Moreover, networking activities within the Hamburg Metropolitan Region itself could be improved, as also noted by the authors of the OECD study[2]. Here, any existing approaches should be expanded in a systematic manner.

A positive risk culture: Innovation begins in the mind. It takes courage on the part of those involved and it takes conditions in which innovations can be developed swiftly and easily. Consistently minimising any administrative hurdles and a supportive local infrastructure for new initiatives are means of contributing to a positive risk culture. Projects should be supported especially in the early phases, where failure is part of everyday life and where successful business models of the future still have to prove themselves.

Non-financial support: Innovations need more than monetary support. Young founders in particular should be able to benefit from the experience of others, e.g. through advisory formats, discussion forums and mentoring programmes. This also includes places where new ideas can be developed and tested easily and conveniently. A decentralised infrastructure with offices and workshops, networks and exchange forums, on-site advice as well as support regarding administrative necessities can contribute to attracting individuals with ideas, skills and innovative energy.

2.4 SWOT analysis

Identifying Hamburg's strengths, weaknesses, opportunities and threats (SWOT) has been an integral part of the overall process. The following overview aims to summarise the findings of the benchmarking analysis as well as the empirical analysis in the form of expert interviews, surveys and workshops. Further information on the findings and the specific challenges entailed can be found in the description of the strategic fields, and, in more detail, in the appendix (German language only).

[2] OECD Territorial Reviews: Hamburg Metropolitan Region, Germany (2019), available at https://www.oecd.org/cfe/cities/Hamburg-Policy-Highlights.pdf

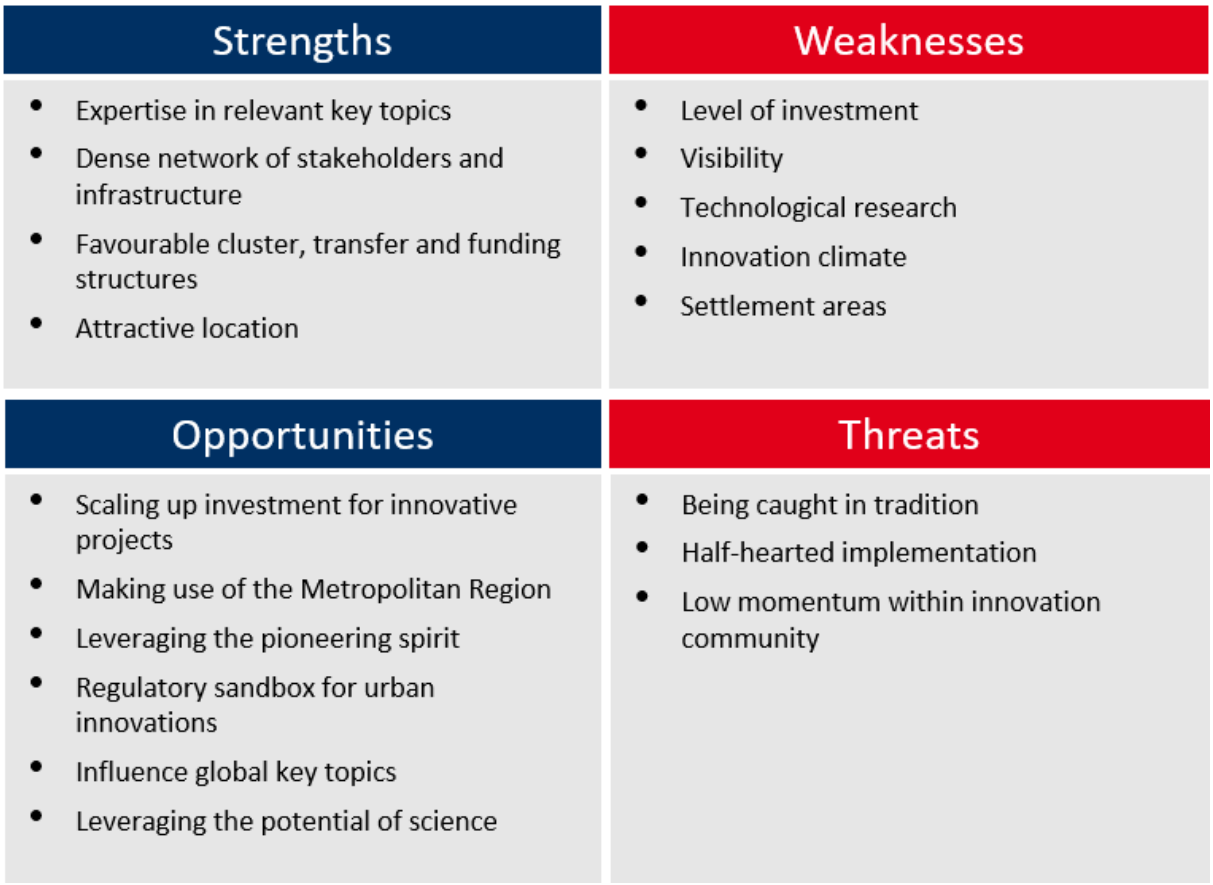


Figure 2-6: SWOT analysis at a glance

2.5 Hamburg's key topics for the future

In the course of the strategy process, it was established that Hamburg has strong science-, research- and business-related expertise as well as relevant networking competencies in several important key areas. When it comes to imagining a liveable future, these key areas are also deemed relevant by the local population. Thus, one of the findings of the strategy process was the belief that Hamburg needs to focus on selected key topics for the future. This would add to value creation, increase the visibility of the various activities taking place at the location and create momentum in the innovation community – which would, by way of reaching critical mass, increase Hamburg's attractiveness and help assume a top-range level of innovation.

The Innovation Strategy proposes that these key topics are specified as part of an ongoing process, while also embedding them firmly in the local innovation structure. The current situation, i.e. the Covid crisis in particular, certainly demonstrates how unpredictable the future is despite any focal areas and planning activities. Against this background, it becomes clear that the defined topics are like snapshot results that need to be reassessed continuously. Moreover, it should be prevented that the focus on these key topics leads to new, potentially rigid parallel structures. Instead, the aim is to connect

stakeholders in such a way that common objectives can be realised as flexibly as necessary, that the key topics can be advanced, and that a powerful Hamburg innovation network can be established across professional, spatial and psychological boundaries.

Five key topics for the future emerged from the constructive discourse with all those involved in the process. In the following, these topics shall be described in terms of their relevance and special reference to Hamburg's innovation landscape, and shall be illustrated using exemplary projects and initiatives.

Hamburg's key topics for the future are:

- Healthcare
- Climate and energy
- Mobility
- Data science and digitisation
- Materials sciences and new materials.

One of Hamburg's unique selling points is its distinctive cluster landscape, which is to be further expanded in the future. Currently, there are eight economic clusters (Hamburg Aviation, Life Science Nord, Hamburg Logistics Initiative, Hamburg Health Cluster, Hamburg Kreativ Gesellschaft, Renewable Energy Hamburg, Maritime Cluster Northern Germany, and nextMedia.Hamburg) as well as four "clusters of excellence" (CUI: Advanced Imaging of Matter, Climate, Climatic Change and Society (CLICCS), Understanding Written Artefacts, and Quantum Universe). In addition, there are plans to establish four new science clusters (Systems and Structural Biology / Infection Research, Climate Research, Materials Research and Data Science) as well as a Food Industry and a Financial Services cluster. Moreover, a Hydrogen cluster will be established as part of the existing Renewable Energy Hamburg Cluster.

The figure below aims to visualise Hamburg's cluster landscape and its interplay with Hamburg's key topics for the future.

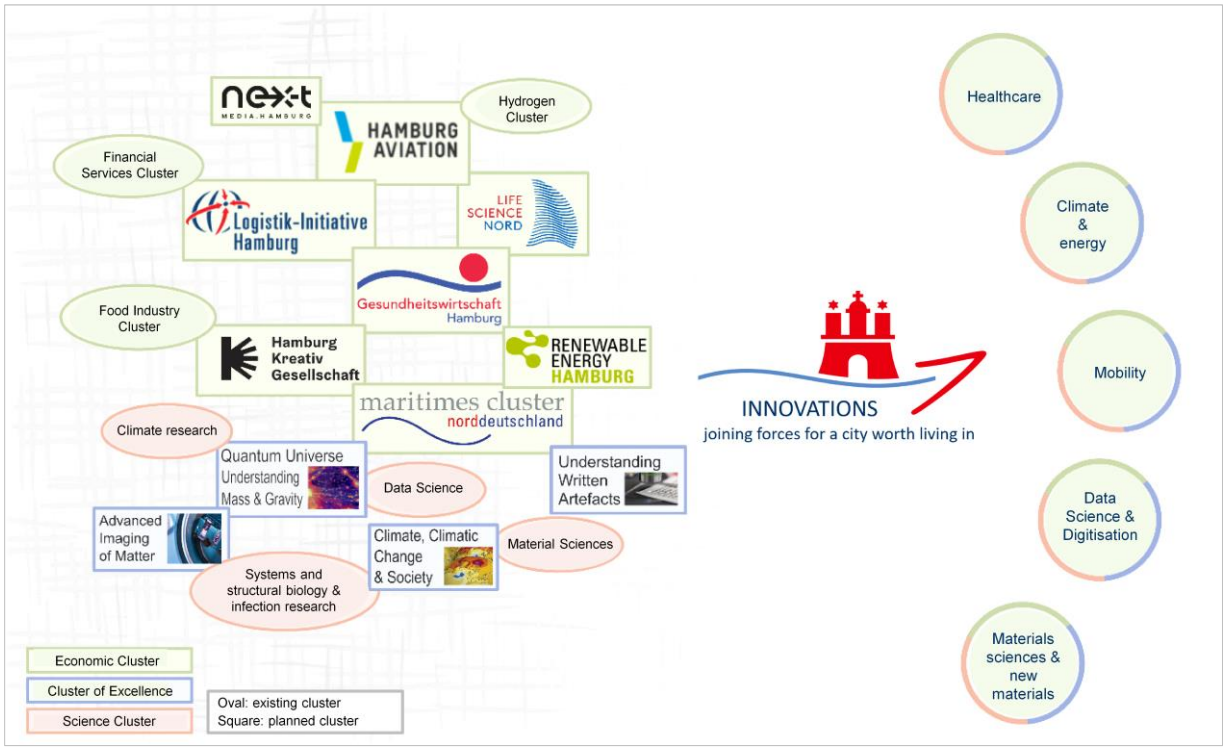


Figure 2-7: Planned and existing clusters as well as Hamburg's key topics for the future[4]

Hamburg's key topics for the future differ in nature and are also characterised by different levels of development. The following overview is intended to outline the potential emanating from Hamburg's key topics. It is a "living document", i.e. going forward, these topics are to be shaped, connected and marketed further.

2.5.1 Healthcare

The Corona pandemic continues to be a major stress test for the healthcare system and has forcefully demonstrated its relevance. At the same time, pandemics – which are likely to happen again in the future, considering our multi-layered, interconnected global economy – can also become drivers for innovation, e.g. in areas such as infection research, vaccine production and digitisation. As a result of today's longer life expectancy, demographic change has led to prolonged life phases with an increased frequency of chronic diseases. Scientific progress and demographic factors are major challenges that highlight the continued need for innovation in the healthcare sector. As the main medical hub in Northern Germany, Hamburg provides a comprehensive medical infrastructure that is ideally suited to develop and test new therapies, technologies, procedures and care structures and to ensure their regular application. Indeed, the healthcare sector has the opportunity to generate a significant innovation boost through new medical technologies, nano-analytical techniques and digitisation – and this opportunity should be fully utilised.

Hamburg's research facilities enjoy an excellent reputation both nationally and internationally. The University Medical Center Eppendorf (UKE) and its medical research department plays a key role in this regard. Not least in the context of the Corona pandemic, infection research has become an important focal area, and Hamburg aims to achieve a leading international position here. In addition to the University of Hamburg (UHH) and the UKE, relevant research is also being conducted at renowned non-university research institutes, such as the Heinrich Pette Institute (HPI) and the Bernhard Nocht Institute for Tropical Medicine (BNITM). Together with the Research Center Borstel (FZB), these two institutes form the Leibniz Center Infection (LCI) research alliance. Other non-university research facilities include e.g. the European Molecular Biology Laboratory (EMBL) Hamburg. In the area of pharmaceutical drug discovery, the ScreeningPort of the Fraunhofer Institute for Molecular Biology and Applied Ecology (IME) is an important player that is dedicated to bridging the gap between basic research into the causes of disease on the one hand and drug development by pharmaceutical companies on the other. The Fraunhofer ITMP ScreeningPort (ITMP SP) has positioned itself as one of the world's leading international facilities for high-throughput screening of chemical molecules.

As well as being home to Science City Hamburg-Bahrenfeld with its comprehensive infrastructure e.g. for research institutions, start-ups and companies, Hamburg also provides research access to radiation sources at the German Electron Synchrotron (DESY) and the European X-Ray Free-Electron Laser (XFEL) – the only ones of their kind in Europe. At DESY's X-ray source PETRA III, for instance, BioNTech, the Mainz-based biotech company, is currently conducting research related to the next generation of RNA agents. In cooperation with other research partners, BioNTech has been investigating how messenger RNA (mRNA) can be packaged better so as to be more effective in the target organism. The relevant research was conducted at a measuring station operated by the European Molecular Biology Laboratory (EMBL) Hamburg.

In the field of structural biology, the Bahrenfeld campus also offers the technical prerequisites needed to observe cellular processes dynamically and in high resolution. The high-end cryo-electron microscopy technique at the Centre for Structural Systems Biology (CSSB) can depict even the smallest molecular structures in 3D.

Innovative power also unfolds in the interplay with social sciences and humanities as these contribute important insights regarding the social, political and economic causes and impact of disease developments and infections, respectively. To strengthen these links further, a number of measures are intended to be introduced. These include e.g. new collaborative research projects, a new "cluster of excellence" application – the University of Hamburg's contribution to the next round of the Excellence Strategy programme by the German Federal Government and the State Governments – as well as strengthening non-university research into infection. What is more, new ways will have to be developed for translating research results into application in a reliable and effective manner. In the area of infection research, the Hamburg Senate aims to partner closely with the research institutions involved.

Initiated by the UKE, the Hamburg City Health Study was set up as the world's largest local health survey, with about 45,000 Hamburg residents taking part. Overall, more than 30 UKE clinics and institutes are working together to conduct interdisciplinary research aimed at shaping the future of medical care and healthcare, e.g. by providing relevant insights into disease prevention as well as more individualised treatment methods.

The Hamburg Health Cluster plays an important role in fostering Hamburg's healthcare network. It supports efforts to optimise medical care and is in charge of consolidating and connecting stakeholders' expertise across sector boundaries. Activities are mainly focused on the following topics: e-health, sustainable care for the elderly, innovative solutions for recruiting skilled personnel as well as creative concepts for corporate health promotion. In addition, the Life Science Nord Cluster, which has been awarded the Gold Label by the European Cluster Excellence Initiative ECEI, acts as a major innovator and economic hub with a strong network in the medical technology, biotechnology and pharmaceuticals industries. As regards Science City Hamburg-Bahrenfeld, the life sciences sector will also be well represented on campus. Established by Philips, the Health Innovation Port (HIP) is yet another location dedicated to fostering innovation. With its specialised infrastructure and its strong network of partners, HIP supports start-ups and established players in developing and growing innovative ideas and new business models in the digital health market.

Hamburg's healthcare sector is also setting trends in the area of education and training. The integrated medical degree programme iMED, for instance, aims to link theory with clinical practice right from the start and, with its forward-looking design, serves as a model for the whole of Germany. For academic health and nursing professions, the Hamburg University of Applied Sciences (HAW) offers a dedicated part-time programme that combines in-depth scientific and practical training. The aim is to qualify graduates for specialist management tasks and enable them to identify research needs and implement research projects. In addition, digitisation in Hamburg's healthcare system is to be advanced further. For example, the H3 project (Health Harbor Hamburg) is currently developing standards for secure data exchange between hospitals based on electronic patient files. While scheduling appointments with medical practices online and digitally transferring initial diagnoses from emergency services have become well established, telemedicine and the use of artificial intelligence (AI) for diagnostic support are also on the rise. Moreover, open innovation platforms are assuming an increasingly important role in the healthcare sector, as many methods only become feasible by tapping an extensive pool of medical knowledge.

