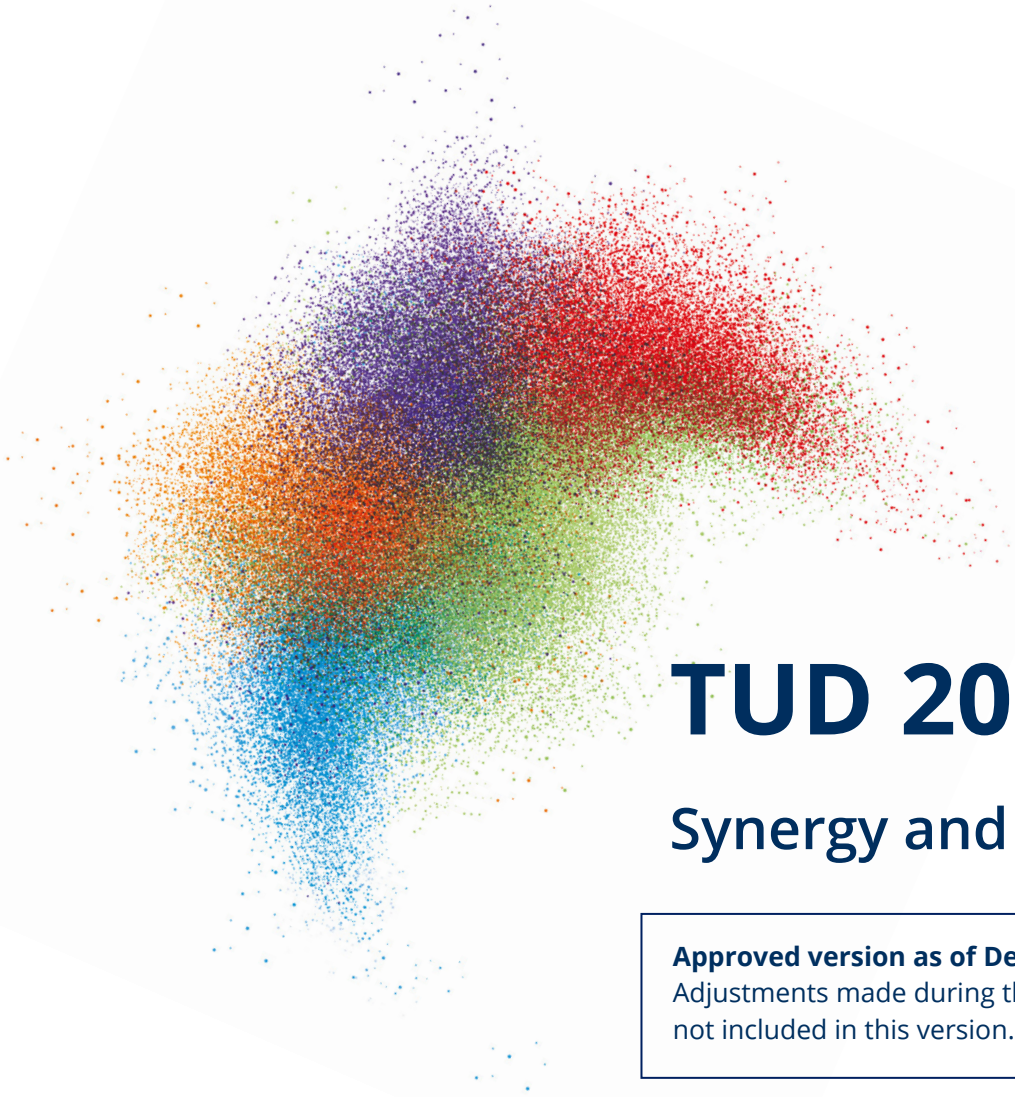
TECHNISCHE UNIVERSITÄT DRESDEN



TUD 2028

Synergy and beyond

Approved version as of December 2018
Adjustments made during the implementation are not included in this version.

Proposal in the Universities of Excellence funding line within the Excellence Strategy programme by the Federal and State Governments

Technische Universität Dresden
Commencement of funding 1 November 2019

DRESDEN concept

Excellence Strategy of the Federal and State Governments

Universities of Excellence Funding Line

TUD 2028

Synergy and beyond

Technische Universität Dresden

Commencement of funding 1 November 2019

Overall Strategy
for Funding in the Excellence Strategy of the Federal and State Governments

TUD 2028
Synergy and beyond

Technische Universität Dresden

Dresden, 6 December 2018	**Prof. Dr.-Ing. habil. DEng/Auckland** **Hans Müller-Steinhagen** **Rector**

Brief profile of the University

Established in: 1828

Academic structural units: 5 Schools, subdivided into 18 Faculties

School of Civil and Environmental Engineering

- Faculty of Architecture
- Faculty of Business and Economics
- Faculty of Civil Engineering
- Faculty of Environmental Sciences
- Faculty of Transport and Traffic Sciences ‘Friedrich List’

School of Engineering Sciences

- Faculty of Computer Science
- Faculty of Electrical and Computer Engineering
- Faculty of Mechanical Science and Engineering

School of Humanities and Social Sciences

- Faculty of Arts, Humanities and Social Science
- Faculty of Education
- Faculty of Law
- Faculty of Linguistics, Literature and Cultural Studies

School of Medicine

- Faculty of Medicine ‘Carl Gustav Carus’

School of Science

- Faculty of Biology
- Faculty of Chemistry and Food Chemistry
- Faculty of Mathematics
- Faculty of Physics
- Faculty of Psychology

131 **Study programmes:** 34 bachelor, 66 master, 22 *Diplom*, 7 state examination, 2 certificate

3 **Clusters of Excellence:**

- Centre for Tactile Internet with Human-in-the-Loop (CeTI)
- Complexity and Topology in Quantum Matter (ct.qmat) jointly with the University of Würzburg
- Physics of Life (PoL)

7 **Profile-forming areas** that have been shaping TUD since 2012:

- **Synergetic University:** Interdisciplinary and interinstitutional cooperations in all performance areas and areas of activity
- **DRESDEN-concept:** Alliance with non-university research and cultural institutions
- **Appointments/Support for Early-Career Researchers:** Tenure Track and Open Topic approach, Graduate Academy
- **Governance:** Bundling of Faculties into Schools
- **Shared Infrastructures & Services:** Cross-institutional technology platforms for equipment and services
- **Culture of Quality:** QM systems in research, teaching and administration
- **Transfer:** Far-reaching knowledge and technology transfer

Data for 2017

Total budget including medicine (revenues) [Dr137]	€586 million
of which third-party funding (revenues/proceeds) [Dr1a or Dr1b]	€269 million
Total budget excluding medicine (revenues) [Dr137]	€462 million
of which third-party funding (revenues/proceeds) [Dr1a or Dr1b]	€225 million
Professors [Be19]	569.2 FTE [Be1] I 607 persons [Be2]
of which male/female/not specified [Be7]	86.0 % m I 14.0 % f I 0.0 % n.s.
of which from other countries [Na58]	7.6 %
Academic staff (excluding professors) [Be68 minus Be19 minus Be18]	3,892.3 FTE [Be1]
of which male/female/not specified [Be7]	66.9 % m I 33.1 % f I 0.0 % n.s.
Doctoral students [Na46/Na38a]	6,273 persons [Be2]
of which male/female/not specified [Be7]	57.5 % m I 42.5 % f I 0.0 % n.s.
of which from other countries [Na58]	20.5 %
Academic support and administrative staff [Be63 plus Be28]	2,146.6 FTE [Be1]
of which male/female/not specified [Be7]	35.1 % m I 64.9 % f I 0.0 % n.s.
Students (excluding doctoral students, 1st subject of 1st course, full-time students in winter semester 2017/18)	30,790 persons [Be2]
of which male/female/not specified [Be7]	56.0 % m I 44.0 % f I 0.0 % n.s.
of which foreign students	12.4 %

Contents

A. Text of proposal

A.1. Summary

Technische Universität Dresden (TUD) has undergone an exceptional development over the past decades, resulting in the award of the University of Excellence title in 2012. The expansion of its core profile areas within the framework of the Excellence Initiative has contributed to a massive boost in performance. Today, TUD boasts three newly approved Clusters of Excellence, ranks 3rd (2016) among German universities with respect to third-party funding, has increased its publication output by 74% (2007-2017) and holds the largest number of patent applications and granted patents nationwide (2007-2017). Its strength in research and transfer is owed to its excellent scientists and scholars, the purposeful formation of its research profile and its effective research support measures. In the area of career development, TUD´s Open Topic approach, its Tenure Track Programme and its Graduate Academy have generated highly visible best practices. Governance reforms, in particular the bundling of Faculties into Schools, has increased our possibilities for strategic development and action. The establishment of QM systems in research, teaching and administration has strengthened TUD's quality culture. Our cooperation with non-university research and cultural institutions within the DRESDEN-concept research alliance is a lighthouse example of pioneering synergetic working methods that is also emblematic of the interdisciplinary interactions within TUD. Synergy, responsibility and professionalism are the constants of the overall strategy, which shall continue to shape TUD's scientific and social endeavours in the future. With the University´s bicentenary **TUD 2028** in sight, a key aim is to consolidate our achievements and successes, and expedite new developments within the framework of the Excellence Strategy. By realising the envisaged projects and measures, TUD aims to (1) recruit and promote academic talents at all career levels, (2) strengthen research areas with great potential while developing its profile, (3) establish and expand regional and international collaborations, (4) increase its impact on science, business and society, and (5) broaden communication and participation guided by the 'Dresden Spirit'. Milestones will be: the university-wide introduction of advanced appointment procedures, the establishment of new key professorships in Emerging Fields, the launch of the Centre for Societal Impact of Disruptive Innovations, the foundation of the transCelerator jointly with King's College London, the pooling of services in the Centre for Transfer and Entrepreneurship, the implementation of a management culture project as well as the inauguration of the redesigned main campus. The further development of fundamental strengths and the mitigation of weaknesses substantially contribute to achieving the primary objective of the overall strategy: to firmly anchor TUD as one of the five highest-performing German universities while decidedly strengthening its international competitiveness and visibility.

A.2. Status quo and prior achievements

A.2.1. Overall profile and starting situation

Since its founding as *Technische Bildungsanstalt* (Technical College) in 1828, TU Dresden's development has been characterised by innovation and the courage to explore new avenues. These attributes helped to overcome the upheavals of the 20th century: TUD recovered from almost complete destruction during the Second World War, and following the German reunification in 1990 - a period of profound political, social, cultural and economic change - the University emerged with renewed vitality. Over the past 25 years, TUD has become one of Germany's leading universities. Its employees' motivation, commitment, willingness to embrace change as well as a culture of innovation, which is firmly anchored at all levels, played a decisive role in this achievement. In the early 1990s, the academic and administrative units were fundamentally realigned, new Faculties (architecture, economics, law, philosophy) were established and various scientific institutions in Dresden were integrated into TUD (Medical Academy, College of Education and College of Transport). TUD gradually expanded its scope of action and took the path towards autonomy without detailed regulation by state ministries. Subsequently, it was the only East German university to be selected in 1997 for the *Stifterverband* model project 'Reform Universities'. In 2000, TUD launched the pilot project 'Results-Oriented Self-Regulation', which subsequently formed the basis for greater financial autonomy of all universities in the Free State of Saxony. The structural development of TUD reached an important milestone in 2018 with the bundling of the Faculties into Schools. By consistently implementing the principle of subsidiarity, the strategic and budgetary capability of its academic units was strengthened, interdisciplinarity was promoted, thus creating room for agility and flexibility.

> The dynamics of TUD's continuous development underline its institutional maturity and its research strength, as recognised by the University of Excellence title in 2012.

The intrinsic willingness to change and innovate is not limited only to the University. It radiates into the entire Dresden region, which, since 1990, has developed into an important business hub and one of the most prominent German scientific locations due to the establishment of new research institutions and high-tech industries. From the outset, TUD recognised the unique potential of close regional collaborations. It was one of the first universities to overcome the detrimental schism between universities and non-university research institutions in Germany by joining forces with partners from science and culture to form the DRESDEN-concept (DDc) research alliance in 2010. Through this institutionalised cooperation between 28 partner institutions, far-reaching synergies in research, teaching, transfer and research infrastructures are realised.

Self-conception

With approx. 31,000 students, over 600 professors and a total budget of around €586 million (incl. €269 million third-party funding), TUD is one of Germany's largest and most distinguished universities, with a particularly strong focus on research. It has not only expanded its traditional strengths in the engineering sciences, but also has a high degree of visibility in the natural sciences, in medicine and in the humanities and social sciences. Nationally and internationally, TUD is highly ranked among other universities (cf. Positioning, p.5). Over the past two decades and together with its non-university partner institutions, TUD has transformed itself into a decisive economic factor and innovation driver for both Dresden and the Free State of Saxony.

We draw our strength from the excellence of our scientists and scholars and the persisting readiness to critically assess priorities, structures and processes, and to embark towards new horizons. The University is convinced that outstanding performance in individual subjects can only be achieved if excellent research and teaching conditions are guaranteed, and if the entire organisation is built on a sustainable foundation, creating a sense of identity. Therefore, a central objective of TUD is to consolidate and continuously develop the quality culture in research, teaching, transfer, infrastructure and administration. Since 2012, the following strategic priorities of the **Institutional Strategy (ZUK) 'The Synergetic University'** have advanced the development of our University:

- Recruiting and promoting the brightest minds
- Ongoing development of quality management
- Intensifying regional and international cooperations
- Expanding transfer activities
- Ensuring optimal conditions for research, transfer, teaching and studies
- Strengthening an equitable, cosmopolitan and family-friendly working environment

The progress achieved and the experience gained in these priority areas contributed to the development and new conception of the measures outlined in this application for the University of Excellence title.

Research Profile

The development of TUD goes hand in hand with the strategic decisions pertaining to its scientific profile, on which appointment planning and research funding are based. Our Research Priority Areas (RPAs) bundle the University´s research strengths and identify areas of particularly high scientific potential. Defined for the first time in 2004, they are designed as flexible, interlinked, thematic platforms that are continuously revised and refined. The current research activities of TUD can be allocated to five RPAs with a high volume of publications and third-party funding. Within the RPAs, Excellence Research

Areas and Emerging Fields are to be identified as ‘profile-forming research areas’, which are described under A.2.2.1.

RPA 1: Health Sciences, Biomedicine and Bioengineering, comprises three research priorities in life sciences, in which fundamental and translational research approaches are combined: regenerative therapies, molecular bioengineering and research on prevalent diseases such as cancer, diabetes and neurodegeneration. This RPA has achieved excellent research results and includes one Cluster of Excellence (EXC), a state-funded research cluster as well as a Graduate School (cf. C.2.1.).

