

Doctorates @ TUM: Preparing for Careers & Involving Future Employers

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Forging Industry-Ready Scholars:

The Future of Employment-Aligned PhDs

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www.gs.tum.de



Prologue

A remark concerning history:

Mandate of “Technical Universities” (Institutes of Technology) in Europe in the 19th century:
Support the industrial revolution | support the developing industrial societies | build capacity
(no Nobel Prizes, impact factors, h-indices etc. around 😊)

Hence, the orientation towards employers | industries | societies is part of our DNA – not new.

Just one number: >90 % of those graduating with an engineering PhD from a Technical University in Germany want to leave and leave the academic sector (a feature, not a bug).

Who We Are

TUM Graduate School

Facts and Figures

(statistics 2022)

9,584

current members



1,159

Graduations in 2022



29%

International doctoral candidates

1,690

Intakes in 2022



Established in
2009



111
different nationalities



40%

Female doctoral candidates



**China,
Austria, Italy,
India, Iran**

Top 5 international countries of origin



Mandate & Structure

TUM: ranked #1 among universities in the European Union

TUM Graduate School: the organizational body to implement uniform standards in the doctoral qualification TUM-wide

TUM Graduate School: is organized into

- **School Graduate Centers** (8) and **Interdisciplinary Graduate Centers** (3)
- **Management Office** at TUM Campus Garching
- **Graduate Dean** as a member of the TUM Extended Board of Management
- **Graduate Council** as representative body of all doctoral candidates at TUM (with explicit representation in the School Councils and in the TUM Senate)

Doctorate @ TUM

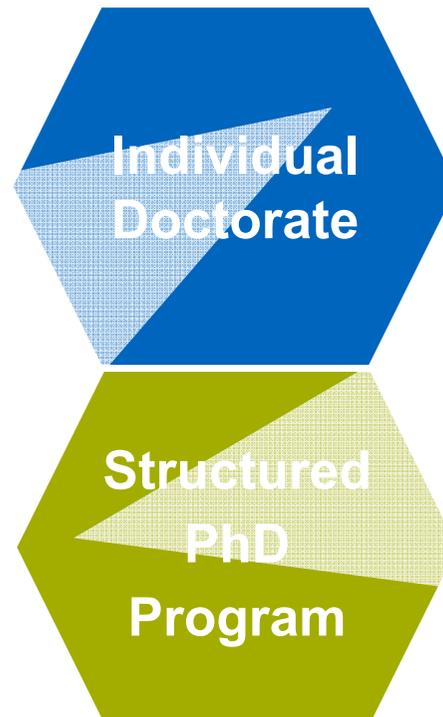
The TUM doctoral model

Doctorate in Germany

Traditional German doctoral model, still the **most common way** to do a doctorate (over 75% of all doctorates in Germany)

Doctoral research under the **supervision of one professor** who is also the **main examiner** and – in particular in STEM – boss

Doctoral candidates not as “students” but as **independent young researchers** in their first career phase



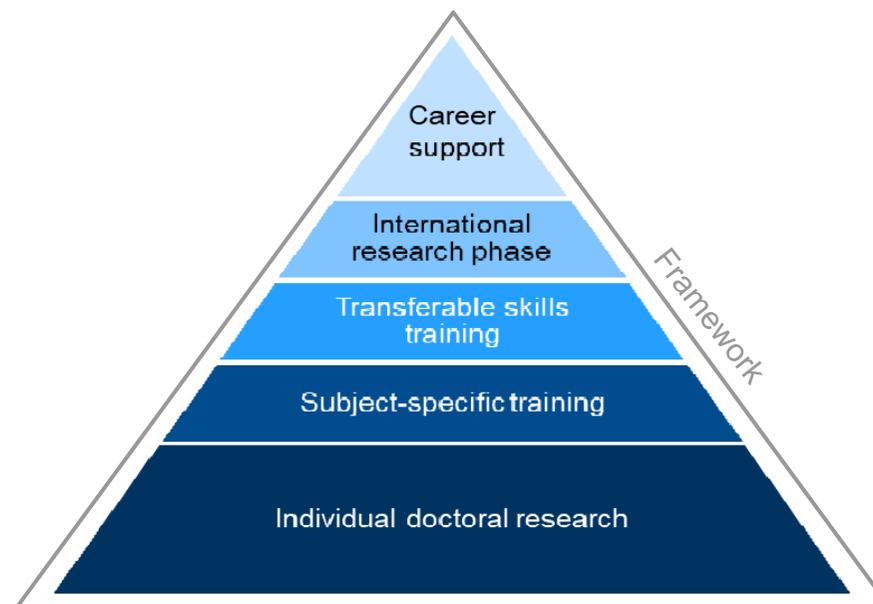
Similar to PhD programs in Anglo-American higher education systems

Clearly **structured doctoral study program** with exams and credit points

Supervisor team | TAC

The TUM doctoral model – combining both

The TUM doctoral model ensures **independent research** while providing a **soft structuring framework** and extensive training opportunities. Each member can tailor the doctorate to his*her individual needs.



