KPMG

Export opportunities of the Dutch ICT sector to Germany

25-04-2017

Global Strategy Group

Laan van Langerhuize 1, 1186 DS, Amstelveen

Private and confidential   20 April 2017

Ministerie van Economisch Zaken

Attn: Mr B. Huijts

Prinses Beatrixlaan 2

2595 AL Den Haag

Project Matrix – High level market scan ICT Sector opportunities in Germany

Dear Sir,

As requested, we enclose a copy of our final report with regards to our market scan of the opportunities in the German ICT sector for Dutch organisations, in accordance with our engagement letter dated 15 December 2016 and its attachments.

Our report is released to you on the basis that it is not to be copied, referred to or disclosed, in whole or in part, without our prior written consent, save as permitted in the engagement letter. We accept no liability to anyone other than the Ministerie van Economische Zaken in connection to this report and our work for you.

Your sincerely,

Raymond Timmer

Important notice

Our work commenced on 15 December 2016 and was completed on 20 April 2017.

In preparing this report, our primary source has been market interviews, secondary research and representations made available to us by the Ministerie of Economische Zaken. We do not accept responsibility for such information which remains the responsibility of management.

The primary scope of our procedures was to analyse and comment on the opportunities within the German ICT market, taking into account the strengths and weaknesses of both the German and Dutch ICT market with a focus on a limited number of sectors (e.g Big data, Cloud, etc). The procedures we have performed as mentioned in the engagement letter, only include the procedures which you indicated as important in respect of your information requirements. As a consequence, we may not have discovered matters which may have come to our attention.

We have satisfied ourselves, so far as possible, that the information presented in our report is consistent with other information which was made available to us in the course of our work in accordance with the terms of our Engagement Letter. We have not, however, sought to establish the reliability of the sources by reference to other evidence.

We would like to emphasise that we do not express an opinion or any form of assurance on the information presented in this report (including Appendices). Furthermore we do not make any representations regarding the sufficiency of the procedures we performed for your informational needs.

Glossary of terms (1 / 2)

20xxE	Estimated data	**GDPR**	General Data Protection Regulation set by the European Union
20xxF	Forecast data	**HR**	Human Resources
BDSG	German Federal Data Protection Act	**HRM**	Human Resource Management
Big4	KPMG, EY, Deloitte and PwC	**HSD**	The Hague Security Delta
BMBF	German Federal Ministry of Research and Education	**i.e.**	In other words
Bn	Billion	**IaaS**	Infrastructure as a Service
CAGR	Compound Annual Growth Rate	**ICT**	Information and Communications Technology
CEO	Chief Executive Officer	**IoT**	Internet of Things
CI	Cognitive Intelligence	**ISAC**	Information Sharing and Analysis Centre
CIO	Chief Information Officer	**IT**	Information Technology
CRM	Customer Relationship Management	**Mittelstand**	German Small and Medium-sized Enterprises
e.g.	Example given	**m**	Million
EPA	Enhanced Process Automation	**MRP**	Manufacturing Resource Planning
ERP	Enterprise Resource Planning	**NCSC**	Dutch National Cyber Security Centre
ES	Enterprise Solutions	**NL**	The Netherlands
EU	European Union	**OCR**	Optical Character Recognition
FS	Financial Services	**OEM**	Original Equipment Manufacturer

Glossary of terms (2 / 2)

p. a.	Per annum
PaaS	Platform as a Service
Qx	Quarter of the year (1-4)
R&D	Research and Development
RPA	Robotic Process Automation
RVO	Rijksdienst voor ondernemers Nederland (Federal agency for entrepreneurs)
SaaS	Software as a Service
SCM	Supply Chain Management
SME	Small and Medium-sized Enterprises
Telecom	Telecommunications
UK	United Kingdom
US	United States of America
USD	United States Dollars
vs.	Versus

Contents

Executive Summary

KPMG

Approach and summary

This study conducted by KPMG for the Dutch Ministry of Economic Affairs aims to give an indication of the areas within the German ICT market that represent attractive export opportunities for Dutch companies.

Summary of the study results

Both large Dutch multinationals and small local niche players offer highly competitive **Internet of Things** (IoT) solutions that are exportable to Germany. Multinational companies of Dutch origin are globally competitive in semiconductors and middleware for IoT. At the same time, the Dutch IoT sector has more start-ups and scaleups with innovative industry-specific solutions than currently present in Germany.

Dutch **Big Data** companies are competitive in industry-specific analytical software (specifically in Agriculture, Healthcare, Automotive and Infrastructure), industry-agnostic solutions based on artificial intelligence algorithms and consulting.
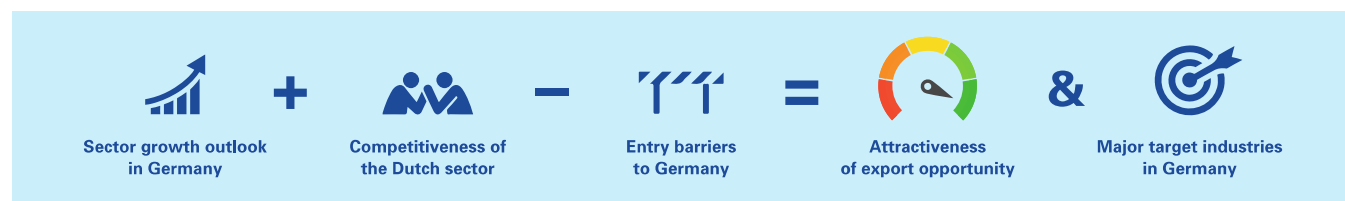
In general, Dutch competitiveness is driven by innovative products and high flexibility in meeting customer demands.

Dutch **Cyber Security** companies are regarded as internationally competitive due to their unique product features, with proven success in Financial Services, the Public Sector and Infrastructure. Competitiveness is diminished by the fact that Dutch players are typically SME sized companies with focus on a limited number of products instead of offering end-to-end cyber protection solutions. Therefore, finding a local distribution and/or complementary solution partner is highly important for successful export to Germany.
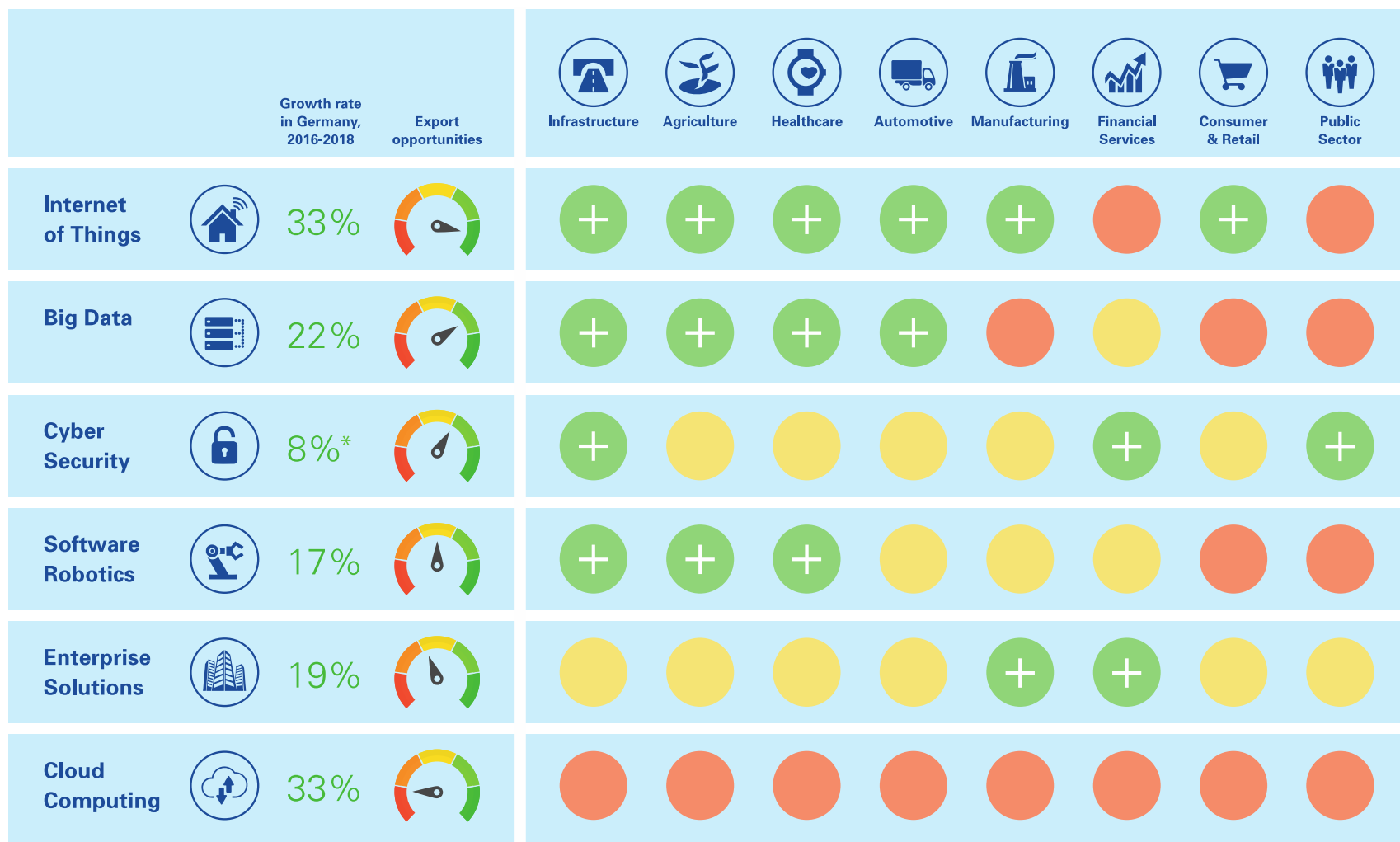
Dutch **Software Robotics** companies offer innovative solutions in the Cognitive Intelligence (CI) segment that appear to have no equivalent in Germany, whereas in Robotic Process Automation (RPA) international players have a strong competitive edge.

Dutch **Enterprise Solutions** (ES) providers appear to have moderate export opportunities to Germany, specifically in the SME segment. However, despite the high maturity of the ES sector in Germany, further investments in ES are a high priority for German CIOs.

Even though the Dutch **Cloud Computing** sector is highly developed, export opportunities for the Dutch Cloud sector to Germany are considered to be low due to a mature German market and strict regulatory requirements. The Cloud Computing market, however, is expected to almost double in value over the next 3 years, which again shows the strength and relevance of this sector.

| Sector growth outlook in Germany | **+** | Competitiveness of the Dutch sector | **–** | Entry barriers to Germany | **=** | Attractiveness of export opportunity | **&** | Major target industries in Germany |

Summary of export opportunities

	Growth rate in Germany, 2016-2018	Export opportunities	Infrastructure	Agriculture	Healthcare	Automotive	Manufacturing	Financial Services	Consumer & Retail	Public Sector
Internet of Things	33%	(gauge)	High (+)	High (+)	High (+)	High (+)	High (+)	Low	High (+)	Low
Big Data	22%	(gauge)	High (+)	High (+)	High (+)	High (+)	Low	Moderate	Low	Low
Cyber Security	8%*	(gauge)	High (+)	Moderate	Moderate	Moderate	Moderate	High (+)	Moderate	High (+)
Software Robotics	17%	(gauge)	High (+)	High (+)	High (+)	Moderate	Moderate	Moderate	Low	Low
Enterprise Solutions	19%	(gauge)	Moderate	Moderate	Moderate	Moderate	High (+)	High (+)	Moderate	Moderate
Cloud Computing	33%	(gauge)	Low	Low	Low	Low	Low	Low	Low	Low

*Reflects growth rate from 2013 to 2019

● High export opportunities   ● Moderate export opportunities   ● Low export opportunities

Internet of Things (IoT)

Both large Dutch multinationals and small local niche players offer highly competitive IoT solutions that are exportable to Germany. Multinational companies of Dutch origin are globally competitive in semiconductors and middleware for IoT.
At the same time, the Dutch IoT sector has more start-ups and scale-ups with innovative industry-specific solutions than currently present in Germany.

Overall assessment of export opportunities for Dutch ICT companies in the **IoT sector** to Germany

33% **Growth rate** in Germany, 2016-2018
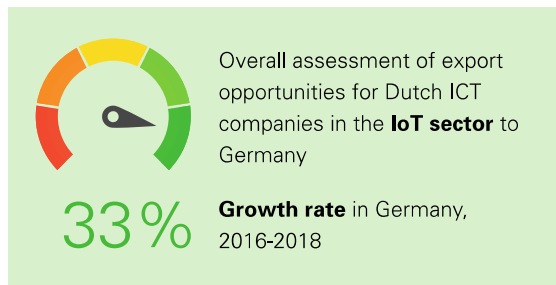
Sector growth outlook in Germany
The expected growth of IoT in Germany significantly outperforms global growth with a CAGR of 34% compared to a global CAGR of 21% between 2014-2020.[1]
• Growth is mainly caused by increasing penetration in automotive and selected other types of manufacturing.
• Growth is also supported by industries that are starting to adopt IoT in Germany: healthcare, energy, and infrastructure (e.g. airports) and consumer products (e.g. smart home).

5/5
Key: 1-Low sector growth / 5-High sector growth

Competitiveness of the Dutch sector
Both large Dutch multinationals and small local niche players offer highly competitive IoT solutions that are exportable abroad.
• Companies of Dutch origin are globally competitive in semiconductors and middleware for IoT (e.g. NXP, ASML).
• There are multiple Dutch examples of cross-industry solutions that cover a certain element of the IoT value chain, specifically IoT security and system integration.
• Compared with Germany, the Dutch IoT sector has more start-ups and scale-ups with innovative industry-specific solutions and readiness to customize their product.

4/5
Key: 1-Lower competitiveness / 5-Higher competitiveness

Entry barriers to Germany
Although no regulatory barriers for Dutch entrants are in place, preferences of local clients should be dealt with:
• German clients appear to expect that the IoT solution is fully tailored to their specific needs (industry, issue faced by the client).
• German clients place special emphasis on a strong component against security breach in the IoT solutions.
• German clients expect long-term commitment to the local market, i.e. local office, German speaking client coverage and technical teams.

4/5
Key: 1-High entry barrier / 5-Low entry barrier

Major target industries in Germany
The industries mentioned below offer solid export opportunities for the Dutch IoT sector: Dutch companies have developed commercially viable solutions, such as sensors and software for remote monitoring of crops, autonomous driving, patient monitoring, predictive maintenance of production equipment, smart home solutions, smart street lighting and water management that are all readily exportable to Germany.

Infrastructure   **Agriculture**   **Healthcare**   **Automotive**

Manufacturing   **Consumer & Retail**

Note: (a) Includes maritime and smart cities I Source: (1) TechNavio, IDC Research

Big Data

Dutch Big Data companies are competitive in industry-specific analytical software (specifically in Agriculture, Healthcare, Automotive and Infrastructure), industry-agnostic solutions based on artificial intelligence algorithms and consulting.
In general, Dutch competitiveness is driven by innovative products and high flexibility in meeting customer demands.

Overall assessment of export opportunities for Dutch ICT companies in the **Big Data sector** to Germany

22%
Growth rate in Germany, 2016-2018

Sector growth outlook in Germany
The Big Data sector in Germany is expected to show strong growth from € 1.4 bn to € 3.7 bn between 2015 and 2020 (CAGR of 22%).[1]
- The growth is mainly driven by adoption by large businesses (companies with over 500 employees).
- High growth rates for Big Data is anticipated in industries with high data usage, such as healthcare, public sector, telecom, financial services and retail.

5/5

Key: 1-Low sector growth / 5-High sector growth

Competitiveness of the Dutch sector
Relative to their German peers, Dutch Big Data companies are competitive in industry-specific analytical software, industry-agnostic solutions based on artificial intelligence algorithms and consulting.
Dutch competitiveness is mainly driven by the innovative products and a high flexibility in meeting customer demands.
Dutch companies are particularly strong in consulting and implementation but do not have a foothold in big data platforms and infrastructure, which is dominated by international players due to large investment requirements to set up infrastructure.

4/5

Key: 1-Lower competitiveness / 5-Higher competitiveness

Entry barriers to Germany
No critical entry barriers have been identified. However the following factors should be observed by Dutch entrants:
- Product offering needs to be adjusted to meet strict local data privacy regulation (Bundesdatenschutzge-setz).
- Banking and Healthcare have most of their data only available in the local language which implies significant adaptation for a Dutch Big Data solution.
- Clients have a strong preference for companies with local office.

4/5

Key: 1-High entry barrier / 5-Low entry barrier

Major target industries in Germany
Interview feedback suggests that Dutch Big Data companies appear to have a strong competitive position compared to German peers, especially for industry-specific analytical applications in agriculture, automotive, infrastructure (maritime and smart city), healthcare and industry-agnostic solutions that process big data with the use of complex artificial intelligence algorithms.

Infrastructure   **Agriculture**   **Healthcare**   **Automotive**
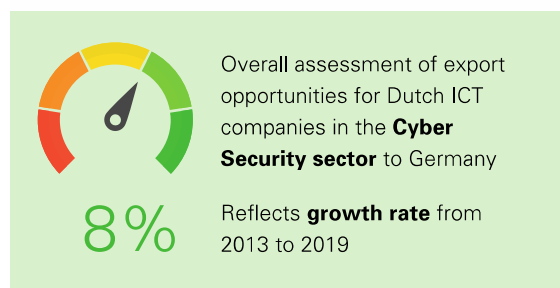
Note: (a) Includes maritime and smart cities I Source: (1) Experton Research

🔓 Cyber Security

Dutch Cyber Security companies are regarded as internationally competitive due to their unique product features, with proven success in Financial Services, the Public Sector and Infrastructure.

Competitiveness is diminished by the fact that Dutch players are typically SME sized companies with focus on a limited number of products instead of offering end-to-end cyber protection solutions.

Therefore, finding a local distribution and/or complementary solution partner is highly important for successful export to Germany.

Overall assessment of export opportunities for Dutch ICT companies in the **Cyber Security sector** to Germany

8%

Reflects **growth rate** from 2013 to 2019

Sector growth outlook in Germany

German cyber security sector is forecast to grow with a CAGR of 10% from € 30bn in 2016 to € 44bn in 2020.[1]

- The growth is mainly driven by the new regulatory standards that will be implemented on an EU level in 2018 (GDPR) enforcing companies to report breaches, introduce data protection officers and anonymize personal data before processing it.
- Especially high growth is expected in selected industries (e.g. defence) and selected segments (e.g. encryption), due to new security standards.

📈 4/5

Key: 1-Low sector growth / 5-High sector growth

Competitiveness of the Dutch sector

The sector is fragmented, with mainly SME players offering specialised security products, which are regarded internationally as competitive due to their unique features (e.g. 'dark web' analysis, GDPR security compliance).

- The overall competitiveness of the Dutch sector is diminished by the fact that even the larger Dutch companies (e.g. Fox-IT) generally have a strong product focus, in contrast to international peers that offer end-to-end cyber protection.

👥 4/5

Key: 1-Lower competitiveness / 5-Higher competitiveness

Entry barriers to Germany

The Dutch companies will face strong competition from local players and will have to address the preferences of the German clients for having a local presence.

- A strong brand name with a full-fledged office in Germany as a sign of long-term commitment to the market is preferred when it comes to security.
- The German cyber security sector is highly competitive, but fragmented with hundreds of local companies offering niche solutions.

⛳ 3/5

Key: 1-High entry barrier / 5-Low entry barrier

Major target industries in Germany

Dutch cyber security solutions are generally industry-agnostic. However, the Dutch companies have more credentials in the industries cited below based on completed projects in the past. The attractiveness of these industries is further reinforced by the high demand in Germany.

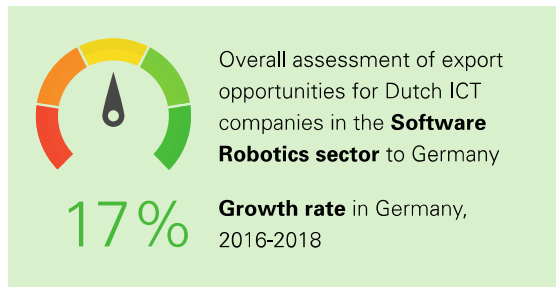**Infrastructure** **Financial Services** **Public Sector**

Software Robotics

Dutch Software Robotics companies offer innovative solutions in the Cognitive Intelligence (CI) segment that appear to have no equivalent in Germany, whereas in Robotic Process Automation (RPA) international players have a strong competitive edge.

Overall assessment of export opportunities for Dutch ICT companies in the **Software Robotics sector** to Germany

17%

Growth rate in Germany, 2016-2018

Sector growth outlook in Germany
The Software Robotics sector includes robotic process automation (RPA) and cognitive intelligence (CI), the latter representing a more advanced technology which currently has a low adoption in Germany.
- Growth in RPA is expected with a CAGR of 13-15% between 2016-2018.[1]
- A higher growth is expected in CI: above 20% annually between 2016-2018[1] as more German clients are seeing the value for investments in CI.

4/5

Key: 1-Low sector growth / 5-High sector growth

Competitiveness of the Dutch sector
We identified a limited number of Dutch companies with commercially viable software robotics solutions which are mainly active in RPA.
RPA: Dutch companies generally offer industry-generic solutions, but their product portfolio is narrower than international players, with limited perceived competitive edge compared with companies active in Germany.
CI: Selected Dutch players (e.g. Scyfer) offer innovative CI solutions that appear to have no equivalent in Germany.

3/5

Key: 1-Lower competitiveness / 5-Higher competitiveness

Entry barriers to Germany
High competitive intensity in RPA (80-100 local companies), with signs of ongoing consolidation. Significant investments are required to speed up the adoption of CI, therefore a general 'wait and see' attitude of German companies to adopt CI solutions may limit the target market to large innovative companies, which command budgets for investments in CI.
We did not come across any local regulations preventing Dutch companies from entering the German market.