RPA 2: Information Technology and Microelectronics, covers the entire spectrum of electronic information processing from fundamental and applied research on data storage, processing and transmission to the development and testing of new semiconductor materials. The main areas of research are investigated in a Cluster of Excellence and a state-funded research cluster. RPA 2 benefits from intensive cooperations with non-university research institutions in the vicinity and from strong business relationships. In addition, the RPA excels in technology transfer and spin-offs.

RPA 3: Materials Science and Engineering, aims to explore novel materials and their synthesis, to understand the principles of structure-property relationships and how materials behave in different environments. Further objectives are the development of nanotechnology concepts, functional and smart materials. Its excellence was fostered by a state-funded research cluster on emerging materials and processes, established in 2007, as well as numerous fundamental or application-oriented large-scale collaborative research projects. This development culminated in the award of an EXC in 2018.

While the first three RPAs are specialised and sharply focused on their respective core topics, **RPA 4: Energy, Mobility and Environment**, is characterised by its holistic approach to the fields of research it encompasses. With special attention placed on global challenges such as climate change, sustainable energy supply and networked mobility systems, research is conducted on both the technical and the social aspects.

RPA 5: Culture and Societal Change, focuses on transformations concerning social and political orders as well as urban and regional developments. It is highly interdisciplinary in nature and builds on numerous local and transregional networks. Thus, many research projects benefit from the cooperation with outstanding cultural institutions such as museums and libraries within the DRESDEN-concept research alliance.

The success of TUD’s profile-forming strategy is well demonstrated by the fact that one EXC was approved in RPA 1 in the first round of the Excellence Competition in 2007. This was followed up by two EXCs in the second round in 2012 (one in RPA 1, RPA 2). Most recently, three EXCs were secured in the third round (one in RPA 1, RPA 2 and

RPA 3). Motivated by these successes, TUD will continue its strategy with the aim of achieving a similarly high level of performance in all RPAs.

Positioning of the University

TUD has substantiated its scientific excellence by numerous benchmarks. In its national peer group consisting of Germany's nine leading Universities of Technology (TU9) and the current Universities of Excellence, it is consistently in the top group with respect to third-party funding, publications and patents. Among the 50 universities of the European network CESAER (Conf. of European Schools for Advanced Engineering Education and Research), TUD excels with exceptional results. Its international competitiveness and positive momentum are reflected in its position in international university rankings (ARWU, QS and THE), in which TUD in the past six years has improved its standing by 70-140 places, thus positioning itself firmly among the world's top 200 universities.

THIRD-PARTY FUNDING In 2017 alone, TUD scientists and scholars acquired a total of €269 million in third-party funding for their research projects from various national and international funding bodies and from the business sector. This is an increase of 120% within ten years (compared to €122 million in 2007). According to the official university financial statistics[1], TUD is one of the three universities with the strongest third-party funding in Germany and boasts extraordinary dynamics: In the decade from 2007-2016, TUD displayed the third-highest increase (+109%) within the national peer group, even though it already had high initial values. With respect to the amount of annual third-party funding per chair, TUD ranks 4th with €525,934 including the University Hospital and €468,387 excluding it.

As early as 2012, the German Research Foundation (DFG) stated that TUD had undergone an 'exceptional development' among all German universities due to its steady increase in third-party funding, and confirmed this once again in its Funding Atlas 2018[2] (cf. Fig. 1): In the first Funding Atlas of the DFG in 1997[3], TUD ranked 35th in Germany, but in 2015, after a steady upward trend, it already ranked 10th. In the current DFG Funding Atlas 2018, TUD now holds 6th place overall and 3rd in engineering. In computer science as well as in systems and electrical engineering, the University has rocketed to 1st place. Top positions are also occupied in other disciplines such as medicine and psychology. With regard to federal and EU third-party funding in engineering, TUD ranks 1st

| [1] The data refers also in the following to the most recent statistics for 2016 (source: Destatis via German Centre for Higher Education Research and Science Studies ICEland, data retrieved on 6th July 2018).

| [2] DFG Funding Atlas 2018, p. 49

| [3] The reference periods are 1991-1994 for the DFG Funding Ranking 1997, 2008-2010 for the DFG Funding Atlas 2012, 2014-2016 for the DFG Funding Atlas 2018 (Sources: http://www.dfg.de/dfg_profil/zahlen_fakten/foerderatlas/fruehere_ausgaben/index.html and http://www.dfg.de/sites/foerderatlas2018/; last accessed: 22nd August 2018)

and 3rd in communication and information technologies respectively. TUD also demonstrates its competence in the highly competitive European funding programmes: In the EU Research Programme Horizon2020, it holds top positions in three of the six categories and thus ranks among the best 2% of all European universities, with 5th place among German universities. TUD is also particularly successful in attracting funding for application-oriented research, as indicated by ranking 3rd with respect to the prestigious grants awarded by the German Federation of Industrial Research Associations (AiF) in the period 2014-2016.

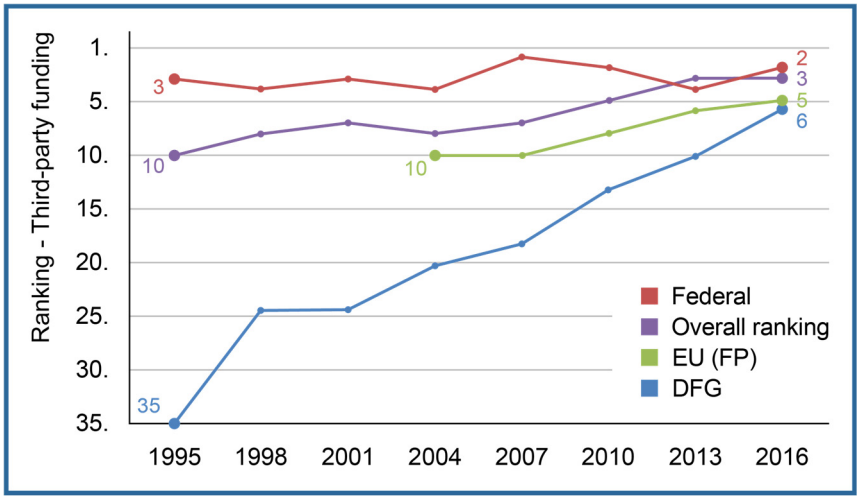


Fig. 1: National ranking of TUD with respect to funding from different sources (Source: DFG Funding Atlas, Destatis; own diagram)

PUBLICATIONS The number of peer-reviewed publications by TUD increased by 74% between 2007 and 2017, thus surpassing the average growth rates in its national and international peer groups (nationwide: +34%; TU9: +58%; Universities of Excellence: +56%; CESAER: +62%). In a nationwide comparison based on the Scopus database, TUD ranks 6th for the years 2012-2017 and ranks among the Top 5 in the national comparison group in 2017 with 4,746 peer-reviewed publications in Scopus (cf. Fig. 2). In the years 2007-2017, the published research results of TUD also achieved a remarkable impact[4]: 13.1% of the publications by TUD scientists and scholars were published in the Top 5 journal percentiles in Scopus (rank 5 in the national peer group). In field-weighted citations, TUD achieved an above-average impact score of 1.63 and an average of 16.9 citations per publication (rank 8 in each of the national peer groups). It also realises remarkably high scores in the international benchmark with the CESAER Group (12.9 % Top 5 share/ 1.57 citations impact/ 13.9 citations per publication).

[4] Source: SciVal, retrieved on 4th July 2018 (in the following: source: SciVal, Indicator 'Top 5 Journal Percentile SNIP (Source-Normalized Impact per Paper)', retrieved on 4th July 2018 and 14th August 2018; 'Field-Weighted Citation Impact', retrieved on 4th July 2018 and 14th August 2018; 'Citations per Publication', retrieved on 5th July 2018)

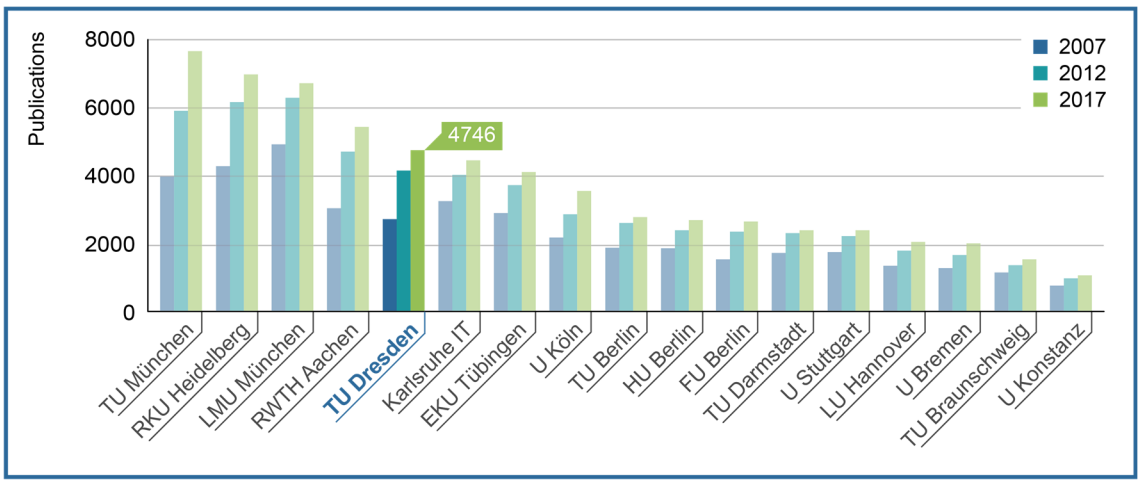


Fig. 2: Publication output of TU9 and Universities of Excellence 2007-2017 (Source: SciVal, retrieved on 4th July 2018; own diagram)

TUD's extraordinary performance is particularly evident when publication output and third-party funding are depicted in relation to the basic funding, as shown for 2016 in comparison with the TU9 and the Universities of Excellence in Fig. 3.

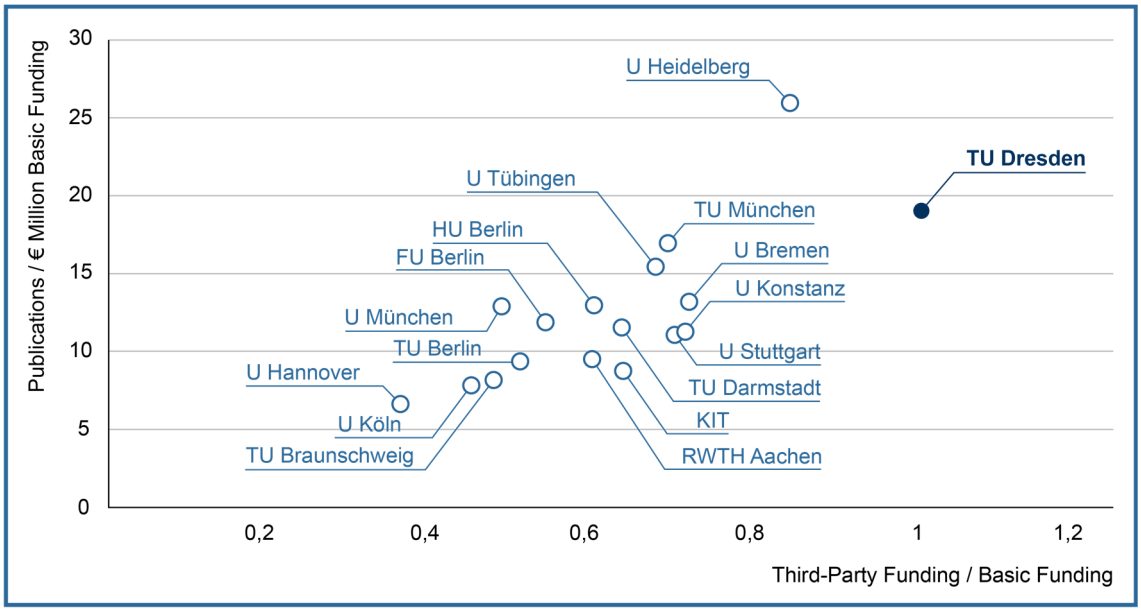


Fig. 3: Number of publications and third-party funding volumes of TU9 and Universities of Excellence (incl. clinics) per €1 million basic funding in 2016 (Source: SciVal, Destatis, retrieved 27th Nov 2018; own diagram)

PATENTS TUD also demonstrates its innovative strength and competitiveness in terms of its impressive patent activity. In Thomson Reuters' ranking on patent volume, citations and success, it is placed 14th, 16th and 26th in Europe. In a direct comparison with the TU9 and the Universities of Excellence, TUD has by far the highest number of patent

applications and approvals (cf. Fig. 4 p.8). This achievement is also reflected in the patent citations: TUD ranks 6th in the national peer group in the patent citations count 2007-2017 and 5th in the patent-cited scholarly output[5].

