Terms of reference: market study

'Artificial intelligence in southern Germany – opportunities and obstacles for Dutch businesses in the industrial sector'

Objective
For many years, the Netherlands and Germany have been working closely together on the digital transformation of the industrial sector. In southern Germany – the country's industrial heartland – the digital transformation is playing an essential role in making the German industrial sector future-proof and keeping it profitable.

In order to gain as clear an insight as possible into the opportunities for Dutch artificial intelligence (AI) companies in southern Germany (Baden-Württemberg and Bavaria) within the context of Industry 4.0, the consulate-general in Munich, together with the Netherlands Enterprise Agency (RVO.nl), wishes to commission a market study that aligns with the relevant economic work plan and the internationalisation agenda for ICT in Germany.

In addition to providing insight into the opportunities for economic cooperation on AI, the research will also identify limitations and challenges within the business environment and provide suggestions as to how businesses and knowledge institutions can best deal with such issues. An important focus will be to identify relevant AI clusters (involving both businesses and knowledge institutions) in southern Germany that relate to the industrial sector.

Research question
How can economic cooperation between southern Germany and innovative Dutch companies and knowledge institutions in the area of AI be strengthened in the context of Industry 4.0?

Anticipated outcomes
In seeking to respond to the question above, the market study must also answer the following questions:

- Which areas of AI provide the greatest opportunities for cooperation in southern Germany in the context of Industry 4.0?
- Where do opportunities for synergy exist for innovative Dutch and German companies and knowledge institutions? How can Dutch and German areas of specialism best complement one another?
- What issues and obstacles exist in relation to these AI domains within Industry 4.0?
- What are the best public-private initiatives for promoting economic cooperation in the area of knowledge valorisation (such as Kompetenzzentren (competence centres), Reallabore (real-world laboratories), etc.) or southern German/German clusters which Dutch parties can join?
- What legislation, guidelines and standards are important within this market?
- Who are the biggest users of AI in southern Germany? Who is investing the most in AI and why?
- Which EU programmes centring on AI and Industry 4.0 (excluding CLAIRE) can we join together (in consultation with IRIS)?

End product
The market study must provide a clear insight into the characteristics and opportunities of the AI sector within Industry 4.0. The resulting report will be made available to interested Dutch companies and knowledge institutions, so that they can explore opportunities in this market and develop follow-up activities. This includes large Dutch companies, trade associations and knowledge institutions, as well as small and medium-sized enterprises (SMEs) that are active in AI.

The results will be presented in March/April 2020. In the Netherlands, this will be done by way of an opportunity seminar, while in Germany it will be done during Hannover Messe. If there is sufficient interest from Dutch companies, trade missions can be organised from Germany to the Netherlands and vice versa. The primary goal over several years is to offer guidance to individual companies and use available instruments

(including the Partners for International Business (PIB) programme) to create clusters of businesses and knowledge institutions.

The report must be written in easily understood Dutch or English; this being the responsibility of the party carrying out the research.

Schedule and reporting
Once the contract has been awarded, desk research and interviews with major stakeholders in southern Germany should be conducted over a period of six weeks. Two weeks before the deadline the contractor should submit a draft report to the consulate-general in Munich. The contractor will then have one week to incorporate the consulate-general's feedback into the final report.

Delivery
The final report should be delivered electronically to RVO.nl. RVO.nl and the consulate-general in Munich will hold exclusive copyright on the research and are the only organisations that may copy the report and disseminate the results.

Budget
A maximum of €20,000, including VAT.

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Annexe
- Background information

Annexe 1: Background information

The definition of AI used in this study

Artificial intelligence is intelligence for machines or computers, i.e. digital intelligence.

Intelligence is the ability to acquire and apply knowledge and expertise. In other words, the ability to learn. AI in this study therefore refers to machines with the ability to learn and apply a given skill. By using this definition, we can ensure that the study[1] focuses on the key aspects of what machines can do now, compared to 10 years ago.

Developments in the Netherlands and Germany

Many EU member states see AI as the technology of the future. The Netherlands has developed its own Strategic Action Plan for Artificial Intelligence (SAPAI) and, together with the National AI Coalition, the Dutch government wants to make €2 billion available for AI investments over the next seven years.[2] In Germany the government, together with German businesses, has made €6 billion available until 2025 to stimulate developments in AI. During government consultations the Netherlands stated its wish to work with Germany in the area of AI.[3] The Netherlands Organisation for Applied Scientific Research (TNO) and the Fraunhofer Society also have plans to work together.