2.5.2 Climate and energy

As climate change continues to accelerate, humanity is facing challenges on a global scale. The provisions of the Paris Climate Agreement have set ambitious targets to mitigate climate change. The Fridays for Future movement, amongst others, has contributed to the fact that large parts of the

population are beginning to acknowledge the relevance of climate change. Today, citizens are expecting a clear path towards a sustainable use of global resources.

Hamburg has set itself the goal of reducing its CO2 emissions by 55 percent by 2030 compared to 1990 and to become climate-neutral by 2050 (i.e. to reduce CO2 emissions by at least 95 percent). Transforming the mobility sector will be one of the many measures to accomplish this goal, alongside e.g. plans to increase the energy efficiency of aircrafts and establish a comprehensive shore power infrastructure for maritime shipping at the port of Hamburg. The Altona cruise terminal already features Europe's first shore power system for cruise vessels, and one by one the other cruise terminals will also be equipped with shore power systems. In addition, several berths at the container terminals will be provided with shore power systems to enable them to supply container ships in the future. With these steps, Hamburg is expanding its pioneering role in the field of supplying alternative energy to ships during docking.

The transformation of the economy, which has only just begun, needs to be pushed forward. Here, the wide range of measures suggested includes anything from large-scale ventures such as the Northern Germany Regulatory Sandbox – a joint project of Germany's Northern states aimed at systematically transforming the energy system with a focus on hydrogen – to supporting small and medium-sized enterprises in their efforts to increase their energy efficiency. For example, companies that have set themselves challenging goals and have taken their first steps successfully can be supported through environmental partnerships. What is more, the City of Hamburg has adopted a Clean Air Plan that provides for ten dedicated policy packages. These include e.g. the expansion of park & ride and car sharing options, innovative delivery solutions for the inner city, traffic restrictions for diesel vehicles, the expansion of the charging infrastructure for e-mobility as well as state-of-the-art drives for port ferries, barges and tugboats. One of the building blocks for achieving this is to make Hamburg's port climate-neutral. In this regard, Hamburg is already taking various measures to reduce emissions, e.g. by increasing the efficiency of supply chains through digital systems and by promoting innovative and eco-friendly energy supplies in the port.

By adopting the North German Hydrogen Strategy, Hamburg underlines the necessity to build a green hydrogen economy. The goal is to develop a green hydrogen economy by 2035 and to be able to supply all parties interested in green hydrogen, industry in particular. As part of this strategy, one of the world's largest hydrogen electrolysis plants is to be created in the port of Hamburg, which will be producing green hydrogen from renewable electricity. In conjunction with this electrolyser, an innovation hub is to be established, where stakeholders from science, industry and start-ups will have the opportunity to jointly develop new applications, thus supporting the goal of creating a self-sustaining hydrogen economy. With this, Hamburg aims to become a hub for the hydrogen industry.

Furthermore, using renewable electricity, sector coupling technologies are to be promoted and strengthened in order to be able to serve the different economic needs both widely and extensively. In April 2021 it was thus decided that the EnergyCampus in the district of Bergedorf would be expanded

to include a sector coupling demonstration centre in cooperation with the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES).

As regards energy research, five higher education institutions in Hamburg have joined forces to form Energieforschungsverbund Hamburg (EFH), an energy research group funded by the Hamburg Senate and aimed at consolidating expertise in the area of energy research. Serving as an interface for the stakeholders involved, EFH primarily takes on a coordinating role, e.g. by identifying and linking up potential project partners for various research ideas. EFH collaborates closely with the Renewable Energy Hamburg (EEHH) cluster initiative. EEHH organises and connects the wide scope of expertise of companies, research facilities and institutions from the renewable energy sector, promotes cooperation projects with other sectors and supports networking, training and innovation activities. Innovation potential is leveraged through lighthouse projects such as the NEW 4.0 - North German Energy Transition and the Northern Germany Regulatory Sandbox projects. The aim here is to achieve a 100 percent coverage of the regional energy demand by renewable energies by 2035. The Hamburg Metropolitan Region is a major international centre for wind energy and is on its way to becoming a leading European player in the areas of sector coupling and green hydrogen in particular.

When it comes to addressing the challenges of climate change, the Climate, Climatic Change, and Society (CLICCS) cluster of excellence plays an important role in Hamburg. Funded as part of the German Federal and State Governments' Excellence Strategy, it is aimed at continuing the long-standing university research focus on climate as well as strengthening cooperation with non-university research institutions at the location – such as the Max Planck Institute for Meteorology, Helmholtz-Zentrum Geesthacht[3] and the German Climate Computing Center (DKRZ). As well as generating comprehensive knowledge resources for a better understanding of the effects of climate change, the cluster actively supports relevant societal transformation and innovation processes, while also helping establish adaptation strategies as needed. The cluster's annual publication, The Hamburg Climate Futures Outlook, outlines different climate-related scenarios and aims to supply political decision-makers with a reliable source of information. The Climate Service Center Germany (GERICS), a cooperation between Helmholtz-Zentrum Geesthacht and academia, serves as a dialogue forum for (climate-related) basic research and project partners from politics, business and administration.

With the German Climate Computing Center (DKRZ), Hamburg boasts a national service facility that is equipped with high-performance computers and data storage capacities, thus providing key research infrastructure for climate science in Germany.

As the most important ecosystems on earth, the world's seas and oceans play a pivotal role in global climate processes. To connect stakeholders involved in research into global climate change, the five Northern German states have joined forces to form the German Marine Research Alliance (DAM).

[3] In March 2021, the Helmholtz-Zentrum Geesthacht was renamed to Helmholtz-Zentrum Hereon

2.5.3 Mobility

The Hamburg municipality provides a comprehensive network of transport options on a relatively small surface area. Due to its trading history, Hamburg has quite a high volume of commercial traffic in addition to passenger traffic. The city accommodates all modes of transport, whether by land (road and rail), by water or by air. Beyond its extensive local public transport system, Hamburg is also Northern Germany's hub for long-distance traffic. In addition to the road network for motorised transport, a cycle route network and pedestrian pathways, there is also a broad range of providers in the area of car, e-scooter and bike sharing, such as StadtRAD, the successful municipal bike rental system.

To integrate all of these systems as part of a sustainable transport policy is a considerable challenge. One of the measures here is to systematically strengthen all eco-friendly means of transport in the locality, i.e. public transport, cycling, and walking. Indeed, Hamburg has set itself the goal of increasing the share of journeys made by eco-friendly means of transport to 80 percent over the course of the next decade. As a prerequisite, the transition of the transport system at large has to be accelerated. Sustainable transport solutions are securing the mobility of the future and provide an ideal environment for getting innovative concepts into practical use in the shortest possible time. Hamburg thus offers excellent conditions for accomplishing the sustainable transition of mobility – from international transport to covering the last mile.

The port of Hamburg is a smartPORT and is one of the world's leading ports in the use of digital solutions. As part of its smartPORT programme, the Hamburg Port Authority (HPA) is implementing numerous innovation and digitisation projects. With its smartPORT philosophy, the HPA embraces sustainable economic growth and maximum benefit for customers and local citizens, while minimising the port's environmental impact. Innovative solutions based on the Internet of Things (IoT), Virtual Reality (VR), Artificial Intelligence (AI) and drones help sustain the port's competitive position in the future.

Hamburg's cluster initiatives are also involved in developing mobility solutions of tomorrow. The Hamburg Logistics Initiative, for instance, strengthens Hamburg's role as a leading logistics hub in Northern Europe, and the Hamburg Aviation Cluster connects stakeholders from the aviation industry in the Hamburg Metropolitan Region, one of the world's major locations for civil aviation. Low-emission aircrafts and sustainable aviation are highly relevant to society today, and the future of flying will be heavily influenced by lessons learnt from the Corona pandemic, e.g. in terms of health protection and hygiene.

For ideas to be translated into innovations, they need the right conditions, ample leeway as well as creative opportunities for testing them out. The Center of Applied Aeronautical Research (ZAL) may serve as an example of how such environment can be provided in the field of aviation. ZAL enjoys high international visibility and is almost unparalleled in the world. Here, aviation research is linked up with industry, and products and services are jointly developed for creating a sustainable future for aviation.

Hamburg's range of activities in the area of drones are also quite promising, with both research and projects being implemented here. For example, the WiNDroVe network, which is being coordinated from the premises of ZAL and is aimed at exploring the use of transport drones in metropolitan regions, has given rise to the MediFly project, where tissue samples are transported between any two hospitals by drone shuttle. The Fraunhofer Center for Maritime Logistics and Services (CML) translates the latest research findings into practical applications across four research fields (maritime logistics, ports, shipping and shipbuilding). The focus is on developing solutions for end-to-end digitisation and process automation, service concepts and AI-supported data evaluation, as well as autonomous maritime systems and sustainable shipping. At Fraunhofer CML, these innovative concepts are tested and optimised by means of simulations, models and real operations.

Technological innovations are having positive effects on the transport systems of the future, e.g. by enhancing traffic control and safety. Such efforts are commonly subsumed under the concept of intelligent transport systems (ITS). Taking place in Hamburg, the 2021 ITS World Congress serves as a platform for testing ideas and capacities that will have lasting effects on mobility in the locality. Examples include field tests in the area of autonomous and connected driving as well as the Digital S-Bahn Hamburg project. In the coming years, Hamburg will be increasing its focus on gearing up its transport network using intelligent transport systems and employing the latest developments and applications. The overall aim is to ensure that people and goods are moved as safely, efficiently and eco-friendly as possible.

When it comes to the ongoing digitisation of society, which affects the logistics industry in a major way, the Digital Hub Logistics Hamburg provides fresh impetus at the location. Here, SMEs, large companies, start-ups, investors as well as stakeholders from research, teaching, politics and administration are brought together in one (physical) place to drive forward the digital transformation of the logistics industry. Offering a wide range of formats and events, collaboration and networking are systematically strengthened within the Digital Hub and beyond.

Electromobility is another important building block in transforming mobility and meeting the relevant climate and clean air targets. To achieve this, Hamburg is making efforts in many areas, e.g. by optimising last mile logistics and by expanding its car sharing fleets, where the Hamburg Senate has entered into Memoranda of Understanding with selected providers. Other core measures include equipping local public transport vehicles with low-emission drives, e.g. by electrifying Hamburg's bus fleet. One of the principle foundations for expanding electromobility is a public charging infrastructure that is needs-based, convenient to use, and non-discriminatory. Even at this point in time, Hamburg provides an excellent infrastructure that is open to everyone and has set itself challenging targets when it comes to electrifying private cars too. According to current planning, another 2,000 charging stations will be added to the network by 2025. Alongside measures to optimise and develop existing structures, Hamburg also aims to promote the creation of charging infrastructure beyond the public space (e.g. at home, at work, et cetera).

In the area of hydrogen and fuel cell technology, Hamburg has the opportunity to initiate a sustainable transformation process and to ultimately establish a self-sustaining hydrogen economy in the mobility sector too, including the relevant climate-related benefits resulting from this. These efforts are actively supported by the North German Hydrogen Strategy, which seeks to establish a green hydrogen economy in Northern Germany by 2035, achieving nearly full coverage among customers interested in green hydrogen. Furthermore, at least 500 megawatts of electrolysis capacity for the production of green hydrogen are to be installed in Northern Germany by 2025, and at least five gigawatts by 2030. As part of these efforts, Hamburg is to generate large volumes of green hydrogen on-site the decommissioned coal-fired power plant in the Moorburg quarter, presumably from 2025 onwards. To this end, the City of Hamburg has forged an alliance with several industrial groups.

The mobility behaviour of the urban population is changing. This is not only owing to rising energy and transport costs, but also a result of technological progress, e.g. in the area of electric bicycles and sharing systems, as well as social factors such as increasing environmental and health awareness and changes in terms of lifestyle and working environments. Going forward, incentives will continue to be in place to influence people's mobility behaviour in a way that supports the use of bicycles and public transport. To ensure that these options are as attractive as possible, additional cycle lanes are being added and the local public transport network is being expanded further.

In view of these strengths, the location's economic power as well as excellent research and science institutions, such as the Center of Applied Aeronautical Research (ZAL) and the German Aerospace Center (DLR), a commitment to innovate has developed among stakeholders, and this will certainly contribute to enhancing mobility in Hamburg further.

2.5.4 Data science and digitisation

Digitisation plays a decisive role in many areas of the economy and many spheres of life. Seeing that the impact of digitisation is all-encompassing, it should not be treated as an isolated trend. In fact, quite the opposite holds true: digitisation is to be regarded as a cross-cutting issue that affects all of the key topics. Against this background, Hamburg initiated a comprehensive digital strategy process in 2019, which pertains to the entire administrative system at authority and district levels. In 2020, the Hamburg Senate adopted its Digital Strategy for Hamburg, which goes well beyond the realms of administration and addresses various aspects of digitisation across all areas of the Digital City vision. The digital spaces, strategic development areas as well as other cutting-edge fields outlined in the strategy are also reflected in some of the topics and projects discussed below.

Accordingly, there is hardly any area of the economy that is not affected by the innovative potential of digitisation. Here, the range includes anything from Artificial Intelligence, quantum computing and Industry 4.0 to digital business models and continuing professional development (Work 4.0) – and thus

the potential for evolutionary, disruptive market developments and research areas is just as pronounced. As overarching as the megatrend of digitisation may be, its effects, opportunities and challenges are specific to the individual branches of the economy and scientific areas, respectively.

Digitisation also constitutes a core topic in all of Hamburg's economic clusters. The nextMedia.Hamburg initiative, for instance, systematically supports media companies seeking to transform their business, and in the Life Science Nord cluster, expertise in the fields of AI and Big Data is used e.g. to advance assistance systems and develop new active ingredients. To drive innovation in the media industry, nextMedia.Hamburg also serves as a facilitator by providing accelerator and incubator programmes as well as prototyping labs. As regards Hamburg's logistics industry, the establishment of the Digital Hub Logistics has been a milestone for the Hamburg Logistics Initiative. As well as strengthening the location's competitive edge, it is aimed at increasing the development activities of established logistics SMEs by integrating new digital approaches and business models as well as capacity building (regarding market requirements, customer needs, et cetera) for start-ups and new enterprises. The aviation cluster too has the challenging task to take digitisation into consideration when dealing with any issue and to address it in a comprehensive manner through collaborations and cross-sectional projects. Today, data security and data platforms have to live up to entirely different new standards to ensure a secure end-to-end data flow. DigiNet.Air, the Hamburg Metropolitan Region's network for digital learning in the aviation industry, is working with small and medium-sized enterprises to develop tools that can be used to shape the process of digital transformation. The impact on qualification and training is also far-reaching, both in terms of the required skills sets and opportunities for providing digital or hybrid training concepts.

With a range of services tailored to individual needs, Mittelstand 4.0 Kompetenzzentrum Hamburg, a service centre for SMEs in particular, supports local companies on their path to digitising processes and products. Likewise, Hamburg Kreativ Gesellschaft, the cluster initiative of the creative industries, contributes its methods skills, industry knowledge and expertise in cross-sectoral innovation processes to the local ecosystem, e.g. within the framework of the Cross Innovation Hub, a project that is supported by the European Regional Development Fund (ERDF). In addition, Factory Hammerbrooklyn is available as an experimental space for organisations, established companies and start-ups from all sectors and is on its way to becoming a global forum for digital innovators.

Digital change is also affecting the world of science as new forms of collaborating and options for research are emerging beyond the boundaries of place, time and disciplines. While collecting, linking, interpreting, storing and making data accessible has always been part of the academic process, digitisation facilitates an open culture of innovation where data, information and ideas can be contributed and exchanged more conveniently.