4/5

Key: 1-High entry barrier / 5-Low entry barrier

Major target industries in Germany
Dutch companies have developed commercially viable solutions both in the RPA and CI segments of Software Robotics, specifically in below-mentioned industries. There is limited evidence that the Dutch RPA solutions have a strong competitive edge over solutions available in Germany. However, solutions in CI appear to have a competitive advantage.

Infrastructure   **Agriculture**   **Healthcare**

Note: (a) Includes operation of traffic flow and street signs | Source: (1) IDC Research, expert interviews, KPMG analysis

Enterprise Solutions

Dutch Enterprise Solutions (ES) providers appear to have moderate export opportunities to Germany, specifically in the SME segment. However, despite the high maturity of the ES sector in Germany, further investments in ES are a high priority for German CIOs.

Overall assessment of export opportunities for Dutch ICT companies in the **Enterprise Solutions sector** to Germany

19% **Growth rate** in Germany, 2016-2018
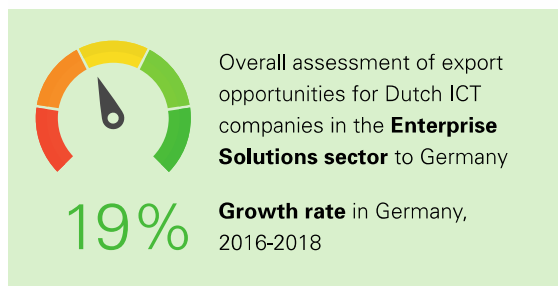
Sector growth outlook in Germany

Despite being a mature market, the German Enterprise Solutions market is forecast to grow with a CAGR of 10% from € 3.2bn in 2016 to € 4.7bn in 2020.[1]

- Growth is predominantly driven by the switch to new generation cloud based systems and the discontinuation of outdated systems (i.e. legacy systems).
- Increasing focus on the development of industry-specific software and higher adoption in the SME segment further drive growth.

4/5

Key: 1-Low sector growth / 5-High sector growth

Competitiveness of the Dutch sector

Dutch companies are mainly competitive in the SME client segment.

- Dutch entrants can take advantage of opportunities in industry- and function-specific solutions (e.g. HR and Finance) for SME clients, where German companies appear to have less credentials.
- Local design of ES hinders the export strength to Germany due to the fact that the solution has to be tailored to the German market (e.g. language, regulations).
- There appears to be little room for successful market entry in the large corporate segment due to strong position of German companies.

3/5

Key: 1-Lower competitiveness / 5-Higher competitiveness

Entry barriers to Germany

Entry barriers appear to be moderate for Dutch companies entering Germany.

- On the one hand, no formal barriers prevent Dutch companies from entering the German market, and some segments of the market are not fully developed and mature (e.g. integrated ES systems, industry-specific solutions).
- In contrast, overall competitive intensity is high in the German ES market, with major competition from both large international and the local players. Furthermore, solutions need to be tailored to local preferences (e.g. language, regulations).

3/5

Key: 1-High entry barrier / 5-Low entry barrier

Major target industries in Germany

The Dutch companies should target the below-mentioned industries and niches due to the availability of internationally recognized solutions.

Financial Services   **Manufacturing**

Source: (1) Gartner Research (projection as per Q3 2016)

Cloud Computing

Even though the Dutch Cloud Computing sector is highly developed, export opportunities for the Dutch Cloud sector to Germany are considered to be low due to a mature German market and strict regulatory requirements. The Cloud Computing market, however, is expected to almost double in value over the next 3 years, which again shows the strength and relevance of this sector.

Overall assessment of export opportunities for Dutch ICT companies in the **Cloud Computing sector** to Germany

33% **Growth rate** in Germany, 2016-2018
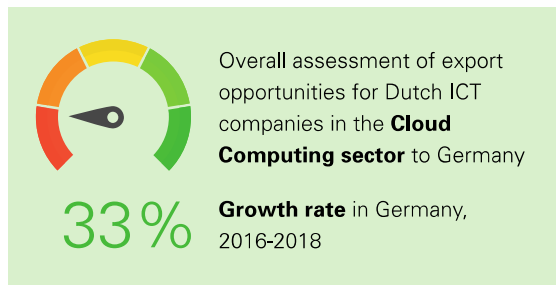
Sector growth outlook in Germany

Overall growth in the German Cloud computing sector is expected at a CAGR of 33% in 2016-2019 (from € 1.9bn to € 4.5bn) driven by increasing adoption by local businesses.
- The German IaaS segment is forecast to grow with a CAGR of 44% between 2015– 2019.
- The German PaaS segment is forecast to grow with a CAGR of 59% between 2015–2019.

5/5

Key: 1-Low sector growth / 5-High sector growth

Competitiveness of the Dutch sector

Dutch companies are mainly competitive in the SME client segment, as large clients mainly use the services of international players (e.g. Google, Amazon, Microsoft).
- There is limited evidence that Dutch companies have a competitive advantage compared to their German peers.
- The offering of Dutch players is mainly focused on IaaS, with limited coverage of PaaS.

2/5

Key: 1-Lower competitiveness / 5-Higher competitiveness

Entry barriers to Germany

Generally, we see high entry barriers that may increase the cost of market entry to Germany:
- German clients strongly prefer that data is stored and processed on servers, which are physically located in Germany (specifically applicable to Financial Services, Healthcare, Public sector and Telecom).
- Strict privacy and security regulations in the Cloud sector (e.g. concerning authentication, physical access, system updates) create additional entry barriers.
- German clients have a strong preference for companies that have local office.

2/5

Key: 1-High entry barrier / 5-Low entry barrier

Major target industries in Germany

No specific target industries identified.

Opportunities for development of the German ICT-Sector

Export opportunities in Big Data, Internet of Things and Cyber Security for Dutch players simultaneously provide opportunities for the German government and German companies

Big Data

- There appears to be an opportunity to strengthen Big Data expertise by developing industry-specific applications / solutions on top of existing hardware capabilities.
- Niche solutions are especially relevant in data-intensive industries where strong growth is forecast such as logistics, healthcare, public sector, telecom, financial services and retail.
- Develop Big Data applications that rely on artificial intelligence / cloud computing to compete with international players.

- Support the development of an "ecosystem" to boost innovation and strengthen start-up efforts in order to increase the agility / flexibility of the industry (for example such as the Amsterdam Big Data hub where companies, Government and academic institutions cooperate to develop talent, knowledge sharing and enable networking).

IoT

- Stimulate cooperation between SME players with large generalists in order to satisfy mid-market client needs and boost overall competitiveness.
- Development of specialised solutions that can be customised to the industry's and client's need, especially in industries with high growth potential such as energy, healthcare and smart homes.

- Efforts are needed to improve internet connectivity in certain areas of the country as it imposes limits on Internet of Things development.
- Further development of industry-specific knowledge hubs (in industries other than automotive and manufacturing) to promote innovation and increase access to human talent.

Cyber Security

- The German Cyber Security industry has a strong reputation for having highly efficient solutions, but could focus more on usability and user experience.
- Anticipate the impact of the European General Data Protection Regulation (GDPR) on security standards to help German companies with 2018 regulatory compliance.
- Continue and build on current federal research programs on Cyber Security and public-private collaborations (e.g. BITKOM Alliance for Cyber Security, fit4sec, Fraunhofer cluster).

- Further strengthen and centralise the collaboration between universities, government and Cyber Security companies to increase innovation rates and education of talent. This can be achieved by increasing collaboration between the existing but fragmented IT clusters (e.g. Bavarian IT Security Cluster, IoT Security Cluster NRW, Fraunhofer Urban Security Cluster).

Digitization impact on industry

Sector	IoT	Big Data	Cyber Security	Software Robotics	Enterprise Solutions	Cloud Computing	Notes
Financial Services	Low	High	Low	High	Low	High	• **Big Data** improves business performance of banks and insurers. - Examples include more accurate credit scoring, product pricing and targeted campaigns for specific client groups. • **Robotics** will enable additional automation of back-office processes. • Disruptive concepts such as Blockchain and potential successors are gaining importance.
Public Sector	High	High	High	Low	Low	High	• **IoT / Big Data**: introduction of new solutions (smart lighting, smart traffic) requires integration of sensors and data analytics capacities. • **Cyber security** is becoming increasingly important to diminish unauthorized access to government data.
Telecom	High	High	Low	Low	High	High	• **Big Data**: Data analytics are among critical success factors when it comes to better customer service, location-based promotions and targeted campaigns.
Healthcare	High	High	Low	High	Low	Low	• **Big Data** increases efficiency of healthcare. - Examples include the modelling of clinical trial results and the prediction of medical trends (e.g. flu outbreaks). • **IoT**: Sensors and health measurement applications will have an impact on remote diagnostics and patient monitoring linking the value chain to telecom.

● High impact of technology on sector   ◗ Low impact of technology on sector

Digitization impact on industry – continued

	IoT	Big Data	Cyber Security	Software Robotics	Enterprise Solutions	Cloud Computing	
Manu-facturing	●	●	◗	◗	◗	◗	• **IoT**: Sensors installed in manufacturing equipment improve efficiency of production processes. - Examples include decrease in down-time and predictive maintenance. • **Big Data**: Data generated by IoT sensors has to be processed with advanced analytics algorithms to generate meaningful insights.
Energy utilities	●	●	◗	◔	◗	◗	• **IoT:** Sensors will increasingly be used in energy grids and smart meters to improve energy efficiency (part of Smart City concepts). • **Big Data**: advanced analytical algorithms are needed to process / visualize the data generated by IoT sensors.
Auto-motive	●	●	◗	●	◗	◗	• **Robotics**: provides solutions in the area of machine-learning algorithms used in autonomous driving. • **IoT / Big Data**: IoT sensors and data analytics will be increasingly used to collect and process real-time data.
Natural resources	●	◔	◗	●	◔	◗	• **IoT**: Use of sensors in machines allows companies improve predictive maintenance to minimize equipment downtime. • **Robotics**: Use of deep learning algorithms enables autonomous functioning of equipment leading to reduction in personnel expenses.

Source: KPMG analysis, BCG Perspectives – Digital Germany, Roland Berger – Digital transformation Low impact of technology on sector of industry

Chapter I
Relevant ICT sectors – trends and prospects

Coverage and structure

This chapter introduces the ICT sectors that are the subject of this report

Enterprise Solutions
Cloud Computing
Cyber Security
Software Robotics
Internet of Things (IoT)

Big Data

Market definition and description	Market size and growth prospects	Sector market structure and major players

Objective and coverage

— As ICT sectors are often given very generic labels, a clear definition is given to the sector.

— Subsequently, the ICT sector is described in terms of segment and solutions.

— Provides an overview of the market in terms of value and growth projections.

— Key drivers enabling growth in the sector are described including major challenges hampering the growth of the relevant ICT sector (if any).

— Describes the sector market structure illustrating major segments and solutions.

— Major players operating across major segments of the market are shown for illustrative purposes.

IoT – Market definition

IoT refers to a network of physical equipment and devices that are interconnected through the internet, enabling decision making through data transmission

Global IoT market landscape

IoT infrastructure			
Hardware	**Software**	**Integrated solutions**	**Consulting**
— Semiconductors — Connectivity — Measurement sensors — Power batteries	— Data analytics software — Firmware devices/sensors — Platform (connection and control sensors without hardware) — Middleware	— Monitoring and controlling — Positioning and tracking — Production optimization — Risk management — Security	— Consulting services

Key solutions

The semiconductors market is crucial for the Dutch ICT sector. Netherlands based companies have a specifically strong competitive position in semiconductor equipment manufacturing.

Semiconductors are widely used in industries that can benefit from IoT, with manufacturing, healthcare and smart home as examples.

The global market for semiconductor equipment is estimated at ~ €28 billion (2015) and ~20% of all the equipment is delivered from the Netherlands, mostly to Asia.

- Rijksdienst voor Ondernemend (RVO) Nederland

The Internet of Things (IoT) refers to a network of physical devices that are connected to the internet through sensors, chips or other networking equipment.

— The key benefit of the IoT is that it enables new sorts of data from objects (infrastructure, machines, lighting etc.) to be collected and sent to a business in real time via the internet which enables more accurate and faster decision making.

— The IoT market is composed of the following 4 major segments:
  - **Hardware**: IoT hardware refers to all semiconductors, sensors, chips and other physical equipment that facilitate the collection and transfer of data.
    - Semiconductors emerges as one of the largest private R&D investment sectors in The Netherlands. In 2015, the investments is estimated at €1 bn, e.g. more than one sixth of the total private Dutch R&D expenditure.[1]
  - **Software**: Software enables the analysis and reporting of inputs (data) which helps end users in decision making.
  - **Integrated solutions**: Integrates the elements from hardware and software solutions. Often these services use Cloud and Big Data technology for storage and data analysis, respectively.
  - **Consulting services**: Mainly revolve around requirement identification, vendor selection for IoT solutions for end users and service delivery.

Source: KPMG desk research & analysis; Cisco, TCS: IoT, the complete reimaginative service, July 2015, (1) Press clippings, KPMG analysis

IoT – Growth prospect

The IoT market is set to grow with a CAGR of 23% between 2014-2019, enabling smart solutions in major industries, among others in agriculture, automotive and infrastructure

Global IoT market forecast,
2014 – 2019F

€ billion

- 570 (2014)
- 704 (2015F)
- 869 (2016F)
- 1,071 (2017F)
- 1,318 (2018F)
- 1,620 (2019F)

+23%

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473
Source: Frost & Sullivan – Worldwide IoT market forecast 2009-2019, 2014

As Big Data and Cloud solutions mature, new applications for IoT solutions arise.

— New applications for IoT drive growth in IoT, the most important drivers are:
  - **Predictive maintenance**: The use of sensors and chips on objects that require maintenance helps collect data which can be used to predict when an object requires maintenance which helps limit the down time of an object.
  - **Smart agriculture**: The use of sensor in the fields and greenhouses can support the monitoring of growth of crops and ultimately increase the efficiency and effectiveness of the entire process.
  - **Smart cities**: By placing sensors in roads, lights and traffic lights energy efficiencies can be achieved.
— Key challenges to growth are the security and scalability of all new connected devices and the adherence to open standards to facilitate large scale monitoring of different systems.
  - Industry players must tackle these problems before adoption can increase.

Source: KPMG desk research & analysis; Cisco, TCS: IoT, the complete reimaginative service, July 2015

IoT – Market structure

On the foundation of well developed hardware, IoT suppliers currently develop innovative software and integrated solutions, often tailored to specific industry needs

Global IoT market structure

IoT infrastructure			
Hardware	**Software**	**Integrated solutions**	**Consulting**
— Semiconductors — Connectivity — Measurement sensors — Power batteries	— Data analytics software — Firmware devices/sensors — Platform (connection and control sensors without hardware)	— Monitoring and controlling — Positioning and tracking — Production optimization — Risk management — Security	— Consulting services

Key solutions

Key players

As the hardware component of the IoT market matures, new players arise to develop solutions that fit specific industry needs.

— Large international players are active on the IoT market, offering both generic and industry-specific solutions, with ongoing acquisitions of companies that a hold strong position in the hardware segment (semiconductors).
  - *"Large international players in the hardware segment are consolidating to achieve economies of scale. This is for instance reflected by the acquisition of NXP by Qualcomm."* – Representative of a Dutch company active in IoT Hardware.

— Going forward the IoT market development shifts towards the development of specific software and integrated solution development and consulting.
  - Solutions are being developed and tailored to specific industries.
  - Integrated solutions (of hardware and software) are easily implementable and thereby respond to the increasing client demand for 'plug-and-play' solutions.

Source: KPMG desk research & analysis; Cisco, TCS: IoT, the complete reimaginative service, July 2015

Big Data - Market definition

Big Data can be defined as the technology to store, process and analyse large volumes of data which cannot be analysed by conventional database management systems

Global Big Data landscape

Major segments		Key solutions

Decision support

Strategy — Big Data Consulting

Process (Analytics) — ICT operations & governance / Analytics / Visualisation reporting

Infrastructure

Systems (Software) — Aggregation & security / Database design / Data management

Systems (Hardware) — Appliances / Storage

Big data unlocks new insights to organisations by using advanced non traditional tooling.

— The purpose of Big Data analytics is to uncover useful business insights, such as customer preferences, market trends and other previously unknown correlations by examining large data sets. New technology allows quicker analysis of larger and more complex data sets.

— The benefit of Big Data is that it enables organisations to perform more advanced and more precise analytics, improve revenue opportunities, achieve operational efficiencies, customise product offerings and better customer service.
  - Analytics solutions can be tailored to the specific characteristics of a certain industry (e.g. patient files in healthcare, customer store data in retail).
  - Certain innovative solutions use artificial intelligence algorithms to process Big Data faster, cheaper and more reliable.

— The most important segments of Big Data are as follows:
  - **Hardware**: Mainly revolves around the storage of Big Data on servers and the network. In the data collection process, Big Data can be collected through different types of connected appliances (e.g. mobile phones, sensors).
  - **Software**: Big Data software is used for setting up a database in a secure manner so that data is stored and ready to be processed for analytics.
  - **Process**: this contains all front end analytics tools to process and visualise Big Data analytics.
  - **Strategy**: the strategic layer contains all consulting and professional services in order to embed Big Data in the organisation or implement solutions into a specific context.

Source: KPMG desk research; IBM Big Data& analytics hub: 2017 trends; Tablue: Top Big Data trends 2016; Experton - Big DataVendor Benchmark 2016; Cisco

Big Data - Growth prospect

Driven by integration with IoT, Robotics and Cloud solutions, the global Big Data sector is expected to quadruple in the next 10 years

Global Big Data market forecast, 2016 – 2026F
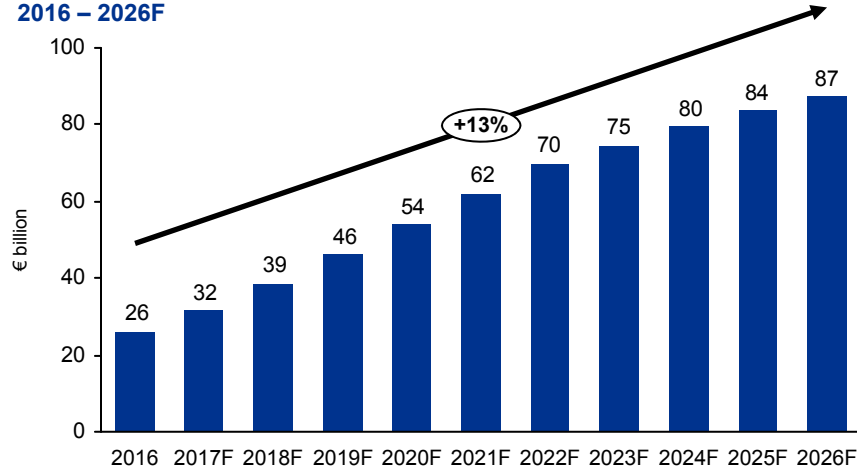
+13%

€ billion

2016	2017F	2018F	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
26	32	39	46	54	62	70	75	80	84	87

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473
Source: Wikibon: 2016 – 2026 Worldwide Big Data market forecast

Big Data growth is driven by developments in IoT, Robotics and Cloud, which have enabled scalability, faster processing times and more specific data to be collected.

— Growth is mainly driven by the following global trends:
  - Continuously increasing data complexity and size of data required to be processed and analysed.
  - Further adoption of cloud computing (enables more flexible access to data and faster processing), Internet of Things (increases the number of physical objects that collect and exchange data) and Robotics (specifically, machine learning algorithms that allow to process various type of data at a higher scale).
  - Industries like banking, healthcare, telecom, energy and manufacturing are expected to show high demand for Big Data solutions.

— In some countries, data privacy concerns and stringent governments regulations are placing limits on the practical applications of Big Data. developments in privacy regulation are becoming an important inhibitor for the success of big data. For instance, privacy regulation can limited the customer data that is being used for analysis.

Source: KPMG desk research; IBM Big Data& analytics hub: 2017 trends; Tablue: Top Big Data trends 2016; Experton - Big DataVendor Benchmark 2016; Cisco

Big Data – Market structure

Infrastructure and consulting services in Big Data are dominated by large international companies while smaller players develop tailored analytics solutions

Global Big Data market structure

Key players	Major components	Solutions
Decision support — Deloitte, EY, KPMG, BAIN & COMPANY, accenture, pwc, Capgemini, IBM	Strategy	Big Data Consulting
we4sea, SEMIOTICLABS, AgroVision, synerscope, Noldus	Process (Analytics)	ICT operations & governance Analytics Visualisation reporting
Infrastructure — hadoop, SPARK, cloudera, Google	Systems (Software)	Aggregation & security Database design Data management
amazon web services, rackspace	Systems (hardware)	Appliances Storage

The infrastructure layer of Big Data is dominated by large international players.

— The infrastructure layer is dominated by a select amount of large multinational companies which have leading, but mostly generic, platforms.

— Local players tend to focus on the development of innovative analytics solutions tailored to fit specific markets or clients.
  - Higher up the value chain in the decision support solutions, a more diversified landscape is visible, with many local players that offer solutions for specific industries.

Source: KPMG desk research & analysis; Experton - Big DataVendor Benchmark 2016

Cyber Security – Market definition

Cyber Security covers a set of technologies and processes used to protect digital infrastructure from cyber attacks and misuse of information

Global Cyber Security landscape

Key domains

- Threat recovery
- Threat identification
- Cyber Security
- Threat respondence
- Threat protection
- Threat detection

National Institute of Standards and Technology (NIST) Cyber Security framework

Action — Prevention

Cyber Security refers to the set of technologies utilised to protect digital infrastructure from cyber attacks, unauthorized access and misuse of information.

— Other than the protection of the digital environment from spyware and intruders, cyber security solutions enables companies to detect fraud and anomalies in document usage by the internal organisation.