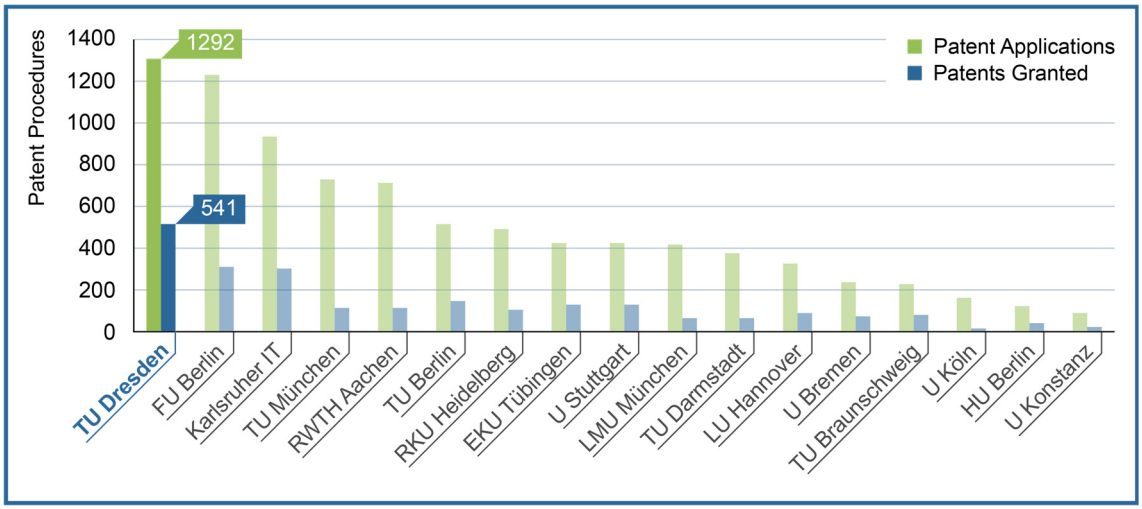


Fig. 4: Patent activity of Universities of Excellence and TU9 (Source: Orbit.com/FullPat, retrieved on 1st Aug 2018; own diagram)

Performance Area Transfer

Since technology and knowledge transfer are central to TUD's mission, the University actively disseminates its scientific findings, thus sharing knowledge on relevant public issues and enabling industry to make use of scientific results for technical and commercial purposes. With resources from its Institutional Strategy (ZUK), TUD has successfully expanded its transfer activities. It has succeeded in establishing strategic partnerships with major companies such as Telekom, Siemens, Bosch, Rolls-Royce etc. (cf. A.2.2.2.b). Considering the specific industrial mix in Eastern Germany, this testifies to the University's perseverance and performance. While Dresden today is an important business location for high-tech industries and Europe's leading location for microelectronics, it has historically not been home to any large corporate headquarters. Rather, it is a powerful, technology-intensive business hub and home to primarily small and medium-sized enterprises (SMEs). For TUD, as a transfer-intensive University (cf. patents p.7/8), close R&D collaborations with these SMEs play an important role. Moreover, TUD also actively promotes its own spin-off projects (on average 25 p.a.). A special feature is TUD's business holding **TUD Stock Company (TUDAG)**, which is currently comprised of 22 companies with a total revenue of €59.8 million and 600 staff (2016). TUDAG realises technology spin-offs from TUD and provides R&D project management for transfer activities as well as a range of continuous education programmes. TUDAG's subsidiary GWT supports industrial and clinical contract research.

| 5 Source: SciVal, retrieved on 4th July 2018

Performance Area Teaching

With around 31,000 students (44.0% women), TUD is the 4th largest technical university in Germany (WS 2017/18, Federal Statistical Office). Most students are enrolled in the School of Engineering Sciences (29.0%), followed by the School of Civil and Environmental Engineering (27.5%), the School of Humanities and Social Sciences (23.2% incl. degree programmes to become school teachers), the School of Science (9.8%), the School of Medicine (8.3%) and several Central Units (2.2%). In order to meet regional and national needs, TUD has substantially increased the number of students enrolled to become school teachers to 3,518 (WS 2017/18).

TUD´s Institutional Strategy firmly states that excellence in research and teaching belong together at a university. Hence, the relevance associated at TUD to studying and teaching has grown continuously over the past decade. With high-quality, research-oriented teaching, TUD supports young academics at an early stage and provides the foundations for a career in academia from the very beginning of their studies. The high quality and relevance of our teaching is confirmed by a recent survey among German companies, which ranks TUD 6th of all German universities and colleges (Trendence, 11/2018).

Through research internships, research-oriented specialisations, interdisciplinary teaching-learning projects, academic writing workshops etc., skills relevant for research are cultivated. In 2014, the **Centre for Interdisciplinary Learning and Teaching (ZiLL)** was founded as part of ZUK.

The establishment of the private sector **Dresden International University (DIU)** in 2003 as the continuing education university of TUD under the umbrella of TUDAG is a unique feature that allows TUD to make its teaching profile more flexible. Complementing TUD's portfolio of courses, DIU offers 39 accredited degree programmes, providing subject-specific education and training for executives, professionals and students. 2,400 students (30% international) are currently enrolled at DIU.

Performance Area Research Infrastructures

TUD offers excellent working conditions for scientists and scholars due to its state-of-the-art research infrastructures. Supported by special programmes of the Free State of Saxony and by federal and EU funds, more than €375 million have been spent on the renovation or construction of buildings on the TUD campus since 2012 and more than €150 million have been invested in laboratories and technical infrastructure. Underpinned by 13 funding recommendations by the *German Council of Science and Humanities*, the investments are closely linked to TUD's Excellence Research Areas (ERAs). With strategic investments, such as the new computing centre with its high-performance computing and storage complex, which ranks among the Top 5 in Germany, TUD is

systematically strengthening cutting-edge research and is laying the foundations for research into future topics e.g. related to digitalisation. These investments are also linked to an excellent information infrastructure, which benefits the entire University through the **Centre for Information Services and High-Performance Computing (ZIH).**

A unique feature of the science location Dresden is the comprehensive joint use of research infrastructures by TUD and non-university research institutes. The **Dresden Technology Portal** that is implemented within the DRESDEN-concept network, successively lists all available large-scale research facilities and services in a database and makes them accessible for all scientists within the alliance. The sharing of equipment in **joint technology platforms** promotes interdisciplinary cooperation and ensures optimum use of available resources. This supports the further development of existing ground-breaking research activities with high infrastructural requirements e.g. in the life sciences, electronic information processing or materials science.

Area of Activity: Career and Personnel Development

Personnel development that goes beyond mere further education and training is a strategic key area for TUD. Accordingly, the TUD development plan (2012-2020) attaches great importance to the recruitment and retention of qualified personnel. In order to meet these requirements, the Personnel Development Concept adopted in 2017 will be continuously extended, e.g. by defining transparent career goals and paths for academic and support staff.

Career development is considered an overarching task of TUD and is supported by various organisational units (e.g. supervisors, Graduate Academy, Centre for Continuing Education, Directorate Personnel) with the aim to achieve

- a distinctive culture of reflection and feedback (e.g. in target agreement discussions with all professors, supervision agreements and discussions with doctoral candidates, Tenure Track evaluations and annual staff appraisals),
- comprehensive, tailor-made information, qualification and support services in all career phases (incl. critical transitions between career phases),
- programmes and measures that promote the reconciliation of work and family life as well as a university culture characterised by diversity and equal opportunity.

In order to offer high potential scientists and scholars a reliable perspective at an early stage in their career, TUD introduced the Tenure Track format in 2012. For its implementation, new structures, processes and regulations have been created. In particular, the appointment and career system has been modernised with the introduction of **Open Topic Tenure Track Professorships**. In 2014, TUD recruited nine Open Topic Tenure

Track Professors exclusively based on their scientific excellence and research innovation potential. This extremely successful approach to active recruitment independent of specific subject areas is now codified in the by-laws of TUD. In 2017, the principle of the Open Topic search for the best minds was extended to the postdoc phase: 17 **Open Topic Postdoc Positions** were filled based on outstanding scientific achievement, creativity and potential for innovation. Building on its experience, TUD was able to continue this successful development in the National Programme for the Promotion of Early-Career Scientists and Scholars with the approval of funding for all 18 professorships that had been applied for. Subsequently, Saxony´s Higher Education Law was amended to include various Tenure Track options including junior research group leaders.

Area of Activity: Cooperation

TUD is connected with strong partners from science, economy and society through multifaceted international, national and regional cooperations. On an **international** level, TUD has since 2013 been creating a network of strategic partnerships with higher education institutions and regions with particularly strong scientific activities. For this purpose, thematically focused strategic partnerships have been established at the School level (e.g. with the Italian University of Trento in humanities and social sciences or with the Chinese Tongji University in engineering). Three types of international strategic partnerships are distinguished: (i) **University** Partnerships with matching institutions (e.g. transCampus with King's College London), (ii) **Regional** Partnerships (e.g. between DRESDEN-concept and the Polish Wrocław scientific region) and (iii) **Development** Partnerships to support universities in developing countries in realising their potential.

On a **national level**, TUD maintains a large number of close scientific cooperations. A prime example is the Centre for Advanced Water Research, which was jointly founded with the Helmholtz Centre for Environmental Research in Leipzig. Its success is demonstrated by numerous joint research projects and five joint professorial appointments. A further example is the German Consortium for Translational Cancer Research, in which TUD and its University Hospital cooperate closely with the German Cancer Research Centre in Heidelberg.

On a **regional level**, the **DRESDEN-concept (DDc)** alliance is a decisive factor in strengthening TUD´s performance and potential. TUD strategically and intensely cooperates with the Dresden-based institutes of the four major German scientific organisations, i.e. the Max Planck Society (MPG), the Fraunhofer-Society (FhG), the Leibniz Association (WGL) and the Helmholtz Association (HGF), as well as renowned cultural institutions that are actively involved in research (cf. Fig. 5). Adhering to the synergy maxim, the institutionalisation of DDc is the result of an interdisciplinary mind-set and joint strategic actions in Dresden as a research location. By synchronising the activities

of their scientists and scholars, expertise, research ideas and research infrastructures, the 28 partner institutions are producing ground-breaking results. DDc was formally established in 2010 and selected in 2018 by the *Stifterverband* as a model for the best practice programme on 'Cooperation Governance'.

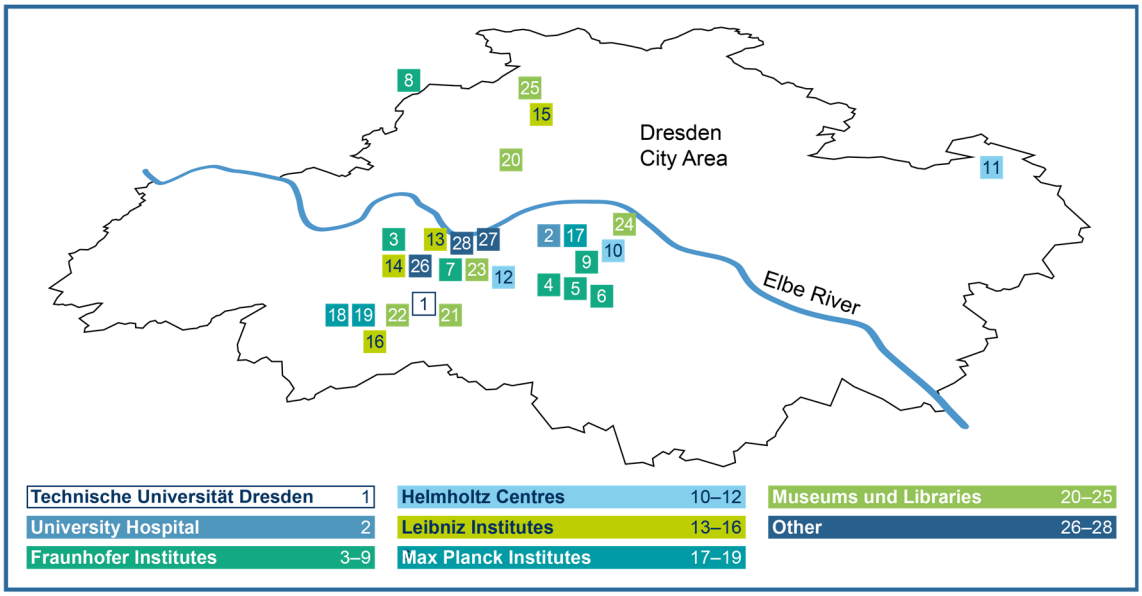


Fig. 5: Member institutions of the DRESDEN-concept research alliance

This success story is the basis for most structure-building research networks of TUD (e.g. EXC, CRC, RTG and other centres), in which the associated DDc institutions are actively involved. It has enabled TUD and its non-university partners to establish new research facilities, such as the (abbreviations cf. Glossary):

- National Centre for Radiation Research in Oncology with Helmholtz Centre Dresden-Rossendorf (HZDR) and TUD's University Hospital,
- DRESDEN-concept Genome Centre with MPI-CBG,
- Centre for Systems Biology Dresden with MPI-CBG and MPI-PKS,
- Dresden Innovation Centre Energy Efficiency with Fraunhofer-IWS,
- Max Bergmann Centre with Leibniz-IPF,
- Germany-wide unique underground accelerator lab with HZDR,
- Dresden High Field Magnetic Laboratory with HZDR, MPI-PKS, MPI-CPfS and Leibniz-IFW (cf. A.2.2.2.c).

In addition, there are numerous coordinated activities for the promotion of early-career scientists, incl. joint structured doctoral programmes with the Max Planck Society, the Helmholtz Association and the Leibniz Association. The joint research centres and programmes for early-career scientists make a major contribution to the international visibility of the Dresden science hub, which is also highly beneficial to local researchers. Due to the close proximity of institutions, DDc opens up attractive networking opportunities to advance their research activities and careers. The 4 Scientific Area Committees in the

fields of biomedicine and bioengineering (speakers: Profs. Brand and Huttner), information technology and microelectronics (speaker: Prof. Fettweis), materials and structures (speakers: Profs. Gude, Voit and Leyens) as well as culture and societal change (speaker: Prof. Vorländer), which bundle outstanding, internationally visible DDc research competencies, play an important coordinating role.

In 2017, the DDc network was extended by Scientific Area Networks. Researchers from all member institutions utilise this platform to present their research questions and approaches on alternating topics, discuss these in working groups, coordinate and plan projects (e.g. Future of Urban and Rural Areas, Change through Digitalisation).

The 61 jointly appointed TUD professors, who concurrently hold first (e.g. Director of Institution) and second (e.g. Head of Department) managerial level positions at the non-university DDc institutions, are proof of the substantially increased intensity of cooperation. Numerous joint projects confirm the close ties and efficiency within the alliance. In December 2017, 71 joint projects between TUD and the DDc partner institutions were active with a budget exceeding €140 million.

The successful institutionalisation of the cooperation forms the basis for joint achievements: The DRESDEN-Board, as the governing body, is comprised of TUD Executive Board members and 12 elected representatives from the partner institutions. Input from the Scientific Area Committees is also addressed within this body. The Administration and Infrastructure Committee deliberates on important cross-institutional topics in dedicated work groups (e.g. monitoring, career and family audit). A joint head office located at TUD coordinates the DDc operations, incl. public relations.

Area of Activity: Equal Opportunity

Establishing and safeguarding procedures to promote equal opportunity is seen by TUD as an inherent duty to fulfil its societal responsibility. In addition, TUD is convinced that diversity in research and teaching is quintessential for scientific advancement and innovation. Hence, diversity and equality are a matter of particular importance and are enshrined in both the mission statement and the by-laws of our University. In the **Diversity Strategy 2030**, the issue of gender equality is embedded and linked to other diversity aspects through measures intended to strengthen the equality between women and men. The Diversity Strategy includes the Equal Opportunities Concept (since 2014), the Strategy for the Promotion of Women (2014-2020), TUD's Action Plan for the Implementation of the UN Convention on the Rights of Persons with Disabilities, the Integration Agreement, the agreed targets from the Audit Family-Friendly University (2016-2019) and TUD's Internationalisation Strategy.