As digitisation increasingly permeates nearly all areas of life, large and complex data volumes are being generated along the way. The handling of such data, from scientific analysis and evaluation to socially accepted ways of using them, offers a range of challenges and opportunities for industry, science,

research and innovation. Hamburg has the locational advantage of being home to a number of higher education institutions with computer sciences as well as other disciplines that contribute greatly to this field that can only be mastered through interdisciplinary collaboration. At the same time, large data volumes provide an indispensable basis for economic and scientific innovations and a treasure trove for various areas of application, such as education, energy, climate, finance, healthcare and mobility. As such, data offer enormous potential for economic, scientific, technological and social innovations.

In the area of data science, Hamburg offers an excellent infrastructure – with high-performance computers available at the location (e.g. at the German Climate Computing Center, the computing centres of the University of Hamburg and at DESY), with leading international large-scale research facilities that generate huge amounts of data (e.g. PETRA III and XFEL) as well as renowned research centres for analysing large amounts of data, such as the Center for Data and Computing Science (CDCS), Helmholtz Graduate School (DASHH) as well as GERICS.

Through the Artificial Intelligence Center Hamburg (ARIC), Hamburg and the Hamburg Metropolitan Region are addressing AI-related questions across all sectors. The aim is to evaluate and utilise the potential of this important scientific discipline and to advance the AI ecosystem in the region. At ARIC, companies can take their first steps with AI, deepen their existing knowledge and benefit from an interdisciplinary network of AI stakeholders.

In recent years, Hamburg has also been collaborating closely with universities (UHH and TUHH) as well as local companies to raise its profile as a location for quantum computing, arguably one of the most important technologies of the future. This also included efforts to mobilise financial resources from a federal funding programme. The Hamburg Senate has set itself the goal of positioning Hamburg nationally and internationally in the field of quantum computing. Hamburg is thus ready to develop and promote this highly relevant cutting-edge technology together with the German Federal Government.

HITeC, the research and technology transfer centre of the Department of Computer Science at the University of Hamburg, is aimed at conveying the knowledge of computer science experts and establishing contact between companies. One of its lighthouse pilot projects, the computer science platform ahoi.digital, is currently creating strong impetus for innovation. As part of this cross-university cooperation project, interdisciplinary teams are working on IT-related topics to generate new insights and ideas, also with a view to launching start-ups as well as other ways of transferring knowledge. Meanwhile, the Urban Data Hub, a cooperation project between the Hamburg State Office for Geoinformation and Surveying (LGV) and CityScienceLab (CSL) at the HafenCity University Hamburg (HCU), is dedicated to developing the strategic design of a joint urban data infrastructure in close coordination with the Office for IT and Digitisation (ITD) at the Senate Chancellery – thus establishing a digital framework for consistent state-of-the-art data governance at city level. Together with partners from civil society, politics, business and science, CityScienceLab conducts research into the transformation of cities in the context of digitisation. By investigating technological issues with a view to social and cultural developments, it pursues a decidedly inter- and transdisciplinary perspective. The

ultimate aim is to make cities of the future healthier, more liveable and more efficient. Using immersive models, Virtual and Augmented Reality applications can help offer solutions at different levels.

The large volumes of data that are generated in Hamburg and that are required for the automatic setting of parameters are a valuable resource for a whole range of application areas they could be used in – such as education, energy, climate, finance, healthcare and mobility. All of these areas provide considerable technological innovation potential. In this context, advances in blockchain technology should also be discussed, especially in relation to designing and implementing digital business processes as well as e-government solutions – and thus societal processes too. Beyond any technological development issues, this also raises legal, fiscal and economic questions. After all, blockchain is still a fairly new cross-sectional technology that has developed at a rapid pace, and thus its practical maturity and actual potential for use have yet to prove themselves.

To help ensure that people can lead a sovereign life in the digital age and to shape the future of society at large, centrally located urban spaces will be essential in allowing low-threshold, open access to new forms of learning and events – for pupils, students, researchers and teachers, as well as founders and entrepreneurs. The “House of the Digital World” (current working title) is to become such a place, facilitating encounters of people from all walks of life – both digital and analogue.

2.5.5 Materials sciences and new materials

New materials have the potential to change the world. Whether it is scratch-resistant, lightweight smartphone cases, ultralight and yet stable aircraft wings, turbine coatings that can withstand extreme heat or efficient photovoltaic systems that generate electricity from waste heat: in all of these examples it is the materials used that are decisive for the usability of the relevant product. Often enough, however, such high demands cannot be met using conventional materials alone. In the course of the strategy process, materials sciences and new materials have been identified as one of Hamburg’s five key topics for the future.

Research into new materials is a prerequisite for leap innovations that have the capacity to change entire industries by means of economic applications. With its unique infrastructure, the Bahrenfeld campus is beginning to attract players from a wide range of disciplines. By continuing to expand the available innovation infrastructure for new materials, Hamburg is contributing to cutting-edge research in Germany.

One of the main tasks of materials sciences is to analyse the fundamental properties and structures of materials. The better the understanding of these, the more effectively this knowledge can be used to develop new materials that are particularly suitable for specific requirements. Materials science often takes place under the umbrella of disciplines such as physics and chemistry as well as life sciences such as biology and medicine, whereas the more application-oriented field of materials development

tends to take place in the context of engineering. In the view of Hamburg, this is a key topic with particularly high innovation potential that should be tapped and harnessed. One of the most active stakeholders at the location is the Center for Integrated Multiscale Materials Systems (CIMMS), an interdisciplinary initiative of the Centre for Advanced Materials (ZHM). Founded in 2015, ZHM is an internal collaboration between the Hamburg University of Technology (TUHH), Helmholtz-Zentrum Geesthacht, the University of Hamburg (UHH) and the German Electron Synchrotron (DESY).

Using 3D printing, scientists at CIMMS are working towards producing a novel material base, with the aim of creating more durable and more cost-effective goods with new types of features. The material properties thus enhanced will facilitate new technological developments, e.g. in the fields of energy, mobility, medicine and healthcare. Moreover, findings from 3D printing with new types of materials are also applied at various experimental facilities across the city, such as the FabLabs and the OpenLabs. Through the processing of digital data and the use of open source software, additive processes and technologies are influencing existing value creation and production processes in the global, national and regional economies.

At TUHH, these questions have been addressed for many years. With a focus on research into material systems, TUHH scientists have now succeeded for the first time in producing macroscopic material systems that are based on nanoscale building blocks such as metal, ceramics and organic molecules. In order to better understand observable properties of different materials, it is essential to gain knowledge of the internal structure of substances. At its Bahrenfeld campus, the University of Hamburg therefore consolidates relevant expertise in the area of basic research in physics as part of the Advanced Imaging of Matter (AIM) cluster of excellence.

The AIM cluster seeks to understand the nature and functionality of materials by observing the interaction of many different building blocks. To this end, a team of researchers from the University of Hamburg (UHH), the German Electron Synchrotron (DESY), the Max Planck Institute for Structure and Dynamics of Matter (MPSD) and the European XFEL GmbH (XFEL) is exploring the structure and dynamics of complex systems on the atomic scale. With its work, the cluster of excellence is also making a major contribution to developing forward-looking technologies. The detailed knowledge thus gained regarding atomic reactions within complex systems will also create space for innovative practical applications, e.g. in the area of drug development.

Further stakeholders include the Fraunhofer Research Institution for Additive Manufacturing Technologies (IAPT), one of the leading establishments in the field of additive production, with its core competencies in additive manufacturing. IAPT’s mission is to industrialise additive manufacturing, and thus facilitate technology transfer, to create resource-efficient products for the future.

3 Hamburg’s Innovation Strategy

The following figure aims to visualise the overall concept of the Innovation Strategy. The vision, the mission and the five strategy fields are supplemented by the expanded understanding of innovation as well as Hamburg’s five key topics for the future.

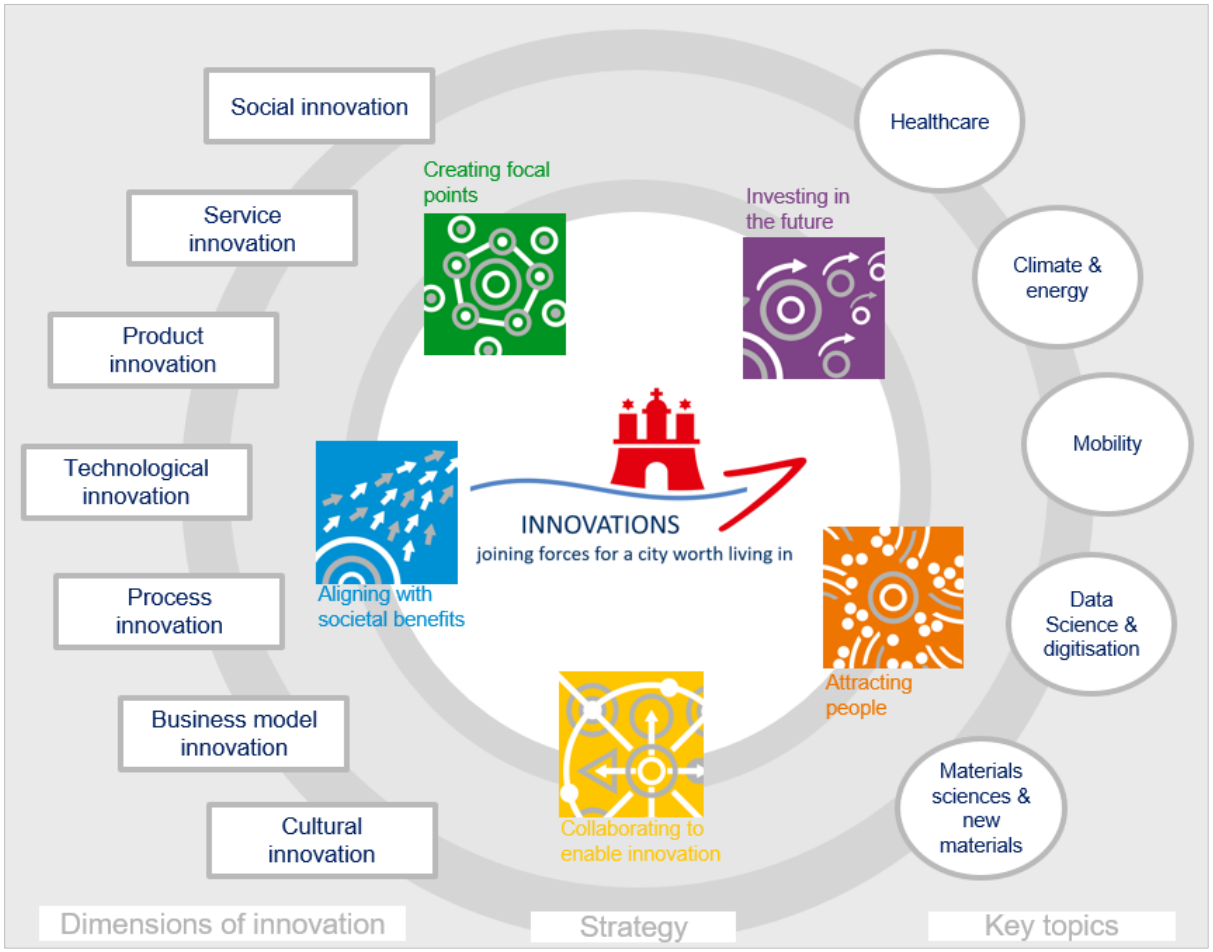


Figure 3-1: The Innovation Strategy at a glance

Innovation is exposed to an ongoing process of change, and thus Hamburg’s innovation environment continues to develop too. As a result, the above overview mainly aims to provide innovation stakeholders with appropriate guidance. All stakeholders involved are asked to follow the strategy and to adapt it as needed as certain conditions change or new experiences and findings are added along the way.

3.1 Vision

Innovations – joining forces for a city worth living in. Hamburg is becoming a role model for a liveable city where people take centre stage. In Hamburg, innovations are the key to shaping a place that people will enjoy living, working and spending time in.

We – the Free and Hanseatic City of Hamburg and the innovation stakeholders from Hamburg's business community, science and research sectors, educational institutions as well as societally engaged cultural and political institutions – are joining forces to accomplish our shared vision for a liveable city.

Hamburg's strong innovative capacity is reflected in the large number of innovative products and services, creative ideas and acquired talent, as well as in forward-looking jobs and an excellent science landscape – and all of these elements provide the basis for a liveable, sustainable city.

By jointly focusing on Hamburg's key topics for the future – i.e. healthcare, mobility, climate and energy, materials sciences and new materials, as well as data science and digitisation – we create innovative and sustainable solutions for major societal challenges. And we measure our success by keeping track of regional implementation and the contributions made to mastering global challenges.

This vision provides innovation stakeholders with guidance for any future activities and puts Hamburg in a leading international position as a centre of innovation and science in the city's key topics for the future.

Figure 3-2: Vision

3.2 Mission

Throughout the entire strategy process, the stakeholders involved collaborated in an agile and creative manner. Participants with different backgrounds, e.g. in business, science and civil society, have been working together closely and across disciplines to jointly develop Hamburg's new Innovation Strategy. This kind of cooperation is a vital prerequisite for shaping the future in an interdisciplinary way and with a broad range of stakeholders involved.

For this vision to become reality, we are creating a bold innovation culture that encourages people to try something new, to aim for change and to shape their environment. We are ensuring that all stakeholders think big about innovation – both in terms of content and space – and connect within a vibrant innovation structure. Based on strong commitment, innovation is given the political and financial priority it needs as a key concern of the city.

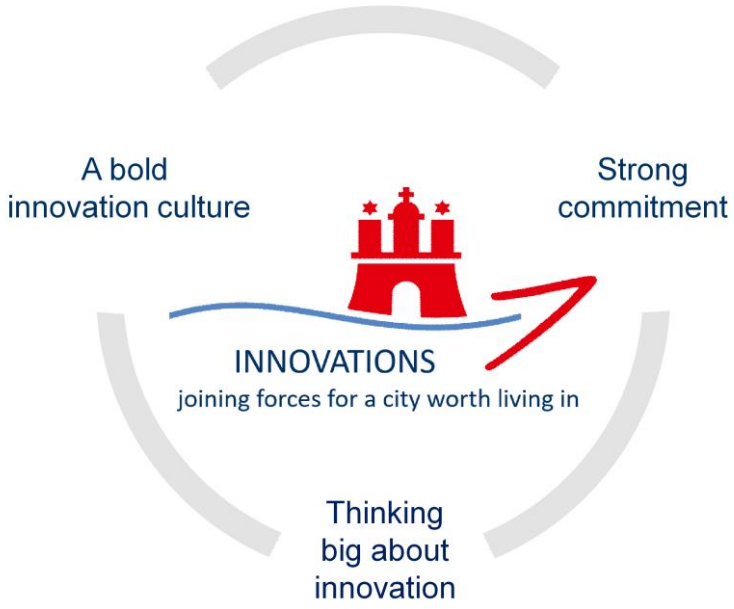


Figure 3-3: Mission

A bold innovation culture

Establishing a bold innovation culture is central to the success of the strategy. This also includes the courage of individuals, and the local community acknowledging such courage. To foster courageous behaviour, we need leeway for having fun, being creative and collaborating. We need places of social encounter that make it easy for interdisciplinary and transdisciplinary ideas to evolve and that cherish innovation skills throughout the educational pathway, from childcare and schooling to further training. This also requires a mindset that is open to trying things out, exchanging thoughts, and getting things done – a mindset that is shared by all institutions and that considers failure as an opportunity. And of course, this also applies to embracing diversity in all of its forms – e.g. through an open welcoming

culture, where differences in terms of origin, gender or age are perceived as an enriching part of everyday life.