— Key components of the cyber security landscape are:
  - **Threat identification**: It revolves around defining what threats could impact an organisation and how they can be detected.
  - **Threat protection**: It defines who has/ can have access to what part of the digital ecosystem of an organisation. Through user access schemes different parts of the digital ecosystem of an organisation can be protected from both outsiders and internal employees.
    - Protection from the external environment is usually done by means of a firewall.
    - Internal environment protection is done via protocols which determine who has access to what.
  - **Threat detection**: Focused on the monitoring of anomalies based on threats that have been identified.
  - **Threat response**: Planning of a response when a breach occurs by analysis of the situation and planning of mitigating measures. Communication to relevant stakeholders at the right time to ensure the breach is recorded.
  - **Threat recovery**: Planning and implementing of improvement solutions which reduces the incidence and impact of breaches and cyber threats.

Source: KPMG desk research; Capgemini – Trends in Cyber Security 2016 – 2017

Cyber Security – Growth prospect

Demand for Cyber Security solutions is mainly driven by the increasing adoption of IoT and Cloud based solutions

**Global Cyber Security market forecast,
2015 – 2020F**

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473
Source: Cyber Security ventures – Cyber Security market report q4 2016

Ongoing proliferation of IoT technologies and increasing adoption of Cloud computing are among the main drivers of growth in the Cyber Security sector

— The global Cyber Security sector is expected to grow with a CAGR of 18% to reach €163 billion by 2020.

— The most important drivers for growth are considered to be the rapid development in IoT devices and Cloud adoption which pose the following challenges:

  - Governments are struggling with the security of critical infrastructure as this becomes 'smart' and connected. Exploits in power grids, bridges and other infrastructure objects may have a significant impact on society.

  - As the number of devices that are connected to a corporate network increases, security moves away from the corporate perimeter to the end point devices including IoT devices, which makes the corporate network potentially more vulnerable.

  - Cloud usage leads to less hardware on the premise, changing the dynamics of what needs to be secured in an organization's digital environment.

Cyber Security – Market structure

Players offering Cyber Security services are increasingly forced to offer new solutions primarily due to high growth and development in IoT and Cloud technology

Global Cyber Security market structure

Key domains

Threat recovery

Threat identification

Cyber Security

Threat respondence

Threat protection

Threat detection

National Institute of Standards and Technology (NIST) Cyber Security framework

Action ← → Prevention

Key players

Industry leaders	Specialists
IBM	REDSOCKS Connect!
KASPERSKY lab	FOX IT
CISCO	aet
AVG	Secure Link
McAfee	BlueFinch

Rapid development in Cyber Security technology is allowing new players to challenge industry leaders with specialist solutions.

— The Cloud and IoT have led to rapid technological developments and increased connectedness. In turn this has led to the need for new Cyber Security solutions.
  - Next generation cyber security solutions combine the use of Big Data and Cloud to perform predictive intelligence analysis in order to prevent security threats.

— Whilst large scale industry leaders always had a competitive advantage in traditional Cyber Security solutions, new entrants with next generation solutions are able to challenge the industry leaders with solutions in specific niches.
  - This trend enables a shift in the market structure and competition rivalry as customers not necessarily buy integrated solutions but use multiple providers with specific (small) solutions.

Source: KPMG desk research; Capgemini – Trends in Cyber Security 2016 – 2017

Software Robotics – Market definition

Robotics Process Automation (RPA) uses technology and algorithms to automate business processes without human intervention

Global RPA landscape

Process Automation		Advanced Robotics
Basic	**Enhanced**	**Cognitive Intelligence/ Machine Learning**

Key solutions

Basic	Enhanced	Cognitive Intelligence/ Machine Learning
— Data collection automation	— Built-in knowledge repository	— Contextual, evidence based self-learning
— General work-flow automation	— Some limited learning capabilities	— Natural language recognition & processing
— Business process management	— Probability driven outputs	— Digestion of super data sets
— Repetitive tasks based on clear rules	— Faster suggested decisions	— Predictive analytics & hypothesis generation
	— Ability to work with unstructured data	— Real time interaction
	— Pattern recognition	

Automation of rule-based processes — **Automation of "knowledge" work**

RPA enables a machine (robot) to process, interpret and perform a specific process in the value chain of a business without human involvement.

— The major benefit of RPA is that for a business a process becomes cheaper, the accuracy and quality of the process increases, work becomes more scalable and is performed faster than would be possible if done by a human.

— A distinction is made between process automation (basic and enhanced process automation), and cognitive intelligence:

- **Basic (rule based) process automation**: The lowest level of automation, focusses on the automation of transactional rule based tasks which are repetitive. Structured data is analysed within well defined parameters.
  - Examples of basic process automation are solutions that revolve around the monthly close of financial periods and the automatic payment and processing of invoices.
- **Enhanced process automation (EPA)**: Incorporates advanced technologies to enable the use of data to support elements of self learning.
  - Enhanced process automation can be used for automatic language translation software and customer care center software.
- **Cognitive intelligence**: Solutions in the area of cognitive intelligence and machine learning (generally – CI) can perform complex predictive analytical tasks and have algorithms that learn from the responses they get on their behaviour.
  - Cognitive robotics is for example currently being deployed in the automotive sector to enable autonomously driving vehicles.

Software Robotics – Growth prospect

RPA market growth is driven by the development of new advanced solutions with which companies can create significant business value

Global Robotics market forecast[1],
2015 – 2019F

Global Robotics spending is expected to reach €128 billion by 2019, driven by development of more advanced solutions based on the current foundation of rule based robotics process automation.

— Interview feedback suggests that rule based RPA solutions are increasingly embraced by businesses. These solutions form the foundation for the development of more advanced cognitive solutions.

- *"As companies are starting to get more acquainted with robotics due to the emergence of RPA solutions for transactional processes, their willingness to try and adapt cognitive solutions increases."* – Representative of a Dutch Cognitive Intelligence company

— Cognitive intelligence applications are still in their introductory state. Commercial viable solutions have been developed and are currently being scaled up. Growth is predominantly driven by the fact that these new solutions can add significant value to companies.

- **Cost effectiveness**: Automation of transactional repetitive processes by software robotics leads to less personnel required to perform the process, more accurate execution of the process (increased productivity) and less fraud possibilities.
- **Scalability and flexibility**: RPA solutions are infinitely scalable and can be ramped up and down as required.
- **Generate advanced insights**: A major benefit of advanced cognitive solutions is that it enables companies to process and analyse large sums of data in real time and have algorithms learn and improve the types of analyses being performed based on prior outcomes. Advanced RPA can help companies in improving customer understanding, production processes and other business processes.

Note: (1) Data specifying share of RPA is not available. However, considering that this technology is relatively new, we estimate that currently the share of RPA software and related expenses (consulting, implementation and relevant hardware) do not exceed 10% in the total global Robotics market.

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473

Source: IDC – Worldwide spending on Robotics forecast, 2016

Source: KPMG desk research and analysis, Grandview research – Robotics process automation Market analysis, 2016

Software Robotics – Market structure

Robotics process automation is witnessing a gradual shift towards development of self learning algorithms from the traditional rule based approach

Robotics process automation market structure

Rule based process automation

Enhanced Process Automation/Robotics

Cognitive intelligence / Machine learning

Practical applications

— Contextual, evidence based self-learning
— Natural language recognition & processing
— Digestion of super data sets and real time interaction
— Predictive analytics & hypothesis generation

— Built-in knowledge repository
— Some limited learning capabilities
— Probability driven outputs
— Faster suggested decisions
— Ability to work with unstructured data
— Pattern recognition

— Data collection automation
— General work-flow automation
— Business Process Management
— Repetitive tasks based on clear rules

1

2

3

Rules Engine + Screen Scraping + Work Flow

Processing of Unstructured Data and Base Knowledge

Adaptive Alteration | Natural Language Processing
Large-scale Processing | "Big Data" Analytics
Machine Learning | Artificial Intelligence

Automation of transactions

Automation of knowledge work

Key players

Automation Anywhere blueprism INVOICE SHARING IPsoft SCYFER WIPRO HOLMES Artificial Intelligence Platform IBM Watson

Source: KPMG desk research and analysis, Grandview research – Robotics process automation Market analysis, 2016

Enterprise Solutions – Market definition

Enterprise Solutions (ES) enable organisations to store, process and integrate data digitally from different parts of the organisation in order to support decision making

Global Enterprise Solutions landscape

- Financial Management
- Supply chain management systems
- Manufacturing resource planning
- Human resource management systems
- Customer relationship management
- Industry specific software

Enterprise solutions

Front end ← → Back end
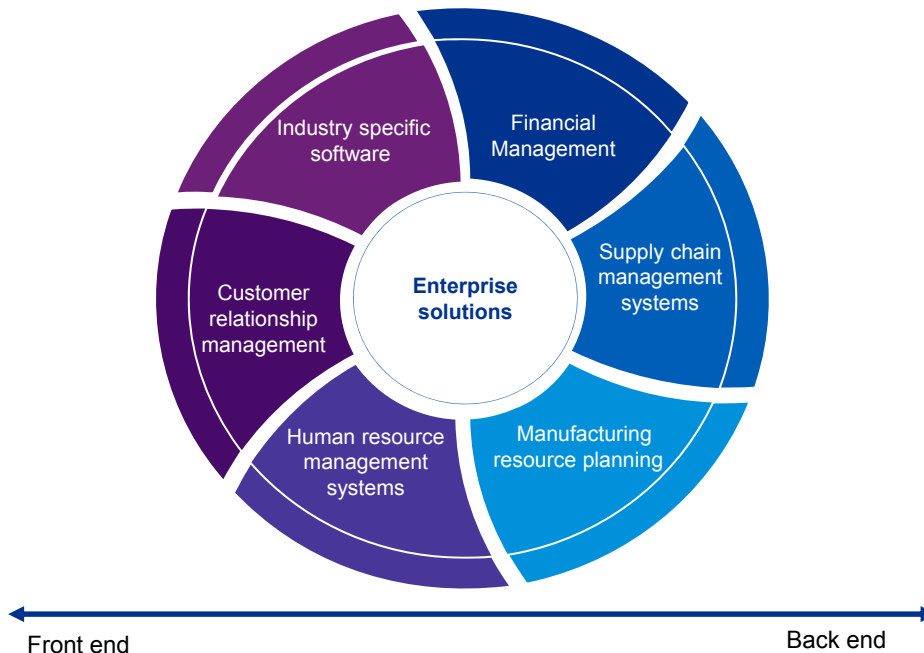
ES refer to the set of systems covering different processes within the organisation such as finance, supply chain, human resource and customers.

— The key benefit of ES is that it enables organizations to integrate various aspects of the business through databases and information systems, enabling more insights in performance and facilitating decision making.

— ES covers modules that support all critical business functions from sales to HR and manufacturing to finance.

— Companies often combine a set of different modules to form their digital administration backbone, this is referred to as Enterprise Resource Planning (ERP). Different companies have the need for different sets of modules.

— ES solutions can be generic or tailored for specific industries. Generic solutions often require customisation to fit specific company needs.

Source: KPMG desk research & analysis

Enterprise Solutions - Growth prospect

Growing with a CAGR of 11% from 2015-2020, the global market of Enterprise Solutions is set to almost double by 2020

**Global market forecast for Enterprise Solutions*,
2015 – 2020F**

€ billion

2015	2016	2017F	2018F	2019F	2020F
55	60	67	75	83	92

+11%

* Refers to ERP systems and embedded functional modules, such as CRM and SCM.

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473
Source: Gartner market statistics 2016, "Forecast: Enterprise IT Spending by Vertical Industry Market, Worldwide, 2014-2020, 3Q16 Update"

Growth is mainly driven by the replacement of legacy systems with second (advanced) generation solutions, which are Cloud based and often have better analytics solutions.

— There is a clear shift from "ownership" to "access". Companies are moving their ES modules into Cloud platforms enabling flexible access and cost savings in hardware.

— Generally, ES are moving towards a new generation of software driven by the integration of Cloud computing, Big Data analysis and Artificial Intelligence which enables more advanced analytics and real time decision making.

— As applications move to the Cloud the landscape of ES becomes more fragmented. Companies often no longer choose to have one full-scale ERP vendor, because companies increasingly add specific point solutions that can improve processes.
  - Examples of specific point solutions revolve around smart order tracking systems for production environments (Produvar) and claims & collection management software in the Financial services sector (Keylane).
  - Penetration of specific point solutions is driven by the fact that implementation and maintenance costs are low for specialised Cloud ES software, which reduces the barriers for customers to try new ES systems.

Enterprise Solutions – Market structure

The ES market is characterised by multinationals offering integrated solutions and local players that focus on specific niches

Enterprise Solutions market structure

Front end ← → Back end
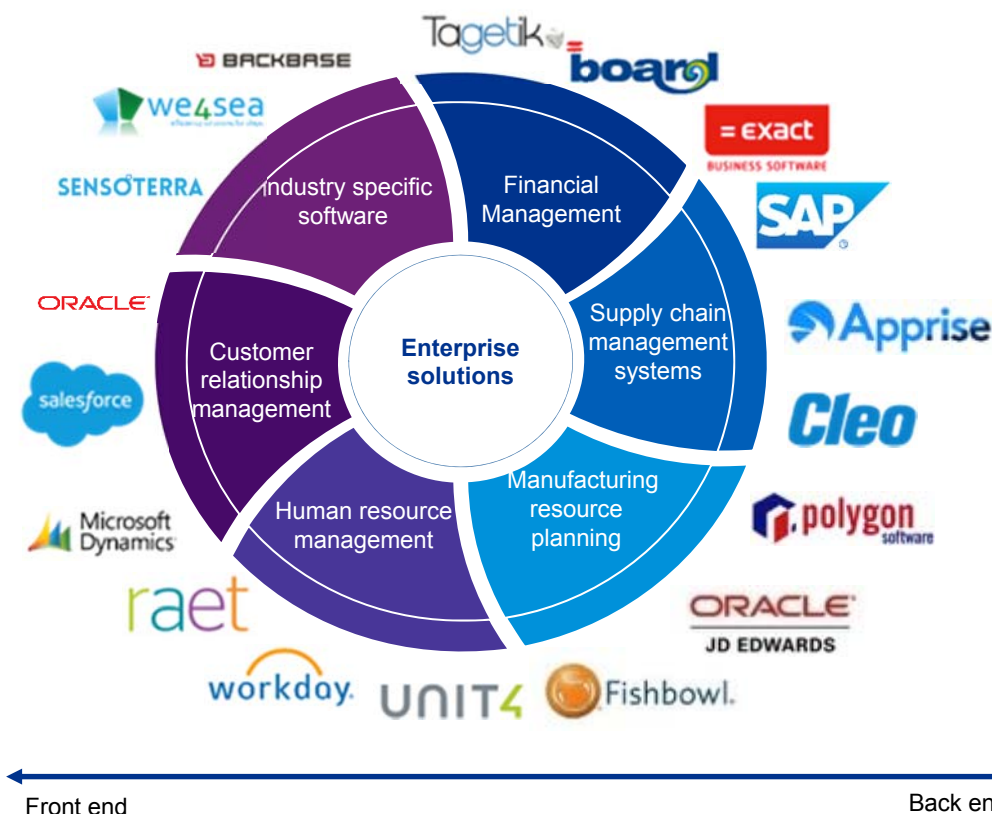
The market for ES is characterised by a diverse set of players. Large multinational companies mainly offer integrated solutions (ERP), while new local players offer specialist solutions for specific applications in industries.

— Integrated service providers are predominantly large scale multinational corporations. A few large companies dominate the market (e.g. SAP, Sales force, Oracle, Microsoft).
  - Competition in this segment is mainly driven by pricing and the fast-paced technological changes that have to be integrated into the solutions in order to keep a leading industry position.

— Within the sector segments, more local niche players are entering the market. Their solutions are often based on new technologies (Cloud and Big Data) and focus on a single application (e.g. CRM, SCM, etc.) or a specific industry.
  - New niche players often do not have the burden of legacy technology, enabling them to customise solutions to specific niches and integrating new technologies such as Cloud and Big Data in their solutions with less effort than large scale players. Large scale players often have to make innovations within their existing systems while new players can start building from scratch.

Source: Desktop research, expert interviews, KPMG analysis

Cloud Computing – Market definition

Cloud Computing refers to internet based hosted services where companies have access to infrastructure, a platform or specific software without physically owning the product

Global Cloud Computing landscape

Key solutions

SaaS (Software as a Service)	PaaS (Platform as a Service)	IaaS (Infrastructure as a Service)
— Cloud hosted software solutions offered to clients via the internet.	— Operating systems to develop and run software.	— Physical data storage across different locations.
— Maintenance, storage and installation of software.	— Platform that connects client software with database software.	— Infrastructure (e.g. network, servers)
		— Maintenance and administration.

Required investment / scale of operation

Low   High

Cloud Computing can be broadly defined as the process of delivery of hosted services over the Internet.

— Cloud Computing gives companies access to computing resources via the Internet such as virtual machines, online storage and other online applications for which they do not own the hardware.

— The main benefit of cloud solutions is that it is a capital expenditure free, flexible and scalable solution that can be accessed from any location, without having the hassle of maintenance.

— Cloud Computing consists of the following 3 layers:
  - **SaaS**: A third party provider hosts a specific application and gives users access to this application. SaaS removes the need for companies to install and run applications on their own server.
  - **PaaS**: The PaaS layer allows customers to develop, run and manage applications without having to build and maintain the infrastructure needed to developing and launching an application.
  - **IaaS**: In IaaS model, a third party hosts all infrastructure for a company covering all hardware and software for servers, storage and other infrastructure components. Furthermore, providers also host applications to support the hardware and handle maintenance, backup and resiliency planning.

Source: KPMG desk research & Analysis; Grail research – Cloud trends; Wikibon– Public Cloud IaaS spending 2015 - 2026

Cloud Computing – Growth prospect

The Cloud Computing market is expected to almost quadruple in value over the next 5 years

**Global Cloud market forecast,
2015 – 2020F**

€ billion

Year	Value
2015	69
2016F	90
2017F	116
2018F	151
2019F	197
2020F	256

+30%

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473
Source: Market media research: Global Cloud market forecast 2015 - 2020

Rapid growth in the Cloud can be attributed to increased customer confidence in the technology which is driven by better security, customised service delivery models and cost effective product offerings.

— Growth in adoption is predominantly driven by an increased sense of security, customised solutions and lower cost for companies:
  - Security, privacy and regulatory concerns in cloud usage have led to growth of Cloud solutions that are hosted in datacentres in the same country as the client that is using the solutions. This helps accommodate traditionally conservative industries such as Healthcare, the Public sector and Financial services.
  - Cloud services are shifting away from a "one size fits all" solution towards a more flexible business model in order to accommodate the needs of individual businesses (e.g. capacity volume, maintenance and service levels).
  - As data centres grow in size, cloud solution costs decrease rapidly. This increases the cost benefit further (relative to hosting solutions in house), which further stimulates cloud demand.
— Key challenges to growth revolve around the reliability and real time accessibility of the network (e.g. minimising the impact of maintenance downtime).

Cloud Computing – Market structure

The Cloud Computing industry is dominated by large players, with smaller players being present in IaaS and to a lesser extent in certain segments of PaaS

Global Cloud Computing market structure

	SaaS (Software as a Service)	PaaS (Platform as a Service)	IaaS (Infrastructure as a Service)
Key solutions	— Cloud hosted software solutions offered to clients via the internet. — Maintenance, storage and installation of software.	— Operating systems to develop and run software. — Platform that connects client software with database software.	— Physical data storage across different locations. — Infrastructure (e.g. network, servers) — Maintenance and administration.
Examples of players	= exact, Office 365, reeleezee, AFAS software	Microsoft Azure, SAAS Plaza, IBM Cloud, wercker	amazon web services, SAP, leaseweb, interxion

Scale of operation needed* Low → High

The Cloud Computing industry is dominated by large players, with smaller players being present in IaaS and to a lesser extent in certain segments of PaaS.

— The SaaS market encompasses a large part of the software market as more and more software developers are moving to a SaaS model instead of the traditional licensing model.
— The IaaS market is dominated by large multinationals such as Google and Amazon as the market is capital intensive and large economies of scale can be achieved. However medium-sized local companies also have an offering in this segment.
  - Although large multinationals dominate the IaaS landscape, companies increasingly seek to adopt flexible service delivery models. These efforts pave the way for new local companies to enter the market and offer tailor made solutions to fit the needs of local clients.
— The PaaS market consists of large players such as Amazon and Google offering a broad range of PaaS solutions and smaller companies such as SaaS Plaza offering a selected number of specialised PaaS solutions.

* Refers to the company providing the service.
Source: KPMG desk research & Analysis; Grail research – Cloud trends; Wikibon– Public Cloud IaaS spending 2015 - 2026

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KPMG

Chapter II
Evaluation of ICT sectors

Our approach

Our evaluation covers the competitiveness of selected Dutch and German ICT sectors and entry barriers to Germany

Relevant ICT sectors

- Internet of Things (IoT)
- Big Data
- Cyber Security
- Software Robotics
- Enterprise Solutions
- Cloud Computing

Sector growth outlook

1 Projected sector growth in Germany

— Forecasted spending on the technologies associated with the respective ICT sector

— Analysis of sector growth drivers

Competitiveness evaluation in international context

2 Netherlands

— Number and characteristics of players

— Ecosystem and environment

— Areas of competitiveness (industry driven and other)

— Overall conclusion of the competitive strength of the Netherlands

3 Germany

— Number and characteristics of players

— Ecosystem and environment

— Areas of competitiveness (industry driven and other)

— Overall conclusion of the competitive strength of the Netherlands

Potential entry barriers

4 Assessment of entry barriers to Germany

— Formal regulations

— Local preferences to doing business

— Competition from local players

— Market maturity

Evaluation of ICT sectors

Internet of Things (IoT)

Big Data

Cyber Security

Software Robotics

Enterprise Solutions

Cloud Computing

IoT – Sector growth

The German IoT sector is expected to grow by 33% CAGR between 2014-2020, mainly driven by increased usage in automotive and other types of manufacturing industries

IoT market expenditures in Germany, 2014-2020F
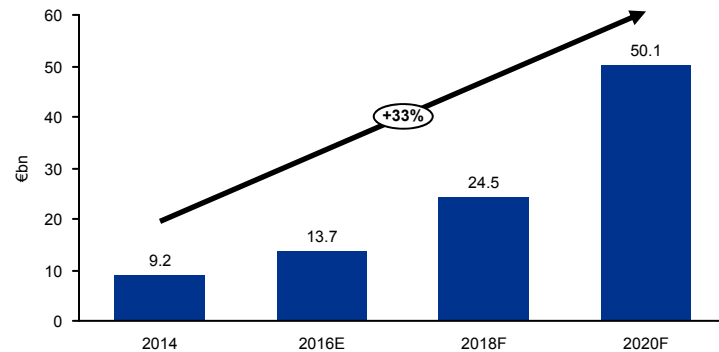
Source: TechNavio, KPMG analysis

Growth in IoT is driven by increasing adoption of IoT technologies in existing industries, primarily automotive and selected other types of manufacturing. These industries are early adopters of IoT technologies in Germany.