Individual doctorate – funding models

Employment at TUM:

Research associates are employed at a TUM research group.

- *Funding: university | public | **industry***
- Work closely with supervisor (also boss)
- Involves teaching and administrative tasks
- Part of TUM research staff with access to staff development facilities

Scholarship/ Grant:

Scholarship holders finance their doctorate with funding from an external organization. No TUM scholarship programs.

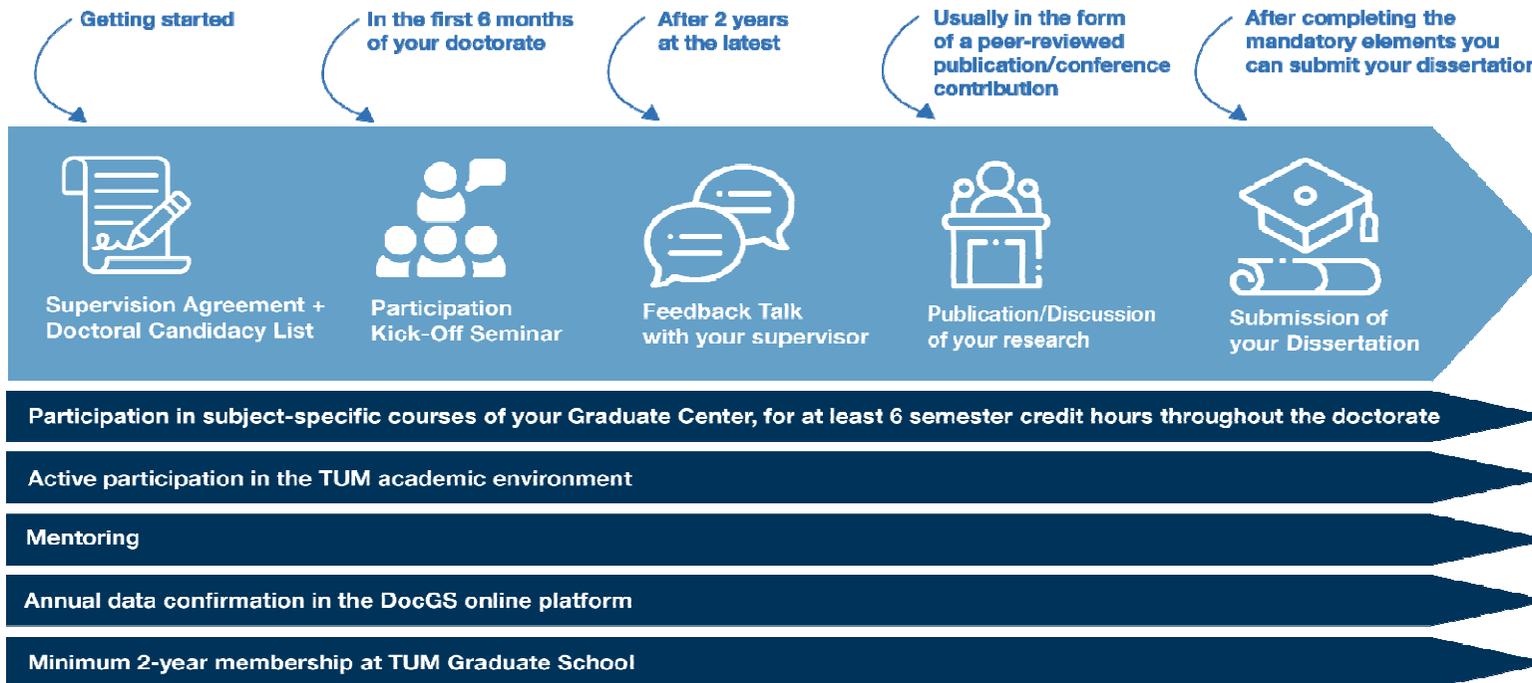
- *Funding: foundations | DAAD | countries*
- Active participation in the academic environment of TUM required
- Often more freedom (topic, time)

External Doctorate:

Candidates work for a company or an external research institution while being supervised by a TUM professor.