Thinking big about innovation

Thinking big about innovation means thinking big at different levels – i.e. innovation encompasses the regional sphere as much as the global sphere and is not only part of economic policy, but also an investment in the future.

The next dimension to the city-state of Hamburg is the Hamburg Metropolitan Region. The OECD study has revealed that cooperation within the region must be strengthened in order to remain internationally competitive as a location for innovation. In a city-state, innovation activities can cause huge impact whenever the surrounding region is integrated into the process. The point here is to seek joint opportunities beyond traditional borders. Thus, it is vital to always include the Hamburg Metropolitan Region and Northern Germany in any and all considerations. Again, this requires an appropriate innovation culture as thinking beyond borders is of course not confined to spatial questions but entails political and social dimensions too.

On a global level, the goal is to expand international cooperation in the context of Hamburg's key topics for the future. Alongside these efforts, Hamburg needs to raise its visibility and sharpen its profile as an innovative international location that attracts talent from around the world with its attractive and cosmopolitan urban environment.

Strong commitment

To achieve our shared vision, a strong commitment is needed at the political and societal levels. The Innovation Strategy needs to be supported by all stakeholders in both words and deeds. Agreeing on the relevance of Hamburg’s key topics and actively contributing to shaping the future of these fields requires participants to get off the beaten track in many ways. In this context, appreciating past successes is just as important as tackling new tasks with confidence.

Not least, commitment is also expressed by means of providing financial resources. All of the partners involved are thus called upon to make a substantial contribution to support the Innovation Strategy. To create a leverage effect, resources must be invested in an intelligent, sustainable manner and financial expenditure – both private and public – should be perceived as an investment decision for the future. This is especially true during times of crisis, when people feel the understandable urge to save money and end up sawing through the branch they are sitting on.

3.3 Strategic fields, areas of activity and individual measures

The five strategic fields are the main levers for sustainably strengthening the Free and Hanseatic City of Hamburg as a liveable city, while at the same time providing a strategic framework for Hamburg's innovation policy. The areas of activity and individual measures derived from these fields are intended to move Hamburg forward in the five key topics for the future and contribute to developing Hamburg's innovation capacity through tangible results and pronounced progress.

As noted in the preamble, the chosen approach is forward-looking in the sense that Hamburg's key topics are being linked up with the strategy and its strategic fields to create a matrix perspective. This innovative matching approach enables us to focus on the strategic elements and their continuous development, while at the same time keeping a firm eye on implementation options with regard to Hamburg's key topics. Thanks to its practice-oriented design, this new approach promises to strengthen Hamburg as a location for innovation and enhance visibility and public approval. Yet, the strategic fields should not be evaluated individually as they will unleash their power especially through the interplay with other strategic fields. In that sense, the focus on societal benefits also promotes political feasibility. Increasing the budget considerably to reach a level equal to that of comparable innovation locations will create momentum in the local innovation community. In this context, focal points will be a prerequisite for convincing marketing measures, which in turn will attract people and companies.

The individual measures displayed below in the strategic fields should be understood as initial projects that have been given high priority. As the Innovation Strategy is elaborated and implemented over time, further measures will be added.

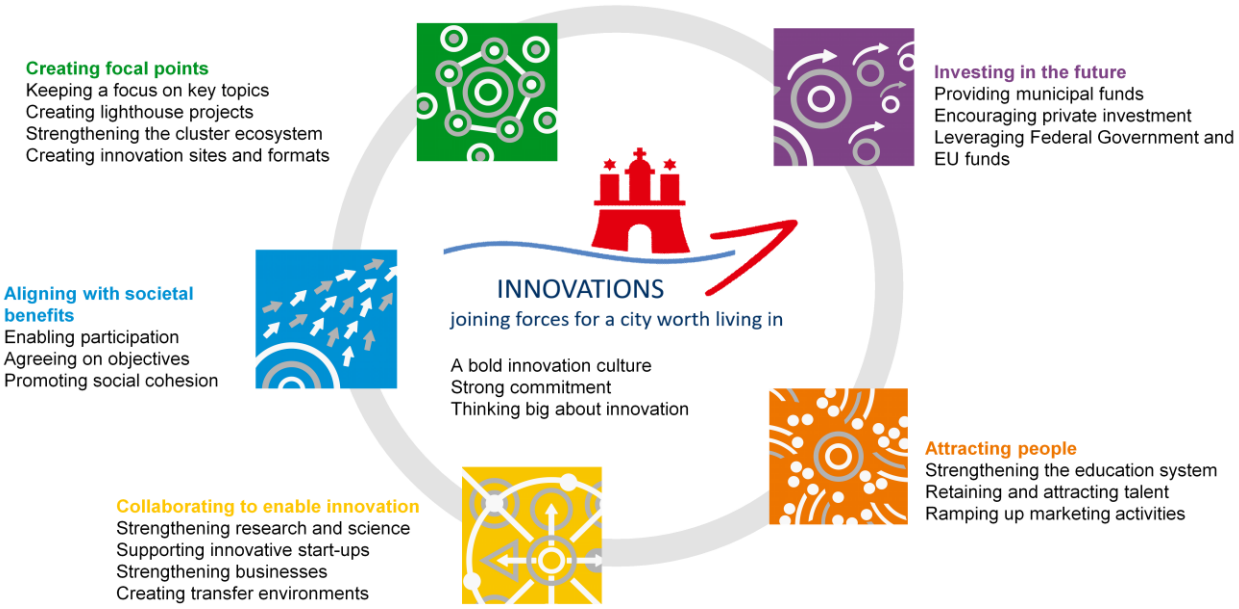


Figure 3-4: Strategic fields and areas of activity

3.3.1 Aligning with societal benefits

Addressing global and regional challenges

Innovation goes well beyond bridging the gap between technological research and economic exploitation. All innovation should be aligned with the needs of society and should, in addition to natural sciences and technological-economic aspects, take impetus from the social sciences, the humanities and social businesses. Policy-makers should be engaged in ongoing exchange with the community, highlight current challenges and share experiences, findings and potential solutions via different event formats and digital communication channels. Such dialogue will improve alignment of innovation activities and accelerate innovation processes. The success of the Innovation Strategy will be measured by the contributions it makes to mastering global and urban challenges and by its ability to tangibly enrich the lives of people in Hamburg and the Hamburg Metropolitan Region.

Challenges

Innovation needs to be able to offer alternative solutions to societal challenges. For this, it is essential to get the urban community and local citizens involved in innovation processes.

Benchmarking with other innovation locations has shown that transparent communication with society is a key success criterion for advancing innovations in a sustainable manner, taking citizens' interests seriously and detecting opposition at an early stage, while also learning from it. This includes not only the provision of exchange formats for dialogue with society, but also the necessity to define goals transparently and to openly share the achievement of goals with all stakeholders. The courage to embrace a culture where failure is part of the journey plays a key role here. Successful projects thrive on transparency even in the face of setbacks.

Moreover, it has been shown that other innovation locations create opportunities for people to get involved locally. Practical assistance in the form of rooms, equipment, networks and advice are essential prerequisites for low-threshold opportunities to get involved, try things out and gather experience.

"Just give it a go and see what happens" in the early innovation phase, without a lot of administrative effort and with a great deal of trust in the innovation stakeholders – this attitude could be felt in all of the expert interviews. Indeed, it is precisely the obstacles at the beginning of an evolving idea that should be reduced as much as possible. Especially the community of social entrepreneurs holds great potential for Hamburg, and this should be tapped accordingly. In this way, innovation does not represent a closed space for specialists, but rather an open network that is capable of taking impetus from society at large.

Areas of activity

The implementation of this strategic field is aligned with the following areas of activity:

Enabling participation

Getting society involved in innovation is a prerequisite for gaining broad public approval and sustainable support for relevant projects. This requires a continuous communication and participation process that generates awareness for global challenges at the local level and leads away from the traditional “Think global, act local” rationale towards a new, more empowering “Act local, think global” rationale.

Agreeing on objectives

When it comes to public participation, one of the main challenges is the necessity to agree on key objectives. These will provide clear guidance for allocating resources and budgets in the context of Hamburg’s key topics.

Promoting social cohesion

It is not only technical and scientific challenges that are deemed relevant by society. Where innovations are used to promote social cohesion, the focus shifts towards including the potential for social and cultural innovation. After all, it is precisely this perspective that is important for realising innovations for the benefit of locals in Hamburg and the Hamburg Metropolitan Region.

Selected individual measures

The following individual measures were developed with the stakeholders in the course of the process. In the implementation phase, these measures will be discussed and specified further with all participants.

Promoting social entrepreneurship

Innovation is more than a process of translating research outcomes into commercially viable products. Rather, it should be aligned with the needs of society, be open to social impetus and be able to develop alternative solutions. Here, the community of social entrepreneurs holds great potential for advancing Hamburg as a location for innovation. Addressing society’s most pressing problems, social entrepreneurs tend to operate in areas of market failure, and with their entrepreneurial spirit, their creativity and high risk tolerance, they provide great economic innovation potential for sustainable developments. Social entrepreneurs are drivers of social and ecological innovation and have the capacity to open up new areas of business by starting up new enterprises with an environmentally friendly, sustainable approach. By increasing the visibility of social entrepreneurs and social businesses and by strengthening networking within the community, stakeholders are to be encouraged to collaborate with other innovation stakeholders and to systematically obtain funding for the creation and development of social enterprises. For this purpose, a social entrepreneurship strategy is to be designed together with the community, alongside discussing key figures for enhancing the effectiveness of and communication about impact investing.

Establishing a Citizen Innovation Lab

Designed as an advisory body for Hamburg's policy-makers in the field of innovation, the Citizen Innovation Lab is intended to promote exchange between academia, business, politics and society. In terms of its structure and background, it should be ensured that it is well diversified (including e.g. experts from the innovation ecosystem, pupils, trainees and students). Any adjustments and quality assurance measures with regard to current societal challenges will be carried out in consultation with the stakeholders involved, and potential solutions are to be developed in collaboration with the innovation stakeholders and the transfer community.

3.3.2 Creating focal points

A stronger profile through strategic focusing

Hamburg's innovation landscape is highly diverse, making it difficult for citizens and the international innovation community to be aware of and to understand the range of activities and stakeholders at the location. By creating focal points in terms of both content and geography, Hamburg is to obtain a sharper profile. While the focus on selected key topics is oriented towards societal challenges and aimed at consolidating available resources, the lighthouse projects are intended to add a global appeal to the different fields of innovation and will be closely integrated into the regional cluster landscape. In addition to the network of individual innovation sites, there is also a need for places that can serve as showcases. Such places would host events, facilitate interactions, offer advice as well as enhance visibility and shall be complemented further by innovative exchange formats.

Challenges

Hamburg's strength as a multifaceted science and industry location is also a weakness when considered in the context of the Innovation Strategy. Compared with other top innovation locations, Hamburg is lacking a clear enough profile with focal points that would enable it to assume a leading position in global competition.

Focusing on key topics helps allocate resources, attract people, enable top positions in global competition and allows us to communicate such successes effectively – this view was shared by all of the experts interviewed. Hamburg's traditional strengths, such as the port, aviation and logistics, need to be advanced in a systematic manner, while at the same time promoting topical issues such as digitisation.

According to the benchmarking analysis, Hamburg needs to tap the potential of international cooperation in order to succeed globally. The proximity to other innovative European locations and evolving networks with these regions should be understood as an opportunity. As a city-state with broad-based business

and science sectors and firmly entrenched in the Hamburg Metropolitan Region, Hamburg has all the prerequisites for accomplishing its vision across the key topics for the future – advancing Hamburg as a location for innovation, while making use of the region's short distances in both senses of the word.

Especially in the early stages of innovation in the start-up and founder community, locations with a clearly delineated profile succeed in attracting nascent entrepreneurs. Other innovative locations have clear thematic priorities and are thus able to create focal points with international appeal. Competitive advantages arise, and value creation potential is increased, whenever such priorities are highly visible, the surrounding infrastructure has low bureaucratic hurdles and a network of transparent, low-threshold contact and advisory services is available to start-ups.

Areas of activity

The implementation of this strategic field is aligned with the following areas of activity:

Keeping a focus on key topics

As part of the strategy process, Hamburg's distinct competencies in the areas of science, research and business, as well as ways of interlinking these, were discussed with a view to strengthening Hamburg as a liveable city. Here, the following selected key topics emerged as particularly relevant: healthcare, mobility, climate and energy, materials sciences and new materials, as well as data science and digitisation. One of the findings of the strategy process was the belief that stakeholders need to focus on selected key topics. These topics should be addressed across all communication channels, guide the allocation of resources and provide the basis for a strong innovation profile both internally and externally.

Creating lighthouse projects

Lighthouse projects are projects with outstanding appeal in the relevant field of expertise. They are intended to highlight the successful interplay of science, business, society and politics in the key topics and thus create regional identity – to be recognised equally by up-and-coming talent from the global specialist community and residents of the Hamburg Metropolitan Region. As part of an ongoing interdisciplinary process with competitive elements, potential lighthouse projects are to be identified, while existing lighthouse projects are to be actively supported and new initiatives are to be selected and promoted accordingly.

Strengthening the cluster ecosystem

The science clusters are to be developed and expanded further and, together with the economic clusters, are to contribute to interdisciplinary collaborations across Hamburg's key topics. The economic clusters are to be further developed in alignment with the societal challenges identified.

Creating innovation sites and formats

Hamburg's innovation landscape needs innovation sites with high public appeal. In addition to the thematic sites and experimental areas spread across the city – such as those that are soon to be found

at Science City Hamburg-Bahrenfeld as a landmark of innovation – further places are needed that could serve as a port of call and a showcase. Such innovation sites would add to the existing infrastructure and should be supported via innovative networking formats.

Selected individual measures

The following individual measures were developed with the stakeholders in the course of the process. In the implementation phase, these measures will be discussed and specified further with all participants.

Science City Hamburg-Bahrenfeld as an international showcase for innovative strength

Combining academia, research, business, innovation, housing and living in an unparalleled way, Science City Hamburg-Bahrenfeld will be providing entirely new, innovative and science-led quarters in the city's west. With its exciting mix of excellent research conditions, an attractive living environment, short distances, inspiring architecture and proximity to Volkspark Altona, it is intended to attract bright minds, become a unique asset for Hamburg and contribute to the city's liveability.

Launch of the Start-up Labs Bahrenfeld Innovation Centre

For high-tech start-ups to thrive, they need the right environment. To strengthen collaboration between science and industry and to support the establishment of deep-tech start-ups, the Free and Hanseatic City of Hamburg, together with the University of Hamburg (UHH) and the DESY Foundation, has launched the Start-up Labs Bahrenfeld Innovation Centre. Opened in the summer of 2021 and comprising approx. 2,600 square metres of floor space, this new facility provides spaces, laboratories and the relevant infrastructure needed for translating science into business.

DESY Innovation Factory I + II

The release of the construction tender for the DESY Innovation Factory marked the launch of yet another forward-looking project in 2021. Here, an innovation ecosystem is to be created that will provide new tech companies with experimental rooms, workshops and office spaces including state-of-the-art equipment.

Embedded in the existing research network of the DESY campus, founders and innovators will be able to benefit from the expertise of experienced specialists and the outstanding campus infrastructure – including competence centres in the areas of structural biology, nanoscience and laser technology as well as DESY's nano-analytical facilities. The construction phase is scheduled to begin in 2023, and the Innovation Factory should be ready for occupancy in the course of 2025.

DESY Innovation Factory I+II will include two buildings: designed as a research building, the first one is being developed on-site the DESY campus in the immediate vicinity of the experimental stations at the PETRA X-ray radiation source and the DESY NanoLab. Newly founded companies and application-oriented research projects will be located here on 7,200 square metres of floor space. The second building is to be developed on-site the Innovation Park at Vorhornweg, in the north-west of the future

Science City Hamburg-Bahrenfeld. Comprising 3,100 square metres of floor space, it will be occupied by established companies that require proximity to the DESY campus and networking with science stakeholders as part of their business model.