The topics of equal opportunities and diversity are structurally anchored at the TUD executive level. Since 2012, their importance has been highlighted by the establishment of central structures such as the Staff Unit Diversity Management and the Equality and Diversity Senate Commission. Supported by the National Women Professors Programme (2010-2020), by the Excellence Initiative as well as by the Special Inclusion Fund of the Free State of Saxony, numerous measures to promote equality and diversity have been established and consolidated since 2012, such as the:

- Maria Reiche Programme for the Promotion of Outstanding Female Postdocs
- Eleonore Trefftz Programme for Visiting Women Professors
- Measures to implement access for people with disabilities and chronic illnesses
- Annual Diversity Days
- ZUK project ‘Gendered University’, which examined gender roles at TUD and hindrances for equal opportunity measures, to recommend remedial actions.

Reciprocal Effects between ‘Performance Areas’ and ‘Areas of Activity’

There are substantial interactions and cross-fertilisation between all ‘Performance Areas’ and ‘Areas of Activity’ that have a positive effect on the expansion of cutting-edge research (cf. A.2.2.1.). Using DRESDEN-concept (DDc) as an example, these synergy-generating effects are described in the following.

DRESDEN-concept creates powerful reciprocal effects in all areas of performance and activity. Cooperations are intensified through the joint use of research infrastructures via the Technology Portal and technology platforms (cf. A.2.2.2.c) or through intensive academic exchanges in Scientific Area Committees and Networks. These efforts often lead to joint large-scale projects, which in turn contribute to raising Dresden’s profile as a prime research hub. Attractive conditions created for early-career researchers across institutions at the Dresden research location (e.g. infrastructure, Graduate Academy, TUD Young Investigator Status, Open Access) foster their academic careers through optimal research conditions and support. Moreover, the combined strength within DDc puts TUD in a favourable competitive position regarding the recruitment and retention of top scientists and talented early-career researchers from abroad. The jointly established DDc Welcome Centre offers comprehensive information and assistance when arriving in Dresden. Through joint appointments and the possibility of creating alternative career models, the Dresden science hub offers ideal conditions for successful personnel recruitment, integration of staff and future-oriented career development.

TUD has the **institutional maturity** of a University of Excellence due to its strong basis for exceptional achievements. This is also reflected in its unusually **dynamic development**, which is evidenced by a continuous, steep increase in various key performance indicators. In a steady optimisation process and in dialogue with its members, TUD creates **outstanding conditions** for researchers and students. Through its **innovative governance** and by aligning structures and processes to the success of the entire University, it is possible to implement and communicate profile-forming measures in such a way that TUD members maintain their traditionally strong identification with 'their' alma mater throughout all changes.

A.2.2. Analysis of strengths and weaknesses based on previous achievements and successes

The **systematic analysis** of strengths and weaknesses is a crucial part of TUD´s quality culture and the basis for guiding its management and capability to embrace change. This is demonstrated by the **multi-stage** and **participatory process** focusing on the whole University that was applied to compile TUD's SWOT analysis: Following the successful launch of ZUK, the University Executive Board **revised** its **SWOT analysis** within the framework of retreats with Senators, Deans and Directors in 2016. Subsequently, these analyses were repeatedly discussed and updated with various stakeholders. The results of the interim **ZUK evaluation by external reviewers**, which was commissioned by the University Executive Board, proved to be most helpful for the continuation of the ZUK measures as well as for the preparation for the Excellence Strategy application.

Based on the findings of this evaluation, the **overall analysis** was carried out starting in 2017 in an iterative process that collected empirical, quantitative and qualitative evidence in order to test previously identified strengths and weaknesses. Interim results were discussed and prioritised by the University Executive Board, the Senate, and the Council as well as by the Deans and Heads of the Schools. Furthermore, additional data and detailed assessments were used to gradually consolidate the analysis. In order to ensure the greatest possible degree of transparency and active participation of the University and the DDc members in the strategy development process, the Executive Board initiated a **web-based, university-wide brainstorming session** in 2017 as well as a dedicated event format. In 2018, six **Future Labs** were held on the topics of governance, cooperation, digitalisation, research funding, career and personnel development as well as university culture. More than 500 participants, from all areas of the University and DDc, gave their feedback on developments in recent years and shared their ideas for future projects. The results of the Future Labs were discussed in the TUD Executive

Board, the committees, advisory bodies and the DRESDEN-board. As a result, key findings were incorporated into TUD's analysis of strengths and weaknesses as well as into the subsequent development of projects.

STRENGTHS	WEAKNESSES
Innovative appointment procedures (Open Topic, Tenure Track) Renowned PIs in many areas of specialisation Broad range of offers to promote early-career researchers (e.g. GA) Large number of TUD degree programmes plus additional qualification programmes via Dresden International University (DIU) and TUDIAS Extensive offers for university and specialised didactics Far-reaching strategies, concepts and guidelines for equal opportunity and diversity Concept for the strategic development of personnel and organisation	Inconsistent quality assurance during appointment procedures Continuing need for more key staff with willingness to lead and change Potential for improvement in the organisation of teaching programmes and in research-oriented teaching (e.g. support of students with particular interest and ability in research) Not enough women in executive positions Inconsistent quality assurance for doctorates Significant administrative burden on academic staff (i.e. professionalisation in management, administration and services can be improved)
Dynamic development, proven research excellence, substantial third-party funding Successful development of scientific profile with three Research Priority Areas with research excellence Purposeful governance with innovative structures and processes (e.g. successful formation of Schools, implemented QM systems in research, teaching and administration) Numerous modern research buildings and a state-of-the-art research and IT infrastructure	Two Research Priority Areas are not yet Excellence Research Areas Potential of digitalisation in research, teaching and administrated only partially utilised In parts, insufficient coordination between sub-strategies and individual
DRESDEN-concept Strong cooperations (interdisciplinary, national, international)	In parts, internationality not adequately pronounced (e.g. staff) and institutionalised
Strong transfer activities (patents, spin-offs, business cooperations, consulting) jointly with TUDAG (TUD stock company) Many offers for children and high school students and the elderly (Seniors' Academy)	Insufficient coordination of transfer activities Visibility and reputation, nationally and internationally, still insufficient for the implementation of strategic goals
Proven determination to change and to perform High level of commitment to and identification with the University Campus University with short distances	Internal communication and transparency can be improved Campus expansion cannot always keep up with scientific dynamics; not enough rooms for meetings and common areas
OBJECTIVES: TALENT PROFILE COLLABORATION IMPACT SPIRIT	

Fig. 6: Summary of TUD Strength and Weakness Analysis, colour coding relates to Fig. 11 in A.3.2.1

In the following chapters, the identified strengths and weaknesses (cf. Fig. 6) will be outlined for the different performance areas.

In summary, it is evident that TUD has achieved an extremely dynamic and positive development over the past years, resulting in further advancement and expansion of its strengths, and significant mitigation of its weaknesses. The established strengths reflect the strategic priorities of ZUK. However, some weaknesses remain where the change processes have not yet been completed or potential improvements are still waiting to be realised due to the multitude of measures.

The strategic projects described in Chapter 3 are designed to continue this highly promising path by developing the specific strengths of TUD even further and, through this process, reducing or eliminating the corresponding areas where some weaknesses still remain.

We will, however, address some of the weaknesses listed (cf. Fig. 6) independently of the Excellence Strategy and with own resources. This includes, in particular, mitigating deficiencies in the development of our teaching programmes through the further strengthening of the Academic Affairs Offices and a reduction in the administrative commitments of academic staff via measures recommended by the QM for Administration.

A.2.2.1. Organisation and quality of research

Strategic Orientation of Research

TUD's Research Priority Areas (RPAs), see also A.2.1., are thematic fields comprised of several **profile-forming research programmes**. They form the framework of existing or envisaged international top-level research at the University. To date, TUD has identified 7 Excellence Research Areas (ERAs) and 5 Emerging Fields (EFs), which are distributed throughout the RPAs as follows:

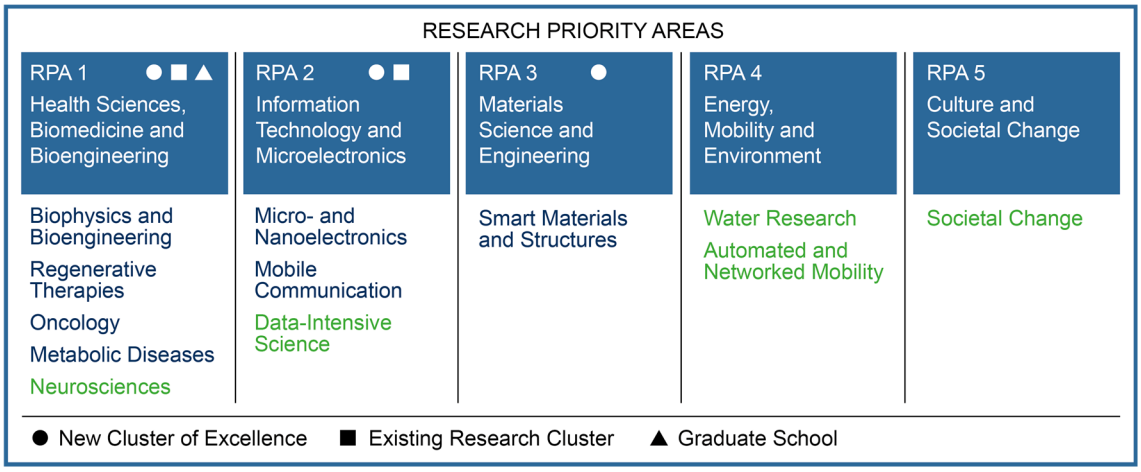


Fig. 7: TUD Research Priority Areas with Excellence Research Areas and Emerging Fields

The ERAs identify concrete thematic fields within the rather wide spectrum of RPAs that are especially strong in research. This is illustrated by the substantial number of successful scientists involved in research cooperation in this field and generating results that are recognised both nationally and internationally. For the scientific work in the ERAs, TUD provides ideal conditions for current and prospective research projects in order to maintain high international standing. The Emerging Fields are characterised by promising, ambitious research activities that are well-recognised at the national level. Much of this research, however, is performed within relatively loose scientific networks. Therefore, TUD intends to strengthen these Emerging Fields through strategic support

measures and investments, in order to raise their performance to a higher level of excellence. In addition to strategic appointments, these measures include infrastructural and structural support (e.g. establishment of centres, provision of coordination offices, building programmes), services (e.g. advice on funding) and the provision of incentives and initial financing. This flexible system has the advantage that within the longer-term RPA the possibility of setting priorities is given, while changes to research topics, e.g. through outstanding new appointments, can be swiftly reflected in the TUD research profile.

To adopt new developments promptly and without major bureaucratic hurdles, the ERAs and EFs are deliberately designed with a low degree of structural formality. Their organisation is shaped in line with major programmes (such as EXC or CRC), and the support provided by TUD is demand-driven and flexibly adapted to the various research groups and activities (cf. Conditions and Support Structures p.20). The integration into the University structures is arranged according to the formal organisational level of ERAs and EFs. It may range from the affiliation of Principal Investigators (PIs) to more than one Faculty, inter-faculty cooperation in informal networks, to formal association in an EXC and similar collaborative projects up to the organisation in centres and central scientific units. All professorial PIs are members of at least one Faculty.

RPA 1 is currently the strongest research field at TUD. In the ERA Biophysics and Bioengineering, research is conducted on the principle physical mechanisms of proteins and nucleic acids, and on the dynamics and structure formation in cellular systems. In the ERA Regenerative Therapies, researchers are investigating molecular and cellular processes in order to learn more about successful regeneration in cases of injury and disease. They are also using this as the basis for developing novel therapies for chronic diseases. The ERA Oncology develops technologies for radio-oncology and surgical oncology as well as personalised oncology. The fourth ERA Metabolic Diseases uniquely combines expertise in Type 1 and Type 2 diabetes and is recognised worldwide for the exploration of metabolic activity of tissues and cells and for the design of medical devices. Moreover, the RPA is complemented by the EP Neurosciences that focuses on therapies for neurodegenerative, neuromuscular and autoimmune diseases as well as their cellular and molecular basis. The extraordinary research strength in RPA 1 is underlined by the research cluster Centre for Regenerative Therapies Dresden (CRTD), the EXC Physics of Life (PoL) as well as the Dresden International Graduate School for Biomedicine and Bioengineering (DIGS-BB). The participating academic units of TUD are mainly located on the Biopolis Campus in order to promote close cooperation with the TUD University Hospital and the MPI-CBG (cf. Fig. 8).

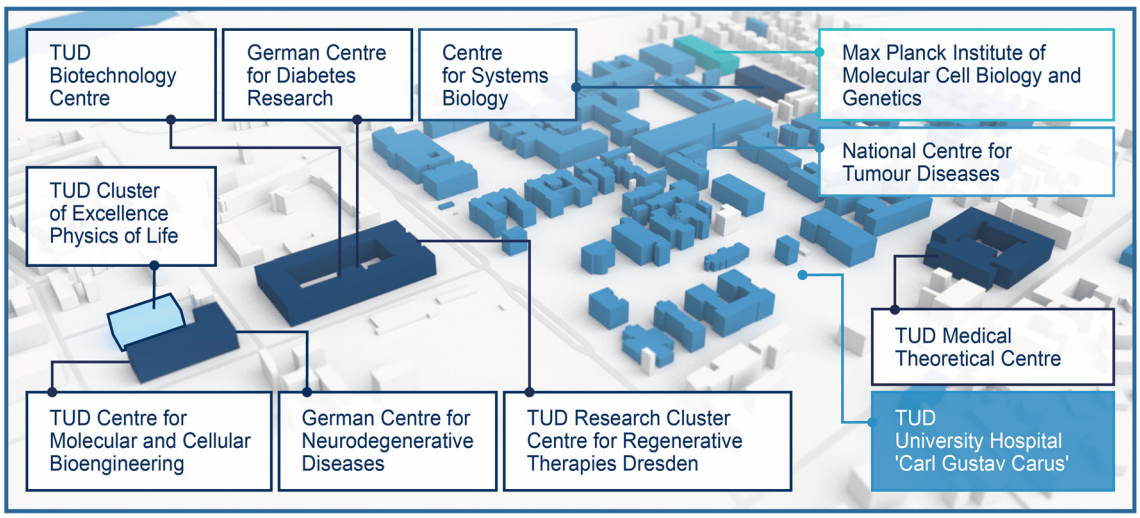


Fig. 8: Biopolis Campus Dresden

RPA 2 includes the research activities of two ERAs and one EF. ERA Micro and Nanoelectronics addresses electronic materials and the manufacturing, design, system integration and conception of miniaturised electronic components, circuits and systems down to nanoscale. ERA Mobile Communication focuses on the research of future mobile communication systems (e.g. 5G), whereby a holistic approach is pursued from applications to electronics as well as from Human-in-the-Loop to the Internet of Things. The EF Data-Intensive Science comprises software methods and system architectures for data-intensive research. The research activities of this RPA that led to the research cluster 'Centre for Advancing Electronics' (cfaed) and the EXC 'Centre for Tactile Internet' (CeTI) are strategically located on the south side of the TUD central campus (Technology Strip 'Nöthnitzer Straße'), in the immediate vicinity of numerous thematically relevant university and non-university research institutes.