- *Funding: national labs (MPG, ...) | **industry***
- Active participation in the academic environment of TUM required
- Less integration into the daily business of the TUM research group

Framework & Mandatory Elements of your Doctorate at TUM



Icons: FlatIcon - Freepik, Write Studio, Julcy Fish

Transferable Skills Training

TUM-GS provides **more than 70 courses** per semester, ca. **50%** of those are in **English**.

The courses are organized in **6 categories**, with “**Business & Industry**” and “**Entrepreneurship & Startups**” especially focused on career-oriented topics outside academia and research

Plus possibility of individual coaching



Doctorates with Industry

@Technical University of Munich



“Industry PhD” @ TUM

- Doctorate in collaboration with industry as a specific model (funding source) of the traditional individual doctorate.
- Either as part of a framework agreement TUM-company R&D or individually arranged doctoral supervision, independent of (pre-)existing collaborations.
- Each doctoral candidate prepares his/her dissertation under the academic supervision of a TUM supervisor.
- The fundamental rules governing doctoral research are the TUM regulations for the award of doctoral degrees.
- All candidates must be involved in the academic environment of TUM, e.g. teaching activities.

Doctorates and external collaborations

Results from the Nacaps survey of doctoral candidates at TUM

Collaborations among doctoral candidates

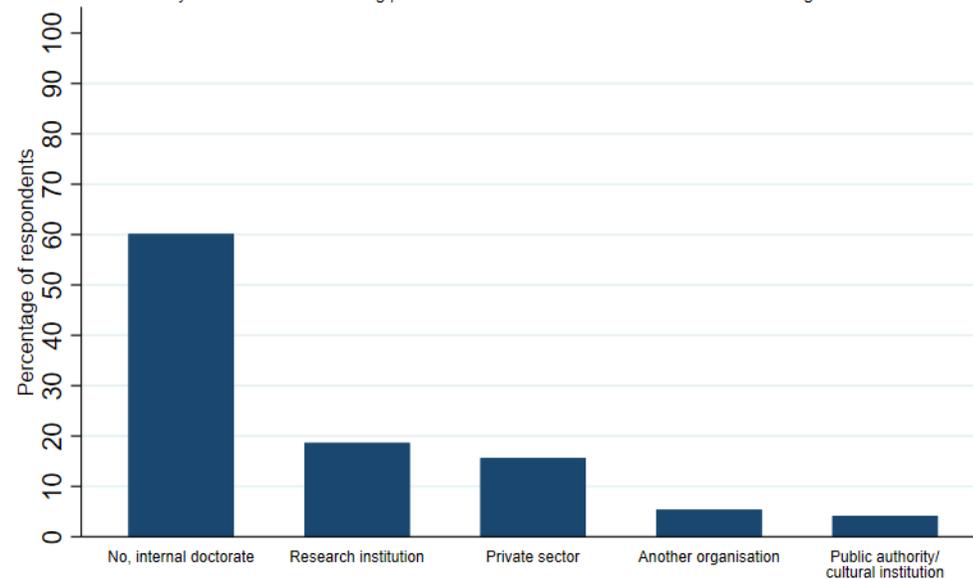
In total, 36 % of respondents report a doctorate in collaboration with at least one external organisation (Cohort 2018: 33 %)

Most commonly, collaborations take place with research institutions (19 %) (Cohort 2018: 16 %), followed by the private sector with 16 %.

Of those collaborating with the private sector

- Collaboration agreement in place for 61 %
- With working contract at company: 32 %
- Private company funds position at University: 30 %

Doctorates in collaboration with external organisations
Is your PhD/doctorate taking place in collaboration with one or several external organisations?



