German Engineering

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Technology Sciences

Technology Sciences describe and document technology, make it accessible and develop it further.

- Gather, evaluate, archive (current state of technology)
- Provide knowledge and teach
- Research

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Fields of Technology Sciences

- Civil engineering
- Mechanical engineering (including materials engineering and process engineering)
- Electrical engineering (including energy engineering and communications engineering)
- Information technology
- Biotechnology
- …

Institutions of Technology Sciences in Germany

- Research institutions
- Universities
- Universities of Applied Sciences
- Others

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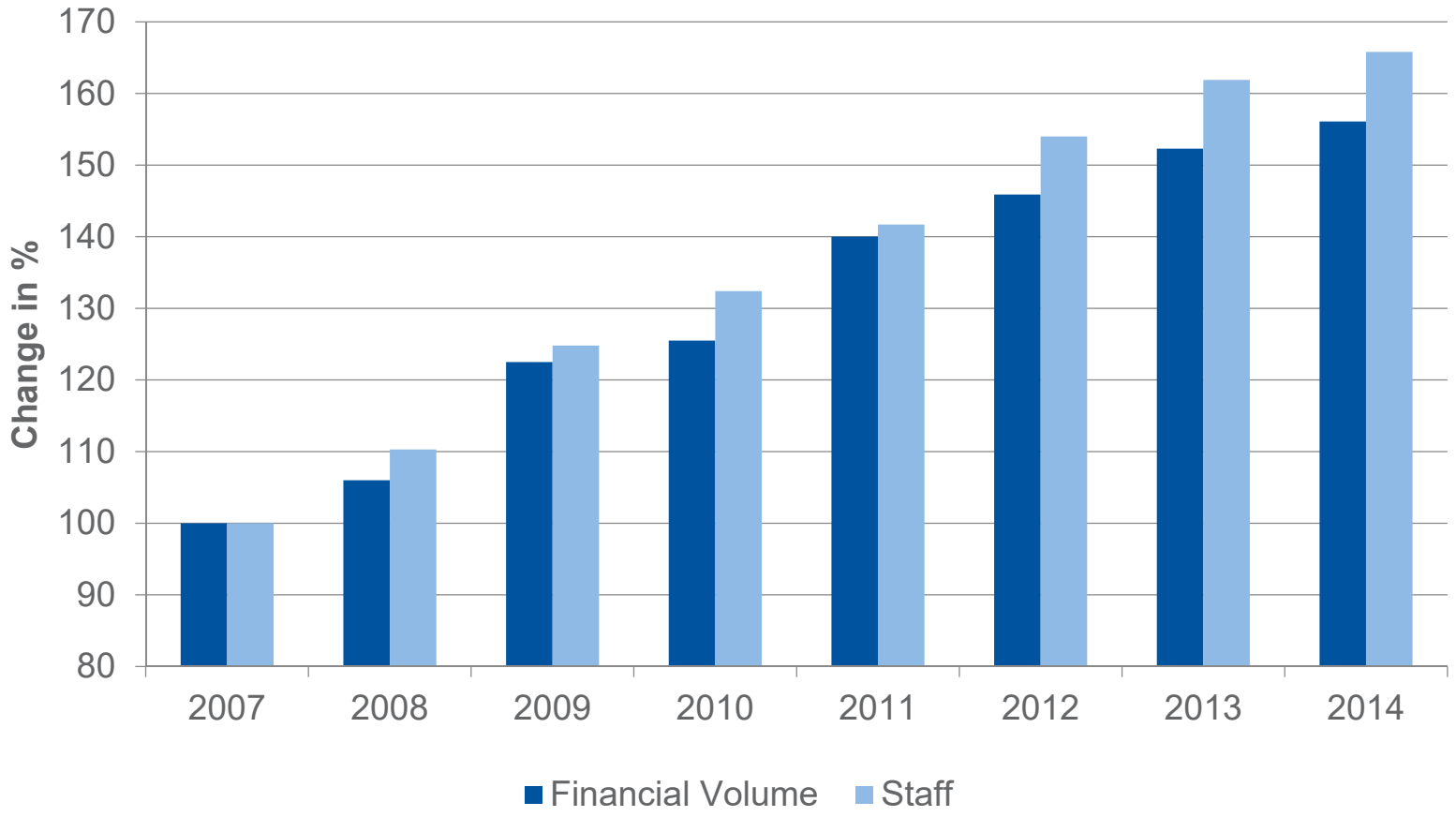
Institutions of Technology Sciences: Fraunhofer Institutes