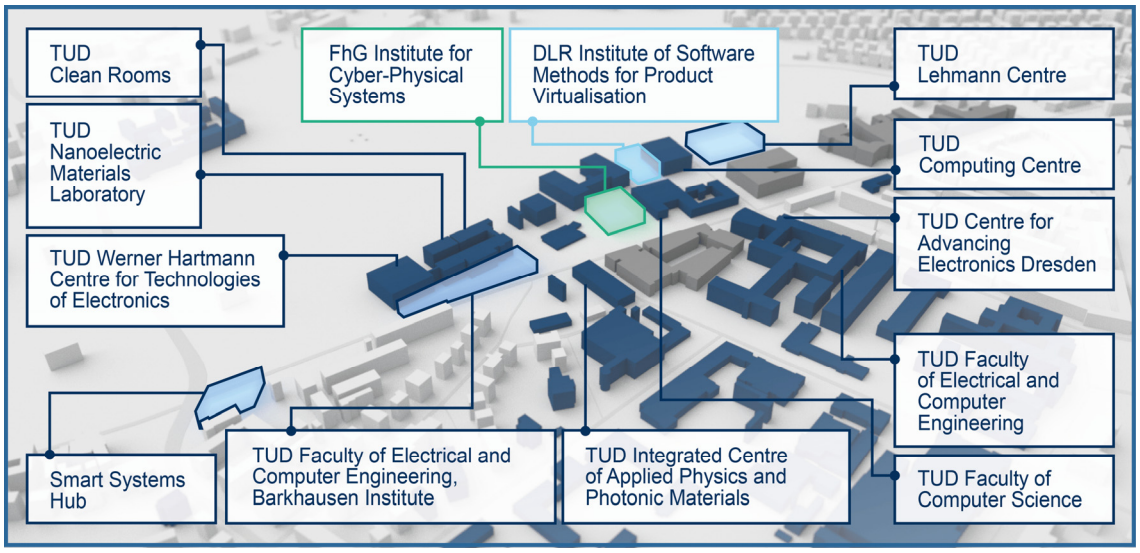


Fig. 9: Technology Strip 'Nöthnitzer Straße'

RPA 3 combines its strongest research activities in the ERA Functional and Engineering Materials. It comprises the research and synthesis of novel materials as well as their simulation-based multiscale design, which are combined to form resource-optimised, smart materials. The focus is on materials for electronics, energy conversion and efficiency, as well as on functional materials. Furthermore, the complexity and topology of quantum materials for the development of concepts for quantum computers and high-efficiency electronics are researched. This topic is investigated in the EXC 'Complexity and Topology in Quantum Matter' (ct.qmat). To strengthen this RPA, a building with 12,000 m^2 of laboratory and office space is approved for the Centre for Materials Research and Engineering, to be constructed on the TUD campus from 2019 onwards.

RPA 4 has a promising foundation for expanding its future research strength and international visibility with its two EFs. Integrated water resource management and data-driven modeling of complex hydro processes, incl. interconnectedness with global (climate) change, will shape the EF Water Research. The EF Automated and Networked Mobility addresses the transformation of the entire mobility sector with a focus on digitalisation and automation of transport and traffic processes. In recent years, the main areas of research of RPA 4 have been strengthened by numerous major construction and infrastructure measures.

RPA 5 considers cultural manifestations and consequences of societal processes of change in the EF Societal Change. Here, the focus is on socio-cultural conflict research, on research observing the relation between societal dynamics and emotional regimes as well as on the interference of culture and disruptive technologies. Specific research topics include invectivity, populism, inter-culturalism, nationalism, media and popular culture as well as social self-descriptions. TUD strengthens RPA 5 primarily through human resource allocation (e.g. 3 Open Topic, 5 Tenure Track professorships, 5 Open Topic postdocs) and resources for the initiation of collaborative projects (e.g. coordination offices for the University School and for CRC 1285 Invectivity).

Framework Conditions and Support Structures

TUD's outstanding scientific development has been facilitated by a purposeful combination of strategic **research support** that encompasses the entire innovation cycle and **tailor-made measures** for individual researchers. TUD's Research Directorate supports the initiation and implementation of research projects all the way to the exploitation of the research findings. **Project Scouts**, as part of the ZUK measures, are instrumental in the early concept phase. Using the interdisciplinary event format IDEAS**TUD**IO, they examine current and prospective funding priorities to form new consortia and develop concepts for research proposals. Specialists for the specific funding programmes then pro-

vide the necessary support from application through to contract finalisation. The **European Project Centre** is the service department for applications for and management of EU-funded projects, and is to a significant extent responsible for TUD´s success in these programmes. Since 2008, (early-career) researchers can refer to the **Research Pool** for the preparation of publicly funded projects. As part of ZUK, the **Support the Best** funding measure was added to support particularly high-performing researchers in exploring entirely new research topics.

Towards the end of project periods, TUD offers advice on the development of follow-up projects or the transfer of research results into applications. The **Transfer Office**, established within the ZUK, provides consultation and assistance regarding the protection, safeguarding and commercialisation of research results and works closely together with TUD's start-up support service and TUDAG (cf. A.2.1.).

The promotion of early-career scientists and scholars plays a pivotal role at TUD. The **Graduate Academy (GA)**, established in 2012, is a central contact and service point for doctoral and postdoctoral researchers. Through career development support and skills development by the GA, young scientists and scholars of TUD and the DDc partners are highly qualified for good positions in science, business and society.

Particularly successful, independent junior research group leaders of TUD and the DDc institutions can apply to the University Executive Board for **Young Investigator Status**, which enables them to act as supervisors, reviewers and examiners in doctoral procedures, to gain teaching experience, to participate in Faculty Council meetings and to take advantage of special qualification and mentoring programmes.

The **Eleonore Trefftz Programme for Visiting Women Professors** aims to increase the proportion of women and to promote their careers, attracting up to five highly qualified female academics each year. The initial goal of providing role models for female students and young female academics and supporting their careers was adapted in the course of the 2016 evaluation. The focus is now on the strategic recruitment of excellent female researchers for forthcoming professorial positions in the Faculties or central scientific units. The visiting professorships offer the opportunity to become acquainted and to explore mutual areas of research interest. Already, two former Eleonore Trefftz Visiting Professors have been appointed to permanent chairs at TUD.

Further support measures and structures are aimed at expanding **internationality**, another strategic priority of TUD. It is driven by the newly created central unit Internationalisation, which unites various initiatives and enables a synergetic approach to this cross-sectional issue and its individual aspects. **International offices** in the academic Schools support specific activities and academic exchange, especially with strategic university

partners. A flexible fund has been established for the initiation of international projects and the promotion of cooperations.

A successful ZUK measure, the **Dresden Fellows Programme,** supports promising Junior Fellows and well-established Senior Fellows to spend up to six months at TUD. Since 2013, 118 fellows (incl. 38 women), mainly from the EU and the USA, have conducted research at our University. In addition, **International Research Training Groups** have been established in materials science and in hydrology, which consolidate cooperations with selected international partner universities and at the same time strengthen TUD's scientific potential through joint doctoral programmes. A further international PhD programme has been jointly established with the Dresden-based UNU-FLORES Institute of the United Nations University.

Support measures for recruiting international researchers and early-career scientists and scholars, for drafting joint publications and for extending the welcoming culture, e.g. through the **DDc Welcome Centre**, promote international cooperation. The **SprInt programme**, which provides language and intercultural qualifications for TUD support staff, is in particularly high demand.

Commitment to Quality and Quality Assurance

TUD pursues a comprehensive approach to quality assurance that includes all areas of University activity. Based on evaluation criteria and regulations for the performance in research, teaching, transfer and promotion of young scientists that have been agreed across all disciplines of the University, a **research quality management** system was set up in 2013 under the aegis of the Institutional Strategy. Since 2015, these criteria have been successfully piloted in the research evaluations of business and economics, transport sciences and chemistry. From 2019 onwards, the performance of all TUD scientific disciplines will be regularly reviewed and benchmarked by external experts.

Ensuring academic integrity is a constitutive topic at TUD, which is omnipresent in the University´s life. Raising young academics' awareness and ensuring the commitment of all academics to the **TUD guidelines for good scientific practice** are, therefore, central elements. The GA offers relevant courses for all doctoral students and postdocs, and 'multipliers' have been trained throughout the University. A supervisory authority that addresses academic misconduct has been installed at TUD. In addition to the central TUD ombudsperson, two further counsellors were appointed for each Faculty.

Strengths and weaknesses in research

The strategic formation of TUD´s research profile as described in A.2.1. has been an outstanding success and contributed significantly to the University's strong performance

in the Excellence Initiative and the Excellence Strategy. In the first round of these programmes, TUD was already successful in RPA 1 with the EXC CRTD and the Graduate School DIGS-BB. In the second round, we managed to additionally secure EXC cfaed in RPA 2 and the Institutional Strategy 'The Synergetic University'. Both EXCs will continue their successful activities as research clusters from 2019 with funding from the Free State of Saxony. At the same time, the funding of three new EXCs starts in 2019, one in RPA 1, RPA 2 and RPA 3.

TUD's research strength in multiple fields is demonstrated by the dynamic development already described by research indicators such as third-party funding, publications, rankings and awards. Strategic support measures of recent years and the synergy effects of top-class cooperations within the scope of DDc have had a very positive impact (cf. A.2.1., C.2.1.1., C.2.5.-C.2.7.). As of November 2018, TUD boasts the following major research programmes, projects and grants:

2	Existing Research Clusters	
3	New Clusters of Excellence	
1	Graduate School	
12	DFG Collaborative Research Centres	(incl. 6 coordinated by TUD)
14	DFG Research Units	(incl. 7 coordinated by TUD)
43	DFG Priority Programmes	(incl. 10 coordinated by TUD)
12	DFG Research Training Groups	(incl. 8 coordinated by TUD)
16	ERC Grants	(incl. 12 Horizon2020, 4 FP7)
2	EU Flagship Projects	
1	BMBF Leading-Edge Cluster	
2	BMBF Zwanzig20 Projects	
18	Other Research Training Groups	
2	Humboldt Professorships	

Fig. 10: Major research programmes, projects and research grants at TUD

By bundling the 18 Faculties into five Schools with unified responsibility for strategy and budget, far-reaching reorganisation of structures and processes has taken place in the academic and administrative units (cf. A.3.3.). Thus, the profile of the University has been streamlined and academic governance and interdisciplinarity bolstered. TUD has now established a structure which we consider optimal for a large, comprehensive University in the German higher education system.

Since 2010, we have appointed 285 new professors (incl. 80 women), thereby continuously renewing and fine-tuning our academic profile. In this context, the introduction of the Open Topic concept, already outlined in A.2.1., should be highlighted as a particularly successful innovation, which will be continued in order to spark renewal processes in our

research profile. Even though TUD has succeeded in appointing numerous excellent academic staff in recent years, there is still potential for further improvement in the strategic planning and preparation of appointment procedures and in the stringency of their implementation. Since weak points in this central field can have serious consequences for a top university striving to attract the best scientists and scholars, TUD wants to improve the professionalism of its recruitment and appointment procedures further (cf. A.3.2.).

This is intended to increase the proportion of internationally renowned PIs and senior staff with strong leadership skills. Having more high-performing members will have a significantly positive impact on the University as a whole. While TUD's research output has improved tremendously in recent years (cf. Positioning, p.5.), there are still considerable disparities within the University when comparing the five RPAs. In particular, RPA 4 Energy, Mobility and Environment and RPA 5 Culture and Societal Change have not yet reached an internationally competitive level of research excellence (compared to standards set by world-class institutions), even though there are – without doubt – internationally visible, outstanding individual achievements.

TUD already demonstrates considerable expertise in the use of and research on digital processes and the reflection of their effects on society. Digitalisation is currently a research area of 50 professors and a subarea for an additional 30. RPA 2 Information Technologies and Microelectronics represents the central point of the related research excellence, as evident in the EF Data-Intensive Science. In addition to this core area, there are also numerous subject-specific competences in the field of digitalisation in the other RPAs. These multifaceted competences, which are dispersed across 18 Faculties and the entire TUD campus, are still insufficiently networked and coordinated. Therefore, the synergy potential of this enormous knowledge base with regard to digital processes must be exploited in a targeted way.

TUD has built up particular fortitude in recent years in the institutionalised promotion of young researchers and personnel development (e.g. GA, Young Investigator Status, Tenure Track procedure; cf. A.2.1.). Despite these significant achievements, there is still scope for improvement: For example, established supervision standards must be implemented throughout the University and safeguarded, and career paths for postdocs must be structured and communicated even more clearly and transparently.

Considering the goals that we have set for ourselves, the internationalisation process is not yet progressing at a sufficient pace, despite structural measures, funding provided at various levels (e.g. support of individuals, intensification of strategic partnerships, international coordinators) and individual successes (e.g. acquisition of more third-party funds in cooperation with international partners). Exemplary of this is that the percentage of international professors has only slightly increased since 2007 (cf. C.1.3.). In addition

to language-barriers and personal considerations, outdated recruitment procedures as well as a certain rigidity of the Faculties may be responsible for this weakness which should be addressed strategically in the coming years (cf. A.3.2.1.TALENT).

With respect to the activity area Equal Opportunity and Diversity, TUD has in recent years drawn up regulations and initiated numerous activities to ensure that women, men and persons with diverse characteristics have equal career opportunities (cf. A.2.1.). Due to these intensified efforts, female applicants now make up 30% of the annual professorial appointments. Nevertheless, this successful path must be continued and further efforts are required as the proportion of women in senior positions – particularly at professorial level - at TUD is still too low. TUD also ranks well below the national average for women among early-career researchers, especially in the STEM subjects.