— IoT solutions that are being developed predominantly revolve around solutions for autonomous driving and predictive maintenance.
  - The global economic impact of IoT in automotive and manufacturing in 2025 is expected to range from €1.3 trillion to €4.2 trillion.[1]
  - *"Automotive and manufacturing companies are relatively developed in IoT, both OEMs and suppliers, because they make significant investments."* – Sales Representative of German IoT Company

— Further on, growth is also driven by the usage of IoT technologies in new industries such as healthcare, energy, smart homes and infrastructure.
  - *"Infrastructure companies are increasingly working on IoT projects. Take for example the development of a smart port in Hamburg, or of the implementation of IoT management systems at the Cologne-Bonn airport."* – Sales Representative of Dutch IoT Company
  - *"The energy industry recently started investing significantly in smart grids and smart thermostats to optimise energy efficiency and be compliant with newly adopted market regulation."* – German IoT market insider

Source: (1) McKinsey

IoT – Dutch competitiveness

Dutch IoT players are leading when it comes to semiconductors and middleware, with a competitive advantage in several industries (1 / 2)

Competitive strength of Dutch sector from an international perspective			
Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**
Number and characteristics of players / **Dutch companies have a strong international position in semiconductors and middleware for IoT; specific expertise in automotive, smart home, healthcare and agriculture.**	— A diverse landscape of players is active in the still developing Dutch IoT sector: - International vendors primarily engaged in the development of industry-generic IoT platforms that enable connection between sensors, data analytics engines and data storage (e.g., Amazon, Google, Thingworx, Ayla Networks); - Dutch companies with international presence and expertise in semiconductors and middleware for IoT (e.g. NXP, ASML, Nedap) across multiple industries, specifically energy, automotive, smart home, agriculture and healthcare); - Local specialists in IoT software and hardware representing either niche providers of platforms (e.g. Zenodys) or analytical applications and sensors usually for a specific industry (e.g. Semiotic Labs, i-Real, The Things Network). — Growth in the sector is mainly driven by Dutch companies, both mature and start-ups. — Our analysis and interview feedback suggest that there are over 30 companies with commercially viable solutions in the Dutch IoT sector.	*"We traditionally have a lot of experience and focus on IoT silicon and middleware, which explains our dominance."* – Representative of a Dutch IoT solution provider in Smart Home industry *"In segments like Smart Home the competition we face is very limited. More than that, I estimate that the Dutch companies deliver up to 50% of IoT solutions for Smart Home globally."* - Representative of a Dutch IoT solution provider in Smart Home industry	5 / 5
Ecosystem and environment / **Ongoing momentum for new IoT players to emerge: supporting infrastructure and access to funding is in place.**	— Availability of a strong IoT infrastructure: first country to implement a nationwide long-range network for IoT (operated by KPN). — Large companies like NXP and ASML create ecosystems for start-ups in IoT. — Examples of Dutch companies taking an effort to develop a global IoT network base using crowdsourcing to raise funds. — Consistent support from public bodies reflected in multiple initiatives around Smart City concepts involving city municipalities (e.g. Amsterdam, Rotterdam). — Growing access to venture capital (e.g. KPN Ventures).	*"KPN's IoT network will strengthen the partner ecosystem in the Netherlands and facilitate the interaction between developers, start-ups, clients, hardware providers and integrators."* – KPMG expert *"Amsterdam has been covered by an IoT wireless network in just six weeks. For example, boats can transmit signals if there is a leak."* – KPMG expert	4 / 5

Key: **1** Low strength   **5** High strength

IoT – Dutch competitiveness

Dutch IoT players are leading when it comes to semiconductors and middleware, with a competitive advantage in several industries (2 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	KPMG insight	Interview feedback	Assessment of strength

Areas of competitiveness (industry driven and other)	**Dutch companies are innovative and are experimenting with new potentially useful IoT technologies,**	— Large companies like NXP and ASML develop semiconductors with IoT applications across multiple industries (e.g. healthcare, automotive, smart city/home) and have developed leading positions partly due to their innovation (e.g. in the areas of cyber security, portables & wearables, connected cars and the Internet of Things).
		— The innovation-driven culture of local start-ups and established companies (e.g. Philips) leads to marketable IoT software solutions that seem to have limited competition in Germany, specifically:
		  - Agriculture;
		  - Automotive;
		  - Healthcare;
		  - Consumer products (Smart Home);
		  - Infrastructure (Smart City, maritime solutions);
		  - Manufacturing (predictive maintenance).
		— Dutch companies have developed Industry agnostic solutions across the IoT value chain e.g. in Cyber Security with Figo.
		— The competitiveness of Dutch players reflected in recent acquisitions which are made to acquire new capabilities:[1]
		  - Offspark, Dutch IoT security specialist, bought by ARM;
		  - Green Peak, IoT provider for Smart Home, bought by Qorvo;
		  - Mobgen, niche software developer, acquired by Accenture.
			"I've heard of only a few companies that provide both silicon and software for IoT in cattle breeding. This is a niche market, where the Dutch clearly excel on a global scale" – Representative of a Dutch IoT company
			
			"In my view, we are the only active player with a solution that predicts down-time and suggests maintenance for electric engines based on proprietary learning algorithm and IoT sensors. However, the competitive landscape is going to change: Germany which is a production driven economy, is catching up. The local companies are bound to fill this gap soon." – Executive team member of a Dutch IoT company
				4 / 5

Overall conclusion of the competitive strength of the Netherlands	**Highly competitive in semiconductors and middleware industry, with strong commercially viable solutions for a variety of industries.**	— Dutch companies do not focus on developing large-scale IoT platforms, but are globally competitive in semiconductors and middleware. — There is an historic focus on certain industries (e.g. agriculture, healthcare) and availability of large companies that act as 'powerhouses' for developing the local start-up scene in IoT sector and a firm international position in semiconductor and smart home segment (e.g. Philips, NXP, ASML) are among the main reasons for the emergence of multiple providers of niche and industry-specific solutions.	*"Dutch IoT sector is developing robustly, with local companies dominating the scene. I would rate overall competitiveness between 4 and 5 on a 1-5 scale"* – KPMG expert	4 / 5

Key: **1**   Low strength   **5**   High strength

Source: (1) Company websites

IoT – Dutch competitiveness

Dutch IoT companies have developed niche solutions in agriculture, smart homes and healthcare and a number of commercially viable cross-industry solutions (1 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Agriculture / Smart Farming	— Sensors and applications for remote monitoring of crops and livestock, (measuring of parameters such as temperature, activity, moisture). - Applications used in electronic individual animal identification for animals that live in large groups. — Sensors and software used in smart equipment (e.g. irrigation, milking, feeding and harvesting).	nedap · DACOM · LELY · JOZ · Connecterra	— Several Dutch companies active in connected equipment have proven track records globally and in Germany. — Evidence of companies with comparable solutions in Germany is adversely affecting the score.	4 / 5
Automotive	— IoT hardware and software for connected driving (i.e. connecting vehicles with traffic lights, signals, information systems and other cars). — Hardware and software to enable autonomous driving (i.e. driving guided by sensors and artificial intelligence).	TOMTOM · BeiJer ELECTRONICS · AND · SIOUX · ATOTECH · NXP · ViNotion	— Dutch IoT companies are involved in the value chain of major German end-manufacturers (e.g. chips, connected cars). — Due to the global nature of this market (in terms of regulation and production), export is facilitated and common. — Multiple examples of Dutch competitive niche solutions available.	4 / 5
Consumer / Smart Home	— Sensors, connectors and applications used in smart homes for connecting locks, thermostats and lighting to the internet. — Consumer wearables such as fitness trackers connected to the internet to measure and analyse personal activities.	TOMTOM · CHESSWISE · MAUER LOCKING SYSTEMS · GreenPeak · innr · NXP · PHILIPS	— Competitive Dutch niche solutions with large global market share (including in Germany). — Interview feedback suggests there are limited comparable German solutions in the hardware & middleware semiconductor segment.	5 / 5

Key: **1** Industry with low export strength   **5** Industry with high export strength   Source: (1) Interview program, desk research, press clippings, KPMG analyses

IoT – Dutch competitiveness

Dutch IoT companies have developed niche solutions in agriculture, smart homes and healthcare and a number of commercially viable cross-industry solutions (2 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Healthcare	— Used for patient monitoring via mobile applications or wearable devices, measuring heart rate, blood pressure, breathing, temperature and movement. — Devices and applications used to improve patient recovery and surgical treatment effectiveness.	Adjuvo Motion, LiveSafe, IncoSense Smart, PHILIPS, inbiolab	— Evidence of strong Dutch niche solutions available that appear to be absent on the German market. — Score may adversely affected by specifically high requirements with regards to data privacy in the German healthcare industry.	4 / 5
Infrastructure & Maritime	— Hardware and software for connected sensors that measure speed, amount of vehicles and weather for improved information gathering. — Traffic solutions with connected lighting and road signs for more optimal traffic management. — Platform for smart water management that enables remote monitoring and control.	Vialis, dynniq energising mobility, I-REAL, TVILIGHT, NXP	— Several Dutch solutions available that are innovative and commercially viable. — Proven tracks record abroad and in Germany of Dutch IoT companies in this industry.	4 / 5
Other industries / Cross-Industry Solutions	— Industry generic IoT chips, receivers, platforms and software. — Smart lighting is used in many sectors including manufacturing, retail and logistics. — Manufacturing: IoT hardware and middleware used in smart industry (i.e. remote monitoring and connectivity of equipment). — Predictive maintenance sensors and applications in production environments.	NXP, Green Peak, PHILIPS, ASML, THE THINGS NETWORK, Metatronics embedded engineering, MIC-O-DATA CONNECTING DEVICES, SEMIOTIC LABS	— Strong Dutch industry-generic semiconductors (e.g. with radio frequency transmission) and middleware solutions available. — Proven track record abroad including in Germany.	5 / 5

Key: **1** Industry with low export strength   **5** Industry with high export strength

Source: (1) Interview program, desk research, press clippings, KPMG analyses

IoT – German competitiveness

The IoT sector is at early stage of development, with a relatively intense competitive environment in automotive and industrial production (1 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Number and characteristics of players	**The current IoT market is polarised between large generalists an a variety of relatively small SME players. These players are acting in a market where customer expectations are perceived to be sophisticated.**	— Interview feedback suggests that IoT sector is at early stage of development evidenced by a relatively limited number of players and the strong position of large generalist players both from the US and Germany that offer IoT platforms mainly for production / manufacturing environment (e.g. PTC, IBM, Microsoft SAP, Bosch, Deutsche Telekom).
		— Apart from the large players, defining clear categories for other IoT companies is challenging due to an overlap in services between software vendors consultancies / service integrators.
		— Based on interview feedback, over 20 local mid-/small-cap companies are present on the market with focus on IoT software; some specific examples include:
		  - Axoom (platform for manufacturers), M2MGO (IoT device management) and Nemetris (niche solutions for automotive).
		— Despite the 'infancy' of the sector, German clients appear to be sophisticated in their expectations: proposed solutions should be fully customized for client's industry and individual requirements, which often can be challenging for the local companies to provide due to:
		  - Lack of relevant knowledge;
		  - Inability to integrate the solution into client's existing IoT environment (current platform, data analytics capacity, sensors).
			"Customers in Germany still have a wait-and-see attitude but we see an increase in demand. Clients start implementing IoT projects instead of just talking about it. We expect high growth rates in the coming years, well above 50% per year." – Sales & Marketing Executive in a German IoT platform vendor
			
			"German IoT sector is represented by international companies. Mittelstand can play a role only if specific client references are shown. Having a partnership with a large IoT platform vendor is helpful." – German IoT market insider
			
			"There is little chance to succeed if you simply offer 'island' solutions without proper integration into big player's IoT platforms." – German IoT market insider
				2 / 5

Ecosystem and environment	**Competitive ecosystem appears to be limited to automotive and industrial production but has government support for further development.**	— There is a relatively developed ecosystem in automotive (primarily due to by semi-autonomous driving and safety) and industrial production, with lack of evidence of competitive solutions offered by local players in other areas. — Multiple networking platforms and efforts by the Government to promote IoT / Industry 4.0 initiatives. — Efforts needed to improve internet connection in certain areas of the country as it poses limits on IoT development.	*"The ecosystem is affected by lack of employees qualified in IoT, whereas investments necessary to implement IoT solutions impede mittelstand companies from trying it."* – KPMG expert *"Recent adoption of the Act on the Digitization of Energy Transition implies the deployment of smart energy meters and smart grid, with high potential for new IoT entrants."* – KPMG expert	**3 / 5**

Key: **1** Low strength (High opportunity for Dutch players) **5** High strength (Low opportunity for Dutch players)

IoT – German competitiveness

The IoT sector is at early stage of development, with a relatively intense competitive environment in automotive and industrial production (2 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Areas of competitiveness (industry driven and other)	**The competitive position of small and medium-sized German IoT companies appears to be increasing.**	— The competitiveness of German small and medium-sized players appears to be improving rapidly due to the cooperation with generalists:
		  - It is increasingly common practice for large international providers of IoT platforms to form partnerships with local SME players, utilising their specific expertise this allows the SME players to obtain new client references.
		  - Multiple efforts by international companies to develop the sector in general:
		    - Recently launched IBM Watson IoT innovation lab in Munich;
		    - Open-source IoT platform that allows third parties develop customized applications (Mindsphere by Siemens);
		    - Dedicated venture capital funding (e.g. next47 by Siemens, Deutsche Telekom Strategic Investments).
		— Ongoing increase in usage of IoT solutions by German business is likely to result in higher competitiveness of local vendors.
			"More than half of German manufacturing companies will be using IoT solutions such as platforms and functional applications in the coming years." – German IoT market insider	4 / 5

Overall conclusion of the competitive strength of Germany	**The IoT market is a rapidly developing market significant potential specifically in energy, healthcare and smart home industries.**	— The sector is in early development stage and dominated by large international providers of generic IoT platforms and a limited number of SME players. — The maturity is still limited to a couple of industries such as automotive and manufacturing. — We expect significant growth potential in energy, healthcare and Smart Home industries. **Major target industries in Germany for Dutch players:** Agriculture Automotive Consumer & Retail Infrastructure Healthcare Manufacturing	*"I would rate the German IoT competitiveness at 2 out of 5. Companies like IBM are in the lead." – Sales & Marketing Executive in a German IoT platform vendor* *"New entrants should focus on a certain vertical industry and be very specific about their product offering" – KPMG expert*	3 / 5

Key: **1**   Low strength (High opportunity for Dutch players)   **5**   High strength (Low opportunity for Dutch players)

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IoT – Entry barriers

Despite strict data privacy regulation and local language dominance in selected industries, no severe entry barriers were identified in the German IoT sector

Entry barriers to Germany				
	Conclusion	**KPMG Insight**	**Interview feedback**	**Assessment**
Formal Regulations	**No formal barriers are prevailing Dutch companies from entering the German market, though IoT security standards are stricter in Germany**	— There is no evidence of formal entry barriers that prevent Dutch IoT companies from entering the German market. — Currently strict security and privacy regulations in Germany may pose a limit for certain IoT solutions from being implemented locally. - Future General Data Protection Regulation (GDPR) in 2018 are set on European level and will diminish inter-country differences to approaches with regards to data privacy within the European Union.	*"We have been active for years on the German market and experienced no detrimental formal entry barriers."* – Business developer of Dutch IoT company *"Traditionally German security regulations are very strict, but from 2018 new laws will be implemented on a European level."* – Business developer of Dutch IoT company	4 / 5
Local preferences	**Preference for customised product with a strong backbone against a potential security breach**	— Despite moderate development level of the German IoT sector, local clients appear to be interested in highly customisable solutions that fit the requirements of a specific industry. — Having a strong cybersecurity backbone is important. — Lack of evidence that local clients have a preference for German IoT providers per se, interview feedback suggests that having a German entity, functioning local office and German speaking client coverage and technical teams is an important requirement.	*"German companies love to buy our IoT products, as they are impressed by the innovative nature of our Dutch solutions."* – Business developer of Dutch IoT company *"Because the German IoT market is immature, I would welcome any Dutch company that offers innovative products."* – German IoT market insider	3 / 5
Competitive intensity	**The competitive intensity is moderate due to limited amount of players.**	— Despite a limited number of companies are active in the German IoT market, indicating competitive intensity is still low. — There is a lack of evidence of niche solutions implies potential for innovative foreign entrants.	*"There are not many local parties active on the German market with competitive solutions, I would say around 15-20 in total."* – German IoT expert	4 / 5
Market Maturity	**The German market maturity is low, especially compared to the Netherlands**	— Overall market maturity lags the Netherlands with the exception of production environments.	*"The German IoT market is less mature compared to the US."* – German IoT market insider *"Due to low internet quality in some areas, the German IoT market is not developing as fast as in other countries."* – German IoT market insider	4 / 5

Key: **1**   High entry barrier   **5**   Low entry barrier

Evaluation of ICT sectors

Internet of Things (IoT)

Big Data

Cyber Security

Software Robotics

Enterprise Solutions

Cloud Computing

Big Data - Sector growth

The German Big Data sector is expected to grow at 22% CAGR in 2015-2020 driven by the fact that more and more large German companies are ready to invest in it

Big Data market in Germany, 2015-2020F

€bn

	2015	2016F	2017F	2018F	2019F	2020F
Total	1,4	1,8	2,3	2,7	3,2	3,7
Services	0,8	1,0	1,3	1,6	1,9	2,3
Software	0,3	0,4	0,5	0,6	0,7	0,8
Hardware	0,3	0,4	0,5	0,5	0,6	0,7

+22%

CAGR 2015-2020

- 24.5%
- 17.8%
- 18.7%

Legend: ■ Services ■ Software ■ Hardware
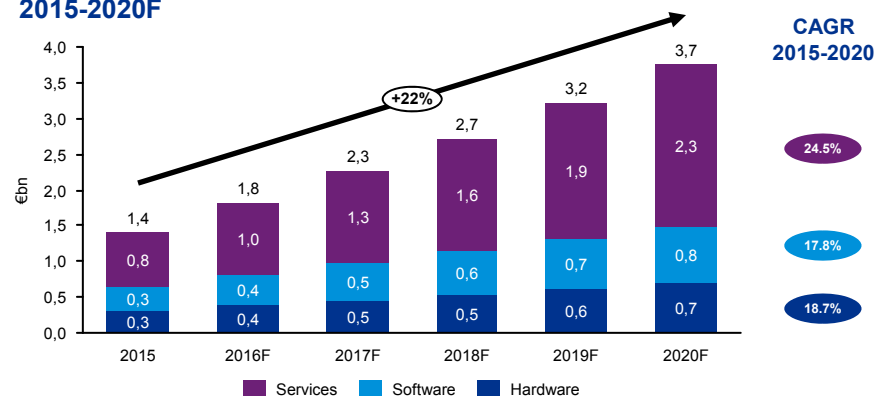
Source: Experton Research Group, BITKOM, KPMG analysis

The anticipated growth is driven by adoption of Business Intelligence and Data Analytics, specifically by large German businesses (over 500 employees).

— Over 60% of large German businesses are expected to use Big Data solutions (companies employing over 500 employees).[1]

— Less than 40% of medium-sized companies either use or intend to use Big Data solutions in the short-term (organisations employing from 50 to 499 employees).[1]

— Expert interviews suggest even higher growth rates in industries with high data intensity, specifically logistics, healthcare, public sector, telecom, financial services and retail.