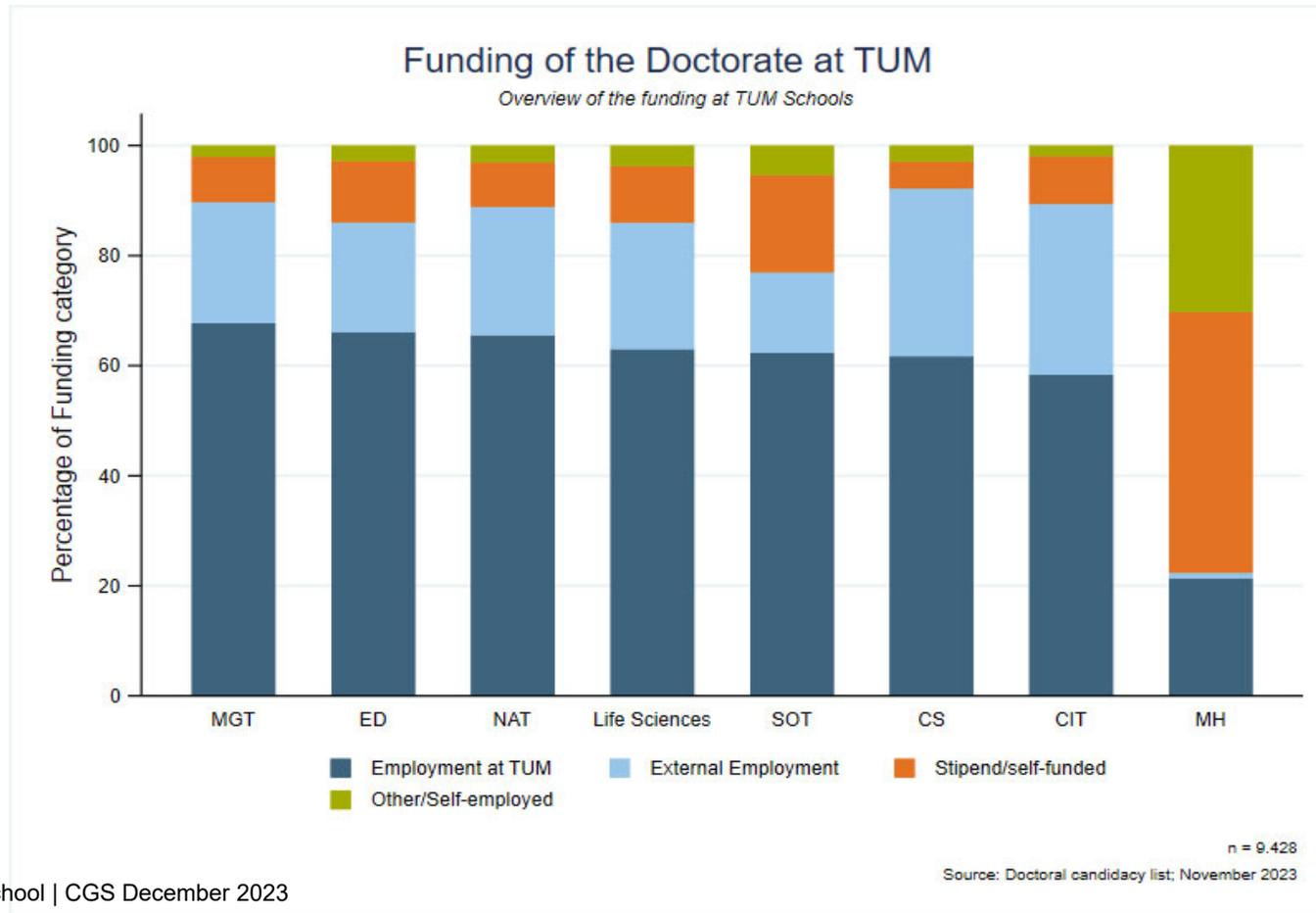
n = 1,299

Source: Nacaps Cohort 2020
Multiple answers possible

Doctoral candidates in external employment

- In total, **17 %** (~ 1,650) of doctoral candidates at TUM are in external employment based on their own disclosure.
- Almost a third of doctoral candidates in the research field of biotechnology and computer science are in external employment.
- 23 % of doctoral candidates in the life sciences are externally employed.
- External employers include companies and external research institutions and other universities
- **Top 8 companies/non-university institutions** with currently active doctoral candidates:

BMW AG: 83	German Aerospace Center – DLR: 77
Infineon: 36	Huawei: 33
Siemens AG: 32	Volkswagen AG: 14
McKinsey & Company: 10	Daimler AG (Mercedes): 10



Recommendations for doctoral projects in cooperation with universities of applied sciences, non-university research institutions, and companies

Last edit: TUM, Oct. 29, 2016 – translation as of Jan. 31, 2018

Introduction

The Bavarian Higher Education Act reserves the right to grant doctorates exclusively to **universities**, with few exceptions. Each doctoral candidate prepares his or her dissertation there, under the supervision of an supervisor at the university, generally as an employee of the university or a recipient of a scholarship, fellowship or grant from the university. Further details are governed by the specific doctoral degree regulations of the universities.