A.2.2.2. Structure and quality of the other performance areas

a) Teaching

TUD's teaching profile is characterised by a broad spectrum of **131 different study programmes** with a multitude of **interdisciplinary teaching-learning projects**, which prove the intertwining potential of natural sciences, engineering, humanities as well as life sciences. This interconnectedness ensures that TUD graduates have skills beyond the subject-specific knowledge in their individual fields of study. Graduates have sound problem-solving abilities, computing skills and an interdisciplinary mind-set that enables them to address the increasingly complex challenges in research, business, administration, education or in other sectors of society.

Over the past ten years, teaching at TUD has undergone an all-encompassing **transformation and restructuring process** aimed at gradually expanding the room and the capacity to remain agile and flexible, at increasing the quality of services and at improving the conditions for students and teaching staff. Important milestones were reached with the implementation of the Dresden Quality Management Model for teaching, which was introduced in 2011-2012 and received **system accreditation** in 2015. It now plays a central part in our commitment to quality in teaching and studying. Through an intensive discourse on quality within TUD, guiding principles and objectives were formulated. Based on this, TUD courses are regularly evaluated in an established process.

As part of the School formation process, TUD has established six Academic Affairs Offices within its five Schools and the Centre for Teacher Education and Educational Research since 2014. These new offices, which pool examination and study management, and also participate in course development and evaluation, make a significant contribution to **the professionalism of teaching development and organisation**. They ensure that academic staff have more time to concentrate on their core duties – thanks to the

reduced administrative burden. Furthermore, the Service Centre Studies was set up to provide swift answers to questions relating to the organisation of degree programmes. Overall, these support structures are a pillar of TUD's teaching strength.

A specific emphasis at TUD is placed on the development of research-oriented teaching. For this purpose, the **Centre for Interdisciplinary Learning and Teaching (ZiLL)** was founded as a ZUK measure in 2014. The centre coordinates teaching modules that familiarise students with research at a very early stage through innovative teaching-learning projects. In the future, the potential of cutting-edge research at TUD and the DDc partners shall be systematically utilised for synergetic, research-oriented teaching allowing considerably more students to reap the benefits of this symbiotic relationship.

Moreover, TUD has launched a plethora of initiatives in order to reach the goal of excellent quality in teaching. In 2016, special commitment to teaching and higher education didactics were integrated into the **appointment regulations** and also added to the regular target agreements with all professorial staff. Since 2017, the participation in training sessions on higher education didactics and staff management has been a mandatory component of the target agreements for newly appointed professors. They are offered by the **Centre for Continuing Education**, which has pooled all university and subject-related didactical qualifications, counselling and networking services. This all-encompassing offer substantially contributes to the quality assurance in the performance area teaching and provides up-to-date support for teaching staff, e.g. in light of the increased heterogeneity of the student body and the possibilities of digitalisation.

The national Quality Pact for Teaching bolsters the 'shift from teaching to learning' approach at TUD via the project 'Teaching Practice in Transfer', which has been funded since 2012. In this context, the expanding cooperation within the **Centre for Higher Education Didactics Saxony** is strengthening our performance in the area of teaching. Even though the individual application that TUD submitted for the 'Quality Pact for Teaching' was not selected for funding, the University has nonetheless initiated several major measures and strategic projects in teaching such as (i) 'Synergetic Teacher Training in an Excellent Context' (TUD-Sylber) was launched in 2014 with a total funding of €11.8 million during the two funding phases of the Quality Initiative for Teacher Training; (ii) the 2016 'Comprehensive Strategy for Academic Success' aimed at reducing the drop-out rates and (iii) the E-Learning Strategy adopted in 2015. For TUD, **e-learning and e-teaching** are not an end in themselves. They are pursued as an integral strategic element for improving the quality in teaching, since they allow a greater degree of personalisation, facilitate high-quality classroom teaching and provide space for excellent re-

search. Although several measures have already been successfully introduced, the comprehensive strengthening of digital teaching represents a challenge, which TUD intends to tackle in the coming years in terms of concept and infrastructure.

The low **proportion of female students in STEM subjects** is a matter of concern (cf. A.2.2.1.). In most subjects however, the implemented measures already had a positive impact. In the academic year 2017/18 (compared to 2012/13), female students made up 17.8% (15.1%) at the Faculty of Computer Science, 15.1% (10.7%) at the Faculty of Electrical and Computer Engineering and 21.8% (16.9%) at the Faculty of Physics.

Room for improvement also exists with respect to the **internationalisation of teaching,** as the present number of 14 degree programmes taught in English must be increased significantly to make TUD even more attractive to international students. Since 2007, 10 new MA programmes taught in English have been started and there is potential for greater internationalisation of teaching through a more efficacious integration of lecturers from the DDc partner institutions and the EXCs. A strong point is the **TUDIAS GmbH**, founded in 1999 as a subsidiary of TUDAG, which specialises in language courses and preparatory German classes. TUD students can participate free of charge in courses on 16 languages offered by TUDIAS.

b) Transfer

The **Transfer Strategy** adopted by the University Executive Board in 2015 (incl. Patent and Licensing Strategy), forms the strategic framework for TUD's technology and knowledge transfer activities. In terms of innovation support, TUD is one of the most transfer-active universities in Germany with a particularly high patent output (cf. A.2.1.). TUD's spin-off activities and start-ups are highly successful, especially those in the fields of microelectronics, medicine, automotive engineering, system integration and software (incl. the particularly successful companies Novaled, Heliatek and GEMoaB). In 2017, TUD ranked 3rd among all German universities in terms of approved EXIST research transfer grants and 8th in the EXIST start-up grants categories. TUD earned great accolades with other research and transfer activities geared towards practical applications. Unmatched by any other German university, TUD researchers managed to win the 'Federal President's German Future Award for Technology and Innovation' twice. This annual award, which is open to all private and public innovations, was launched in 1997 and is endowed with €250,000. TUD professors were successful in 2011 with innovations in organic electronics and in 2016 with the development of carbon-reinforced concrete. From the ten projects funded within the BMBF programme 'Zwanzig20 - Partnership for Innovation', two originate from TUD with a total support of €32.7 million. In addition, TUD hosts three large-scale projects in the BMBF programme 'Validation of the technological and social innovation potential of scientific research' (VIP+) with a volume of €3 million.

TUD has concluded framework contracts for R&D cooperation with numerous leading companies. With reference to mobility and logistics, Deutsche Bahn AG, DB Schenker, the Bombardier Centre of Competence for Railway Systems Engineering and Integration, Rolls-Royce and Thyssen-Krupp are just some of the most important partners.

In contrast to the numerous collaborations between TUD and SMEs, there are comparatively few strategic collaborations with large corporations, or research centres run by companies on the campus itself. TUD will overcome this deficiency, which is related to the particular economic structure in Saxony, due to its persistency and outstanding scientific expertise. Already now, partnerships with global players such as Vodafone, Deutsche Telekom and Global Foundries testify to the attractiveness of cutting-edge research in RPA 2. TUD will continue on this path, will sustainably safeguard cooperations, push new development ideas together with its industrial partners, and ideally bring these to the campus in order to meet the challenges of the coming decades.

The close cooperation between transfer-relevant stakeholders at TUD and our partner organisations guarantees extensive transfer and start-up support measures. The **Transfer Office**, established as a ZUK measure in 2013, supports researchers in safeguarding and commercialising their research results in the form of intellectual property rights, spin-offs, and establishing contacts and cooperations with businesses. It collaborates with the **start-up initiative dresden|exists**, which designs business models, carries out qualification measures and supports the acquisition and the project management of research projects relevant to start-ups. The **Centre of Production Engineering and Management** at the Faculty of Mechanical Engineering is a specialist technology and knowledge transfer partner for regional SMEs. The **HighTech-Startbahn** was developed as part of the EXC cfaed and serves as a network, incubator and as a company specialising on innovation management and business development by networking established companies and young companies from the high-tech sector.

The business holding **TUDAG** is both a central partner of TUD and a central pillar in our transfer strategy (cf. A.2.1.). As the business branch of TUD, TUDAG supports knowledge and technology transfer to the private sector and provides entrepreneurial flexibility. TUD benefits from TUDAG's dividends and uses them to fund approx. 350 individual support measures per year.

In addition to entrepreneurial activities, there is also a scientific approach at TUD to the topic of transfer. The **Chair of Entrepreneurship and Innovation** at the Faculty of Business and Economics was established in 1999, followed by **the Institute of Intellectual Property, Competition and Media Law** in 2005. A **junior research group for knowledge and technology transfer** was set-up in 2015.

TUD has a wide range of offers with respect to the transfer of knowledge to the general public. This is highly visible through our presence in regional and national media, membership in advisory boards and cooperation with cultural institutions. An important focus is on opportunities for children and high school students to spark their interest in science from an early age, e.g. the Children's University in cooperation with the Deutsche Hygiene Museum, the DLR_School_Lab TU Dresden, the Maths Experience Park or the DIGS-BB project 'Science goes to school'. Furthermore, TUD is actively involved in societal discourse and advises policy-makers by contributing analyses, assessments and expert opinions. Especially topical is the work of institutions such as the interdisciplinary **Centre for Integration Studies**, the **Mercator Forum for Migration and Democracy** which focuses on political sciences, and the interdisciplinary **CRC 1285 'Invectivity. Constellations and Dynamics of Disparagement'**. In thematic events on topics such as populism, moral courage or racism, TUD scholars address pressing social problems and debate them with the public.

It can be firmly stated that TUD has successfully broadened its transfer activities and created a solid foundation. This concept must now be expanded to match increased demands and to optimise the exploitation of commercialisation potential. For this, contacts to industry must be managed, monitored and developed more professionally. Present structures in transfer are still too fragmented, bearing the risk of functional disarray. Furthermore, the interface between TUD's internal transfer promotion, the economic innovation marketing, and business development should be strengthened.

The performance area of transfer is firmly established in the regulations and agreements of TUD. It is seen as a central goal to facilitate the transfer of scientific results into economy and society, and regularly assessed by experts. The relevant criteria include the success rate of patent applications, the share of international patents as well as the share of commercialised IP rights through spin-offs, sales and licenses.

c) Research Infrastructures

One of the important quality goals of TUD is to procure state-of-the-art research infrastructures and to operate them professionally and efficiently. They are, therefore, regularly assessed within the framework of subject-related research evaluations (cf. A.2.2.1.). Available research infrastructures are an important factor in attracting excellent professors and research group leaders. Early-career scientists particularly benefit from the possibilities provided by cutting-edge technologies.

TUD's state-of-the-art **research facilities** are one of its fundamental strengths. Since the German reunification, more than €1 billion have been invested in the modernisation of the campus – particularly in new research buildings and facilities – thus creating excellent working conditions. In the last five years, this process has even been accelerated

by focused investments in research infrastructures (cf. A.2.1.). With the help of the Free State of Saxony, the backlog on renovation of existing buildings has been shortened and plans for new building adjusted to reflect the changes of the University´s profile. New research buildings for BIOTEC, CRTD, B CUBE, DZNE and NCT allow cutting-edge research in RPA 1 (cf. Fig. 8, p.19). Investments in the 'Technology Strip Nöthnitzer Straße', incl. the buildings for the high-performance computing centre and the future Lehmann Centre (cf. 3.2. p.46), the Hermann Krone Building for Applied Physics, the laboratory and office building for the research cluster cfaed, as well as other institute buildings on the TUD campus such as the Hempel Building for Chemistry, provide excellent conditions for research in RPA 2 and RPA 3. For research in the field of future mobility in RPA 4, infrastructural measures amounting to more than €40 million have already been undertaken. An additional major investment of €12.5 million was approved by the Federal Ministry of Transport and Digital Infrastructure (BMVI) in September 2018.

Next to these state-of-the-art research environments are, however, numerous buildings that do not yet meet the requirements or quality standards of a leading university. With support from the Free State of Saxony, this challenge will be tackled through ongoing and projected investments of more than €780 million for buildings until the year 2028.

Investments of €45 million in the new computing centre with its High Performance Computing and Storage Complex already strengthen numerous research activities at TUD. In 2014, the centre went into operation and was awarded the German Computing Centre Prize for the best concept in the 'energy and resource-efficiency' category. It is already one of the five most powerful mainframe computers at a German university, yet its capacities will be significantly expanded in the coming years by extensive hardware installations, including the new high-performance computer of the German Aerospace Centre (DLR). The Centre for Information Services and High-Performance Computing (ZIH) delivers efficient services in data communication, information processing and user support and conducts its own research and development. In collaboration with other institutions, ZIH provides central IT services not only for TUD and its University Hospital, but also for DDc research institutions such as the MPI-CBG and the SLUB. With its group storage drives, cloud services and IT-based project management tools, ZIH also makes a significant contribution to the social research infrastructure. Further improvement is desirable regarding the provision of digital communication and working environments with user-friendly interfaces.

Access to state-of-the-art large-scale research equipment is a prerequisite for cutting-edge research in many of the scientific core activities at TUD. In this respect, the close cooperation of the DDc partners proves to be an outstanding asset. Through the joint use of research infrastructures, particularly in the form of **technology platforms**, it has

been possible to make highly specialised technologies as well as the associated support services and scientific expertise accessible to a broad user base. Through this truly synergetic use of equipment and facilities, the existing resources (investments, human and material resources, infrastructure) can be utilised efficiently.

The joint technology platform of the Centre for Molecular and Cellular Bioengineering, which was established in 2016, comprises several life science research institutions. It plays a key role for RPA 1 and is a blueprint for similar installations. In addition, the technology platform of the DDc Genome Centre is of pivotal importance in the field of gene sequencing for collaborative research of TUD, MPI-CBG and the Centre for Systems Biology Dresden. The performance capability of this technology platform is demonstrated not least by the fact that it has been selected for funding by the DFG in 2018, as one of four national competence centres for next generation sequencing.

The expansion of the microelectronics and nanoelectronics infrastructure in RPA 2, which has been intensified since 2012 is supported by the technology platform of the Dresden Centre for Nanoanalysis (DCN). Strengthened by investments of €6.5 million in a transmission electron microscope and a 3D x-ray microscope, this technology platform is a key to success not only for research cluster cfaed, but also for many fundamental and application-oriented research projects in the natural and engineering sciences (esp. materials science and engineering) at TUD and our DDc partner institutions.

The **web-based Dresden Technology Portal** has been in development since 2011 in order to offer scientists information on the availability of and access to research equipment, services and expertise available across institutional boundaries. As of October 2018, around 2,300 entries for large-scale equipment and services are already listed. It is our aim to extend this in due time to all facilities in all DDc institutions. The technology portal is another important element of the available research infrastructure (cf. A.2.1.). It is an outstanding example of the benefits of the synergetic cooperation between the DDc partner institutions with respect to research excellence, efficient use of resources and active collaboration.