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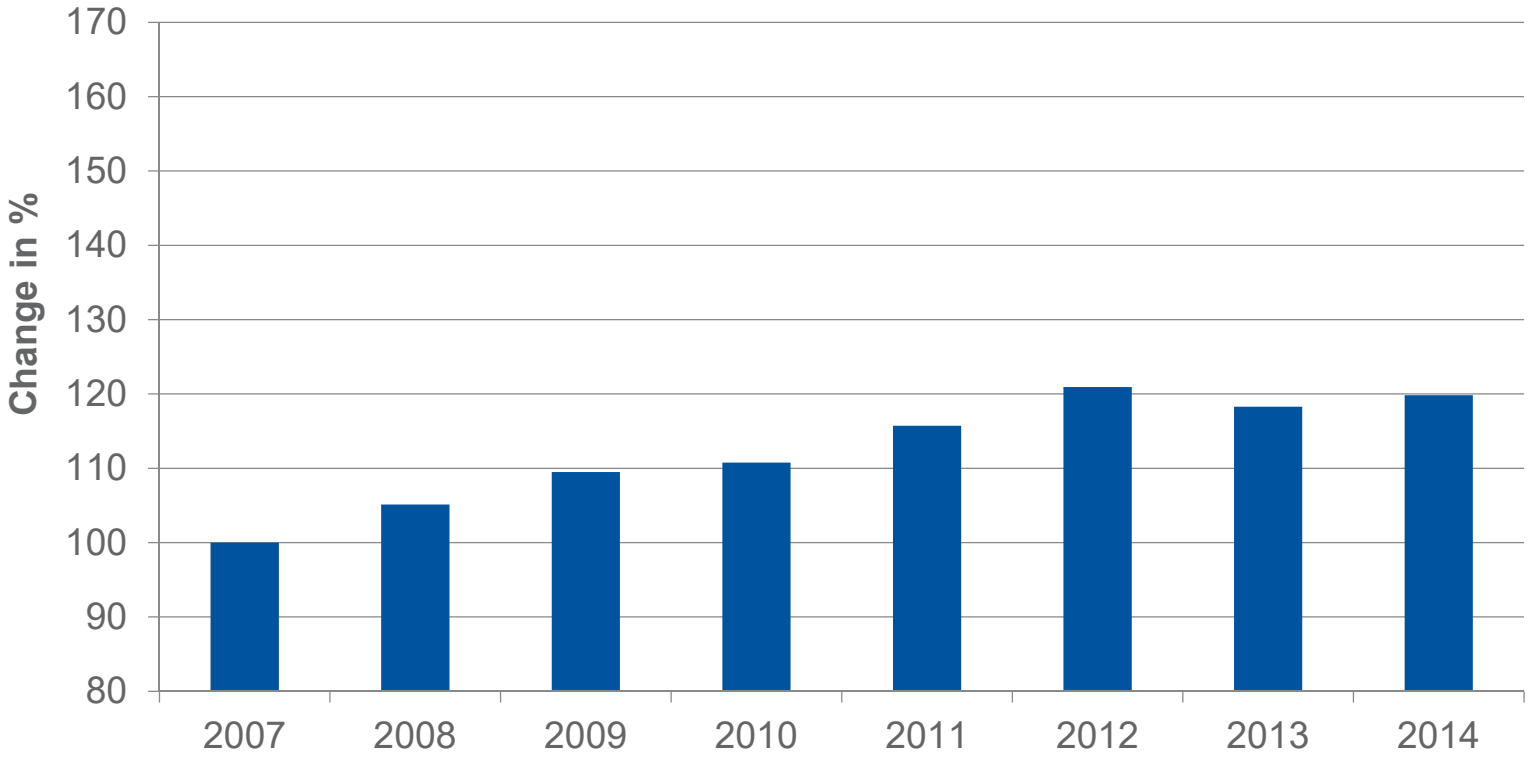
Institutions of Technology Sciences: AiF (Industry Research Alliance)



Budget development of German Federation of Industrial Research Associations
(2007: €117 MM.)

Institutions of Technology Sciences: Universities
Median annual funding of DFG 2011 - 2013

Field of Science	Funding (€MM)	% of total
Humanities	346.2	15.4
Life Sciences	737.1	32.8
Natural Science	476.7	21.2
Technology Science	447.6	19.9
Other fields	241.2	10.7
Total	2248.8	100.0

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Institutions of Technology Sciences
Compare: External Funds and Students in First-Subject-Related Semester

Type	Characteristic	Third-party funding/ professor (€)*	% of total students**
University	"equipped for research"	604,100	43 %
University of Applied Sciences	"mostly involved in teaching"	27,100	57 %

* 2012
** WS 2014/15
www.destatis.de

Other Institutions of Technology Sciences

- Scientific associations
- Academies
- Museums
- Patent agencies
- Testing authorities

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Technology Research

Research is the methodical and systematic search for the unknown, based on open questions with an uncertain outcome.

- Research and knowledge are closely linked
- The unknown most often lies on the edges of the discipline
- The great challenges in technology research today lie in the investigation of the behavior of large systems

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Technology Research Methods

- Model building
- Experiments

} To analyze and synthesize operating principles

- Hermeneutic methods to verify knowledge based in experience
- Social-scientific methods in the man-machine-interaction

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Relevance of Technology Research

- Goal of technology research: New and improved technology (application)
- Necessity to cooperate with industry: Gather relevant questions for technology research!

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Engineering

The term engineering defines the profession of those who develop technology based on knowledge and implement it.

The profession historically developed from an experience-based (craftsmen) to a science-based profession

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The Profession of an Engineer

- Method competence (mathematics, sciences, technology)
- Application competence (experience in product development, production technology, use of technology)

Technology develops evolutionary, in big businesses – specialization, long-term success, ability to co-operate

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Engineering Education

University	University of Applied Sciences	Education
Technology-scientifically oriented	Engineering-professionally oriented	Dr.-Ing. (ability to research)
		Master
		Bachelor (qualified for a profession)

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Facts: Engineers in Germany (VDI)

Working engineers:

• Year 2005:	1.39 M
• Year 2011:	1.66 M
• Increase 2005-2011:	ca. 19 %

Engineering gap - 1st quarter 2015:

• Job-seeking:	29,728
• Open positions:	59,430
• Engineering gap:	29,702

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Conclusion

In the fields of technology we distinguish between

Technology Scientist	Engineer
Mastering the scientific work methods	Mastering the knowledge of the state of technology
Ability to teach and research	Ability to develop and operate technology

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Thank you for your attention!