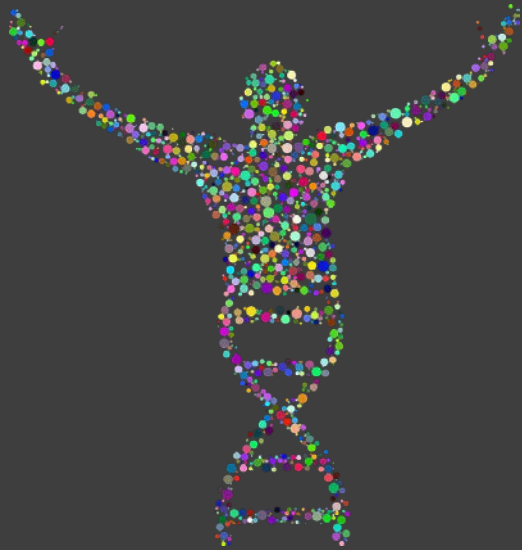


A satellite view of Earth at night, showing a dense network of city lights across the continents. The horizon is visible, and a vibrant aurora borealis (northern lights) is seen in the upper right portion of the image, displaying shades of blue and green. The overall scene is set against the dark backdrop of space.

Software-Verlässlichkeit – entscheidender Erfolgsfaktor für Industrie 4.0 und Künstliche Intelligenz

Ina Schieferdecker, 13. März 2019, Berlin

SOFTWARE ?



DNA → Biochemie → Leben



Software → Mikroelektronik → Ausführung

KEINE ZENTRALEN SYSTEME OHNE SOFTWARE



Da Software unsere Welt steuert, unsere Autos und Flugzeuge lenkt und unsere medizinischen Instrumente dirigiert, wie schaffen wir es, zu gewährleisten, dass die Software verlässlich genau das tut, was sie soll?

SOFTWARE ALS GRUNDLAGE VON INNOVATION UND NEUEN MÄRKTEN



The Economic Impact of Software

EUROPEAN UNION¹

Software changes lives. The way we work, play, and move is being transformed by new software — not just on your computer, but by apps, big data, and access to the cloud. From [optimizing plane routes](#) to [improving life for people with Parkinson's disease](#), innovation is happening at every level. To understand the impact of this, Software.org: the BSA Foundation commissioned the experts at The Economist Intelligence Unit (EIU) to examine the software industry's economic role. They studied the European Union (EU) and seven member states: France, Germany, Italy, the Netherlands, Poland, Sweden, and the United Kingdom. The research shows which countries are seeing the biggest benefits from software's growth — and how others can share in that success.

The stakes are high: All in, software was responsible for €1 trillion of total EU value-added GDP in 2016.² That's an increase of 9.9 percent from 2014, compared to overall GDP growth of 6.0 percent over the same period. And software supports other sectors, too — think of it as double-clicking on growth.



It's not just about coders. The software industry provides jobs in every field, from disaster recovery services to data processing and accounting. As Europe closes the digital skills gap,³ companies are hiring for jobs that simply didn't exist a decade ago — roles like strategic cloud data engineer, big data product specialist, and futurist. Across the EU, work supported by the software industry through direct, indirect, and induced contributions represents 12.7 million jobs.

Total³ Value-Added GDP:

€1 trillion

Up from €910 billion in 2014, a 9.9% increase

Direct Value-Added GDP:

€304 billion

Up from €249 billion in 2014, a 22.4% increase



The total direct wages paid by the software industry for all 28 EU member states grew to €162.1 billion from €139.2 billion in 2014, an increase of 16.4 percent. Wage growth in smaller countries is particularly impressive: total salaries paid by the sector in Sweden grew 31.4 percent over the two years to 2016, and by 30.4 percent over the same period in Poland.

GERMANY

Europe's largest economy, Germany is the continent's manufacturing powerhouse and recognised worldwide for its motor industry, precision engineering, and chemicals expertise. The German economy isn't just driven by global names like Siemens, Daimler, and BASF, but also the wide range of SMEs that supply them, or are world leaders for a specific niche product, known as the *Mittelstand*.

These smaller companies are increasingly using software to improve manufacturing techniques, integrate their products with the internet of things (IoT), or just make more effective use of data for a better customer experience.⁴

Germany is also home to major software companies like SAP, Maxon, and Software AG. The software industry directly contributed €66 billion to the German economy in 2016, up 6 percent from 2014. Within the EU, it is second only to the UK in terms of this metric. Germany spent €2.9 billion on R&D in 2015, the latest available data. In addition, Germany's software industry paid the highest direct annual wages from the countries surveyed.

Total⁷ Value-Added GDP:

€159.7 billion

Up 4.6% from 2014

Direct Value-Added GDP:

€66 billion

Up 6.0% since 2014



While most jobs are concentrated in computer programming, Germany saw an increase in direct jobs in data processing, hosting, and related activities of 12.1 percent since 2014.



Total direct wages paid by the software industry are the highest in Germany, followed by the UK and France.

⁴ "Germany's Mittelstand Adds New Data to Old Technology," Financial Times, October 24, 2016, available at <https://www.ft.com/content/50e971c-690d-11e6-a0b1-d87a9fe0334f>.

⁷ Direct, indirect, and induced.

Software-Verlässlichkeit ist ein differenzierendes Merkmal in einer zunehmend vernetzten Welt!



Verlässlichkeit von Software

Software ist allgegenwärtig und kommt überall im täglichen Leben zum Einsatz: in der Kommunikation, der Industrie, im Haushalt, in der Medizintechnik und in sicherheitskritischen Bereichen. Umso entscheidender, dass Software verlässlich ist. Dabei umfasst Verlässlichkeit von Software sowohl funktionale Anforderungen als auch Fehlererkennung, Datenschutz und weitere Aspekte. Die Grand Challenge der Informatik: Entwicklung durchgängiger Methoden und Werkzeuge, um die Verlässlichkeit von Software zu garantieren. Mittel- bis längerfristig lässt sich so das Verhalten von Software vorhersagen. Auf Basis von Dokumentationen können Softwaresysteme dann sowohl in der Entwicklung als auch im Betrieb automatisiert zertifiziert werden. Auf Fehler kann ein Softwaresystem mit selbstheilenden Mechanismen reagieren, so dass bei lokalen Ausfällen die Stabilität des gesamten Systems nicht beeinträchtigt wird.

Verlässliche Software steigert das Vertrauen der Nutzer, führt zu einem effizienteren Einsatz knapper Ressourcen und verhindert Katastrophen in sicherheitskritischen Bereichen.

5
DIE
GRAND CHALLENGES
DER INFORMATIK

VERLÄSSLICHKEIT

- Funktionalität
- Leistungsfähigkeit
- IT-Sicherheit
- Datenschutz
- Robustheit
- Langlebigkeit

→ Software-Qualität

- Verantwortung
- Wirkung
- Kennzeichnung
- Nachvollziehbarkeit
- Beherrschbarkeit

→ Gütekriterien



iRights.Lab und Bertelsmann
Stiftung stellen Algo.Rules vor

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**Interessante und inspirierende Diskussionen
und Erkenntnisse !**