In order to realise the full potential of the technology portal and platforms, improvements are under consideration regarding the flow of information and handling of the sometimes very complex conditions of use and accounting procedures. In the future, the resources provided in the context of new appointments will be linked to the configuration and use of technology platforms, i.e. for expansion, operation, maintenance and repair, instead of partially redundant purchases of individual pieces of equipment.

A challenge in the joint use of research infrastructure by scientists from TUD and various DDc partner institutions is the complex fiscal legislation by State and Federal Government. In 2018, TUD in collaboration with the MPI-CBG succeeded in establishing an

internal partnership under civil law (*BGB-Innengesellschaft*) to develop a unique and exemplary model for the joint use of research infrastructure by a state-funded university and a federal government funded non-university research institute. This model, the first of its kind in Germany, will also be applied to other research areas, infrastructures and DDc partners in the future.

As outlined above, TUD gives the expansion of its research infrastructure a high priority and, therefore, pursues this goal persistently. Complementing the above measures, the University Executive Board launched a three-year, €58 million investment programme in 2017 to improve the research and teaching infrastructure even further.

The Saxon State and University Library Dresden (SLUB) is one of the most productive academic libraries in Germany, and a further asset of TUD's information infrastructure. It supplies information as well as library coordination services and other services to students and staff of TUD. With the 'Material Hub' platform for questions pertaining to materials-related research, transfer and applications, the SLUB contributes to strengthening the visibility and performance of the Dresden Materials Research (RPAs 2/3). The SLUB has been able to acquire extensive third-party funding, in particular for digitalisation and the development of infrastructure and software, making it an important centre for innovation and coordination in the European library landscape. With OpARA, a multidisciplinary repository for the publication and long-term archiving of research data has been developed since 2014. Since 2018, the SLUB provides tools, methods and workflows for **research data management**. This laid the necessary groundwork for the long-term archiving, adequate description and management of research data in accordance with good scientific practice and the release and accessibility of data for subsequent use (open access policy). The contact office for research data is jointly operated by TUD and SLUB to provide services and consultation.

The central element of TUD's information infrastructure is the internet-based **Current Research Information System (CRIS)**, in which data on research and transfer at TUD – such as current research projects, scientific publications and IP rights can be updated and researched. With over 800,000 stored data sets, the system provides a solid information base. Nevertheless, it no longer fully meets requirements with respect to presentation and usability. For this reason, TUD and SLUB will implement a new CRIS in order to improve the availability of research information, to support decentralised scientific units and to provide research administration and university management with data for strategic developments and decisions.

The distinctive **campus** structure and proximity to Dresden's city centre are the basis for copious successful, interdisciplinary projects at TUD. Short distances on the main campus as well as the local concentration of related research topics (e.g. 'Biopolis' campus

in Dresden-Johannstadt) facilitate an uncomplicated dialogue and close cooperation within TUD as well as with DDc partners. The campus also has substantial potential for intensified interaction between TUD and the Dresden community. At present, this is hindered by the lack of spaces and formats for encounters and exchanges outside lecture halls, seminar rooms and labs. Similar to the backlog for renovation of some buildings, this constitutes a weakness that needs to be remedied.

A.2.2.3. Excellence of researchers and framework conditions

TUD owes its dynamic development to academic colleagues who make exceptional contributions to research in their scientific fields and who bring their expertise and enthusiasm to fruition in regional, national and international collaborations. This particular type of personality, which is essential for a synergetic university, is a paramount criterion for TUD appointments and the promotion of scientific talents. The scientists and scholars listed in C.2.4. and named on the following pages meet this requirement to a high degree. They are exemplary for many of the more than 600 professors and 4,700 scientific staff at TUD, who perennially make excellent contributions to fundamental and application-oriented research, to technology and knowledge transfer, to public discourse on societal issues as well as to the promotion of young researchers and the teaching of students.

When describing excellence, we are invariably aware that the different academic cultures must be reflected differently and that – in view of the diversity of performance areas – there are very individual criteria. Furthermore, it would be inappropriate to evaluate academic achievements exclusively with quantitative performance indicators due to the different ‘academic age’ of the scientists and scholars. For TUD, excellence of academic staff is certainly indicated by the leadership of internationally visible research consortia, such as the **existing research clusters** (e.g. Profs. Bonifacio and Fettweis) and the **new EXC** (e.g. Profs. Fitzek, Grill, Vojta). The prerequisite for achieving this are **outstanding research results** that have made a significant impact in the respective discipline or research field (e.g. Profs. Chavakis, Cuniberti, Ludwig). TUD owes its strong position in **influential publications** to scientists such as Profs. Feng, Grill, Kalbitz, Kirschbaum. Many of our academics are extraordinarily successful in acquiring **third-party funding** for their research (e.g. Profs. Bornstein, Cherif, Kaskel) and have thus made a significant contribution to TUD’s outstanding third-party funding balance. A hallmark of quality is the success in the **highly competitive third-party funding** procedures of the European Research Council (e.g. Profs. Brand, Buchholz, Koch). Furthermore, **participation in academies** with substantial scientific, technical and political influence, such as the National Academy Leopoldina (e.g. Profs. Curbach, Kempermann, Kirschbaum) or acatech (e.g. Profs. Fettweis, Voit), is regarded as evidence of special scientific achievement and visibility. Another criterion for excellence is membership in high-ranking **national expert**

committees (e.g. Profs. Fricke, Münkler, Thum). In engineering and life sciences in particular, the impact of researchers is indicated by transfer activities such as **patents** (e.g. Prof. Buchholz) and **spin-off companies** (cf. Positioning p.5). As an example, the PIs of the cfaed research cluster alone have founded more than 60 start-up companies in recent years. Profs. Besand, Münkler and Vorländer, among others, have contributed to the transfer of knowledge in the humanities and social sciences and have significantly influenced the **discourse on current societal problems** through their publications. **Awards** such as the Gottfried Wilhelm Leibniz Prize also represent a conclusive indicator of excellence (e.g. Profs. Eckert, Leo, Schwille). As a University with *people-focus* in all scientific career phases, TUD also commends the excellence of academics who have already made extraordinary contributions to their field of research at an early stage of their scientific career and have played a decisive role in the conception and realisation of large-scale projects (e.g. Profs. Koch, Krötzsch).

TUD is committed to promoting the excellence of its academics at all career levels. The toolbox for this includes science-supporting structures, the personnel development concept as well as a comprehensive quality assurance system. TUD's third-party funding balance and the successfully acquired EXCs confirm the effectiveness of this holistic approach. Within this context, four particularly effective individual measures designed to promote excellent scientists and scholars have to be highlighted, which have led to new research projects, publications and collaborations:

1. Through the dedicated support of particularly well-established and high-performing researchers, the ZUK measure 'Support the Best' demonstrably enables the formation of new networks and collaborative projects.
2. Tenure Track professorships and postdoc positions which are filled according to the Open Topic principle in order to attract young researchers who achieve outstanding scientific results through highly creative and interdisciplinary approaches.
3. Excellent academics at all career levels and their scientific networks benefit from the promotion of international cooperations.
4. The Young Investigator Status creates better overall conditions for independent junior research group leaders on their way to a professorship.

In continuing and complementing these measures, greater emphasis will be placed on ensuring that they lead to an increase in the numbers of female and international scientists and scholars. In addition to the above ZUK measures, the regular appraisal meetings with all professors that TUD has introduced in 2009 to discuss expectations on their performance, the required resources, past experiences and future project ideas are of fundamental importance in ensuring the appropriate conditions for excellence.

A.3. Plans and potential

A.3.1. Strategy and objectives

TUD will continue its successful overall strategy (cf. A.2.2.), which is centred around the research excellence of our scientists and scholars. The profile-forming developments that were accelerated by TUD's success in all funding lines of the Excellence Initiative constitute a solid foundation for this process. Strategic decisions outlined in ZUK initiated a decisive paradigm shift, which has an impact far beyond the actual funding period. We will pursue our long-term overall strategy to firmly position TUD among the Top 5 universities in Germany, based on internationally visible cutting-edge research. The measures described in the following five sets of objectives are essential for reaching these goals and for addressing central elements of the strength and weakness analysis summarised in Fig. 6 on p. 16. To achieve these targets, TUD must act responsibly and professionally at all levels and make the best possible use of synergies through interdisciplinary and inter-institutional cooperation.

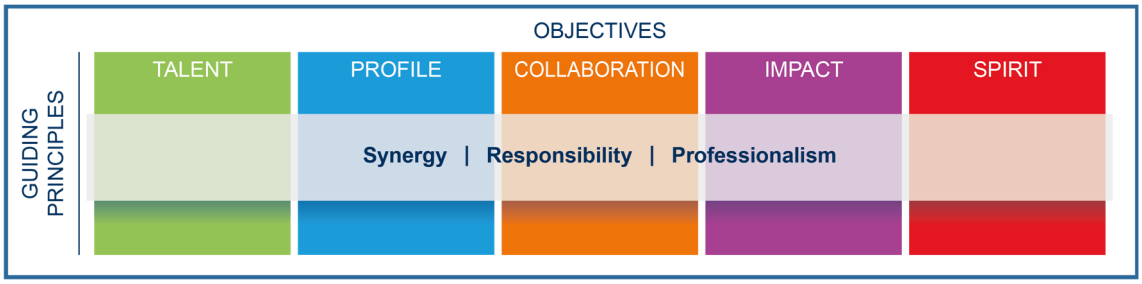


Fig. 11: Objectives and guiding principles to reach the strategic targets of TUD

TALENT aims to strengthen TUD in finding and recruiting the passionate scientists and scholars who shape their subject area through excellent research, and provide them with space to pursue their curiosity and develop their ideas. This is to be achieved by further professionalising the recruitment processes of leading researchers and supporting them with optimal conditions for research and personal development. In addition to comprehensive support structures, TALENT also facilitates transparent career paths, such as those established by TUD within ZUK and the Programme for the Support of Early-Career Researchers by the Federal and State Governments. Paving the way for talented students to get involved in research at an early stage is a step towards achieving the objective, which – in line with the Higher Education Pact 2020 – also contributes to increasing the attractiveness and academic success rate at TUD. This strategic ***people-focus*** addresses key aspects of the SWOT analysis in that dynamic and highly qualified people represent an enormous opportunity, while demographic change poses a risk with regard to staff shortage and departure of top researchers.

PROFILE includes raising the potential of Emerging Fields at TUD to become competitive at the top level of international research. In this context, the all-encompassing digital turn is an opportunity that TUD wants to seize as an institution and respond to with interdisciplinary research. The profile-formation process of TUD may be hindered by a too slow pace of construction activities. The University intends to reduce this risk by assuming responsibility for planning, implementing and financing building projects.

COLLABORATION aims to advance national and international research cooperations to a higher level of commitment. Central to this is DRESDEN-concept. Its strong collaboration will expand into many performance areas and areas of activity. Additional joint appointments and new non-university research institutes in Dresden are an opportunity to mobilise further collaborative potential.

IMPACT has its focus on strengthening the public outreach of TUD. To achieve this, we will enhance support for transfer activities, reform our scientific and general communication, and create spaces for exchange with society, cultural institutions and businesses. TUD utilises the inherent opportunities of this exchange and mitigates the risk of a growing scepticism towards scientific findings and methods in certain parts of the population.

SPIRIT focuses on the expansion of transparent, target group-oriented communication and interdisciplinary encounters as well as on the continuous further development of a shared understanding of TUD's goals and values. From this 'Dresden Spirit', further strength and innovative ideas are generated for new achievements in all performance areas and areas of activity.

In the process of strategy development, the university-wide exchange in various formats such as retreats (e.g. with Senate, University Council, Deans, DRESDEN-Board), Future Labs and working groups has been of great value (cf. A.2.2.). Together with the members of the University and the other representatives mentioned in C.2.4., the University Executive Board reviewed the overall strategy in preparation for the University of Excellence application. We updated and prioritised objectives, collected impulses and feedback for further development of existing and new measures with the Directorate Strategy and Communication, while relaying the results to the aforementioned partners in suitable formats. This interactive adjustment of assessments and experiences makes it possible to identify and address conflicts early on. TUD has thus been able to counteract the **conflicting objectives** that may arise, for example, due to the need for differentiation while at the same time maintaining a balance between all performance areas and scientific disciplines. It did so by both continuously involving the University community and by establishing measures aimed at strengthening interdisciplinary research across the University. Nevertheless, the setting of higher and lower priorities is indispensable in order to achieve an improvement in performance with the funds available. The identification of

activities with lower priority is based on valid data and accompanied by intensive coordination as well as the evaluation of alternative objectives. In this process, emphasis is placed on a responsible design of adjustments and transparent communication. TUD's specific mix of committees, innovative exchange formats and regular evaluations establishes a system of checks and balances that ensures the viability of the overall strategy, as proven with the successful implementation of the ZUK measures.

A.3.2. Planned measures and anticipated effects

To secure a place among the world's leading universities, TUD is building on the long-term overall strategy encompassed in its **Institutional Strategy 'The Synergetic University' (ZUK)** and the successful measures developed therein. The objectives outlined for the **University Allowance** and for the **University of Excellence** application form a coordinated further development of this strategy and are again aimed at the strengthening of the entire University and its governance. Whereas the University Allowance in and of itself facilitates the partial realisation of central elements, it does not enable the achievement of the overarching target in its full breadth and in an appropriate timeframe. The set of objectives described in the following relates, therefore, to the fundamental goals of the University Allowance. They are, however, underpinned and complemented through essential additional measures.

A.3.2.1. Talent

Excellent minds are the essential prerequisite for academic excellence. Therefore, it is crucial for the University´s scientific success to recruit and retain outstanding staff at all appointment levels. In order to fulfil their potential, newly recruited as well as existing employees are to be promoted and supported in the best possible way. TUD takes on these tasks within the context of its personnel and organisational development and at the same time fosters particularly promising students. Due to the high strategic relevance of these aspects for the University, three measures will be implemented to strengthen this key area. In addition, specific measures for high-performing scientists will be realised in cooperation with the DDc partners (cf. A.3.2.3.COLLABORATION).

T1 - Appointment of Excellent Professors

TUD will **optimise and reorganise its appointment procedures** in order to safeguard its strategic orientation and capacity for renewal. This starts with the further professionalisation of the appointment process itself, where a bundle of interlocking activities will be introduced to strengthen the selection and acquisition of the best candidates. Based on the strategic orientation of a vacant chair, which is agreed upon between the University Executive Board and the Schools, a comprehensive analysis of potential candidates is carried out. To attract the brightest minds, TUD introduces a global active recruitment

process for all appointment procedures, which supplements the usual job advertisements and increases the number of suitable applicants. Highly promising candidates are invited to TUD prior to the start of the official procedure, either individually or as part of smaller workshops or similar events.