Developing a tecHHub on-site the Altona Innovation Park at Vorhornweg

The Hamburg Senate has set itself the task of creating a comprehensive network of innovation parks, and this network is to be expanded further. From among these, the Altona Innovation Park is the most advanced development yet and also very promising. Located at Vorhornweg, it is integrated into the ecosystem of Science City Hamburg-Bahrenfeld as well as the local DESY infrastructure. According to the potential and needs identified, the Vorhornweg location is to be developed at an accelerated pace. To meet the demand for rentable lab and office space for start-ups and young, technology-based companies from the fields of life sciences, medicine and biotechnology, a hub for innovative start-ups will be established in the vicinity of the planned DESY Innovation Factory II. The planned “tecHHub” centre will have a high share of laboratories and flexible usage options. To ensure swift implementation, it is to be constructed modularly.

Reinforcing the innovation belt and strengthening innovation sites

Hamburg’s innovation belt comprises a network of innovative places across the entire municipality and the Hamburg Metropolitan Region.

Innovation infrastructure for local initiatives: Local stakeholders should be provided with easy access to important innovation resources. For example, there should be a range of maker spaces, regulatory sandboxes, social business yards, affordable spaces for start-ups and FabLabs available locally on the outskirts of the city. In addition, commercial and industrial spaces should be made available for founders, start-ups and innovative companies in particular.

Showcase locations: The diversity of Hamburg’s innovation ecosystem is also to be made accessible via innovation sites that serve as showcases. Events and advisory sessions to be held at these locations will add transparency and turn innovation into a tangible experience. Such sites are to complement the existing infrastructure and are to be connected with the different lighthouse projects, local initiatives as well as FabLabs and regulatory sandboxes.

Research and innovation centres: Efforts to expand the Center of Applied Aeronautical Research (ZAL) and to develop as well as expand the German Aerospace Center (DLR) and the Fraunhofer institutes are to be advanced further.

Innovation parks: The implementation of the innovation park strategy, the development of a University Campus innovation park as well as private initiatives are to be advanced.

Establishing science clusters

Similar to Hamburg’s existing economic clusters, initial financing from the city’s innovation fund will be allocated to the creation and development of a number of science clusters. While Hamburg’s economic

clusters largely emerged from existing economic centres/large enterprises and were supported through sector-specific scientific expertise (e.g. Airbus – aviation cluster – aviation research), the opposite approach is taken with regard to the science clusters: here, the focus will be on Hamburg-based fields of science that excel and have special transfer potential. These will provide the basis for an economic innovation ecosystem that encompasses start-ups, technology centres, company branches, transfer facilities, et cetera (“Cambridge model”). In term of their thematic focus, the following science clusters would be perceivable as all of these are relevant to Hamburg’s key topics for the future: materials research, systems and structural biology and/or infection research as well as climate research and data science.

Expanding excellence and generating new clusters of excellence

In the context of the Excellence Strategy, the University of Hamburg (UHH) has made significant progress with the clusters “Advanced Imaging of Matter; Structure, Dynamics and Control of the Atomic Scale” (AIM), “Quantum Universe” (QU) as well as “Understanding Written Artefacts: Material, Interaction and Transmission in Manuscript Culture” (UWA) and "Climate, Climate Change and Society” (CliCCS). In all of these fields, cutting-edge research has been conducted on various topics. UHH has also been successful in the second funding line of the Excellence Strategy and has been awarded the label of “university of excellence”. As regards the performance areas set forth by the Excellence Strategy, the university has established a transfer agency as well as a chair for innovation research. These two lighthouse projects are highly visible both nationally and internationally, will attract academics and young researchers from around the globe and will also serve as valuable resources for fresh ideas and innovative trends.

In spite of increasingly strong competition among Germany’s federal states, efforts will also be made to acquire at least one new cluster of excellence, most importantly in the field of infection research. Led by UKE and UHH, Hamburg’s interdisciplinary cluster initiative on infection research is aimed at investigating not only scientific aspects but also the social, political, economic and cultural dimensions of infectious diseases. As well as performing outstanding basic research in the field, the initiative with the working title “Gateways to health: how pathogens shape the living world” intends to also include various transfer formats (e.g. exhibitions, discussion forums and political consultation formats) targeted at members of the public and stakeholders from politics.

Strengthening Artificial Intelligence (AI) in the locality

Hamburg’s potential in the field of AI encompasses, among other things, universities and scientific institutions involved in research on a range of AI topics. A large number of scientists are currently addressing pioneering issues, and more still need to be recruited, e.g. within the framework of “ahoi digital”, the IT alliance co-funded by the City of Hamburg. This cross-university cooperation project is expected to have a strong boosting effect on innovation, as digital themes are worked on in interdisciplinary teams, generating new insights and ideas along the way. To be able to assess and leverage the potential of this key digital technology and to advance the regional AI ecosystem, Hamburg

and the Hamburg Metropolitan Region are addressing AI-related issues across all sectors through the Artificial Intelligence Center Hamburg (ARIC). Here, companies can take their first steps with AI, deepen their existing knowledge and benefit from an interdisciplinary network of AI stakeholders. In future, ARIC is to forge closer ties with other transfer initiatives as well as science and economic clusters, and measures in the field of AI are to be promoted further.

Moreover, as of 2021, the European Digital Innovation Hub (EDIH) programme is to be established as a Europe-wide network of digital innovation locations that is scheduled to be operational for up to seven years. According to current planning, the individual EDIHs will be funded proportionately by the European Union and co-funded by other sources (such as Member States, federal states, municipalities, and companies). For this purpose, a Hamburg-based applicant consortium supported by BWI has designed a suitable project. The consortium consists of ARIC, the Digital Logistics Hub, Kompetenzzentrum Mittelstand 4.0 (MKZ) and other partners, such as HITeC, the research and technology transfer centre of the Department of Computer Science at the University of Hamburg, as well as Innovations Kontakt Stelle (IKS) Hamburg. Thematically, the Hamburg Hub will place a focus on supply & value chains/networks, city logistics, distributed business processes and public infrastructure as well as associated technologies such as AI, IoT, cybersecurity, edge computing and high-performance computing.

Expanding the Center of Applied Aeronautical Research (ZAL)

To support the development of innovative, sustainable aeronautics research in Hamburg, the Center of Applied Aeronautical Research (ZAL) in Hamburg-Finkenwerder is to be expanded further. More specifically, the existing TechCenter will be expanded by around 7,000 square metres to make room for the two growing institutes of the German Aerospace Center (DLR), i.e. the Institute of System Architectures in Aeronautics on the one hand and the Institute of Maintenance, Repair and Overhaul on the other. Moreover, a new additional building is to be constructed opposite the premises. As well as accommodating office and lab spaces, it will house the planned ZAL Innovation Hub, which is aimed at providing start-ups and SMEs in particular with the opportunity to work on joint projects using shared spaces and co-working spaces. The City of Hamburg will cover the planning costs for this project.

Green aviation

Today, Hamburg is one of the largest aviation locations in the world. Yet this position can only be maintained if Hamburg continues to actively and visibly shape the future of aviation. The EU's Clean Aviation initiative encourages stakeholders to establish local partnerships to identify and realise projects with a focus on green aviation and climate-neutral flying. Under the leadership of the Hamburg Aviation cluster and ZAL, Hamburg's aviation industry has thus developed a Green Technology Roadmap, the main recommendation for action of which is to transform Hamburg and Northern Germany into a leading centre of competence for hydrogen-based aviation. The aim is to obtain co-funding from the EU by initiating and financing projects, and the City of Hamburg has also earmarked resources for this purpose. The projects were detailed within the framework of a dedicated Hamburg Aviation Task Force.

Establishing FabLabs

Hamburg intends to establish a network of FabLabs in decentralised neighbourhoods in order to create a “FabCity Hamburg”. As a decentralised digital production technology, 3D printing holds great innovation potential, promotes application-oriented STEM skills and can have a disruptive impact on global value chains through local production chains. The potential of the FabLab movement is to be promoted by means of networking formats aimed at initiating a broad social dialogue and fostering sustainable economic development at a local level. One of these FabLabs is to be created at the Altona Innovation Park. Going forward, FabLab capacities may be established in each of Hamburg’s municipal districts. In the long term, the creation of a coherent FabCity network will add locational advantages for Hamburg. In addition, FabLabs are to be supported by the Federal Government's stimulus package in the context of the Centre for Digitalisation and Technology Research of the German Armed Forces (DTEC Bw) established in 2020. Using DTEC Bw funding, the Manufacturing Technology Laboratory at Helmut Schmidt University (HSU) aims to test a number of use cases for FabLabs within the framework of regulatory sandboxes and, once completed, integrate these into the Hamburg FabCity network as an open lab, making them easily accessible to a wider public.

Promoting the Innovation Hub

Alongside Hamburg's innovation belt and strong innovation infrastructure, dedicated innovation locations with interactive formats are to be created too. As well as serving as showcases, these sites are intended to add transparency and turn innovation into a tangible experience, making the diversity of Hamburg’s innovation landscape accessible to everyone. The planned Innovation Hub will be one such place. Designed as a physical place of encounter, it will be housed at a fairly central location. In alignment with the strategy’s idea of a culture of trying things out and learning as you go along, the Innovation Hub should be regarded as an innovative, agile experiment. It is to be supported by private as well as public stakeholders as part of an experimental public-private partnership. According to the concept, three different formats will ensure the attractiveness and public appeal of the venue. Ideas could be introduced and discussed by a large group of stakeholders as part of an easily accessible weekly dialogue format (“weekathon”). In addition, each month, one key topic for the future could be discussed and worked on in more depth (“monthly focus”). These formats will be supplemented by an annual theme (“challenge of the year”), where comprehensive, long-term issues will be discussed with a view to concrete implementation steps. In this respect, the planned Innovation Hub will also contribute to the strategic field of “Aligning with societal benefits”.

Launching the Profi Kristall funding programme and process for identifying lighthouse projects

Hamburg needs more private initiatives that could serve as focal points for forward-looking ideas and their implementation within the local ecosystem. Launched by the Hamburg Investment and Development Bank (IFB), the new Profi Kristall funding programme aims to provide incentives for more diversity and competition among private initiatives – thus promoting new infrastructure for innovation as well as fresh ideas regarding new places and formats, while also enhancing their public profile. This also

includes innovative initiatives with social and sustainable business models. The new funding programme will contribute to the strategic field of “Aligning with societal benefits”.

Any future lighthouse projects are to be identified within the framework of a discursive process with a competitive element. This process is also aimed at supporting innovative approaches to solving socially relevant issues in Hamburg and enhancing the visibility of such approaches. According to current planning, an interdisciplinary panel of experts will select projects from the aforementioned key topics and these will be actively promoted and supported as lighthouse projects. In the key topic of climate and energy, for example, a lighthouse project could be created around the application fields of energy transition and hydrogen.

Continuing the Hamburg Innovation Summit (HHIS)

Ever since 2015, the Hamburg Innovation Summit (HHIS) has been Hamburg’s main cross-sectoral information and networking event for anyone involved in innovation. Serving as a platform for transfer innovation, HHIS bridges the gap between science, research, business, politics and society. By connecting visionary minds, founders and makers, HHIS gathers innovation stakeholders with a view to strengthening Hamburg as a location for innovation. With its conference, academy and expo components as well as the HHIA award ceremony, the summit attracts some 1,500 attendees annually. The goal is to strengthen HHIS as Hamburg's lighthouse event in the field of innovation both regionally and nationally and, in the future, also internationally. Since 2020, the event has been held in a virtual/hybrid format with a focus on digital programme items.

Strengthening economic clusters and forging ties within the region

Hamburg’s eight economic clusters are to be further developed in alignment with relevant societal challenges. Moreover, ties should be forged with local initiatives within the Hamburg Metropolitan Region and Northern Germany at large. Here, the new hydrogen cluster is to make an important contribution through cross-functional approaches in the field of sustainable energy and climate. Fostering links with transfer initiatives such as the Cluster Bridges initiative, the Artificial Intelligence Center Hamburg (ARIC) and the emerging science clusters will ensure that Hamburg’s economic clusters are supported in a comprehensive manner.

3.3.3 Collaborating to enable innovation

A learning transfer culture with common goals and individual strengths

The large number of innovation stakeholders in Hamburg – such as cluster initiatives, transfer institutions, start-ups, companies as well as research and science organisations – are to be strengthened and linked up further. New networking formats, strategic partnerships and transfer processes are to be used to address the needs of society, science and business and to develop targeted

solutions and innovations. In addition to strengthening the individual stakeholders, the concept of transfer in particular is to be reassessed. Organisations tend to collaborate successfully whenever the people involved know and appreciate each other and approach one another with an open mindset – and this needs to be ensured in the long term. Frequent, ongoing opportunities to meet up provide fresh impetus and help stakeholders overcome any project-related obstacles and bottlenecks.

Challenges

Hamburg features a versatile transfer ecosystem to support innovations emerging from collaborations between science, research and industry.

Yet, the results of the benchmarking analysis indicate that there is a considerable gap between Hamburg and the top performing locations. For example, compared with the leading location of Copenhagen, Hamburg records only one tenth of spin-offs from universities when measured against the total number of students. This may be partially owing to the fact that Hamburg offers a rather limited range of STEM subjects when compared with other locations and isn't home to a great number of large, innovative companies from technology-driven industries, i.e. Hamburg cannot rely on the relevant pull effect.

Cutting-edge locations succeed in positively influencing the transfer rate not only by means of financial support, but also by providing relevant networks and advisory services. One of the main success factors here is to make such networks and services available at universities and close to industry.

In the area of collaborative and contract research at local universities, Hamburg's performance is almost on par with that of the leading locations, and the number of clinical studies is also at a high level. Embedding transfer as one of the tasks defined in Hamburg's higher education law has been an important step towards supporting the activities of higher education institutions in the area of knowledge and technology transfer and contributing to a changing culture that acknowledges the importance of multidirectional transfer between business, science, society and politics besides research and teaching.

The individual interviews confirmed that an attractive innovation environment is key to a location's attractiveness. This includes aspects such as available accommodation, exciting topics, and fully developed, easily accessible infrastructures. Such environments can unleash momentum that has the capacity to create a pull effect and draw more than a critical mass of talent, companies and research projects to Hamburg.

Areas of activity

The implementation of this strategic field is aligned with the following areas of activity:

Strengthening research and science

Higher education institutions and non-university research facilities are important drivers of innovation. Here, it will be crucial to strengthen high quality degree programmes, academic excellence as well as

applied research. Technical sciences should be strengthened, and innovation activities in the humanities and social sciences should be stepped up further.

Supporting innovative start-ups

Businesses from Hamburg's start-up community need to be strengthened, and stakeholders should be linked up more closely. To succeed in the competition of locations, Hamburg needs to ensure that new entrepreneurs are provided with the best possible conditions and a vibrant start-up culture.

Strengthening businesses

As well as offering traditional incentive systems for companies, Hamburg's attractiveness should be boosted by addressing highly relevant focal themes and by serving as a regulatory sandbox. New, research-intensive companies are to be attracted through projects and topics that are deemed relevant across the globe.

Creating transfer environments

Transfer facilities, cluster initiatives and support services for start-ups play an important role in creating an effective innovation ecosystem. Therefore, they need to be strengthened and linked up further to facilitate collaborations on joint innovation projects. This will contribute to creating an agile transfer environment that allows for swift, flexible responses to changing challenges with regard to the key topics. Essential elements to achieve this include e.g. "cluster bridges" such as the Co-Learning Space project, systematically connecting stakeholders with relevant transfer environments as well as creating networks in the field of method knowledge and expert knowledge. As regards the latter, Hamburg Kreativ Gesellschaft with its Cross Innovation Lab and other projects as well as nextMedia.Hamburg are among those that are successfully involved in implementing such measures.

Selected individual measures

The following individual measures were developed with the stakeholders in the course of the process. In the implementation phase, these measures will be discussed and specified further with all participants.