  - *"22% growth per year seems reasonable, though we foresee even higher growth rates going forward."* – Representative of a German Big Data company

Mapping of German Big Data market segments

Services	Software	Hardware
— Consulting	— Standard application software	— Server
— Integration	— Data Warehouse	— Storage
— Management services	— Middleware	— Sensors
— Hosting	— Big data as SaaS	— Devices
— Customisation		

Source: BITKOM, KPMG analysis

Source: (1) BITKOM Research

Big Data - Dutch competitiveness

The Dutch Big Data sector appears to be competitive in terms of consulting and service, with a growing number of players focusing on specialist analytics solutions (1 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**

Number and characteristics of players	**The Dutch big data sector is fragmented, with a large number of companies active in the area of consulting or development of niche analytical solutions (industry-specific or aimed at specific type of analysis)**	— Large Dutch organisations with a global presence primarily use big data analytics platforms and infrastructure supplied by international vendors (e.g. IBM, Microsoft, Oracle, SAS).
		 — Installation / customisation of the solutions above is executed either by international consultancies (e.g. Accenture, Big4 companies) or local operators.
		 — A limited number of companies are involved in development of fundamental solutions (e.g. platforms for processing big data) as more capital is needed for this purpose.
		 — The sector is generally fragmented with a large number of Dutch companies employing from 5 to 30 individuals that are usually active with a focus on a certain type of activity:
		  - Consulting / services or development of specialist analytics solutions tailored for specific area (e.g. insurance or critical infrastructure);
		  - Type of analysis (e.g. machine learning).
			"Competitiveness of Dutch companies is mainly fuelled by expertise in consulting and readiness to experiment. However, having strong capabilities for building platforms and databases requires more capital than is currently available to the Dutch players" – *Dutch* Big Data market insider
			
			 "The large number of local companies can be also explained by the fact that data intensive industries in Netherlands are based on local language implying the need for in-depth product adaptation." – *Dutch* Big Data market insider
				4 / 5

Ecosystem and environment	**Ecosystem revolving around universities and start-up hubs is in place to support new big data players with talent and capital**	— There is a well developed infrastructure of local academic programs and research centers on big data engineering and data science to develop talent (e.g. Tilburg, Eindhoven, Delft, Amsterdam) and networking / knowledge sharing platforms (e.g. Amsterdam big data hub, Big data alliance). — Multiple business accelerators provide support big data projects (e.g. Rockstart, Start-up Bootcamp, Start-up Delta). — Increasing access to venture capitalists and private equity for Dutch big data start-ups as confirmed by expert interviews.	*"We definitely see acceleration now: more Dutch companies are starting to build own solutions"* – *Dutch* Big Data market insider *"More Dutch companies with specific analytical solutions will emerge as funding becomes more accessible"* – *KPMG expert on Big Data*	4 / 5

Key: **1**   Low strength   **5**   High strength

Big Data - Dutch competitiveness

The Dutch Big Data sector appears to be competitive in terms of consulting and service, with a growing number of players focusing on specialist analytics solutions (2 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Areas of competitiveness (industry driven and other)	**Quick adoption of innovation and expected better access to capital is expected to reinforce the competitiveness of Dutch players**	— Dutch big data companies are considered to be prompt in adopting and steering innovation, especially compared with the German companies that more commonly have a 'wait and see' attitude.
		— Expert interviews suggest that Dutch players tend to liaise freely with their peers stimulating sector-wide benefits, whereas the German companies are more inward-looking in their problem solving.
		— A growing number of data science hubs will support continued inflow of data science specialists.
		— There is better access to capital for Dutch big data start-ups.
		— Multiple examples of flexible pricing approaches implying very limited upfront investments by the clients.
		— High competitiveness of Dutch companies is further evidenced by the following acquisitions in 2016:
		  - Silk, Dutch big data visualisation specialist, acquired by US-based Palantir Technologies;
		  - Ydatalytics, data analytics and business intelligence specialist, acquired by Antuit .
			"Dutch companies have a reputation for trying new things and being service oriented, whereas the German players are not eager to try new technology unless there is a clear business case." – Representative of a Dutch big data company with focus on maritime industry
			
			"Our business model is based on an annual fee only." – Representative of a Dutch big data company with focus on maritime industry
			
			"Strong service orientation is an advantage and we are well ahead of German companies on this front." – CEO of Dutch big data company
				3 / 5

Overall conclusion of the competitive strength of the Netherlands	**Specific strength in consulting and services, with increasing expertise in development of specialist analytics software**	— Dutch companies do not command a foothold in big data platforms and infrastructure (dominated by international players), but can be considered highly competitive in consulting and specialist software. — Flexible approach to pricing and quick adoption of innovations enables Dutch players to compete on international scale.	*"We compete with global firms by being more specialised and flexible"* – *Dutch* Big Data market insider *"In such niches as machine learning we are way ahead of German players; companies like Scyfer are positioned among the top-10 globally"* – KPMG expert on Big Data	**4 / 5**

Key: **1** Low strength   **5** High strength

Big Data - Dutch competitiveness

The competitive advantages of Dutch Big Data companies suggest a high export potential in agriculture, automotive, infrastructure and healthcare (1 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Agriculture	— Software for analysis, monitoring and benchmarking based on Big Data algorithms in crop growing and cattle breeding. - Applications include irrigation management, cattle feeding, national milk benchmarking, and crop quality control.	AgroVision, uniform.agri, LimeTri, DACOM, akkerweb	— Competitive niche solutions with proven track record abroad including in Germany. — Interviews suggest a competitive edge compared big data solutions present in Germany (e.g. Gea, Farmworks, FARMInfo) in terms of product flexibility and intuitiveness of data visualisation.	5 / 5
Automotive	— Big Data analytics and machine learning software for intelligent transportation and autonomous driving. — Big Data applications that analyse data generated by connected vehicle technologies to improve efficiency, safety or functionality of driving.	Cygnify, Noldus, TomTom, AND, monotch smart mobility	— Dutch Big Data companies are already involved in the value chain of major German end-manufacturers. — Due to the global nature of the market (in terms of regulation and production), export is facilitated and common.	4 / 5
Infra & Maritime	Maritime — Software for ship owners, ship designers and cargo owners to optimise fuel efficiency and utilisation. — Software to predict the impact of weather on the safety and efficiency of working on sea. Smart city — Analysis of location-based traffic information to forecast and manage potential congestions.	dφnniq energising mobility, MeteoGroup, SEMIOTICLABS, we4sea, Civity, TomTom	— Evidence of several competitive solutions with proven track record (client credentials) abroad. — Limited evidence of comparable solutions in the German market.	4 / 5

Key: 1 Industry with low export strength   5 Industry with high export strength   Source: (1) Interview program, desk research, press clippings, KPMG analyses

Big Data - Dutch competitiveness

The competitive advantages of Dutch Big Data companies suggest a high export potential in agriculture, automotive, infrastructure and healthcare (2 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Healthcare	— Big Data analysis algorithms aimed to improve medical testing. Applications include medical research and clinical disease detection. — Software to improve treatment by analysing medical data.	Omnigen pacmed CLOUD SOFTWARE BLUEBEE P X HealthCare	— Significant number of Dutch niche solutions available that appear to be absent on the German market. — Score adversely affected by dominance of local language in German healthcare and specifically strict data privacy requirements.	4 / 5
Financial Services	— Big Data algorithms used to create customised customer propositions based on behavioural patterns in customer data. — Software to improve credit decisions by analysing financial data to assess risk.	SCYFER synerscope	— Highly competitive data analytics solutions based on machine learning algorithms. — Competitiveness may be impacted by the fact that in case of export significant localisation efforts would be required as national banking industries in EU are dominated by data in local languages (also applies to Germany).	3 / 5
Other industries / Cross-Industry Solutions	— Industry-generic solutions for Big Data analyses and visualisation to improve decision-making. These solutions analyse a variety of data including market data, operational data, financial data and survey data.	MAGNAVIEW synerscope Simbify SCYFER elastic	— Competitive solutions with international client credentials that can be applied in multiple industries. — Proprietary machine learning algorithms that are not commonly offered by the vendors active in Germany.	4 / 5

Key: **1** Industry with low export strength   **5** Industry with high export strength

Source: (1) Interview program, desk research, press clippings, KPMG analyses

Big Data – German competitiveness

Despite a significant number of players, the competitiveness of German big data sector is moderate and offers room for foreign entrants with industry-specific solutions (1 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	KPMG insight	Interview feedback	Assessment of strength

Number and characteristics of players	**The sector is fragmented and dominated by international vendors. Moderate competitiveness of local players in industry-specific big data application**	— Fragmented landscape of approximately 280 companies active in the sector ranging from large international vendors with extended portfolio of hardware, software and consulting services (IBM, Microsoft, Oracle, SAP) to local niche vendors (mezzodata, RapidMiner), with none of the latter players having a dominant role in the sector.
		— However, hardware is provided by international vendors only (e.g. SAP HANA, Microsoft Azure).
		  - Several International vendors partner with local consulting companies for implementing solutions.
		— All large universal vendors are companies from the US except for SAP.
		— Consolidation trends are starting to be noticeable.
		— Large number of local start-ups specialised on certain type of application:
		  - Mapegy – big data visualisation;
		  - BlueYonder – predictive analysis;
		  - Alacris – patient data analytics.
		— Despite significant number of local players, our interviews confirm that the competitiveness of the German big data sector offers room for new entrants due to:
		  - Early phase in sector growth;
		  - Lack of competitive solutions in multiple industries.
			"International companies supply hardware, while Mittelstand has a significant role in the implementation of solutions" – Representative of a German Big Data start-up
			
			"Large international companies are the main players on the German market" – Sales Executive in a German Big Data company
			
			"Competition is quite high, since a lot of international companies want to participate on the market. However, since big data market is expected to show huge growth rates, there will be enough room for new market entrants, especially those with innovative industry-specific solutions." – Sales Executive in a German Big Data company
				3 / 5

Ecosystem and environment	**A genuinely competitive ecosystem seems to be lacking in general, with the exception of Banking, Telecom and Media**	— There is a strong ecosystem in banking (big data usage for customized product offerings and client assessment)
		— Germany has a competitive position in telecom and media due to:
		  - Early adoption that supported industry-specific expertise development by local companies;
		  - German telecom companies are active in developing big data analytics for their own use and other industries (e.g. Deutsche Telekom has commercially viable solutions for fleet management and retail).
		— With regard to other industries we do not see clear evidence of German industry-focused solutions.
			"Except for Telecom and Banking, other industries still have a lot of potential for new entrants" – Representative of German Big Data company
			
			"Usually I do not see clear competitive edge of solutions developed by German companies as they are rather general." – German Big Data sector insider
				3 / 5

Key: **1** Low strength (High opportunity for Dutch players)   **5** High strength (Low opportunity for Dutch players)

Big Data – German competitiveness

Despite a significant number of players, the competitiveness of German big data sector is moderate and offers room for foreign entrants with industry-specific solutions (2 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	KPMG insight	Interview feedback	Assessment of strength
Areas of competitiveness (industry driven and other)	**The general competitiveness of big data companies active in Germany is likely to increase going forward**	— As per our understanding, it is highly likely that competitiveness of the German big data sector is expected to increase in the short-term perspective as a result of: - Commitments by international vendors to enhance their presence (e.g. IBM Watson innovation center based in Munich as development lab for big data and IoT, Cisco investment of USD 500 mln in specific digitization projects, including big data); - Multiple platforms and research centers associated with universities (e.g. Berlin Big Data Center / TU Berlin, Center for Scalable Solutions / TU Dresden); - Support of public funding programs (Ministry of Education and Research and Ministry of Economic Affairs and Energy). — Increasing adoption of cloud computing in Germany will lower the entry costs and processing speed for clients willing to use big data analytics and potentially resulting in more competitive solutions developed by vendors active in the sector.	*"German companies are increasingly open to cloud solutions, which allows German Big Data companies to address new clients with higher processing speed and lower costs"* – Big Data market insider *"Increased collaboration between public and private sector is driving knowledge sharing and product innovation in the sector"* – Big Data market insider	**4 / 5**
Overall conclusion of the competitive strength of Germany	**The current competitiveness of German big data sector appears to be moderate, offering opportunities for foreign entrants with industry-specific applications**	— The sector is still in early stage of growth and dominated by international vendors (mainly from the US) that mainly offer industry-generic solutions. — Except for Banking and Telecom, the players active in German are still lagging when it comes to the competitiveness of industry-specific solutions. — However, the competitiveness of the German companies is expected to increase in the short term. **As described above major target industries in Germany for Dutch players:** Agriculture Automotive Infrastructure Healthcare	*"I say the competitiveness of the German sector is between '2' and '3' on a 1-5 scale"* – German Big Data market insider *"Although the market seems 'crowded', expected strong growth rates will create space for new providers"* – Sales executive of a German Big Data company	**3 / 5**

Key: **1**   Low strength (High opportunity for Dutch players)   **5**   High strength (Low opportunity for Dutch players)

Big Data - Entry barriers

Despite strict data privacy regulation and local language dominance, no critical entry barriers were identified in the German Big Data sector

Entry barriers to Germany				
	Conclusion	**KPMG Insight**	**Interview feedback**	**Assessment**
Formal Regulations	**No genuine regulatory barriers prevent Dutch players from entering the German market, though current privacy regulations have to be overcome**	— Generally, there is no evidence of regulatory entry barriers for foreign Big Data companies to enter on the German market. — Current strict German data privacy regulations (Bundesdatenschutzgesetz) could hinder the entry of non-German parties, because local players are better equipped to meet local data storage standard. However, in 2018 European privacy regulations will replace local laws. - Certain privacy regulations require selected data sources to be stored in separate databases. Large international databases like Hadoop have limitations with regard to complete separation.	*"I see no serious regulations preventing us from entering the German Big Data market."* – Sales representative of Dutch Big Data company *"Due to security regulations certain data must be stored separately which cannot be ensured by international players such as open source databases like Hadoop."* – Dutch Big Data company	**4 / 5**
Local preferences	**German companies work with Dutch players, but prefer that Dutch players show a commitment to the German economy by opening an office and speaking the language**	— German companies seem to have a positive perception towards Dutch companies, however, having a local legal entity and staff is seen as a prerequisite for business, because German companies prefer to do business with international firms willing to invest in Germany. - Dutch big data companies can partner with local German distribution partners, but local resellers prefer working with established (rather than small) foreign players. — Banking and Healthcare are among industries where data is available mainly in local language leading the client to prefer working with local providers.	*"German companies have no problem working with international firms, however, you need to have local people who speak German to do business in Germany."* – Business developer of Dutch Big Data company *"We are looking for a partner in Germany. So far, this has been challenging due to our size."* – Dutch Big Data company	**4 / 5**
Competitive intensity	**The competitive intensity is moderate because of a high differentiation in the German Big Data market**	— A high number of market participants in the Big Data market drives competition, however, due to high differentiation of players the overall competitive intensity in the market can be considered moderate. - Many Big Data players operate in a niche (mainly driven by type of data analysis) and face limited competition from other companies.	*"Expected growth and increase in adoption still gives room for foreign Big Data solutions."* – Sales executive of German Big Data company *"Because our Big Data product is unique, we face no competition."* – Sales executive of German Big Data company	**3 / 5**
Market Maturity	**The German market appears less mature than the Netherlands in using Big Data**	— The US and the UK lead in terms of market maturity, due to early adoption. — The Netherlands follows the US and UK but leads relative to Germany.	*"The German market is still behind the Dutch when it comes to migrating enterprise IT to the cloud; this is an impediment for big data sector development in the short-term."* – German Big Data expert *"German companies are generally lagging behind NL, US and UK."* – German Big Data expert	**3 / 5**

Key: **1** High entry barrier   **5** Low entry barrier

Evaluation of ICT sectors

Internet of Things (IoT)

Big Data

Cyber Security
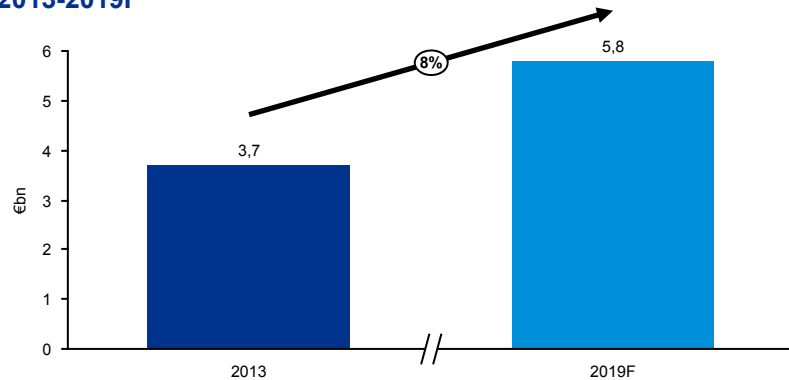
Software Robotics

Enterprise Solutions

Cloud Computing

Cyber Security – Sector growth

Growth of 8% CAGR expected in the German Cyber Security sector, driven primarily by growth in Healthcare, Public Sector and Financial Services

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European Cyber Security market, 2013-2019F

€bn

- 2013: 3,7
- 2019F: 5,8
- 8%

Source: MicroMarket Monitor, KPMG analysis

The German Cyber Security is expected to grow with a CAGR of 8% until 2019

The General Data Protection Regulation (GDPR) that will be implemented on European Union level in 2018 is expected to drive growth of 8% CAGR in the German market for Cyber Security.[1,2]

— Due to GDPR, data security standards will change (e.g. companies have to report breaches, introduce data protection officers and anonymise personal data before processing it). These changes are expected to increase demand for Cyber Security software, hardware and services that ensure compliance.

In selected industries (e.g. public sector, healthcare and financial services) and in certain segments (e.g. encryption technology) higher growth is expected.[2]

— Due to recent national Cyber Security threats in Germany, public sector demand is expected to grow;

— Healthcare and financial services are impacted most by the GDPR regulations as they process large amounts of personal client data.

Source: (1)   MicroMarket Monitor
            (2)   IHS Research

Cyber Security – Dutch competitiveness

Dutch Cyber Security companies offer competitive specialised software products, supported by public-private partnerships and the Hague Security Delta (1 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**
Number and characteristics of players	**The Dutch market is highly fragmented with mainly small and medium-sized companies providing innovative specialised products or consulting services.**	— This Dutch Cyber Security sector is very fragmented with mostly small companies active in it. There are roughly 2,500 players active in the Dutch Cyber Security sector (in service or hardware) with over 5 employees.[1] — Several large international companies are active in the Dutch market (e.g. IBM, Cisco and AGT). These large companies are best positioned to serve Dutch multinationals due to their international presence. — A significant portion of Cyber Security companies active on the Dutch market partner with large third party resellers (e.g. Accenture, Big4, Secwatch) that support the distribution and implementation of their software in combination with other security products. — Most Dutch security software companies are product specialists (e.g. AET, Fox IT), with only a few Dutch companies offering a comprehensive range of security products (e.g. Compumatica, Group 2000).	*"Earlier, the Cyber Security sector was dominated by large international players, however we see many new specialised solutions coming from the Netherlands that can add value globally." – Dutch* market insider	4 / 5

Ecosystem and environment	**The supporting Dutch Cyber Security ecosystem supports the sector by increasing access to talent, knowledge and capital and by facilitating innovation and knowledge sharing. This gives Dutch Cyber Security companies a competitive advantage.**	— The Hague Security Delta (HSD) constitutes the largest security hub in Europe, connecting over 200 Cyber Security companies, regulators and research institutions to share knowledge and increase access to funding.
		— Currently there is a shortage of roughly 500 Cyber Security professionals-Which is relatively low compared to Germany.[1]
		  - Dutch universities (e.g. Cyber Security Academy) increase the inflow through collaboration with Cyber Security companies (e.g. Fox-IT, Thales) and local municipalities.
		— Dutch universities (e.g. Delft University) and knowledge institutes (e.g. TNO) perform leading research in the area of Cyber Security.
		— Strong collaboration within the "triple helix" (government, universities and business) in the Dutch Cyber Security sector increases awareness of potential vulnerabilities and promotes the development of new technologies.
		  - Significant collaboration of Dutch companies with the National Cyber Security Centre (NCSC) in Information Sharing and Analysis Centres (ISAC's) facilitates knowledge sharing and networking between public and private parties;
		  - At the HSD Campus, the Dutch government and 43 organisations (e.g. TNO, Thalis), develop Cyber Security technologies as part of public-private partnerships.
			"The Dutch Cyber Security hub in The Hague promotes Cyber Security innovation in their campus and connect start-up businesses to capital." – Dutch Cyber Security market insider
			
			"Dutch IT research is of high quality relative to international peers. In addition, these school educate a significant number of Cyber Security professionals every year." – Dutch Cyber Security market insider
				5 / 5

Key: **1** Low strength   **5** High strength

Source: (1)   SEO Economisch Onderzoek

Cyber Security – Dutch competitiveness

Dutch Cyber Security companies offer competitive specialised software products, supported by public-private partnerships and the Hague Security Delta (2 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**
Areas of competitiveness (industry driven and other)	**Competitiveness is further promoted by collaboration of government, universities and business to improve Dutch Cyber Security per industry.**	— Cyber Security has a high priority on the political agenda and regulations of the Cyber Security sector are continuously improved to enhance protection (e.g. legalisation of ethical hackers, obligations to report data leaks). — High degree of digitalisation and good internet connectivity support a strong Dutch Cyber Security sector, because they attract business and facilitate the distribution of online software and service. — The Netherlands is one of the countries where most Cyber Security threats originate, which historically has increased the urgency of developing strong protection. - The Netherlands is an attractive location for hackers due to the Dutch internet infrastructure. In addition favourable privacy regulations result in a relatively low risk for cybercriminals to be caught.	*"Cyber Security has a high priority on the political agenda, resulting in public-private collaborations and regulations that benefit the sector."* – *Dutch* Cyber Security market insider *"Dutch security solutions are perceived to be very innovative. When we presented our product at a convention in Germany, German companies were very impressed by several Dutch products."* – Sales representative of Dutch Security company	4 / 5
Overall conclusion of the competitive strength of the Netherlands	**Multiple Dutch product specialists offer competitive software solutions that could be exported abroad.**	— The Cyber Security sector is highly fragmented, with mainly small and medium-sized companies active. — Most local Cyber Security software companies are product specialists. — Multiple local product specialists appear to have competitive solutions that they are currently exporting or planning to export. — A strong hub and private-public collaboration promote the competitive position of Dutch companies. — This sector is strengthened by a strong internet infrastructure, and by the presence of a large cybercriminal community which increase the urgency of developing Cyber Security solutions.	*"Dutch start-ups and scale-ups could make a difference in the global Cyber Security sector, as many such companies can offer innovative solutions."* – *Dutch* Cyber Security market insider	4 / 5

Key: **1** Low strength **5** High strength

Cyber Security – Dutch competitiveness

Cyber Security products are usually industry-generic, however Dutch players appear to have specific exposure to several industries based on completed projects

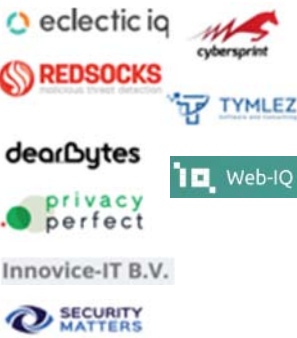| Industry	Level of exposure[a]	Examples of companies with credentials in this space[1]	Examples of industry-specific solutions / products
Financial Services	⬤	SecureLink, aet, BlueFinch, GRC CONTROL, eclectic iq	— Protected storage and secure exchange of personal financial data. — Protected authentication and identification for online payments, e-banking and other financial services. — Forensic platform that detects cyber attacks by scanning the 'dark web'.
Critical Infrastructure[b]	⬤	eclectic iq, FOX IT, REDSOCKS, group 2000	— Intelligence platform that detects and prevents threats concerning the security of confidential data such as client data, project data and strategic information. — Malware detection software that analyses outgoing data flows to detect the unwanted outflow of confidential data.
Public Sector	⬤	COblue, FOX IT, Compumatica, BlueFinch, group 2000, Web-IQ, DataExpert	— Safe infrastructure for storing and exchanging confidential policy data. — Forensic platform that detects and locates criminal behaviour by scanning the 'dark web'. — Protecting personal data of citizens from malware cyberattacks. — Safe identification and authentication platform to enable government organisations to provide digital services to citizens.
Healthcare	⬤	SecureLink, aet, GRC CONTROL	— Protecting patients' medical files from malware threats. — Secure network platform exchanging medical information between patient and doctor. — Online identification for patient and medical staff used to provide digital services to patients.
Manufacturing	⬤	SECURITY MATTERS, REDSOCKS	— Analysis of information flows to ensure the continuation of core industrial processes and the protection of intellectual property. — Analysis of the connected production line to minimise malware threats.