SAPAI puts forward the idea that the smart-industry approach will strengthen knowledge sharing and the valorisation of AI applications. In light of the action plan only just having been published, it seems to be a

[1] The broad definition of AI includes anything that could be conceived to fall under AI for marketing purposes.
[2] Strategic Action Plan for Artificial Intelligence (SAPAI) (2019).
[3] In these consultations, State Secretary for Economic Affairs and Climate Policy Mona Keijzer stressed the need for a 'human-centric' approach to AI, as well as cooperation within the CLAIRE network.

favourable time for gaining more insight into opportunities in Germany. Cooperation between both countries will not only strengthen AI's position in Europe, but will also promote trade between Dutch and German counterparts.

Focus on Industry 4.0

The market study will focus on opportunities for Dutch companies already active in AI or AI applications in an Industry 4.0 context.

- Germany's own AI action plan Strategie Künstliche Intelligenz focuses on making better use of the opportunities AI can offer the industrial sector.[4] The industrial sector is a central focus of the organisation responsible for implementing Germany's AI strategy, Plattform Lernende Systeme, particularly in terms of interaction between humans and machines and data sharing.
- Within the Dutch Smart Industry programme, specific attention is paid to cooperation with Germany and there is an even more specific focus on cooperation in the area of AI. One of the aims of the 2019-2021 Smart Industry action plan is to exchange best practices between Smart Industry Field Labs and the German Labs Network Industrie 4.0.[5] Steps are also being taken to create a European network of smart factories that work together on the basis of international standards. AI will play a major role in this.
- In addition, a wide array of missions focusing on Industry 4.0 have taken place in Germany, which has led to partnerships being formed.[6] These partnerships offer excellent opportunities to strengthen the appeal of Dutch AI in the German market. They primarily offer a chance to establish links between clusters but also to bring companies closer together so that they can learn from one another.
- According to the Federal Ministry for Economic Affairs and Energy (BMWi), opportunities exist in the area of automated solutions and increased cooperation between both countries with regard to Industry 4.0.[7] Within Germany's High-Tech Strategy, AI – as a key enabling technology – receives additional support and companies can gain more AI experience through Kompetenzzentren and Reallabore. As yet, no Dutch partners are involved.
- Industry 4.0 is one of the four focus themes of the German accelerator appliedAI. Furthermore, the Dutch Artificial Intelligence Manifesto published by ICT-Research Platform Nederland's (IPN) AI Special Interest Group (SIGAI) also highlights the wish to strengthen AI in Dutch industry in the 'autonomous agents & robotics' focus area.[8]

Recent research

Right now, AI is a hot topic and a significant amount of research has already been done, including on opportunities for synergy between the Netherlands and Germany.

Research carried out by Technopolis on innovation and trade opportunities for the Dutch ICT sector in Germany included a quick scan of German and Dutch strengths, weaknesses and opportunities (including for export) in the area of AI. The research offers a good overview of the German and Dutch AI landscape. The reports drawn up by EY and commissioned by Microsoft (Artificial Intelligence in Europe, The Netherlands and Artificial Intelligence in Europe, Germany (2019)) give a good insight into how companies look upon and use AI.

The reports *Potenziale der Künstlichen Intelligenz im produzierenden Gewerbe in Deutschland*; *Technologieszenario KI in der Industrie 4.0*; and *Zielmarktanalyse Industrie 4.0 in der Lebensmittelindustrie:*

[4] See Germany's AI action plan: Artificial Intelligence (AI) Made in Germany (2018).
[5] FME, *Konturen eines deutsch-niederländischen Aktionsplans für die Industrie*.
[6] Several partnerships were formed as a result of the royal working visit in October 2018. Examples include the Smart Factory network and the agreement between dcypher and the Center for IT Security, Privacy and Accountability (CISPA).
[7] BMWi, *Zielmarktanalyse Industrie 4.0 in der Lebensmittelindustrie: Schwerpunkt Logistik und Verpackung* (2019).
[8] Dutch Artificial Intelligence Manifesto, http://ii.ewi.tudelft.nl/bnvki/wp-content/uploads/2019/09/Dutch-AI-Manifesto-2019.pdf (2018).