Expanding the higher education sector and strengthening research institutions

Science and research are vital in securing the future of our city. Hamburg's goal is to become the leading science city in Northern Europe. To achieve this, considerable long-term investments in Hamburg's universities and research institutions are necessary in order to boost the international competitiveness of local institutions. The greatest potential lies in developing and advancing Hamburg's research and innovation priorities across different institutions.

Technical universities are decisive in the sense that they serve as a region's innovation engine. Operating internationally, they are required to position themselves in global competition. For Hamburg to stand its ground on an international stage, the Hamburg University of Technology (TUHH) needs to

be transformed into a think tank and a laboratory for the future of research and development. The planned expansion of TUHH will certainly benefit Hamburg as an innovation location at large.

Scientific excellence provides the basis for innovation. With four clusters of excellence and its distinction of being a university of excellence, the University of Hamburg (UHH) has been highly successful as regards the Excellence Strategy programme of the Federal and State Governments – and this success needs to be consolidated and built upon. What is more, Hamburg offers research facilities of international renown but must not rely on the status quo. Expenditures on new radiation sources at DESY, the expansion of the University Medical Center Eppendorf (UKE) or new research facilities at Science City Hamburg-Bahrenfeld are therefore investments in the future that are both necessary and worthwhile.

In the field of applied science, it will be important to promote the ongoing expansion of Fraunhofer facilities and DLR institutes as important drivers of innovation.

Taking part in scientific competitions with a focus on cutting-edge research and an international design will add to Hamburg's profile in the race for recruiting experts from abroad.

The Hamburger Zukunftsverträge agreement

As part of its "Hamburger Zukunftsverträge" agreement (formerly Higher Education Agreements), the Hamburg Senate provides greater financial security for higher education institutions, e.g. with a view to facilitating cross-university projects and modernising facilities. When factoring in the increase in state funding to account for salary and price increases, individual university development projects as well as additional funding in 2020/2021, a financial framework arises that equals a cumulative budget increase of approx. EUR 750 million in the 2021–2027 period, with approx. EUR 400 million of basic funding and approx. EUR 350 million of programme-related special funds allocated. This means that during the period of the Zukunftsverträge agreement, i.e. between 2021 and 2027, the funding volume for universities, the UKE and the State and University Library (SUB) will be raised by more than 3 percent in total. This budgetary increase reflects the growing relevance of science for Hamburg's development and greatly increases the planning security of higher education institutions for the coming decade.

Strengthening the scientific infrastructure further

In an effort to strengthen research and teaching, further investments will be made together with the universities in modernising Hamburg's scientific infrastructure over the coming years. In particular, funds will be made available to strengthen the area of building construction as well as investment planning in university construction.

Growth concept of the Hamburg University of Technology (TUHH)

Serving as a region's innovation engine, technical universities play a key role today. The further expansion of the Hamburg University of Technology (TUHH) as a think tank and laboratory for the future of research and development is a vital step in ensuring that Hamburg is able to compete in global competition. Both Hamburg and the Hamburg Metropolitan Region will benefit from the growth of TUHH.

The extra space requirements arising from this expansion will be satisfied on-site the Hamburg Innovation Port (HIP) at the Harburg upriver port, among other places. Even at this stage, the area around the Harburg upriver port is characterised by a mix of teaching, research and transfer facilities – such as TUHH institutes, private universities, a new Fraunhofer CML building, the German Aerospace Center (DLR), a start-up dock and Tutech alongside technology-driven companies. The spaces available at the HIP are thus ideally suited for accommodating a second TUHH campus and also reflect the Hamburg Senate's strategy of creating a citywide network of innovation parks.

Developing the HafenCity University (HCU)

With architecture, civil engineering, geomatics and urban planning as its disciplines and its inter- and transdisciplinary focus on the development of modern cities, the HafenCity University (HCU) has high innovation potential for Hamburg's future, and projects such as the City Science Lab demonstrate this fact. Today, mobility and wireless digital technologies are shaping large parts of the economy, e.g. in the context of Industry 4.0, and will continue to shape the daily lives of people. In 2021, HCU has therefore established the Hamburg Wireless Innovation Competence Center (HAWICC) on-site the HCU premises, which will serve as an innovation centre for smart infrastructures and mobility.

Innovative University – the Alsterphilharmonie project

The Hamburg School of Music and Theater (HfMT) was the only arts institution in Germany to win the nationwide Innovative University competition aimed at promoting the research-based transfer of ideas, knowledge and technology. The funding received for the "Stage 2.0 – Alsterphilharmonie" project, which explores the stage as a place for artistic knowledge transfer and social participation, can be used to realise new artistic concepts and creative strategies. By providing leeway for a wealth of ideas and creativity, students and teachers are empowered to shape their world. Examples such as these may also serve as inspiration for others to create similar opportunities in other spheres.

Establishing an innovation promotion agency

In future, all innovation measures of the Hamburg Ministry of Science, Research, Equality and Districts (BWFGB) in the science sector will be bundled under the umbrella of a dedicated innovation promotion agency at city-state level. The agency will comprise three modules: science clusters, funding programmes (including scouting and seed money facilities), and transfer initiative (including transfer prize and legislative/administrative steering incentives). All activities are to be conducted within the framework of the new facility. The innovation promotion agency is also aimed at enhancing the competitive capacity of Hamburg's universities with regard to important funding programmes at federal and EU levels and thus facilitate the acquisition of third-party funding from such programmes. To stimulate and consolidate Hamburg's economic power in the long run, the multifaceted potential of the local science sector needs to be explored in more depth. Based on the relevant institutions' excellent research results, possible applications need to be identified more swiftly, and ways of implementing these in the market need to be initiated accordingly. With its Calls for Transfer (C4T) funding programme, BWFGB has created a successful tool for providing local scientists with partial financing

for their transfer and spin-off ideas in a swift, unbureaucratic and flexible manner. Initial evaluations of the first funding period show a leverage effect in the acquisition of additional third-party funding by a factor of 6.5 alongside a number of filed patents, invention disclosures and start-up businesses. Another effective tool here is the Science Scout project, which helps identify innovation potential at Hamburg's universities with the aim of presenting it in front of Hamburg's business community and other stakeholders based on targeted digital formats.

Expanding existing IFB funding programmes

The Innovation Fund of the Hamburg Investment and Development Bank (IFB) serves to finance innovation promotion measures and was created in mid-2013 alongside the founding of the IFB itself. Continuing the successful track record of innovation support programmes – such as PROFI Programm für Innovation, InnoRampUp, InnoFounder, Innovationsstarter Fonds, Hamburg Kredit Innovation, the Cluster Bridges initiative, Hamburger Investoren Netzwerk HIN, PROFI Bridge, the Artificial Intelligence Center Hamburg (ARIC), Innovations Kontakt Stelle (IKS) Hamburg and the European Enterprise Network (EEN) – the Hamburg Senate has created a reliable basis for the IFB's 2021 economic planning by increasing the Innovation Fund further. To ensure Hamburg's innovative capacity as a business and science location, start-ups and (social) entrepreneurs in particular are to be supported across different development phases by continuing the IFB Innovation Fund and expanding the start-up support structures in the areas of financing, consulting and marketing as well as matchmaking and networking activities with research institutions, companies and investors. Aimed at creating a culture of trust and thus facilitating risk investments, support measures will be made available via simplified access and based on low-threshold requirements. A special focus shall be placed on female founders, and simple spaces are to be made available to start-ups and (social) entrepreneurs according to their needs. What is more, funds from the REACT-EU programme have been earmarked for the expansion of the IFB's funding portfolio, with a view to supporting promising projects from the life sciences sector among other fields. Moreover, the tried-and-tested Innovationsstarter Fonds Hamburg II is to be topped up and extended to provide Hamburg-based start-ups with equity capital. IFB Innovationsstarter GmbH is one of the most active venture capital providers for local start-ups with digital, sustainable business models and helps alleviate market failure in the area of early-stage start-up financing, strengthens the start-up ecosystem and enables innovative companies to get off the ground.

Strengthening transfer projects

Exchange and networking between economic and science clusters should be institutionalised via dedicated transfer initiatives and in alignment with Hamburg's key topics. Such transfer initiatives are to be facilitated by means of strengthening contact structures within the innovation community, e.g. Innovations Kontakt Stelle (IKS), the Co-Learning Space (Cluster Bridges 2.0) as well as transfer facilities at the universities and research institutions. Innovative platforms and process innovations will add further to promoting transfer projects.

The Hamburg Startup Unit and Beyourpilot

The Hamburg Startup Unit and the Beyourpilot project should be continued further. The only one of its kind in Germany, Beyourpilot is a digitisation and cooperation project designed to sustainably increase the number and quality of start-ups from Hamburg-based universities and research institutions. The project had been developed since 2017, and the platform was successfully launched in 2019 by the Hamburg Innovation (HI) project management agency. The funding (for personnel and operating costs) is not only used to run the digital platform, but also to provide on-site support to the incubators at Hamburg's universities. Initiated in 2018 by Hamburg Invest Wirtschaftsförderungsgesellschaft mbH (HIW), Hamburg's business development agency, the Hamburg Startup Unit was created to position Hamburg as a start-up hotspot by means of marketing the location to innovation stakeholders beyond regional and national boundaries. In addition, the Startup Unit is aimed at strengthening, and adding transparency to, the city's start-up ecosystem. Serving as the first port of call for start-ups, organisations and investors, it has become an established player in Hamburg's business community.

Continuing the Cross Innovation Hub and cross-sectoral cooperation with the creative industries

Due to their networking skills, their experimental way of thinking and their resilience-generating flexibility, the creative industries are regarded as innovation drivers for other industries and sectors too. Supported by the European Regional Development Fund (ERDF) and established by Hamburg Kreativ Gesellschaft in 2017, the Cross Innovation Hub has been gaining an edge in Germany and beyond when it comes to understanding and applying the concept of cross innovation. The term relates to collaborations between creative professionals and stakeholders from other sectors of the economy during the early stages of entrepreneurial innovation processes. As of 2021, the Cross Innovation Hub's various formats will increasingly include experts from academia too. This approach of cross-sectoral, solution-oriented ways of collaborating is to be continued and deepened further – also as part of other market segment initiatives, such as nextMedia.Hamburg, Gamecity Hamburg and designxport. Under the umbrella of Hamburg Kreativ Gesellschaft, all of these initiatives strategically address major challenges of our time – whether digitisation, mobility, climate change, healthcare, urban development or crisis management. Moreover, all of these activities are aligned with the UN's Sustainable Development Goals (SDG). In addition, Hamburg Kreativ Gesellschaft is firmly entrenched in a number of international networks and programmes, and thus both the global and the regional dimension is included in any forward-looking joint learning processes.

Measures to shape the future of mobility

Taking place in Hamburg in October 2021, the ITS World Congress acts as an incubator for innovative mobility solutions. In collaboration with stakeholders from industry and science, some 200 projects from the field of intelligent transport systems (ITS) are currently being implemented (about 90), in preparation, or have been completed. The RealLab Hamburg project, which is funded by the Federal Ministry of Transport and Digital Infrastructure (BMVI), serves as a showcase for testing digital mobility solutions under real conditions. As new mobility has undoubtedly become a field of innovation that is

attracting attention beyond the city boundaries, the successful work accomplished in Hamburg should be continued beyond the duration of the ITS World Congress. Therefore, it should be ensured that the implementation of application-oriented urban mobility projects with strong partners from industry and science can be carried forward seamlessly. The overarching goal should be to not only promote the continuation of the RealLab project and the ITS strategy for the development of future mobility solutions in a liveable metropolitan region, but also to bring it into use in an innovation-friendly city as a prototype for Germany. To this end, the proven administrative structures in the field of ITS (the project management office in particular), the RealLab Hamburg project and, in part, ITS Hamburg 2021 GmbH (the city-owned company for preparing and implementing the 2021 ITS World Congress) are to be integrated and expanded into a centre for digital and sustainable urban mobility. The aim is for Hamburg to become part of the BMVI's German Centre for Future Mobility research network.

Developing a relocation strategy for companies with a focus on research and innovation

In order to attract companies with a focus on research and innovation in particular, a cluster-related relocation strategy is to be developed. This would enhance the competitiveness of Hamburg and the Hamburg Metropolitan Region and secure sustainable jobs by means of offering attractive plots of land and tax models. To achieve this, standardised advisory and support services for planned investment projects should be made available alongside facilitating the provision of commercial land in line with demand.

Establishing new networking formats

In alignment with Hamburg's key topics for the future, new networking formats should be established so as to connect innovation stakeholders and identify potential for collaboration. Encounters between stakeholders should be facilitated by hosting networking events with different focal themes. Here, special emphasis should be placed on early-stage networking between research institutions and industry to familiarise stakeholders from industry with the relevant research fields and infrastructures and to spark their interest in collaborating and getting involved early on. This would make it easier for strategic partnerships to be formed between universities as well as research institutions and companies – including any corporate venturing and corporate venture capital – while also promoting innovative ideas. Furthermore, new innovation stakeholders could be supported through a network of "carers" and innovative approaches could be further promoted by connecting new entrepreneurs with innovation managers as well as students (e.g. in the context of bachelor's and master's theses).

3.3.4 Attracting people

Recruiting and fostering innovative minds

For a location to assume a leading role as a city of innovation, it needs to get the public involved. Local citizens need be open to innovation and its capacity to shape the city of the future, and they should also have the right skills and a creative mindset. Hamburg needs to attract people who are captivated by the spirit of innovation and who are willing to spread the word. For such an “innovation society” to evolve, a critical mass is needed that can inspire others and generate a far-reaching appeal. Against this background, innovation skills need to be strengthened systematically in all stages of the educational path, from childcare to school and university to further education. New talent, experts and entrepreneurs from around the world should be actively recruited and provided with easy access to the innovation system.

Challenges

The analysis of the megatrends has shown that the competition for talent is extremely important today. As an international, transparent and mobile market has emerged, locations are increasingly engaged in competition for the brightest minds. This entails both internal and external activities, i.e. the promotion of talent at the location as well as efforts to systematically attract individuals with innovative ideas and concepts.

As an international centre of learning, Hamburg has potential for improvement, which has also been confirmed by the benchmarking analysis. When it comes to higher education institutions as well as education and training in more general terms, other international cities’ approaches not only generate a very good level of education, but also succeed in enhancing the respective location’s attractiveness in front of the outside world.

Moreover, the experts interviewed expressed the view that designing a coherent educational concept is an essential means of strengthening entrepreneurship. And this not only applies to secondary and higher education institutions. In their role as engine of the economy, the SME sector in particular has a great need for entrepreneurial minds and would certainly benefit from easily accessible support.

Areas of activity

The implementation of this strategic field is aligned with the following areas of activity:

Strengthening the education system

Innovation competencies are to be systematically promoted as part of a broad-based initiative that includes childcare facilities and secondary schools, vocational and continuing training as well as higher education institutions. The aim is to create a sustainable innovation climate in all segments of society.

Retaining and attracting talent

A clear profile and an open, welcoming culture contribute to making Hamburg an attractive location for new talent and companies. To attract and retain the best of them, processes need to be designed in a way that makes it easy for incoming individuals to be integrated into Hamburg's innovation community as swiftly as possible.

Ramping up marketing activities

Via the selected key topics defined, Hamburg is to be marketed globally as an attractive location for innovation with a clear profile. The vision of joining forces to create a liveable city through innovation is to be turned into a tangible experience through events and competitions.

Selected individual measures

The following individual measures were developed with the stakeholders in the course of the process. In the implementation phase, these measures will be discussed and specified further with all participants.