Key: ⬤ Size of the bubble indicates the level of industry exposure of Dutch companies.

Note: (a) Exposure is based on availability of specific evidence that we came across during research (interviews and desktop research).

(b) Critical infrastructure includes energy, telecom and transport.

🔒 Cyber Security – Dutch competitiveness

Most Dutch companies in the Cyber Security sector are product specialists, rather than competing with large internationals in the end-to-end security segment

Type of player	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Companies with several products in a certain area of specialisation	— These players have product portfolios focused on a certain area of specialisation (e.g. encryption products). — Examples of specialisation areas: 　- Use of forensics, encryption and intelligence information to prevent and manage security breaches; 　- Secure identification, authentication and digital signing solutions;. 　- Lawful interception, storage and analyses of data to support criminal investigation.	Compumatica SECURE NETWORKS aet group 2000 FOX IT SecureLink	— Proven track record abroad including Germany. 　- Some players partner with local distributors or resellers, while other players have set up offices abroad. — Companies in this segment are generally large and well-known and could therefore be more attractive for German companies / resellers to work with. — Interview feedback suggests that some players have plans to enter the German market in the near future, because they see unmet demand in Germany.	4 / 5
Mono-liners / product specialists	— These players specialise in a single product. — These solutions are used by clients in combination with other security solutions. — Examples of Dutch products: 　- Dark web analysis to identify cyber attacks; 　- Mapping information flow and storage to ensure compliance with security regulations (e.g. GDPR); 　- Network and communication monitoring for manufacturing companies.	eclectic iq cybersprint REDSOCKS TYMLEZ dearBytes Web-IQ privacy perfect Innovice-IT B.V. SECURITY MATTERS	— Evidence suggests that several Dutch niche solutions have no equivalent in Germany (e.g. RedSocks, Innovice IT). — Evidence of players that work with resellers / distributors abroad including in Germany (e.g. AET has two sales partners in Germany). — Multiple examples exist of plug-and-play solutions. These solutions are more easily exportable via resellers / distributors, because limited service is required. — Interview feedback suggests that several players are planning to expand to Germany (e.g. Innovice IT, PrivacyPerfect).	4 / 5

Key:　**1**　Industry with low export strength　　**5**　Industry with high export strength　　　　　　Source:　(1)　Interview program, desk research, press clippings, KPMG analyses

Cyber Security – German competitiveness

The German Cyber Security sector is generally competitive, supported by a fragmented set of IT and Cyber Security hubs with different areas of specialisation (1 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**

Number and characteristics of players	**Many players are active in the German market, both international and local, while the market is highly fragmented.**	— A large number of players are active in the German Cyber Security market, both large international players (e.g. Microsoft, IBM, GE) and small / medium-sized companies (e.g. Hornet Security, ZenMate).
		  - Highly fragmented market where even the large international Cyber Security companies have limited market shares;
		  - Large multinationals generally only work with large international Cyber Security companies from the US, Germany, Russia, Japan and China since they require worldwide support.
		— Interview feedback suggests that US companies (e.g. CyberArk) aim to enter the German market, together with Israeli and French Cyber Security companies.
			"Our market is very fragmented, with even the largest players taking up limited market share." – Business developer of German Cyber Security company	**4 / 5**

Ecosystem and environment	**Government involvement and a wide range of supporting ecosystems facilitate innovation and increase access to capital.**
	
	Germany faces a shortage of Cyber Security talent.
		— Wide range of fragmented IT security clusters available throughout the country with different specialisation areas (e.g. Bavarian IT-Security cluster, IoT Security Cluster NRW, Fraunhofer Urban Security cluster) to increase innovation and increase access to funding.
		— Germany faces one of the most severe shortages of Cyber Security professionals in the world, with 35% of Cyber Security vacancies not being filled in Q3 of 2016.[1]
		  - Limited evidence of German programs run by government or universities to solve shortage, especially relative to the Netherlands.
		— The federal government promotes Cyber Security in key industries.
		  - Cyber Security regulations (e.g. IT Security Act in 2015) are often revised to increase the quality requirements for German Cyber Security solutions;
		  - The National Cyber Response Centre identifies weaknesses per industry by pooling resources and information from other federal departments and industry institutes;
		  - Attacks are reported to the Federal Office for Information Security who also evaluates Cyber Security products, trends and risks.
		— The Federal Ministry of Research and Education (BMBF) initiated several research programs on Cyber Security technologies and launched three competence centres to improve the quality of German Cyber Security solutions.
		— Evidence of significant government subsidies (e.g. Research for civil security) and public-private collaborations (e.g. BITKOM Alliance for Cyber Security, fit4sec, Fraunhofer cluster) to increase innovation and access to funding.
			"The BMBF spends millions of euros to improve the national Cyber Security level in German critical infrastructure companies." – German Cyber Security market insider
			
			"The German security sector is organised via numerous geographic and functional groups throughout the country, with function to share knowledge on Cyber Security" – Sales representative of German Cyber Security company
				4 / 5

Key: **1** Low strength (High opportunity for Dutch players) **5** High strength (Low opportunity for Dutch players)   Source: (1) Indeed, McAfee

Cyber Security – German competitiveness

The German Cyber Security sector is generally competitive, supported by a fragmented set of IT and Cyber Security hubs with different areas of specialisation (2 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	KPMG insight	Interview feedback	Assessment
Areas of competitiveness (industry driven and other)	**German competitiveness is driven by a relatively high probability of attack. Solutions appear to be less user friendly than international alternatives. German companies have most credentials in critical infrastructure industries.**	— Cyber Security is a top priority for German companies and the government, because of a relatively high probability of cyber attacks in Germany.[1] - Cybercriminals can target German companies because of Germany's mature digital infrastructure, which allows cybercriminals to access valuable information digitally. — Interview feedback suggests that German Cyber Security solutions are highly efficient, though German solutions are less competitive when it comes to usability and user experience, especially relative to Dutch solutions. — Evidence suggests that for highly confidential information German companies prefer to use local players. — Active German Cyber Security players mainly offer industry-generic solutions, though German players appear to have most credentials in critical infrastructure industries. — Interview feedback suggests that German Cyber Security companies have least credentials in the small to medium-sized client segment, suggesting this segment could be attractive for Dutch companies.	*"Cyber Security is a top priority for businesses, because many cybercriminals target their attacks at German companies."* – Sales representative of German Cyber Security company *"Though German Cyber Security solutions are of high quality, we do sometimes lose to international competition when it comes to usability and interface friendliness."* – Sales representative of German Cyber Security company	4 / 5
Overall conclusion of the competitive strength of Germany	**Generally the German sector is very competitive, with certain products potentially being less competitive due to user friendliness, especially in SME client segment.**	— The German sector is highly fragmented, with many international and local players active across all segments of the Cyber Security segment. — Supporting infrastructure and collaboration between government, universities and businesses strengthens the competitive position of German Cyber Security companies. — The SME segment could provide opportunities for Dutch companies, German companies have least credentials in SME client segment. — Interview feedback suggests that German Cyber Security companies have relatively low presence in the small to medium-sized enterprise segment and score lower on usability relative to international players.	*"The German Cyber Security market could be Germany's most developed sector, illustrated by the amount of attention and investments it receives."* – Sales representative of German Cyber Security company	4 / 5

Source: (1)   German BSI

Key: **1**   Low strength (High opportunity for Dutch players)   **5**   High strength (Low opportunity for Dutch players)

Cyber Security - Entry barriers

Entry barriers are moderately strong driven mainly by high competitive intensity in the German market

Entry barriers to Germany				
	Conclusion	**KPMG Insight**	**Interview feedback**	**Assessment**
Formal regulations	**Regulations are stricter, but do not hinder Dutch companies from entering the German market.**	— The German security regulations currently in place (BDSG) are stricter concerning standards of processing and storing personal data than other European regulations including current Dutch security regulations. In 2018 the BDSG will be overruled by the European GDPR. — Interview feedback suggests that compliance is generally not a concern for Dutch security companies, as their solutions generally improve protection levels. Limited tailoring of their products appears needed to comply with German regulations.	*"We don't need to adapt our product to be compliant with German law."* – Business developer of Dutch Cyber Security company *"Dutch Cyber Security products help German companies be compliant with German regulations."* – Sales representative of Dutch Cyber Security company	4 / 5
Local preferences	**Dutch companies should set up local offices or work with local distributors, because German companies trust local companies more when it concerns security.**	— Interview feedback suggests that German companies do see the value of innovative Dutch solutions. — German Cyber Security companies appear to prefer local German solutions for securing highly confidential information, under the assumption that local companies only process data within German borders. They are also perceived to understand local business and local regulations better. - By setting up local offices with German speaking staff, or by working with local resellers, these barriers can be overcome.	*"German companies are very suspicious of non-German Cyber Security companies. New entrants are critically assessed before doing business."* – Sales representative of Dutch Security company	3 / 5
Competitive intensity	**Competitive intensity in the general market is high, though some innovative niches might be less competitive.**	— Overall competitive intensity is high, driven by a high number of market participants on the German Cyber Security sector. A high level of software differentiation somewhat alleviate competitive pressure. — Innovations in the Cyber Security sector create new segments in which competitive pressure is lower.	*"The German market is very competitive with a lot of large international players, but also many medium-sized and small companies."* – Representative of German Security company	2 / 5
Market Maturity	**The German market is very mature.**	— The German market is highly mature reflected by high Cyber Security spending, though the Dutch market could be more mature. — The market is fragmented and consolidation is taking place. — The Netherlands and Germany both follow the United States in terms of maturity.	*"The German market for Cyber Security is highly mature, with many players on the market each taking up a small market share."* – Representative of German Security company	3 / 5

Key: **1** High entry barrier   **5** Low entry barrier

Evaluation of ICT sectors

Internet of Things (IoT)

Big Data

Cyber Security

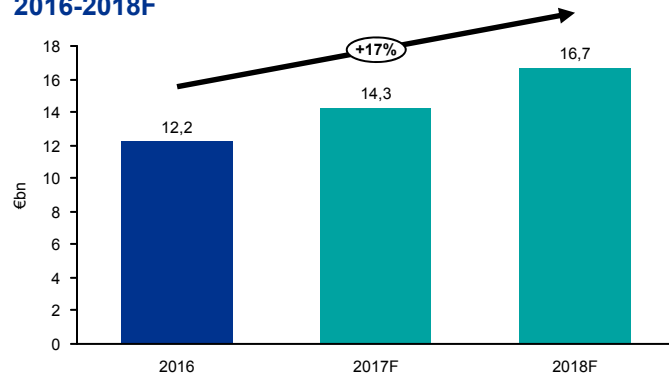Software Robotics

Enterprise Solutions

Cloud Computing

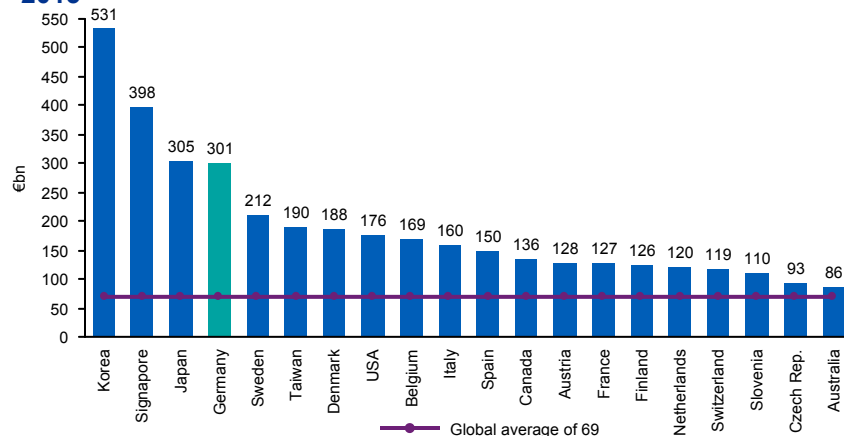# Software Robotics – Sector growth

The overall Robotics sector in Germany is expected to grow with a 17% CAGR in the coming years with machine learning software being the highest growth segment

Robotics and automation sales in Germany, 2016-2018F

+17%

- 2016: 12,2
- 2017F: 14,3
- 2018F: 16,7

(€bn)

Source: Reuters, IDC, KPMG analysis

Number of robots per 10,000 employees per country, 2015

Country	Value
Korea	531
Singapore	398
Japan	305
Germany	301
Sweden	212
Taiwan	190
Denmark	188
USA	176
Belgium	169
Italy	160
Spain	150
Canada	136
Austria	128
France	127
Finland	126
Netherlands	120
Switzerland	119
Slovenia	110
Czech Rep.	93
Australia	86

Global average of 69

(€bn)

Source: IFR report, KPMG analysis

High growth is expected in the machine learning segment, while robotic process automation is expected to show moderate growth

In line with global growth, a CAGR of 17% is expected between 2016-2018 in the overall German robotics sector (including software, hardware and services).[1]

Within the scope of this research we focused on software robotics, which mainly covers robotic process automation (RPA) and advanced robotics, such as cognitive intelligence (CI).

— RPA is expected to grow at a more moderate rate compared to CI because this segment's mature character.
  - All relevant industries[a] (e.g. financial services, telecom, manufacturing) appear to have high penetration rates, with many international and local players active on the market.
— Interview feedback shows that advanced robotics has higher growth potential of above than 20% annually, if German companies are convinced of the value proposition of machine learning software.
— Interview feedback suggests that the German advanced robotics is still in early development stage, with high growth potential going forward due to expected increasing penetration from the current low base.
— Current lagging penetration levels are explained by:
  - German companies are not yet fully convinced about the business case of machine learning, given most solutions are still new;
  - Many German companies lag when it comes to cloud adoption, which is preventing the adoption of machine learning applications that run on the cloud;
  - Privacy and security concerns may prevent some companies from using self learning algorithms to analyse sensitive data.

Source: (1) IDC

Note: (a) Industries that are most susceptible to using robotic process automation

Software Robotics – Dutch competitiveness

The sector is in early development and includes a limited number of players with commercially viable products and competitive advantage (1 / 2)

		Competitive strength of Dutch sector from an international perspective		
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**
Number and characteristics of players	**There is a limited number of Dutch players in the market. A handful of local players predominantly focus on the development of cognitive robotics solutions.**	— Our analysis suggests that the Dutch software robotics sector can be split in two main segments: robotic process automation (RPA) and cognitive intelligence (CI). — Both categories have a mixed representation of international and local players, with international players appearing to have a relatively stronger foothold. — Companies in RPA are focused on automating rule-based processes relating mainly to back-office functions, such as finance and accounting, with local players offering end-to-end solutions (e.g. Bluepond) and niche solutions (e.g. Invoice Sharing – invoice processing). — The CI segment is mainly dominated by international players (e.g. IBM Watson), Some Dutch companies have recently developed highly advanced algorithms that can be applied across various industries (e.g. Scyfer, Synerscope). These companies are ready to compete with their international peers. — We estimate that approximately 20 Dutch companies with commercially viable solutions are active in software robotics sector.	*"US and UK companies are in the lead for most software robotics initiatives. Nevertheless, there are proven Dutch examples of successful companies in RPA space, such as Invoice Sharing."* – Dutch market insider *"Take self-learning and deep learning algorithms. I don't think that there is similar expertise on the German scene."* – Executive in a Dutch start-up focused on machine learning (CI)	3 / 5
Ecosystem and environment	**The 'RoboValley' cluster is expected to become the driving force for bringing robotics start-ups to the market and is exemplary for a developing ecosystem.**	— Lack of strong ecosystem at this point, however, proper steps are taken to develop a supporting environment: - Robotics hub supported by TU Delft: a platform for research and entrepreneurs, with own venture capital fund. — Dedicated funding of €100 mln for Dutch robotics start-ups pledged by Chrysalix Venture Capital. — Amsterdam, Groningen, Maastricht and Delft being the main locations for MSc programs in Artificial Intelligence and Robot Cognition.	*"The expectation is that in the coming years up to 25.000 jobs will be created in RoboValley."* – Dutch market insider	3 / 5

Key: **1**   Low strength   **5**   High strength

Software Robotics – Dutch competitiveness

The sector is in early development and includes a limited number of players with commercially viable products and competitive advantage (2 / 2)

	Competitive strength of Dutch sector from an international perspective			
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Areas of competitiveness (industry driven and other)	**The main competitive advantage of the Dutch sector resides on well developed Cognitive Intelligence solutions.**	— The competitive advantage of Dutch companies in RPA appears to be moderate. Dutch companies are mostly focused on industry-agnostic solutions that in terms of product features appear to be on par with better known players in this field (e.g. UK based Blue Prism and Automation Anywhere from the US).
		— RPA: Competitive strength of Dutch players is diminished by the fact that they lack international presence, whereas large clients with global footprint may prefer to have local support. However, in CI there appear to be a much stronger proposition.
		— CI: Dutch players that have specific expertise in machine / deep learning (e.g. Scyfer) command high competitive and export strength due to the following:
		  - Limited evidence of relevant expertise in Germany;
		  - Industry-agnostic character of these solutions.
		— In addition to companies that are focused purely on either RPA or CI, there is evidence of players that often blend software and physical robotics (hardware) having strong expertise in the following industries:
		  - Agriculture;
		  - Automotive;
		  - Industrial manufacturing (other than automotive);
		  - Healthcare;
		  - Infrastructure (traffic management).
			"Computer vision algorithms are implemented by Dutch companies that produce autonomous field robots to determine, for example, if a certain plant needs a dose of pesticide." – Owner of a Dutch farming estate.
			