Scherpunkt Logistik und Verpackung can be used as reference materials in order to better map out the specific opportunities in southern Germany.

There are a great number of synergy opportunities in Germany for innovative Dutch companies in the area of AI.[9] One example is predictive maintenance in combination with machine learning. 97% of German companies in the industrial sector believe that AI offers opportunities to implement new business strategies or design new production processes.[11] But only 23% state that they are actually rolling out AI in their business processes.[10] The main AI applications for Industry 4.0 in Germany are computer vision, deep learning and machine learning.[11]

When it comes to Research & Design, the Netherlands is particularly strong in machine learning, neural networks, text and image analysis, deep learning and autonomous learning.[12] In addition, the Eindhoven Artificial Intelligence Systems Institute (EAISI) has recently been established, specialising in AI applications in the industrial sector. German companies are primarily still at the AI pilot stage.[13] By contrast, Dutch companies state that AI is actively contributing to a range of business processes. Companies in both countries expect machine learning and smart robotics to be the most useful areas within their businesses. The question is whether German companies expect that Dutch companies can help in this regard. In so doing, attention can be paid to the experiences already gained in Germany and the Netherlands relating to these themes, as well as looking at where synergy lies.

Networks

The CLAIRE network was set up to promote international cooperation on AI between EU governments. The network is formed by nine EU member states that want to work together as the EU's centre of excellence for AI. The network will be headquartered in The Hague and a large number of German researchers will be involved in it. In Germany, the public-private knowledge and advice platform Plattform Lernende Systeme[14] has been set up. The platform is comparable to the Netherlands' national network ICAI (Innovation Center for Artificial Intelligence). Since networks and clusters play a major role in international cooperation in the area of AI, we want to highlight relevant business and knowledge clusters in southern Germany in this area.

Southern Germany

Southern Germany is responsible for more than 40% of Germany's total Gross Domestic Product (GDP), and the industrial sector (i.e. the main user of AI applications) is located primarily in the states of Bavaria and Baden-Württemberg. The region is home to the highest levels of economic growth and the lowest levels of unemployment. In addition, the investment ratio is higher than average and twice as many patents are applied for than the German average. Furthermore, the four themes for public-private partnerships, as designated by the International Enterprise Department (DIO), are concentrated primarily in this region. Finally, the Netherlands is missing out on a lot of opportunities in southern Germany, with a market share of only 7%, compared to a 9% market share in the German market as a whole.

By far the most investments in AI in combination with Industry 4.0 are made in southern Germany; Bavaria wants to invest €1 billion in innovations in key technologies, with a focus on AI.[15] In Baden-Württemberg millions are being invested in developments in the area of AI and Industry 4.0. According to a study by the German government, in the next five years AI could result in €32 billion in added value.

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[9] Strategic internationalisation agenda for ICT in Germany, based on KPMG and Technopolis reports (2019).
[10] Random sample of 35 German businesses, of which 54% stated they were in the experimental phase (EY, Artificial Intelligence in Europe, Germany (2019)).
[11] BMWi, *Potenziale der künstlichen Intelligenz im produzierenden Gewerbe in Deutschland* (2018).
[12] See PM Elsevier (2018) and others.
[13] EY, Artificial Intelligence in Europe, Germany (2019) and Artificial Intelligence in Europe, The Netherlands (2019).
[14] See https://www.plattform-lernende-systeme.de/themen.html for more information about this platform.
[15] https://www.sueddeutsche.de/bayern/bayern-digitalisierung-wissenschaft-startups-1.463362.

Germany is home to 241 AI startups; a 62% increase compared to 2018.[16] In 2018 there were 309 AI startups in the Netherlands.[17] The startup climate in southern Germany is particularly encouraging. Two of Germany's six startup 'hotspots' are located in the south of the country, in Munich and Stuttgart.[18] In terms of universities, in 2018 the Technical University of Munich ranked sixth in the list of the most influential universities in the area of AI. When weighted in terms of impact however, the Netherlands scores better, coming in sixth, with Germany in eighth place.[19]

[16] appliedAI, Startup Landscape 2019 (2019).
[17] StartupDelta, Dutch AI Startup Infographic (2018).
[18] KPMG, Deutscher Startup Monitor: Mut und Macher (2017).
[19] See https://www.timeshighereducation.com/data-bites/which-countries-and-universities-are-leading-ai-research.