Strengthening the welcoming culture by means of an innovation portal

To strengthen Hamburg's welcoming culture, an innovation portal is to be developed as a one-face-to-the-customer platform. Here, interested individuals will be able to find information on a wide range of topics from the field of innovation, such as contact details for current projects and research questions, information on the local funding system and advisory services, scheduled events, success stories, profiles of Hamburg's innovation parks, et cetera. Moreover, the portal should provide international talent with advice regarding accommodation, schooling and the recognition of international degrees – even though the last three points are being covered through comprehensive support structures provided by the Hamburg Welcome Center, which reopened in January 2021, as well as the Hamburg Welcome Portal. Irrespective of this, to create transparency and as a marketing tool, the innovation portal is to gather any innovation-relevant information, reduce redundancies and help users by featuring relevant services and links in one place.

Education as a pathway to innovation

Highly qualified individuals are vital for innovative solutions to be developed. The innovation and start-up competencies of young people should be promoted through a lifelong learning process – in alignment with the idea of "learning to innovate" and embedded in Hamburg's education curricula as a cross-sectional task. Such an initiative is to be supported by strengthening project-oriented teaching approaches and by promoting digital competencies. The "learning to innovate" process should also be made available at physical locations, such as the planned "House of the Digital World" (working title).

In today's digital world, learning requires investment in digital infrastructure. Running under the tagline "Invest in tablets and talent", schools and further education institutions are to be equipped with digital hardware systems (tablets, laptops, microcomputers), while at the same time investing in the training

and further education of teaching staff. By providing easy access to local, hands-on initiatives, STEM competencies are to be promoted throughout the entire educational path, from childcare facilities and schools to further education institutions. In Hamburg, these include e.g. the FabAcademy at the OpenLab, the NAT initiative including mint:pink and mint:match, MINT Forum Hamburg as well as a number of private initiatives. In addition, new event formats such as guided innovation tours are to foster networking between companies and educational institutions with a focus on innovation and research. Intended to open up new prospects for talented young individuals, such programmes can also help increase permeability in the area of further training and facilitate smoother transitions within the education system.

Developing qualification formats and Regionales Zukunftszentrum Nord

Funded by the Federal Government, the Regionales Zukunftszentrum Nord project comprises a consortium of partners from Bremen, Hamburg, Lower Saxony and Schleswig-Holstein. At city-state level it is coordinated and co-financed by the Hamburg Ministry of Social Affairs. The project is aimed at evaluating the support needs of local companies in order to develop innovative teaching and learning concepts for SME staff as well as solo entrepreneurs. The focus is on digital processes, transformation processes and an introductory module on the use of AI. The project was launched on 19 May 2021 and will be running until December 2022. In addition to this, the Federal Government will continue to provide funding for a supra-regional knowledge and information centre for AI. As well as acting as a coordinating body for the regional centres, it is to generate and transform knowledge in the field of AI.

Fostering entrepreneurship at Hamburg's schools

In an effort to strengthen problem-solving skills and to foster the entrepreneurial spirit of pupils, the Entrepreneurship Education Hamburg project aims to add new learning methods and (social) entrepreneurial approaches to Hamburg's general schooling system. In the framework of practice-oriented training sessions, entrepreneurial knowledge and tools are imparted to young people while still in secondary school. The project also comprises a compact training course, where teachers are familiarised with the concept of starting up a business and can gain insights into relevant teaching methods. As well as fuelling an entrepreneurial mindset among teachers and pupils and sparking their interest in founding, the project helps secure Hamburg's future as an innovative business location and sustainably strengthens its SME sector. Originally launched as a pilot in the 2018/19 school year under the patronage of Hamburg's First Mayor, it is to be continued as a separate project in the 2021/22 and 2022/23 school years, and perhaps beyond, under the umbrella of the Social Entrepreneurship Education (SEEd) programme. Project partners are the Hamburg Ministry of Economy and Innovation (BWI), the Hamburg Startup Unit and the State Institute for Teacher Training and School Development (LI). An essential component of this programme is to design and implement training courses for teachers in the field of entrepreneurship education and to provide a teaching concept aimed at introducing young people to the idea of entrepreneurship and raising their enthusiasm. This is to be accomplished via a practical approach that actively involves existing start-ups as role models. In addition to competencies

in developing business ideas and designing business plans, technical skills and methods for building one's personality and entrepreneurial mindset are also to be taught.

Kleine Forscher Hamburg network

The non-profit foundation Haus der kleinen Forscher ("Little Scientists' House") is committed to promoting valuable early education in the fields of science, technology, engineering/computer science, and mathematics (STEM) so as to strengthen boys and girls for the future and empower them to act sustainably. In close collaboration with its local network partners, the foundation offers a nationwide educational programme that supports educators and teachers in facilitating children from the pre-school and primary school age groups to discover, explore and learn. The programme improves children's educational opportunities, promotes their interest in STEM subjects and helps professionalise the work of pedagogical staff in these fields. As regards Hamburg, the local Kleine Forscher network is supported by the German Electron Synchrotron (DESY). In the future, the network is to be co-financed by the foundation's partners, private companies as well as the Federal Ministry of Education and Research (BMBF) via a Special Innovation Fund. In addition, the City of Hamburg has also announced an interest in providing financial support to the Hamburg network.

Continuing the MINTFIT Hamburg programme

The inter-university MINTFIT Hamburg programme will be continued throughout the 2021–2023 period. It has been running since 2013 as a joint project of the Hamburg University of Applied Sciences (HAW), the HafenCity University (HCU), the Hamburg University of Technology (TUHH), the University of Hamburg (UHH) and the University Medical Center Hamburg-Eppendorf (UKE) and is funded by Hamburg's Ministry of Science, Research, Equality and Districts (BWFGB). MINTFIT pursues several goals at the same time: the project's tests and courses serve the purpose of supporting students in transitioning from secondary school to university. Beyond this, it is also aimed at raising awareness for degree programmes in STEM subjects such as mathematics, natural sciences and engineering. Via a digital learning portal that is accessible nationwide, interested individuals can take part in STEM tests and courses in mathematics, physics, chemistry and computer science. The programme's e-assessment component focuses on expanding digital teaching and learning at partner institutions. The primary goal here is to promote the use of technology-supported examinations through the development and use of various e-learning and e-assessment tools.

3.3.5 Investing in the future

Private and public investment for all phases and aspects of innovation

For an innovative city to stand its ground in global competition, contributions from all sectors of society are required. In addition to public investment, the private sector needs to invest considerably in innovation too. On the one hand, this includes financing "creative playgrounds" in the early stages of

investment, when a clear-cut business case may not be perceivable yet. These will give a wealth of new ideas and approaches a chance to unfold. On the other hand, there is a need for investment in private incubators and accelerators that will drive innovation across companies and disciplines. Venture capital and third-party funding are increasingly needed here, especially from the private sector. These require a stronger risk culture and an innovative mindset.

Challenges

The benchmarking study revealed that Hamburg is one of the top locations in terms of public expenditure on research and development. The University of Hamburg's designation as a university of excellence and the acquisition of four clusters of excellence are expected to lead to further significant funding volumes in the coming years.In contrast to that, the benchmarking also found that the City of Hamburg needs to catch up with the leading locations when it comes to private financing. Here, the main development dimensions include third-party funding as well as the private sector's expenditure on research and development.

As for third-party funding, the best performing location actually achieves ten times the amount per capita. This is partially due to the fact that in the case of territorial states the investments of the entire country tend to accumulate in the conurbations, thus creating better conditions. Having said that, Hamburg still has clear development potential when compared with other regions.

Hamburg is also lagging far behind in terms of expenditure on research and development by private businesses, which is also owing to the structure of many Hamburg-based companies. Traditionally, these are characterised by a lower R&D intensity than companies based in other surveyed locations with corporate head offices located there.

In the race for venture capital, Hamburg records significant growth but still lags well behind the benchmark locations, with one third to one half of the volume raised per capita.

The individual interviews confirmed that while there is a lot of private money available in Hamburg, this is mostly being invested in the later phases of innovation, when the risk has decreased and business plans are less speculative. Thus, there needs to be more willingness to provide venture capital in the early investment phases too.

Throughout the entire process it became evident that a new quality level of innovation can indeed be reached on the excellent basis of what has been accomplished so far – leaving the hesitant, cautious approach behind and embracing a more courageous, focused approach to new ideas and opportunities. And this demand not only applies to the mindset of innovation stakeholders at the location, but also to the resources made available. Investment in innovation is an essential means of shaping a successful future as today's ideas have the capacity to create and ensure tomorrow's prosperity.

Areas of activity

The implementation of this strategic field is aligned with the following areas of activity:

Providing municipal funds

As a location for innovation, Hamburg should systematically invest in strengthening the selected key topics as well as the lighthouse projects in global competition. To attract relevant innovation stakeholders, it needs to be ensured that the respective activities reach a critical mass. The Hamburg Senate has already enhanced its investment in innovation activities to a considerable extent. This includes e.g. efforts to expand the innovation funding system, strengthen innovation infrastructures such as innovation parks, establish a start-up ecosystem, support scientific research of excellence, create and develop high-profile innovative sites such as DESY and Science City Hamburg-Bahrenfeld as well as strategic investments in forward-looking fields such as energy, AI, digitisation and quantum computing.

Encouraging private investment

The volume of private investment needs to be increased significantly. Currently, the early phases of innovation in particular are predominantly funded by the public sector. What is needed here is both a boost in corporate R&D spending as well as increased efforts in the areas of venture capital activities and third-party funding.

Leveraging Federal Government and EU funds

Hamburg needs to ensure that any funds provided at federal and EU levels are utilised to a much greater extent as this will offer great potential for supporting research and project activities in a targeted manner. Already in the next funding period, Hamburg will be receiving substantial resources from the EU's structural funds for innovation. Moreover, thanks to its designation as a university of excellence and the four selected clusters of excellence, Hamburg will also be provided with substantial funding from the Federal Government.

Selected individual measures

The following individual measures were developed with the stakeholders in the course of the process. In the implementation phase, these measures will be discussed and specified further with all participants.

Providing resources for innovation

If Hamburg is to achieve a top position as a location for innovation and science, considerable investment in the future is needed, and this is also true during the current economic situation shaped by the pandemic. While Hamburg has already made a considerable investment in the future, efforts need to be maintained and strengthened, especially during times of crisis. To prevent Hamburg from falling behind competing regions, investment in innovation needs to happen now to have a visible impact in the coming

decades, similar to the climate context. To this end, private and public investment must be made available for all phases and areas of innovation.

Investments in innovations are vital in ensuring a successful, liveable city of the future as today's ideas contribute to ensuring tomorrow's sustainable prosperity. To succeed as a region in international competition and for sustainable value creation and future-proof jobs to be created in Hamburg, the city's innovation ecosystem requires an intelligent interplay of public and private funding as well as a coherent, forward-looking innovation policy that is anchored in society. When it comes to funding decisions in general, a stronger risk culture and an innovative mindset are needed – towards a courageous, focused approach to new ideas and opportunities.

In the area of public R&D spending, a positive trend is emerging not least due to the University of Hamburg's awarding as a university of excellence and the subsequent funding that is to be expected as a result. For the benefit of research and project activities in Hamburg, federal and EU funds need to be leveraged more extensively. In future, private (business and society, including e.g. foundations) and public funding options (Hamburg Senate, German Federal Government) should be integrated closely to facilitate the financing of joint projects in Hamburg. Here, the complementary interplay between the different stakeholders is to be strengthened through greater coordination.As a cross-cutting theme, innovation is unfolding in almost all of Hamburg's government agencies. Accordingly, there are numerous municipal measures in place to promote innovation in Hamburg, e.g. in the fields of education, culture and the environment. This also means that the funding of innovative projects is anchored in the individual budgets of all Hamburg Ministries. Clear priorities have been set with the new innovation funding programme by the Hamburg Ministry of Science, Research, Equality and Districts (BWFGB) as well as the current and scheduled measures of the Hamburg Ministry of Economy and Innovation (BWI), including the IFB funding programmes. For the implementation of the priority measures outlined in this paper, resources will be made available by the Hamburg Senate, the Federal Government, and the EU.

For the 2021/22 period in particular, considerable funds for innovation are earmarked with a view to swiftly implementing high-priority, high-impact measures. To ensure that science and innovation are strengthened in the long term, we would like to commit to the target of investing about 7 percent of the budget in innovation.

Setting incentives for private initiatives

Hamburg needs more private initiatives that could serve as focal points for excellent ideas and their implementation within the local ecosystem. The new Profi Kristall funding programme intends to provide a suitable incentive system for boosting diversity and competition among private initiatives, with the aim of creating new infrastructures for innovation, such as fresh ideas for new sites and formats, while also enhancing their public profile.

New networks for business angels and investors are to be attracted by approaching high-net-worth individuals and family offices, and existing investor networks are to get involved more closely in

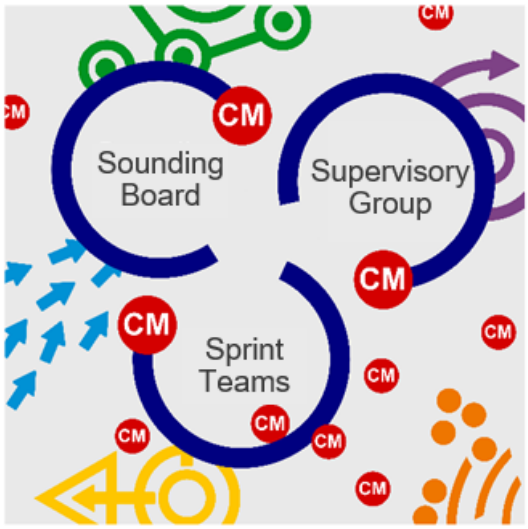
innovation promotion activities. High-profile events with innovative start-ups will contribute to attracting professional venture capital investors and facilitate access for Hamburg-based merchants to the innovation system via matching and “speed dating” events as well as challenge-based formats.

Hamburg is rich in foundations, and this potential should be utilised. Foundations should be provided with incentives to support socially relevant innovation activities, also with a view to getting social businesses involved (social innovation).

4 Follow-up process

To meet the demands of a market environment that continues to develop at a rapid pace, adjustments and changes are required continuously and at all levels. In light of this, the Regional Innovation Strategy is to be understood as an ongoing development process. For this process to evolve further, participation structures are being created that will continue the strategy's lively, creative and open design as part of a follow-up process (cf. Figure 4-1).

The follow-up process comprises two levels: the implementation process and the continuous development of the strategy based on current societal challenges and emerging key topics.



Sounding Board

Political decision-making and financing

Role: Align and develop the Regional Innovation Strategy
Participants: Hamburg's First Mayor, Ministers of BWI, BWFGB, BSB, BKM, Revenue Authority, Head of the Senate Chancellery, others and/or externals as appropriate
Meetings: annually

InnovationsAllianz Supervisory Group

Coordinating in one place

Role: Set goals for the target state, specify the realisation of measures and the course of action, identify responsibilities, control and review
Participants: InnovationsAllianz Supervisory Group
Meetings: three times a year

Change Makers (CM)

Initiating progress

Role: Provide input for new activities, trend analyses, advise the three groups in a needs-oriented, approachable manner
Participants: Experts, citizens, innovation stakeholders, e.g. companies, R&D stakeholders, creative industries, start-ups, social entrepreneurs, founders
Meetings: as needed; to be consulted by the three groups on a flexible point-by-point basis

Sprint Teams

Implementing with agility

Role: Design measures in detail, identify key figures, implement measures, report to Supervisory Group
Participants: Experts, organisational team, activity mentors
Meetings: as needed and on a point-by-point basis, with the possibility of several parallel teams

Figure 4-1: Follow-up process for implementing and developing the Innovation Strategy

As part of its role, the **Sounding Board** is responsible for aligning and further developing the Innovation Strategy, e.g. by promoting and supporting specific projects along Hamburg's key topics for the future. The Sounding Board is supported in an advisory capacity by the Change Makers as needed. The shared belief that the Regional Innovation Strategy is to be aligned and developed in a wide-reaching, cross-departmental manner should also be reflected in the composition of the Sounding Board.