			"Companies like Scyfer need more scale to enter the German market. They seem to be too busy with the current project portfolio." – Executive in a Dutch start-up focused on machine learning (CI)
				3 / 5

Overall conclusion of the competitive strength of the Netherlands	**Dutch companies seem at par with their peers when it comes to RPA but have problems in geographical presences and reach. There is a stronger position in CI.**	— Dutch companies do have commercially viable solutions in RPA space (automation of generic back-office processes) although limited evidence of specific product advantages compared with international players is evident. — Selected local small-sized companies have deep expertise in cross-industry machine-/deep learning algorithms which seems to be more advanced vs. German examples.	*"You need to showcase a very specific competitive advantage with visible bottom-line effect in order to win clients in Germany."* – KPMG expert in Germany	**3 / 5**

Key: **1** Low strength **5** High strength

Software Robotics - Dutch competitiveness

The Dutch sector is mainly competitive in specialist artificial intelligence, process automation and a number of industry-specific niche solutions (1 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Agriculture	— Software robotics used for autonomous flying drones to monitor crops or scare off unwanted birds. — Software and hardware to operate autonomous agricultural equipment such as milking, feeding and cleaning machines. — Machine vision software used to monitor and control crop growth.	AEROVINCI, LELY, TYKERTECHNOLOGY, ARIS, Vencomatic Group, CNH, CLEAR FLIGHT SOLUTIONS	— Strong hub in the Brabant region of innovative Dutch solutions with proven track record abroad. — Limited evidence of comparable agricultural solutions in Germany. — Score adversely affected by the large hardware component of these solutions, which may not be immediately within the scope of this research.	4 / 5
Automotive	— Artificial intelligence algorithms for autonomous vehicles. — Machine learning to analyse driver and traffic data to improve self-driving applications. — Artificial intelligence and simulations are used to train drivers.	Cygnify, TOMTOM, robotTUNER, AND, anwb, ULU	— Evidence of several Dutch companies developing products in software Robotics. — Interview feedback suggests that Dutch companies have a strong competitive position in connected car algorithms. — Score adversely affected by the immaturity of Dutch solutions, as some are not yet commercially viable.	4 / 5
Healthcare	— Artificial intelligence is used to analyse medical data to improve the client's experience and the efficiency of medical treatments. — Artificial intelligence is used to provide more service and functionality to patients. — Robotic systems to automate medical measurement, treatment or information exchange.	PHILIPS, PICTO CONNECTION, tinybots, FOCAL meditech, DEMCON	— Evidence of healthcare Robotics solutions in the Netherlands that have no equivalent in Germany. — Interview feedback suggests that security and privacy concerns could hinder the export of certain Robotic solutions (e.g. software robots that process sensitive patient information).	4 / 5

Key: **1** Industry with low export strength   **5** Industry with high export strength

Source: (1) Interview program, desk research, press clippings, KPMG analyses

Software Robotics – Dutch competitiveness

The Dutch sector is mainly competitive in specialist artificial intelligence, process automation and a number of industry-specific niche solutions (2 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Infrastructure & Maritime	— Artificial intelligence and deep learning algorithms that improve data analytics in smart traffic, infrastructure and transportation. — Connected traffic algorithms to improve and optimise traffic management. — Robotic automation and artificial intelligence software to automate construction tools in infrastructure.	Cygnify TOMTOM Vialis dynniq energising mobility TYKERTECHNOLOGY CNH	— Evidence of commercially viable solutions that have a proven track record abroad including in Germany. — Interview feedback suggests that Dutch infrastructure companies have a strong reputation in connected and smart traffic. — Score adversely affected by the fact that infrastructure companies develop in-house Robotics capabilities that they are unlikely to sell or export as it is part of their competitive advantage.	4 / 5
Manufacturing	— Automation software to operate physical robots and manufacturing lines. — Machine vision to monitor and control the production process. — Robotic palletizing systems and packaging systems.	TANIQ 8100 CCM Assembléon CSi Beltech Industrial Automation with Vision RM ROBOMOTIVE	— Evidence of medium and large-sized international companies with a track record abroad. — Strong reputation in food & beverage production (e.g. CSi). — Score adversely affected by the large hardware component which is an area where the Dutch sector has relative less strength.	3 / 5
Other	— Industry-generic machine learning software used to analyse data in various sectors including Financial Services and Manufacturing. — Accounting Robotics software used to automate financial invoice sharing. — Machine learning software used to detect cybersecurity threats by analysing big data.	INVOICE SHARING Innovice-IT ROBOFINANCE synerscope SCYFER DOTS	— Several strong industry-generic solutions with track record abroad including in Germany. — Interview feedback suggests that several Dutch Robotics software solutions rank in the global top when it comes to innovativeness, with few comparable solutions available in Germany. — Score adversely affected by availability of strong international industry-generic solutions (e.g. IBM, Blue Prism).	4 / 5

Key: **1**   Industry with low export strength   **5**   Industry with high export strength   Source: (1)   Interview program, desk research, press clippings, KPMG analyses

Software Robotics – German competitiveness

RPA is commonly used by large businesses in Germany, whereas the ecosystem for advanced solutions such as machine learning is limited (1 / 2)

Competitive strength of the German sector from an international perspective			
Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Number and characteristics of players — The CI market is still relatively under developed with limited German player that can compete with Dutch providers. The RPA market is very mature and competitive.	— We distinguish the following 3 segments in the German robotics sector:
	  - International players offering solutions both in RPA (e.g. Blue Prism) and CI (IBM Watson, Microsoft) areas, with solutions that appear to be mainly industry-generic with generally a limited degree of customization;
	  - Local Mittelstand companies and start-ups with specialized solutions primarily in RPA area. Interview feedback suggests that these players are significantly behind the Dutch peers in terms of know-how in CI and machine learning software;
	  - Large companies, mainly German ones, focused on hardware robots that are primarily used in production environments. Although Germany is specifically strong in this area, we consider it not to be fully relevant for the scope of this research due to the inconspicuous software component.
	— Generally, there appear to be roughly 80-100 players in software robotics, with international companies appearing to have dominant position.
		"Challenging to name any obviously 'weak spots' with regard to software for process automation in Germany: the market is well-developed and competitive, with a lot of players." – KPMG expert
		
		"Advanced robotics, such as cognitive intelligence and machine learning are still not common, may be adopted by largest companies, but all in all the market is very immature." – KPMG expert
		
		"There is a huge untapped market for niche solutions like ours. We expect double-digit growth in the short term due to low-base effect." – Representative of German company focused on computer vision algorithms
			3 / 5

Ecosystem and environment — There is a mature RPA ecosystem and in some German industries, the CI ecosystem seems to be under developed and provides ample opportunity for Dutch companies.	— Our research indicates developed ecosystems around software for back-office processes' automation* (RPA) in the following industries:
	  - Financial services;
	  - Telecom and Media;
	  - Retail;
	  - Logistics;
	  - Pharmaceutical and chemical production.
	— Interview feedback suggests that automotive and industrial manufacturing are lagging in terms of back-office automation, whereas core production is covered due to historically high usage of industrial robots.
	— The ecosystem identified around CI is limited to international companies catering to selected large corporate clients.
		"I would rate the competitive ecosystem as 4 out of 5 when it comes to process automation." – KPMG expert
		
		"Advanced robotics are still mainly the playfield of US companies that work with a limited number of large German companies. The strength of competitive ecosystem is between 1 and 2 out of 5" – KPMG expert
			3 / 5

Key: **1** Low strength (High opportunity for Dutch players) **5** High strength (Low opportunity for Dutch players)

Software Robotics – German competitiveness

RPA is commonly used by large businesses in Germany, whereas the ecosystem for advanced solutions such as machine learning is limited (2 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Areas of competitiveness (industry driven and other)	**German companies have commercially viable niche solutions aimed to automate rule-based processes, with limited competitive strength in more advanced solutions (e.g. machine learning).**	— Areas of competitiveness in software robotics is differentiated between international and local companies active in Germany:
		- International companies command strong expertise in both RPA and CI. However, they generally demonstrate limited flexibility with regard to:
		  - Further product tailoring to specific industry or client situation;
		  - Approach to pricing (e.g. 'success fees' based on decrease in clients' operating costs).
		— Local players appear to have developed niche software solutions in RPA with specific focus on financial services, telecom / media, retail, logistics, pharma and chemicals*, whereas their competitiveness in CI and other similar solutions in advanced robotics is modest.
			"Only a few local companies are active in cognitive intelligence and machine learning. This segment is dominated by the likes of IBM Watson and Microsoft." – KPMG expert
			
			"I find it difficult to estimate the size of the German market for cognitive intelligence / machine learning software, most likely it is very small." – KPMG expert
				3 / 5

Overall conclusion of the competitive strength of Germany	**Germany has a very developed RPA market but there are limitations in the CI space.**	— Generally, international companies dominate the German software robotics sector*. — Local companies appear to be competitive in various niches of back-office process automation (RPA), with limited know-how in CI. — Dutch entrants can take advantage of opportunities in CI if the local clients are convinced in economic effect of these investments. **Major target industries in Germany for Dutch players:** Agriculture Healthcare Infrastructure	*"CI requires substantial investments. None of the industries widely apply it yet and lag behind the US."* – Representative of German company focused on computer vision algorithms	3 / 5

* Automation of core production is not taken into account due to material hardware component (physical robots), which is out of scope for the purpose of this report.

Key: **1**   Low strength (High opportunity for Dutch players)   **5**   High strength (Low opportunity for Dutch players)

Software Robotics – Entry barriers

No major entry barriers have been identified, with specifically favourable situation for companies offering innovative and industry-specific solutions in advanced robotics (e.g. machine learning)

Entry barriers to Germany			
Conclusion	**KPMG Insight**	**Interview feedback**	**Assessment**
Formal regulations — No evidence of specific regulations, though local clients are likely to have concerns around security, data storage and predictability of machine learning software.	— There is no evidence of regulations preventing Dutch companies from entering the German market. — There are likely to be certain client concerns with regard to: - Storage location of data collected by robotics solutions; - Security of robotic sensors and their connections to the internet; - Potentially unpredictable nature of self-learning algorithms.	*"We haven't come across serious barriers when doing business in Germany, but we had a connection to a specific client when we entered the market."* – Sales representative of Dutch Robotics company	4 / 5
Local preferences — No local preferences, though in the machine learning segment most German companies appear not convinced of the added value of international (or local) solutions today.	— Interview feedback suggests that few German companies currently see the value of machine learning and advanced robotics software in general, indicating that the market for Dutch machine learning companies may be limited in the short term and a long commercial horizon needs to be taken into account. — No preference for companies with German origin, only for companies that invest in the German market by setting up a local office with German speaking representatives.	*"German companies are interested in working with us provided we can add value and have local representation."* – Business developer of Dutch Robotics company	4 / 5
Competitive intensity — Competitive intensity in Germany appears to be low in the machine learning segment (CI), but high in the robotic process automation (RPA) segment.	— Competitive intensity is high in RPA segment: roughly 80-100 players active, with signs of ongoing consolidation. — In contrast, interview feedback suggests that almost no German companies are active in the self-learning Robotics market, suggesting German competitive intensity is low in this segment.	*"In the machine learning segment, Germany lags behind international leaders such as US and UK, in part evidenced by the low number of active local or international players active on this market."* – German market insider	3 / 5
Market Maturity — The German CI segment is immature, whereas RPA segment is highly developed.	— The German Robotic process automation sector is highly mature and in general more advanced than the Netherlands. — In contrast, the German machine learning segment is very immature with no evidence of wide adoption among German companies.	*"The software automation market is very mature in Germany and leads globally as one of the most automated economies."* – German Robotics expert	3 / 5

Key: **1**   High entry barrier   **5**   Low entry barrier

Evaluation of ICT sectors

Internet of Things (IoT)

Big Data

Cyber Security

Software Robotics

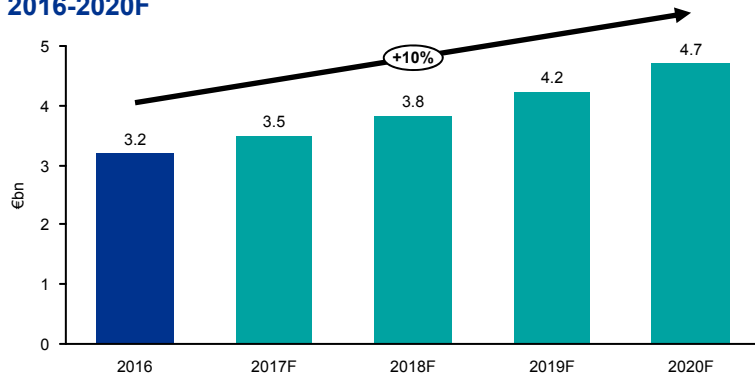Enterprise Solutions

Cloud Computing

Enterprise Solutions - Sector growth

The German Enterprise solutions (ES) sector will grow with a CAGR of 10% in the coming years

End-user spending on ES in Germany, 2016-2020F

€bn

2016	2017F	2018F	2019F	2020F
3.2	3.5	3.8	4.2	4.7

+10%

Note: Market value in € converted using average annual (2016) conversion rate of $1.0 = €0.9473
Source: Gartner - German ICT spending forecast q3 2016, KPMG analysis

Despite the high maturity of the ES sector in Germany, further investments in ES are a top priority for German CIOs.

— Growth of 10% in the German Enterprise Solutions sector is in line with global growth of 11% until 2020.
  - Growth is expected to be industry agnostics.[1]
— Despite high penetration levels, further investments in ES are on top of the agenda of German companies driven by the following factors:[1]
  - Switch to cloud-based ES systems and discontinuation of 'legacy' systems;
  - Further customisation for industry-specific needs;
  - Improvements in ES cyber security;
  - Implementation of ES (primarily, generic ERP systems) by Mittelstand; companies which have not used it previously.

Top technology investment priorities for CIOs in Germany [1]

1st	2nd	3rd
Enterprise solutions	Business analytics	Cloud computing

Source: (1) Gartner Germany CIO Survey, 2014

Enterprise Solutions - Dutch competitiveness

Dutch companies have a strong position in ES with SME clients for both end-to-end and function-specific modules, such as HR and Finance (1 / 2)

Competitive strength of Dutch sector from an international perspective			
Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**
Number and characteristics of players	**International players dominate the Dutch ERP market. However, Dutch companies have a strong position with SME clients.**	— The Dutch ERP market is dominated by international players who mainly target large international companies. - SAP and Microsoft cumulatively have 32% market share;[1] - The top-10 companies hold a cumulative 62% share. The Top 10 includes 5 local players (Exact, AFAS, Unit4, Planon, Isah);[1] - Outside of the Top-10, there are currently over 20 Dutch companies operating as ES providers. — Local companies are mainly active in the SME segment, where they compete on price and customization (e.g. language, local regulations, taxation and specific industry needs).	*"They (local companies) are competitive in their segments, e.g. SME. However, the overall market is dominated by big players."* – Representative of an international ERP company *"Exact is the strongest Dutch company in ES space. However, I cannot recall of any multinational clients of Dutch origin that use Exact ERP."* – KPMG expert *"Most SMEs in the Netherlands still work on locally installed ERP software. However, large business usually have a remote location where they host their ERP application."* – KPMG expert	**3 / 5**
Ecosystem and environment	**No strong ecosystem around enterprise solutions has been identified.**	— No specific evidence found of an ecosystem around ES / ERP solutions. — However, the highly developed local industry of external data centers will support the competitive strength of Dutch players due to the fact that more clients (especially large companies are shifting to remote locations for hosting their ERP software.	*"Because the market is dominated by large players, there is not really a local ecosystem in which local stakeholders share knowledge and develop solutions."* – KPMG expert	**2 / 5**

Key: **1**   Low strength   **5**   High strength

Source: (1) Computer Profile Survey in 2016, Consultancy.uk, KPMG analysis

Enterprise Solutions - Dutch competitiveness

Dutch companies have a strong position in ES with SME clients for both end-to-end and function-specific modules, such as HR and Finance (2 / 2)

Competitive strength of Dutch sector from an international perspective

	Conclusion	KPMG insight	Interview feedback	Assessment

Areas of competitiveness (industry driven and other)	**While international players focus on offering integrated solutions to large corporates and governments, local players are able to offer competitive niche solutions to the SME segment.**	— Despite the market dominance of international players with an integrated ERP portfolio, local players do have competitive solutions on specific domains.
		  - Local players (e.g. Exact, AFAS, Unit4, Planon, Isah) have developed solutions on specific domains (e.g. financial management, Human Resources, industry specific software).[1]
		— Solutions of local players are predominantly used by the SME segment, in some cases large corporates also use these modules.[2]
		— Dutch players indicate that their primary focus is the local market which they believe is large enough in the near term
		  - The focus on the local market is furthermore driven by specific regulatory requirements in the Netherlands (i.e. Tax & payroll) which is different than in other countries;
		  - Different regulatory requirements impact the design of specific tooling, which makes it difficult to export a solution that is tailored to the Dutch market without altering it to local requirements.
		— Dutch companies appear relatively weak in cloud implementation of ES, which may hinder the export strength to Germany.
			"Lots of parties are active, but the market can grow as not all companies use ERP solutions. Many systems are still locally stored. Due to the switch to cloud we see more international parties." – Leading Dutch ERP player focused on manufacturing industry.
			
			"It is difficult to enter the German market because our software is designed around specific Dutch regulation. We will need to invest to update this for the German market, and because we still have plenty of work in the Netherlands, there is no need to go down this road." – Leading Dutch ERP player.
				3 / 5

Overall conclusion of the competitive strength of the Netherlands	**Dutch players are strong in the SME segment, but local design and a relative weakness in cloud implementation of ES limit the export strength to Germany.**	— Dutch companies are strong in the SME segment where they compete on price and customization. — Local design of ES may hinder the export strength to Germany due to the fact that the solution has to be tailored to the specifics of the German market (e.g. language, local regulations, taxation and specific industry needs). — Relative weakness in implementing cloud-based ES represents a disadvantage as more clients are switching to cloud environment.	*"In the Netherlands there is too much competition in the market. Every time, the end customers are flooded by companies who try to sell at the cost of the other companies."* - Leading ERP player focused on manufacturing industry.	3 / 5

Key: **1**   Low strength   **5** High strength

Source: (1) Company website; (2) interview feedback

Enterprise Solutions – Dutch competitiveness

Dutch players have developed commercially viable solutions in manufacturing, financial services, public sector and infrastructure (1 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Heavy industry / Manufacturing	— Software that streamlines operations and commercial activities in heavy industry. - Integrated ERP solutions covering functions across the whole value chain (production management, finance / accounting, HR, CRM, etc.).	= exact isah BUSINESS SOFTWARE PLANON AIM FOR THE OPTIMUM PRODUVAR m|k|g	— Multiple Dutch players active in the heavy industry. — Solutions appear to have a competitive proposition, especially in the SME segment. — Several players are currently active in the German market, and interview feedback suggests that other players consider future entry opportunities (e.g. Produvar).	**3 / 5**
Financial services	— Integrated ERP solutions for companies in insurance and pensions covering front- and mid-/back-office processes. - Country specific rules are embedded in the functionality (local regulations, taxation, etc.).	EPICOR. | scala. UNIT4 Keylane insurance & pension software	— Dutch companies primarily compete with international players such as Sapient and Guidewire. — Proven track record abroad of several Dutch players (e.g. Keylane, Unit4). — Interview feedback suggests that several Dutch ERP solutions in financial services are competitive relative to German alternatives due to a more flexible integration with other enterprise systems.	**4 / 5**
Public sector	— End-to-end ERP solutions for public bodies.	UNIT4 = exact AFAS software inspireert beter ondernemen	— Dutch companies primarily compete with international players (e.g. SAP and Peoplesoft). — Interview feedback suggests that Dutch companies have several commercially viable and cost competitive solutions. — The need to tailor ES to specific local rules could be a weakness when trying to export to Germany. — Score adversely affected by the preference of the German public sector for working with local companies.	**2 / 5**

Key: **1**   Industry with low export strength   **5**   Industry with high export strength   Source: (1) Interview program, desk research, press clippings, KPMG analyses

Enterprise Solutions – Dutch competitiveness

Dutch players have developed commercially viable solutions in manufacturing, financial services, public sector and infrastructure (2 / 2)

Industry	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
Infrastructure	— Integrated software that manages all aspects of infrastructure and construction projects. - ERP software enables control on Engineering, Procurement & Construction (EPC) services coupled with digitalisation of project finance, schedules, logistics and planning.	centric connect.engage.succeed. van meijel P4PS AFAS software inspireert beter ondernemen	— Multiple Dutch companies offer integrated industry-specific solutions, while evidence appears limited of similar German solutions. — Currently Dutch players have limited presence in Germany, though interview feedback suggests that Germany could be an attractive market in the medium term.	4 / 5

Industry-generic with focus on specific function (HR and Finance)	— Industry-generic software targeted towards specific functionality, specifically HR and Finance:
	  - HR: Specific services covering payroll management, recruitment, talent management and compensation.
	  - Finance: Covering invoicing, tax, financial reporting, cash management, accounts receivable and payable among others.
		VISMA ACCOUNTVIEW BUSINESS SOFTWARE
		MACCS INTERNATIONAL raet
			— Several strong industry players with proven international track record for specific functional level ERP solutions including in Germany.
			— International companies are increasingly acquiring Dutch ES companies as "buy and build" options. This supports the unique offerings Dutch vendors have which could also be used to enter the German market.
				4 / 5

Key: **1** Industry with low export strength **5** Industry with high export strength Source: (1) Interview program, desk research, press clippings, KPMG analyses

Enterprise Solutions – German competitiveness

With the presence of strong local players, Germany appears to be a mature market for Enterprise solutions, however potential exists for sector specific services (1 / 2)

Competitive strength of the German sector from an international perspective			
Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**

Number and characteristics of players — **High number of players (both local and international) offering services across the ERP value chain.**	— The German market appears to have a large number of players offering ERP solutions. Customers tends to use multiple ERP products.
	  - Approximately 20% of interviewed large German companies have more than 50 ERP systems, however systems are increasingly integrated and companies increasingly opt for a consolidated platform and single vendor;[1]
	  - 36% of the CIOs prefer to have one common ERP system while 68% favour a common vendor strategy.[1]
	— Local German players like SAP hold a dominant position in the market. Even after global expansion, the home market appears to remains a major focus for SAP's growth.
	  - For SAP, Germany is still the second largest market after the US.
	— Interview feedback suggests that whereas larger multinationals compete by offering a range of integrated systems, smaller players appear more flexible in pricing and the customisation of software.
	— German ES companies are increasingly developing sector-specific propositions to meet demand for specialised solutions.[2]
		"There are both large multinational and small local companies active on the German ERP market. Large companies have good products but often lack flexibility when it comes to customisation of functionality and pricing." – German consultancy focused on Enterprise Solutions
		
		"Most of the German CIOs would like to make sure that all of their companies' processes are covered by a common ERP system. This is not the case now due to the fact that there are many legacy systems currently in place." – German ERP provider with international presence.
			4 / 5

Ecosystem and environment — **Germany has a strong ecosystem for ES. Co-innovation of products and access to talent is promoted by ERP programs at universities and by collaborations between SAP and German universities.**	— SAP collaborates with universities to promote co-innovation and to increase their access to ERP talent.
	  - SAP collaborates with three universities (e.g. Steinbeis Center of Management and Technology) to develop a two-year master's degree in SAP ERP systems;
	  - SAP creates an ecosystem that promotes research and product co-innovation through University Innovation Centres.
	— Multiple German universities (e.g. Hannover University) have dedicated ERP bachelor and master programs to increase the access to ERP talent.
		"SAP collaborates with universities to promote innovation of their systems and to increase their access to talent." – Representative of Dutch ES company	4 / 5

Key: **1** Low strength (High opportunity for Dutch players)   **5** High strength (Low opportunity for Dutch players)

Source: (1) Detecon Survey
(2) Experton Research

Enterprise Solutions – German competitiveness

With the presence of strong local players, Germany appears to be a mature market for Enterprise solutions, however potential exists for sector specific services (2 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment**
Areas of competitiveness (industry driven and other)	**The German ES firms have a solid foothold in the large corporate client segment, but appear to be weaker compared to Dutch solutions focused on SME clients.**	— In the large corporate segment, German ES firms appear to be class leading. — However, given that the German SME market is lagging the Dutch market in adoption of ES, the strength of German SME focused ES solutions appear to be weaker compared to Dutch solutions. — German companies will have a natural advantage regarding implementation of regulation heavy components (e.g. HR, Tax) and in regulation heavy industries (e.g. Financial Services, Public Sector), but appear to be less adept in customisation than some of the Dutch solutions, which could be an opportunity. — At the same time German companies have the advantage of having partnerships in place with local consultants and distributors. This makes finding a strong partner in Germany crucial for Dutch companies.	*"German competitors already have partners in Germany for distribution and implementation. We are trying to find local partners."* – Dutch ERP market insider *"Although German ERP providers are larger than the Dutch peers, success in Germany is possible without large scale. It is critical to be focused on a specific industry and be flexible to customize the product. German players are not particularly good at it."* – Leading Dutch ERP player focused on manufacturing industry.	3 / 5
Overall conclusion of the competitive strength of Germany	**The German ES market provides most opportunity for industry-specific solutions in the SME segment.**	— Dutch entrants can take advantage of opportunities in industry- and function-specific solutions (e.g. HRM, FM) for SME clients, where German companies appear to have less credentials. — There appears to be little room for successful market entry in the large corporate segment due to strong presence of German companies and strong German ecosystem.	*"German Mittelstand represents key source of growth – German ES market insider.*	4 / 5