Non-university research institutions (such as the Max Planck Society, the Helmholtz Association, and the Fraunhofer-Gesellschaft), **universities of applied sciences**, and a number of companies (collectively referred to herein as "partners") offer their employees or scholarship holders the opportunity to engage in scholarly and scientific work as part of research projects, and, in cooperation with a university, to write a dissertation. In an "**institutional cooperation**,"¹ too, the doctoral project is guided by a supervisor from the university awarding the degree. A professor from a university of applied sciences or non-university research institution can also be included in the doctoral project as a second supervisor and, later on, as a reviewer with equal status. A contact person within the company who has academic qualifications can be designated to act as a mentor for the doctoral project.

The fundamental rules governing doctoral research are the **university's doctoral degree regulations**, in the then-applicable version thereof. These regulations take precedence in the event of any conflict with the rules set out in this guide. Because a doctoral process that takes place through institutional cooperation involves the interests of multiple parties, careful coordination of content and overall conditions is needed, as is unambiguous clarification of the roles that apply in the doctoral process, which should be done early on, when the groundwork for the cooperation is still being laid.

These recommendations were developed and coordinated within a Munich-wide working group among the institutions entrusted with awarding doctorates and the responsible parties from the universities

Technical University of Munich and Universität der Bundeswehr München,
the universities of applied sciences
Munich University of Applied Sciences and Technische Hochschule Ingolstadt,
and the companies

Audi AG, Siemens AG and Infineon Technologies AG.

They represent a shared understanding of what constitutes good cooperation and clarify where and when there is a specific need for coordination on subjects such as identifying topics, supervision and publication of research findings. Further rules and regulations and any agreements that may already be in place with partners, such as those setting down rules on IPR and employment, are not affected by this guide. The goal is to use the principles and best practices outlined to improve the cooperation among all parties involved in doctoral projects in

¹ This guide concerns doctoral projects that take place through institutional cooperation between universities and non-university research institutions, universities of applied sciences, or companies. Depending on how the arrangement is structured, the doctoral process may involve bilateral cooperation between a university and a non-university research institution, university of applied science, or company, or trilateral cooperation among all three. When we speak of "cooperative doctoral projects," we also mean arrangements in which the doctoral candidate is an employee or scholarship holder of the higher education institutions, but cooperates with a partner as part of a research project.

Quality Control: ProMUC

“ProMUC” recommendations for doctoral projects in cooperation with universities of applied sciences, non-university research institutions, and companies

Jointly developed and coordinated within a **Munich-wide working group** representing

- the universities (1) TUM, (2) University of the Armed Forces Munich, (3) UAS Munich, (4) UAS Ingolstadt (LMU Munich associated), and
- the companies (1) Audi AG, (2) Siemens AG, and (3) Infineon Technologies AG

as a quality management tool.

ProMUC – recommendations

- Research project must be **jointly defined** by all parties involved before the start of the doctorate.
- The specific dissertation topic is subsequently assigned by the university supervisor; the content and scope must meet the **academic and scientific standards** of the university.
- Supervising academic and scientific projects is among a university supervisor's original tasks. As a basic principle, no separate remuneration is provided for this.
- Dissertation topics and supervision inquiries submitted by candidates without prior coordination between the partners are typically rejected.
- All interested parties meet at **regular intervals to discuss the status of the doctoral project** and the next steps. Written determination of the discussion cycle and specification of the content discussed form the basis for this coordination.

ProMUC – recommendations

- The doctoral candidate must be **integrated into the academic environment at the university** to an adequate degree and must **participate in subject-specific qualification** activities and measures, including rules for **minimum time spent** at the university and involvement in student teaching and thesis supervision.
- As a basic principle, companies affirm the **freedom to publish**, but in individual cases they may reserve the right to require that written consent be obtained.
- All company processes surrounding publication must be appropriate in terms of time and have transparent content, and the interested parties must be familiar with them.

Further plans

Currently discussed: “**Entrepreneurial Doctorate**”

- **Starting point:** TUM as the most important player in terms of start-ups in the German academic landscape (numbers & impact)
- **Motivation:** doctoral candidates as main pillar of hi-tech start-ups
- **Idea:** combine the “research thread” and the “business thread” in a more organized way than just “let it happen”
- **Implementation:** still to be defined (resolve conflict of “publish results” and “protect IP” | extended entrepreneurial training and support | start-up activities count for PhD)

Thanks!