Change Makers are tasked with providing input for innovative activities across all areas, such as education, science and research, business, as well as culture and society. Depending on the topic at hand, Change Makers will get involved in processes on a point-by-point basis and as required by the Sounding Board, the Supervisory Group and the Sprint Team. This will help ensure that the follow-up process is as open and interdisciplinary as possible. The continuous involvement of the different innovation stakeholders in the follow-up process is aimed at keeping participants motivated and raising awareness for any emerging societal developments. In addition, it will strengthen Hamburg's external image and support the marketing of Hamburg-based innovation activities.

The **InnovationsAllianz Supervisory Group**, which was expanded in the course of the strategy process, will be in charge of outlining and specifying measures derived from the Innovation Strategy, while also identifying responsibilities in the scope of the policy packages in joint consultation. The controlling and reviewing of measures will be taken care of by the Supervisory Group.

The responsibilities thus identified are then used to create dedicated **Sprint Teams** that will be assigned to the individual measures. Based on the specifications made by the Supervisory Group, the relevant Sprint Team will refine the respective measures, define key figures and take care of implementation. Regular meetings will be held to ensure that measures are implemented in a transparent way and to report any project results to the Supervisory Group.

Beyond the structural involvement of stakeholders, topic-related and stakeholder-specific exchange formats are also being developed, allowing the innovation community and stakeholders from society to get involved by other means as well. Such formats are to be understood as components of the Innovation Strategy's individual areas of activity and a further integral element of the follow-up process.

The follow-up process is intended to ensure that the Innovation Strategy is implemented consistently. We are committed to tread this path together – including a broad range of Hamburg-based stakeholders, from schools and academia, industrial players and political stakeholders to young entrepreneurs and individual citizens. In doing so, we are strengthening a culture of innovation that embraces our ability to change and drives our vision of joining forces to create a liveable city through innovation.

5 Monitoring and evaluation

5.1 Methods

Throughout the implementation of the Innovation Strategy, the progress of measures will be tracked via systematic monitoring. The primary purpose here is to measure the success of the scheduled steps and to identify any delays as swiftly as possible. This will allow us to respond in an agile manner where necessary and e.g. reassess priorities, shift resources or adjust the design of measures as appropriate.

The Regional Innovation Strategy will be monitored on an ongoing basis and according to its progress. The aim is to document the success of the strategy and to determine in more detail whether the intended goals have been accomplished and whether expectations have not been met – or perhaps been exceeded – in individual areas of the strategy.

In the context of monitoring and evaluation, the following activities shall be implemented:

Tracking of measures

This entails the tracking of specific measures and activities as defined in the priorities and elaborated in subsequent action plans. Depending on the type of measure, progress may be assessed via yes/no checkboxes or by providing a percentage value indicating the degree of completion. A progress curve visualising the intended progress compared with the actual progress could be created on the basis of the underlying timeframe. Tracking should mainly focus on those areas of activity that create conditions for innovation. The tracking of measures thus indicates whether measures have been implemented successfully and, in certain areas, whether the strategy itself is on the path of success.

Updated benchmarking analysis

Within the framework of the strategy design, a comprehensive benchmarking analysis was carried out to compare Hamburg with other leading European and international locations for innovation. As well as providing valuable impetus for developing the strategy, it allowed us to gain insights into Hamburg's innovative strength against other peer cities. An updated benchmarking analysis in accordance with the analytical system developed is therefore deemed well suited to document the progress achieved. In future, a regular benchmarking analysis conducted at appropriate intervals would help gather important information on Hamburg’s relative performance at a reasonable expense.

Benchmarking using the Regional Innovation Scoreboard

Using the established Regional Innovation Scoreboard, the success of the Innovation Strategy could be assessed against other European locations and regions at regular intervals. While the Scoreboard does not include all of the Innovation Strategy’s strategic fields and may thus have a somewhat limited explanatory power, the process is easily accessible and could thus provide a meaningful additional way of measuring the success of the strategy, if only in specific sub-areas.

Surveys

Building on the online survey that was carried out as part of the strategy development, subsequent direct surveys or online surveys could be conducted in the innovation community over time. The advantage of this evaluation and monitoring method is that it provides innovation stakeholders with the opportunity to actively get involved. Therefore, surveys are also an appropriate tool for gathering important impetus in the course of implementing the strategy.

Especially in light of the unpredictability of future global and societal developments, it can be assumed that the Innovation Strategy will be adjusted whenever the need arises. Here, the direct links to the innovation community that were created in the course of the project can be useful for incorporating any suggestions and realigning the focus both swiftly and accurately. Using the findings from the initial survey, it may also make sense to ask participants to take part in a before/after comparison.

5.2 Implementation

Depending to the nature of the strategic field concerned, evaluation and monitoring activities may be carried out using different methods. While surveys can be an effective method for those strategic fields with a focus on people and getting citizens involved, the benchmarking analysis seems well suited for assessing the sustainable success of strategic fields with a focus on finance and innovation stakeholders.

The following figure provides an overview of the different evaluation and monitoring methods and their use.

	Tracking of measures	Updated benchmarking	Regional innovation scoreboard	Survey
Aligning with societal benefits Enabling participation Agreeing on objectives Promoting social cohesion	●			●
Creating focal points Keeping a focus on key topics Creating lighthouse projects Strengthening the cluster ecosystem Creating innovation sites and formats	●			
Investing in the future Providing municipal funds Encouraging private investment Leveraging Federal Government and EU funds	●	●	●	
Attracting people Strengthening the education Retaining and attracting talent Ramping up marketing activities	●	●	●	●
Collaborating to enable innovation Strengthening research and science Supporting innovative start-ups Creating transfer environments Strengthening businesses	●	●	●	

Figure 5-1: Implementation of evaluation and monitoring activities

6 Appendix

This paper is mainly aimed at outlining the findings of the strategy process and presenting these in a suitable form and within a reasonable scope.

In the appendix, the accumulated findings shall be made available to stakeholders in more depth.

Especially the visual presentation of work results from the process may highlight the innovative mindset of the stakeholders involved and may be used as a further source of inspiration.

The documents of the appendix are snapshots from different phases of the project. The full benchmarking analysis is available for quantitative analysis and may also be used as a reference document for any future assessments of Hamburg as a location for innovation. The trend analysis was carried out at the very beginning, the workshops were hosted throughout the course of the project, and the online survey was conducted towards the end of the project. Thus, the appendix also includes preliminary stages of ideas that were subsequently developed and elaborated as part of the strategy process.

Due to the volume of material, the appendix is available in digital form only. It can be accessed via the website of InnovationsAllianz Hamburg at www.hamburg.de/bwi/innovationsallianz/ (German language only).

7 Acknowledgements

We would like to take the opportunity to sincerely thank all stakeholders involved, who contributed tremendously to the numerous workshops and events that have taken place. We would also like to thank all participants of the anonymous online survey for their input as well as the experts for their valuable interview contributions. With their innovative and creative approaches, the Da Vinci team with Dr Jens Braak and Klaus Elle played an important role in shaping the process, and the data analysis and research conducted by Statista GmbH has provided important impetus for designing the Innovation Strategy.

The commitment and enthusiasm displayed by those involved in the strategy process have clearly demonstrated that Hamburg's innovation community is ready for the next big step. So now the City of Hamburg and these innovation stakeholders are joining forces to create a liveable city through innovation.

We would like to express our gratitude to the following organisations for contributing to the development of Hamburg's Regional Innovation Strategy:

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Behörde für Schule und Berufsbildung (BSB)	Helmut Schmidt Universität
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Behörde für Umwelt, Klima, Energie und Agrarwirtschaft (BUKEA)	Hochschule für Angewandte Wissenschaften Hamburg
Behörde für Wirtschaft und Innovation (BWI)	Hochschule für bildende Künste Hamburg
Behörde für Wissenschaft, Forschung, Gleichstellung und Bezirke (BWFGB)	Hochschule für Musik und Theater Hamburg
Bernhard-Nocht-Institut	hySOLUTIONS GmbH
Berufsbildungswerk und Weiterbildung Hamburg e.V.	IG BCE Industriegewerkschaft Bergbau, Chemie, Energie
Blockchain Research Lab	Impact HUB
Center for Free-Electron Laser Science	IMPCT gGmbH

Chainstep GmbH	Indeed Innovation GmbH
Climate Service Center Germany (GERICS)	Industrieverband Hamburg e.V.
Climate, Climatic Change and Society (CLICCS)	Initiative für transparente Studienförderung gUG
Co-Learning Space für Hamburger Cluster	Initiative Naturwissenschaft & Technik NaT gGmbH
Competence Center für Erneuerbare Energien und EnergieEffizienz (CC4E)	Innovations Kontakt Stelle Hamburg (IKS)
Consider it GmbH	Intermediate Engineering GmbH
Consist ITU Environmental Software GmbH	Joachim Herz Stiftung
Cross Innovation Hub	Jungheinrich PROFISHOP AG & Co. KG
data42 GmbH	KCI KompetenzCenter Innovation GmbH
DERMALOG Identification Systems GmbH	Kirchlicher Dienst in der Arbeitswelt (KDA) der Nordkirche
Deutsches Elektronen-Synchrotron (DESY)	Körber-Stiftung
Deutsches Zentrum für Luft- und Raumfahrt Hamburg (DLR)	Kroop & Co. Transport + Logistik GmbH
DIE FAMILIENUNTERNEHMER e.V. / Hamburg Finance GmbH	Life Science Nord Management GmbH
Digital Hub Logistics Hamburg GmbH	Logistik-Initiative Hamburg Management GmbH
Dr. Knigge & Rohleder - Gesellschaft für Unternehmerische Begleitung im Mittelstand mbH	maritimes cluster Norddeutschland e.V.
Elbpatent Marschall & Partner mbB	MediGate GmbH
Energieforschungsverbund Hamburg	Neues Amt Altona eG i.G.
Erneuerbare Energien Hamburg Clusteragentur GmbH	Neuhaus Partners GmbH
Facts and Stories GmbH	Next Commerce Accelerator GmbH
Fehrmann GmbH	Next Media Accelerator
Fraunhofer Anwendungszentrum Leistungselektronik für regenerative Energiesysteme (ALR), Außenstelle Fraunhofer-Institut für Siliziumtechnologie (ISIT)	nextMedia.Hamburg
Fraunhofer-Center für Maritime Logistik und Dienstleistungen (CML)	Olympus Europa SE & Co. KG
Fraunhofer-Einrichtung für Additive Produktionstechnologien (IAPT)	OpenLab Hamburg
Fraunhofer-Institut für Molekularbiologie und Angewandte Oekologie (IME)	Otto Group Digital Solutions GmbH
Fraunhofer-Institut für Windenergiesysteme (IWES)	Philips GmbH
Fraunhofer-Zentrum für Angewandte Nanotechnologie (CAN), Forschungsbereich Fraunhofer-Institut für Angewandte Polymerforschung (IAP)	pilot Hamburg GmbH & Co. KG
Frontiers in Attosecond X-ray Science: Imaging and Spectroscopy (AXSIS Team)	Scharlatan Theater Gesellschaft GbR
GALAB Laboratories GmbH	Senatskanzlei Hamburg
Garz & Fricke GmbH	Shortcut Ventures GmbH
gemeinnützige CLIMB GmbH	SicherheitsCampus Nord
Gesundheitswirtschaft Hamburg GmbH	Silpion IT-Solutions GmbH
GIS-Akademie GbR.	Smaato Inc.
Grone Wirtschaftsakademie Hamburg GmbH	SpiceVR
h+h Versicherungskontor Hamburg GmbH	Stadtteilschule Niendorf

HafenCity Universität Hamburg	Stiftung Initiative Courage
Hamburg Aviation e.V.	Ströer Digital Publishing GmbH
Hamburg Centre for Ultrafast Imaging	Technische Universität Hamburg-Harburg
Hamburg Energie GmbH	Tutech Innovation GmbH
Hamburg Innovation GmbH	Understanding Written Artefacts
Hamburg Invest Entwicklungsgesellschaft mbH & Co. KG	Universität Hamburg
Hamburg Invest Wirtschaftsförderungsgesellschaft mbH	Universitätsklinikum Hamburg-Eppendorf
Hamburg Kreativ Gesellschaft mbH	Viva con Auga de Sankt Pauli e.V.
Hamburg Media School GmbH	W.H.S.B. Weiterbildung Hamburg Service und Beratung gemeinnützige GmbH
Hamburg School of Business Administration gGmbH	Wärme Hamburg GmbH
Hamburger Hochbahn AG	Weiterbildung e.V. Hamburg
Hamburger Institut für Berufliche Bildung (HIBB)	Zentrum für Angewandte Luftfahrtforschung GmbH (ZAL)
Hamburger Software GmbH & Co. KG	

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List of abbreviations

AI	Artificial Intelligence
AIM	Advanced Imaging of Matter
ARIC	Artificial Intelligence Center Hamburg
BKM	Behörde für Kultur und Medien (Hamburg Ministry of Culture and Media)
BNITM	Bernhard Nocht Institute for Tropical Medicine
BSB	Behörde für Schule und Berufsbildung (Hamburg Ministry of Education and Vocational Training (BSB)
BWFGB	Behörde für Wissenschaft, Forschung, Gleichstellung und Bezirke (Hamburg Ministry of Science, Research, Equality and Districts)
BWI	Behörde für Wirtschaft und Innovation (Hamburg Ministry of Economy and Innovation)
CDCS	Center for Data and Computing Science
CIMMS	Center for Integrated Multiscale Materials Systems
CLICCS	Climate, Climatic Change, and Society, Helmholtz Association
CM	Change Makers
CSL	CityScienceLab
CSSB	Centre for Structural Systems Biology
CUI	Hamburg Centre for Ultrafast Imaging
DAM	Deutsche Allianz Meeresforschung e.V.
DASHH	Data Science in Hamburg Helmholtz Graduate School
DESY	Deutsches Elektronen-Synchrotron (German Electron Synchrotron)
DKRZ	Deutsches Klimarechenzentrum (German Climate Computing Center)
EEHH	Erneuerbare Energien Hamburg (Renewable Energy Hamburg)
EFH	Energieforschungsverbund Hamburg
ERDF	European Regional Development Fund
EMBL	European Molecular Biology Laboratory
ESI	European structural and investment funds
FZB	Forschungszentrum Borstel (Research Center Borstel)
GERICS	Climate Service Center Germany, Helmholtz Association
HAW	Hochschule für Angewandte Wissenschaften (Hamburg University of Applied Sciences)
HCU	HafenCity Universität Hamburg (HafenCity University Hamburg)
HI	Hamburg Innovation GmbH
HITeC	Hamburger Informatik Technologie-Center
HIW	Hamburg Invest Wirtschaftsförderungsgesellschaft mbH
HPI	Heinrich Pette Institute
HZG	Helmholtz-Zentrum Geesthacht
IAPT	Fraunhofer Research Institution for Additive Manufacturing Technologies
IFB	Hamburgische Investitions- und Förderbank (Hamburg Investment and Development Bank)
IKS	Innovations Kontakt Stelle Hamburg
IME	Fraunhofer Institute for Molecular Biology and Applied Ecology
IoT	Internet of Things
ITS	Intelligent transport systems
IWES	Fraunhofer Institute for Wind Energy and Energy System Technology
LCI	Leibniz Center Infection
LGV	Landesbetrieb Geoinformation und Vermessung (Hamburg State Office for Geoinformation and Surveying)
MPSD	Max Planck Institute for the Structure and Dynamics of Matter
OECD	Organisation for Economic Co-operation and Development
SME	Small and medium-sized enterprises
SWOT	Strengths, Weaknesses, Opportunities and Threats
TUHH	Technische Universität Hamburg (Hamburg University of Technology)
UHH	Universität Hamburg (University of Hamburg)
UKE	Universitätsklinikum Eppendorf (University Medical Center Hamburg-Eppendorf)
XFEL	X-Ray Free-Electron Laser

ZAL	Zentrum für angewandte Luftfahrtforschung (Center of Applied Aeronautical Research)
ZHM	Zentrum für Hochleistungsmaterialien (Centre for Advanced Materials)

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