Key: **1**   Low strength (High opportunity for Dutch players)   **5**   High strength (Low opportunity for Dutch players)

Enterprise Solutions – Entry barriers

Although there are no critical regulatory barriers in Germany, Dutch companies need to overcome local preferences to successfully enter the ERP market in Germany

Entry barriers to Germany			
Conclusion	**KPMG Insight**	**Interview feedback**	**Assessment**
Formal regulations **No evidence of specific regulations.**	— No evidence of regulations preventing Dutch companies from entering the German market to offer ERP services. — Interview feedback suggest that the German ERP sector is comparatively open with no major regulatory barrier for international players. — The Dutch consulate is supportive to Dutch companies trying to enter the German market.	*"It is not hard to enter…it is easier than other European counties (e.g. France), Germany is more open to foreign companies. We don't really see serious barriers.– Leading Production sector specific ERP player*	4 / 5
Local preferences **Export opportunities are hampered by the need for adaption to local requirements and the need for a strong physical presence / strong partnerships.**	— Dutch players need to adapt software to local preferences which cover customizations around language and local regulations if they want to enter the German market; — Physical presence or having a strong partner in the German market is considered to be a requirement in order to compete.	*"Our software takes in into account specific Dutch regulations. It has to be customized to meet German regulations. Furthermore the software needs to be translated to German but this is not a significant barrier" – Leading Cross industry ERP player*	3 / 5
Competitive intensity **Competitive intensity in Germany appears to be high with local companies offering competitive solutions, especially in the large corporate segment.**	— Competitive intensity is high in German Enterprise solutions market with major competition from local and global players. — Generally it will be difficult for Dutch players to differentiate in the German market. However, there appears to be some room for market entry in some niches in the SME segment.[1]	*"It is not easy for us to deploy our solutions in the German market, it is essential to enter the market with a strong partner that legitimises our solution. If we do not have a strong partner, we cannot compete at all." – Leading Dutch ERP player focused on financial services industry*	2 / 5
Market maturity **The market generally appears mature relative to the Netherlands, though the functional and industry-specific solution segment appears less mature.**	— The German market is mature relative to the Dutch ERP market, which is reflected by high ERP penetration rates. — In the SME segment, penetration rates are lower because smaller German companies historically had less aptitude to invest in Enterprise Resource Products. - Especially the industry-specific product segment is less mature, reflected by unmet demand.[1,2]	*"It is a very attractive big market which has not yet implemented standardized back office solutions in specific sectors yet." – Leading Dutch ERP player focused on financial services industry*	4 / 5

Key: **1** High entry barrier   **5** Low entry barrier

Source: (1)   Kepler Cheuvreux Equity Research
              (2)   Interview feedback

Evaluation of ICT sectors

Internet of Things (IoT)

Big Data

Cyber Security
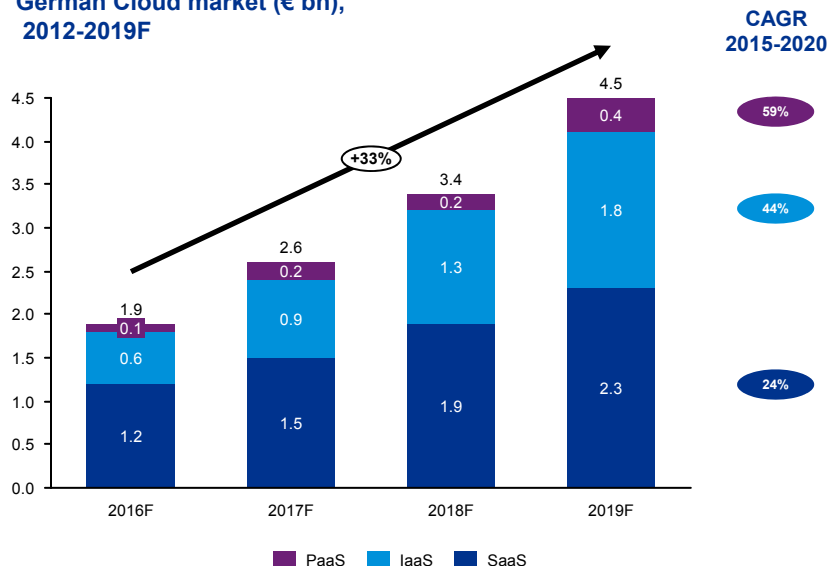
Software Robotics

Enterprise Solutions

Cloud Computing

Cloud Computing – Sector growth

The German Cloud computing sector is expected to grow with a CAGR of 33% from 2016 to 2019

German Cloud market (€ bn), 2012-2019F

CAGR 2015-2020

- 59%
- 44%
- 24%

Source: Arthur D Little, KPMG analysis

High growth is forecast in the German Cloud computing sector due to rapidly increasing adoption.

The German Infrastructure as a Service (IaaS) market is forecast to grow with a CAGR of 44% between 2016 and 2019.

— Growth in this segment is driven by the rapidly increasing adoption rates of IaaS solutions, because Cloud storage is more flexible and requires less in-house management (e.g. security, administration);

— Increasing popularity of more advanced propositions (e.g. multi-cloud sourcing propositions, enterprise IaaS) is further driving growth.

The German Platform as a Service (PaaS) market is forecast to grow with a CAGR of 59% between 2016 and 2019.

— Growth of PaaS to a large extent depends on IaaS due to the fact that PaaS and IaaS are often sold together.
  - As customers become more mature in their adaption of cloud services, the demand for PaaS functionality (e.g. development of applications and running of operating systems) becomes more evident;

— PaaS is replacing traditional company platforms (e.g., reflected by higher adoption rates including the SME segment).

The German Software as a Service (SaaS) market is forecast to grow with a CAGR of 24% between 2016 and 2019.

— Penetration of SaaS solutions is increasing across all industries, because more software providers move to the Cloud to facilitate distribution and computation speed. Interview feedback suggests that current penetration of SaaS services is around 50%.

— Due to the fact that SaaS includes all software that is run via the cloud, we consider SaaS too broad for the scope of this research.

Cloud Computing – Dutch competitiveness

The Dutch Cloud landscape is dominated by large players from the US, with several smaller local companies offering IaaS solutions (1 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**
Number and characteristics of players	**The Dutch Cloud sector is dominated by international players mainly from the US. In the PaaS segment evidence of local Dutch solutions is limited, while in the IaaS segment several Dutch companies are able to compete by tailoring their proposition to customer needs and by providing additional services.**	— In the Dutch PaaS segment a limited amount of local players is active, and these players have difficulty competing with multinational PaaS providers from the United States. - Interview feedback suggests that smaller (Dutch) PaaS players cannot compete with multinationals from the United States on functionality or price, due to significant scale disadvantages; - Evidence of other unique differentiators for Dutch PaaS companies appears limited. — In the Dutch IaaS segment both local Dutch players (e.g. Interxion, LeaseWeb) and international players (e.g. Microsoft) are active. – Though economies of scale are also large in this segment due to high capital investments in datacentres, interview feedback suggests that Dutch players (e.g. Leaseweb, Centric) are able to compete with international players by offering higher levels of customisation and additional.	*"Due to massive economies of scale, especially in the PaaS segment, we see a limited amount of local Dutch players active on the Cloud market."* – Dutch Cloud market expert *"The market is dominated by large multinationals from the United States who invest heavily in local datacentres around Amsterdam."* – Representative of Dutch IaaS Cloud company	2 / 5
Ecosystem and environment	**The Dutch Cloud infrastructure is leading in Europe and is supporting Cloud providers to invest in local datacentres. The availability of knowledge sharing and educational programs appears limited.**	— The Dutch Cloud market is supported by world's leading digital infrastructure (referred to as the Dutch 'Third Mainport'), high internet connectivity and a mature industry of data centres. - Amsterdam internet exchange (AIX) is world leading in terms of peak traffic and number of participants; - Dutch connection speed scores 4th highest in the EMEA region in 2015. — Limited evidence of Cloud start-up ecosystem, or of knowledge sharing, mainly because the Cloud segment is dominated by large players. — Dutch universities educate around 4,500 students in IT related fields, though only few schools or universities appear to have dedicated Cloud programs or knowledge centres (e.g. NCOI).	*"The Dutch Cloud infrastructure is leading in Europe due to its central location and direct connection with the United States, which is why many Cloud providers have set up datacentres around Amsterdam."* – Dutch Cloud market expert	4 / 5

Key: **1**   Low strength   **5** High strength

Cloud Computing – Dutch competitiveness

The Dutch Cloud landscape is dominated by large players from the US, with several smaller local companies offering IaaS solutions (2 / 2)

Competitive strength of Dutch sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Areas of competitiveness (industry driven and other)	**The Dutch infrastructure is not strengthening Dutch competitiveness, as it primarily benefits international players. However, Dutch companies are competitive in the SME segment.**	— Despite the strong Dutch internet and connectivity infrastructure, Dutch Cloud companies are not able to fully leverage its advantages as international companies seem to be its largest beneficiaries.
		  - The strong Dutch infrastructure has attracted several large international players to set up their European Cloud infrastructure in the Netherlands;
		  - These companies have taken market share from local companies, leveraging their size to generate economies of scale. As such they appear the primary users and beneficiaries of the Dutch infrastructure.
		— Interview feedback suggests Dutch players could compete with large international players based on added services and higher customisation in the SME segment.
		  – Dutch IaaS companies report they win market share from large multinationals because they are willing to provide local services (e.g. help desk and dedicated post-sale customer support) and product tailoring (e.g. security, pricing, capacity) that international companies are not willing to offer to SME customers.
			"The Dutch infrastructure is attracting multiple players from the United States. It does little to improve the competitiveness of local Dutch players." – Dutch Cloud market insider
			
			"We are able to compete with Google and Amazon by tailoring our proposition for SME clients and by offering additional local services." – Representative of Dutch Cloud company
				2 / 5

Overall conclusion of the competitive strength of the Netherlands	**General Dutch competitiveness appears limited, though in the IaaS segment some Dutch players manage to compete on flexibility and service.**	— The Dutch sector is dominated by a few large international companies mostly from the US (e.g. Amazon Web Services, Microsoft, Google), because Dutch players lack scale relative to large multinationals. - Few Dutch companies are active in the PaaS segment (e.g. SaaS Plaza) due to large economies of scale in developing a diverse PaaS ecosystem. — In the SME segment Dutch IaaS players compete with international players based on customisation and added services.	*"Dutch Cloud companies have limited competitive strength relative to international players because they lack scale and can leverage a limited number of other differentiators."* – *Dutch* Cloud market insider	2 / 5

Key: **1**   Low strength   **5**   High strength

Cloud Computing – Dutch competitiveness

Dutch companies in the Cloud computing sector mainly offer IaaS solutions

Type of player	Description of solution	Examples of Dutch companies	Reasons for export strength[1]	Assessment of export strength
PaaS	— Platform to support the prompt development of new software. Capacity could easily be scaled up if necessary, enabling faster development cycles. — PaaS platform to enable the online use of SaaS software such as ERP software (e.g. Microsoft Dynamics) to the customers.	SaaS servoy, wercker, AppMachine THE NEXT STEP IN APP BUILDING	— The number of local Dutch PaaS providers appears limited. — Some PaaS providers (e.g. Servoy) already have a presence abroad in Germany. — Lack of evidence that Dutch companies have a significant competitive advantage over German companies due to limited scale of Dutch players relative to German players (e.g. SAP and Deutsche Telekom).	2 / 5
IaaS	— The use of data platforms for data storage, Big Data analytics and data protection. — Provision of dedicated servers and virtual servers to enable fast and secure information exchange. — Colocation of data across different centres to ensure protection and enhance operational efficiency. — Advisory services to help the customer form an IaaS strategy.	leaseweb reliable hosting, centric connect.engage.succeed, interxion, EQUINIX, kpn, eshgro cloud services, uniserver, CTAC ENABLING YOUR AMBITION, Interconnect	— Significant number of Dutch IaaS providers available. — Evidence suggests that Germany is already an important market for some Dutch players (e.g. LeaseWeb). — Limited evidence of competitive advantage of Dutch players over large German players on price or functionality.	3 / 5

Key: **1**   Industry with low export strength   **5**   Industry with high export strength

Source: (1)   Interview program, desk research, press clippings, KPMG analyses

Cloud Computing – German competitiveness

The German Cloud computing sector is dominated by US-based players which invest heavily in local data centres (1 / 2)

Competitive strength of the German sector from an international perspective

	Conclusion	KPMG insight	Interview feedback	Assessment of strength

Number and characteristics of players	The sector is dominated by international providers from the US, with Top-5 players taking up more than 50% market share in both the PaaS and IaaS segment. Especially in the PaaS segment small players find it difficult to compete.	— The German IaaS segment is dominated by large international players from the US, with Amazon Web Services, Microsoft, IBM and Google taking up 50% market share.[1]
		  - Almost all IaaS capabilities are imported from the US, because US players can offer low prices due to massive economies of scale.
		    - The market leader Amazon Web Services leads the market with 30% market share and rapidly increasing profit margin of over 20%.[1]
		  - Several smaller German players (e.g. Dunkel, Nexinto) can compete because of strict data storage regulations.
		— The German PaaS segment is also dominated by large multinationals whom cumulatively have roughly 70% market share[1] (Amazon, Microsoft, Google, Salesforce and HP).
		  - The PaaS segment is dominated by large US players (even more so than in the IaaS segment) because clients prefer providers with a broad range of cloud ecosystems.
		    - Due to a comprehensive product range customers do not have to contract several provider and can buy all their PaaS products from one company;
		    - Amazon is the leading player with a market share of around 30%.[1]
		  - Interview feedback suggests that small players in particular find it difficult to satisfy the demand for flexible cloud ecosystems.
			"Large companies from the United States take up most of the market. Smaller German competitors cannot compete based on price." – Sales representative of German Cloud company
			
			"Large companies from the US take up most of the market. Smaller German competitors cannot compete based on price." – Sales representative of German Cloud company
				4 / 5

Ecosystem and environment	The German Cloud infrastructure is strong due to its central location in Europe, driving significant investments that further strengthen the position of Cloud providers active on the German market.	— Most Cloud service providers that are active on the German market have physical data centres in Germany, which also serve the rest of Europe.
		  - Currently Frankfurt is one of the largest hubs in Europe in terms of data centre density and connectivity.[2]
		— Although the Dutch infrastructure is strong, the Frankfurt Internet Exchange is equally powerful, similarly strengthening the competitive position of cloud providers active on the German market.
		  - Most international companies (e.g. Google, IBM, HP) have set up local datacentres in Germany to win customers in the German market;
		  - Major investments were made in German data centres by all international players (e.g. by Amazon, IBM).[2]
			"Frankfurt has the unique advantage to be located in Central Europe, guaranteeing low latency and a high connectivity density at the same time, which renders it the preferred location for us." – Representative of US Cloud provider[2]	3 / 5

Key: **1**   Low strength (High opportunity for Dutch players)   **5** High strength (Low opportunity for Dutch players)

Cloud Computing – German competitiveness

The German Cloud computing sector is dominated by US-based players which invest heavily in local data centres (2 / 2)

Competitive strength of the German sector from an international perspective				
	Conclusion	**KPMG insight**	**Interview feedback**	**Assessment of strength**

Areas of competitiveness (industry driven and other)	**Strict German regulations could strengthen the position of players with local data centres. Cooperation between the German regulator and Cloud providers could further benefit the competitiveness of locally active players.**	— Due to historically strict privacy regulations (e.g. IT Security Act in 2015) local Cloud providers may have a competitive advantage when it comes to meeting data protection and other security standards for IaaS and PaaS solutions.
		  - Evidence suggests that most locally active companies have more experience meeting local rules and regulations (e.g. guarantee to store Telecom data in Germany in line with German privacy regulations);
		  - Future privacy regulation in EU will be more aligned due to the General Data Protection Regulation (GDPR).[1]
		— The German government cooperates closely with Cloud providers to promote the security of Cloud solutions.
		  - The German government has recently published requirements and recommendations to promote security standards in the German Cloud sector while maintaining quality and flexibility.[1]
		    - Market participants were invited to discuss what regulations would optimise protection without harming the sector.
			"Germany has one of the most strict privacy regulations in the world, and these regulations are increasingly getting more strict. This is beneficial for local German Cloud providers who know the German compliance standards." – German Cloud market insider
			
			"The German Federal Office for Information Security invited a range of Cloud providers and users to discuss minimum security standards in Cloud computing." – Sales representative of German Cloud company
				3 / 5

Overall conclusion of the competitive strength of Germany	**The competitive strength of the German market is high. However, the market is dominated by international companies.**	— The German market is dominated by multinationals both in the IaaS and the PaaS segments. — Due to massive economies of scale the role for smaller players from Germany or the Netherlands is limited, especially in the PaaS segment. — German cloud computing infrastructure is strong, driving active international players to invest heavily in German Cloud data centres.	*"Large American players are highly competitive and it is not easy to enter this sector if you do not have scale."* – Sales representative of German Cloud company	3 / 5

Source: (1) German BSI website

Key: **1** Low strength (High opportunity for Dutch players) **5** High strength (Low opportunity for Dutch players)

Cloud Computing – Entry barriers

Entry barriers are high due to increasingly strict regulations and severe competitive intensity

Entry barriers to Germany				
	Conclusion	**KPMG Insight**	**Interview feedback**	**Assessment**
Formal regulations	Strict formal regulations could require Dutch companies to set up local datacentres. Compliance with German regulations could also be challenging.	— German telecommunications data is legally required to be stored locally in order to prevent serious crimes. Dutch players that would like to store this data should set up local data centres for IaaS and PaaS solutions, or sub-contract local data centres. — Increasingly strict Cyber Security regulations in the Cloud sector (e.g. concerning authentication, physical access, back-ups, system updates) create barriers for international players that have no experience with Cloud regulations in Germany.	*"In Germany rules and regulations are different. We have to build a datacentre locally, which is what we plan to do."* – Business developer of Dutch Cloud company	2 / 5
Local preferences	German customers have a strong preference for working with Cloud providers that store data in Germany and that have local staff and offices.	— German companies have a strong preference for working with cloud providers that host physical datacentres located in Germany, with 76% of clients indicating this is a "must-have".[1] — German companies also have a strong preference for Cloud providers with local offices: 72% of respondents indicate that Cloud providers must have offices in Germany.[1]	*"German companies have a strong preference for Cloud providers with local offices and datacentres. They will generally not trust companies without"* – Representative of Dutch Cloud company	3 / 5
Competitive intensity	Smaller companies could find it difficult to compete on price as they lack the economies of scale required to offer competitive prices.	— Differentiation in both industries is moderate to low. Companies only differentiate on customisation, service levels, and the diversity of your PaaS ecosystem. — Competitive intensity is high as not a lot of differentiation is possible. The market is dominated by large international players whom have achieved significant economies of scale.	*"Due to low ability to differentiate and high-capital investments, large players generally earn high margins and small players earn low margins."* – Cloud market insider	2 / 5
Market Maturity	Although the Dutch adoption rates are slightly higher, both Germany and the Netherlands have a mature Cloud sector.	— The adoption of both the IaaS and the PaaS segment of the Cloud sector is growing rapidly in both countries. — Interview feedback suggests that Germany lags behind the Netherlands in terms of cloud adoption due to Germany's initial reluctance to adopt Cloud solutions, though both countries lag behind the United States.	*"The market for Cloud solutions in Germany and the Netherlands is mature relative to other European countries, though the Netherlands has even higher adoption rates."* – Cloud market insider	3 / 5

Key: **1**   High entry barrier   **5**   Low entry barrier

Source: (1)   KPMG Germany Cloud Computing Survey (2015)

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Appendix
Sources for data collection: primary and secondary research

Sources for data collection

Primary and secondary research

Primary research (74 interviews)		
Sector	Netherlands - 58	Germany - 16
Inst. Industry experts and institutions	13	-
Companies Big Data	9	2
IoT	9	5
Robotics	5	3
Cloud	6	-
Cyber Security	11	6
Enterprise Solutions	5	-

Main secondary research sources
Dutch market
CBS (Central Bureau for Statistics in the Netherlands)
Gartner ICT spending forecast (Q3 2016)
Monitor Top Sectoren (2016)
Digitale agenda – vernieuwen, vertrouwen, versnellen
SEO – Economische kansen Nederlandse cyber security sector
Roboned – Dutch Robotics Strategic Agenda
German market
Experton Group – IoT German vendor benchmark (2016)
Experton Group – big Data German vendor benchmark (2016)
Experton Group – Cyber security German vendor benchmark (2016)
Experton Group – Cloud computing German vendor benchmark (2016)
Roland Berger – Digital transformation of industry (2015)
Acatech – Industry 4.0 in a global context
BCG Perspectives – Digital Germany
Arthur D. Little – The German Internet Study (2016)
Acatech – Industry 4.0 in a global context
KPMG Germany – Cloud computing survey (2015)
Global market
Wikibon - 2016 – 2026 Worldwide Big Data market forecast
Wikibon – Public Cloud spending IaaS 2015 - 2026
Frost & Sullivan – Worldwide IoT market forecast 2009-2019 (2014)
Grandview research – Robotics process automation Market analysis (2014)
IDC – Worldwide spending on Robotics forecast, 2016
Cyber Security ventures – Cyber Security market report q4 2016
Market media research - Global Cloud market forecast 2015 - 2020
IHS – network security appliances & software market tracker (2016)
TCS – IoT, the complete re-imaginative service. (2015)
Capgemini – Trends in cyber security 2016 - 2017
Micro market monitor – Cyber security market research report

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