The **quality of the selection procedure** is crucial for the appointment of top candidates. For this purpose, the criteria for the choice of external committee members and for the committee members without subject-specific background in the professorial appointment committees, should be fine-tuned, standardised and made mandatory for all procedures. The 'fast track appointment procedure' stipulated in TUD's professorial appointment regulations shall become the standard to increase the chances of successful recruitment. An extended visit and familiarisation programme is envisaged for short-listed candidates to meet future colleagues and to obtain information about the advantages of the scientific location and the Dresden region.

DRESDEN-concept partner institutions support the recruitment and appointment phase by offering - where appropriate - additional research infrastructure, personnel, income and dual career possibilities. Thus, first-class academics, whose appointments would have been out of reach for a single institution alone, can now be attracted by pooling resources.

With the above general measures, five pathways lead to permanent chairs at TUD (cf. Fig. 12), which are systematically adapted to the University's strategic development. In all cases, firm regulations exist to safeguard that strong attention is paid to aspects of equal opportunity and internationality.

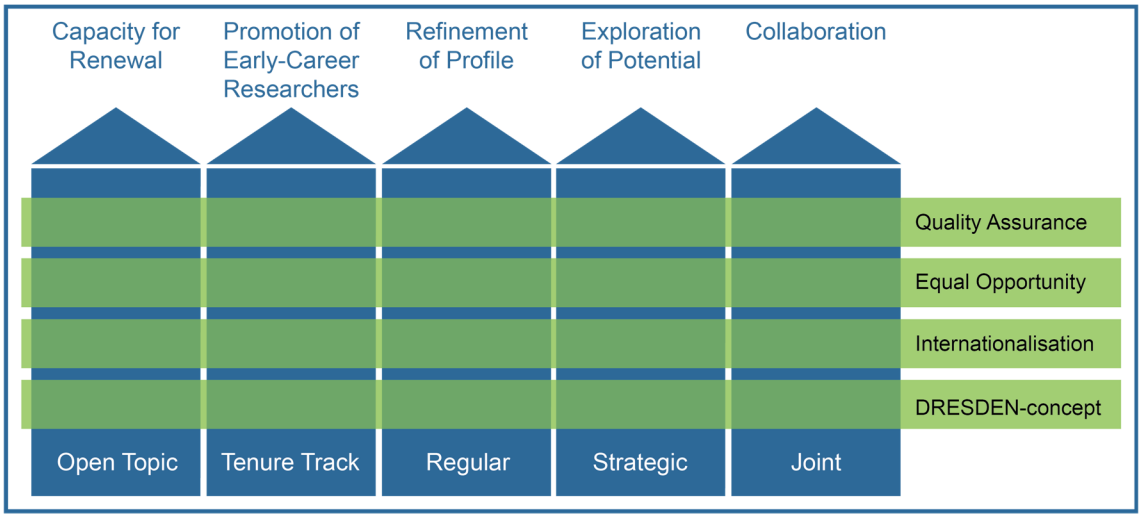


Fig. 12: Pathways to professorial positions at TUD and their specific objectives

OPEN TOPIC The format of Open Topic Tenure Track appointments, successfully introduced within the scope of ZUK, has proven to be an excellent format for triggering academic rejuvenation within the University. Hence, 10% of new appointments in all Schools

are to be advertised as Open Topic Professorships, without subject-specific affiliation. With the help of a commission of high-ranking experts, they will be filled exclusively based on academic potential.

TENURE TRACK From the Open Topic format, important experiences with regard to successful Tenure Track appointments have been gathered and enshrined in the University regulations. This was fundamental for TUD's success in the subsequent Programme for the Support of Early-Career Researchers by the Federal and State Governments. In the future, TUD will realise at least 20% of its appointments via Tenure Track procedures. Recruiting talented young researchers and selecting them for permanent professorial employment through these competitive procedures increases TUD's academic dynamism and thus contributes to its capacity for institutional renewal. It also improves the transparency of academic careers for junior staff.

REGULAR APPOINTMENT PROCEDURES The majority of professorial appointments will continue to be advertised internationally as permanent positions for clearly defined academic subject areas. However, the above quality assurance (QA) measures will become mandatory.

STRATEGIC APPOINTMENT In justified exceptional cases, the Saxon Higher Education Law allows a direct appointment without public advertisement in order to recruit eminent researchers in a swift and confidential process. The prerequisite is the recommendation of a selection committee composed of high-ranking external experts. In the future, this option, which permits targeted appointments, will be used to fill positions of particular strategic relevance to the development of TUD (cf. A.3.2.2.PROFILE).

JOINT APPOINTMENTS For the benefit of both organisations, many outstanding scientists and scholars are jointly appointed to a chair at TUD and a concurrent senior management position at a DDc or other non-university partner institution (cf. p.12/13). Framework agreements regulate mutual expectations and obligations, such as teaching and research performance at TUD, staffing and infrastructure of the chair and the recognition of both affiliations in publications and presentations.

The appointment of excellent professors does not end with the signing of contracts, but continues with their successful **integration into TUD**. In addition to the extensive support programme by the appointment team and the Welcome Centre for new appointees, a reduced teaching load is offered to first-time appointees (especially those coming from abroad) during the first two years in order to support scientific success, career development and the compatibility of work and family. Additional teaching staff will be assigned to compensate during this period. All Junior Professors shall be supported by an individual qualification programme and will be guaranteed sufficient resources to independently and purposefully pursue their scientific careers.

As a family-friendly University, TUD provides additional funds to expand the successful **Dual Career Service** to support newly hired professors and research group leaders who come to Dresden with their partners. In cooperation with the DDc partner institutions, a comprehensive dual career support concept will be further developed and realised.

Despite the introduction of multiple measures and major efforts by the University, the proportion of **female academics** at TUD, especially at the professorial level, is not yet satisfactory (cf. A.2.1., A.2.2.1.). Consequently, TUD will intensify its activities to attract outstanding women to senior positions. The Equal Opportunity Concept updated in 2018/19 contains numerous measures that address this objective. Reinforcing equality is also a central element of the Excellence Strategy, which extends to all measures in this document. Especially with regard to female professors, the **active recruitment** mentioned above will be an instrument to seek out excellent women and to motivate them to apply. This includes measures such as identifying and approaching potential candidates, establishing personal contacts and inviting them to TUD to present their research achievements, in order to reduce the obstacles for applying. More than 50% of the approached scientists and scholars shall be women in order to ensure a high proportion of female applicants. Appointment processes are suspended or repeated if no suitable female candidates could be invited for an interview. A lack of women on any short list of candidates must be justified in a report to the Rector.

A special format for the recruitment of female researchers is the **Eleonore Trefftz Programme for Visiting Women Professors** (cf. A.2.2.1.). It was established within the context of ZUK and shall be continued with more flexibility to match newly identified requirements. Visits for 3-12 months will be possible for (junior) female professors and advanced postdocs, who will contribute to research and teaching but – most importantly – become well acquainted with the Dresden academic environment. Preference will be given to candidates with an expertise in areas were professorial vacancies will arise in the near future.

T2 - Promotion of Early-Career Researchers

To strengthen its pool of excellent junior researchers, TUD will continue on the successful path established by the DIGS-BB since 2007 by, as a rule, advertising all doctoral and postdoctoral positions internationally. Over the past five years, the **Graduate Academy (GA)** has succeeded under the directorship of Prof. Rödel to establish a wide range of centrally organised, high-quality offers for doctoral candidates. These counselling and support services for the development of expertise and soft skills are open to all doctoral candidates in Dresden. They will be continued and refined.

Following the introduction of fundamental elements of **quality assurance** in the doctoral phase, **university-wide standards** are now being implemented. Replacing the common

practice at German universities of having only one supervisor, a second supervisor will become obligatory for each TUD doctorate. A further important aspect of QA will be the dissertation assessment by two professors who themselves were not supervisors of the doctoral student. At least one of them shall be from another institution.

Over the coming years, TUD will focus in particular on expanding its **offer of support for postdocs**, which will also be realised in cooperation with the DDc partner institutions. This includes special coaching sessions, career planning events and individual career counselling. The support of female researchers and the compatibility of career and family is particularly important during this phase, since it is decisive for the further development of scientific careers. For the preparation of their own applications for third-party funds, sophisticated Postdoc Starter Kits (seed funds for research students, travel and equipment), a TUD Grant Factory as well as workshops for the development of relevant leadership skills are available. Brilliant postdocs can apply for TUD Young Investigator Status (cf. A.2.2.1.) and qualify to head a DDc Lab (cf. A.3.2.3.COLLABORATION).

The **Lab2Lab Cooperation** programme supports international collaborations between young researchers from Dresden and from abroad. The collaborating groups can jointly apply for funding, whereby various modules (e.g. short research stays, workshops, meetings to prepare joint publications or applications for third-party funding) can be flexibly combined according to a mix-and-match principle. By expanding international networks, the programme can also sustainably promote the future academic careers of postdocs.

Postdocs who consider a lateral career move outside the scientific community are supported by the GA's **Future Career Programme**, including courses on management skills, networking opportunities and job fairs with potential employers as part of the Get in Contact programme.

T3 - Research-Oriented Teaching

With **FOSTER – Funds for Student Research**, TUD will support the next generation of researchers through student projects. Funding lines for students with a particular interest and talent in research are (i) participation in student research competitions, (ii) organisation of student research activities (conferences, competitions, exhibitions etc.) at TUD and (iii) attending international conferences together with professors. FOSTER is a suitable funding instrument for making student research initiatives visible and at the same time increasing TUD's brand recognition.

A **Teaching Synergies Programme – Joint Teaching, Synergetic Learning** will be introduced to promote students with a particular interest in science. This programme aims to exploit the teaching potential of non-university DDc academics beyond the mandatory lectures by institute directors and the supervision of research work. It includes:

- a coordination office at the Centre for Interdisciplinary Learning and Teaching,
- a higher education didactics qualification programme for young DDc researchers (in cooperation with the TUD Centre for Continuing Education),
- an experimental laboratory for research-oriented and digital teaching, and
- QA of cooperative teaching in cooperation with the Centre for Quality Analysis.

The highly desirable access of TUD students to top-level university and non-university research is an important concern in teaching. In order to systematically facilitate this access, **Teaching Excellence Tracks** shall be established for outstanding students interested in interdisciplinary research. These courses, project seminars and student research projects as well as internships are carried out together with leading researchers and using the infrastructures of the participating institutions (e.g. from TUD research clusters and DDc partners). The courses, frequently taught in English, are to be integrated as modules or electives into existing degree programmes, preferably using digital forms of teaching and learning. In addition, they may also be considered in the development of new interdisciplinary degree programmes, e.g. by the EXC.

A.3.2.2. Profile

Only with a clear profile can a university optimally harness its potential and resources to tackle current and future challenges with a high standard of disciplinary and interdisciplinary research. It will lead to an increase in global brand recognition and will attract the best minds. TUD will continue on its successful path and will implement the following measures to strengthen its profile:

- Selected scientific areas will be strengthened in order to raise the entire University to a higher level of performance according to its profile,
- Digitalisation will be used as a driver for scientific excellence and rooted as a multidisciplinary topic in all scientific disciplines of TUD,
- Incentives and support instruments for research will be enhanced to ensure the University's capacity to embrace renewal and to further form its scientific profile.

P1 - Strengthening research areas with strong potential

Over the past 10 years TUD has, based on its institutional research, strategically concentrated its research activities into 5 RPAs, which it continues to advance and strengthen through appointments, investments and incentives (cf. A.2.2.1.). Achieving scientific excellence and international visibility in all 5 RPAs is TUD's stated goal, thus promoting the University as a whole to a higher standard. This has already been accomplished in 3 of the RPAs. However, TUD also has substantial research potential in the three EFs of RPA 4 and RPA 5, which already boast high levels of third-party funding,

influential publications and numerous research projects with national visibility (cf. Fig. 7). Yet, this potential must be unleashed by means of clear structures and responsibilities, a coordinated research and appointment strategy and the bundling of complementary infrastructures and resources to form internationally competitive scientific programmes. In order to catalyse this process, well-financed **strategic key chairs** for these three research programmes will be established. Excellent academics with high international visibility, experience in leading large-scale scientific projects, a strong international network and pronounced cooperation, communication and integration skills are to be recruited to fill these positions. The selection and recruitment of these extraordinary individuals is carried out with the help of a high-ranking selection committee comprised of internal, external and international experts (cf. A.3.2.1.TALENT). The integration of university and non-university research partners, the appropriate definition of forthcoming professorial replacements, and the accompanying establishment of junior research groups will accelerate the growth and consolidation of the identified EFs. Thus, it should be possible to successfully apply for a DFG Research Training Group in each of the three EFs after about three years, for a DFG Collaborative Research Centre after about five years, and to submit a promising proposal for a new EXC after seven years.

If no suitable candidates for the key strategic chairs may be found or appointed due to the stringent criteria, the search will be continued and intensified with a modified denomination. Alternatively, particularly promising younger scientists and scholars (‘rising stars’) may be considered for appointment. Both options would, however, delay the anticipated development. The following fields are to be strengthened strategically:

AUTONOMOUS AND NETWORKED MOBILITY With the rapidly increasing digitalisation in the mobility sector, disruptive changes are arising in lead-technologies as well as in economic and infrastructural settings. Automated and digitally networked vehicle and aircraft concepts show potential for an optimised transportation of passengers and goods, but must first prove that they are safe, efficient and environmentally friendly. Transport infrastructure itself must become smarter across all modes of transportation. Real-time risk models and assessments are required for this purpose. TUD is responding to these challenges by establishing a **Centre for Autonomous Mobility** (founding director Prof. Bäker), in which it combines the relevant expertise of the largest Transport Science Faculty in Germany with other TUD Faculties (e.g. Mechanical Engineering, Electrical Engineering and Information Technology, Psychology and Humanities) and cooperates closely with non-university research institutes and industry. New investments (approx. €50 million) for construction and infrastructure as well as substantial research projects and training groups in this field provide excellent starting conditions for advancement. In addition, several vacancies arising in the next few years will be strategically adjusted to this research area. This development is to be catalysed by the strategic appointment of

a professor in the area of **Smart Mobility Technologies** focusing on methodological breakthroughs for the automated and secure operation of processes in highly complex mobility networks. For research in this field, TUD also has access to the infrastructures of the largest independent centre for automated and networked driving in Europe, which is operated by DEKRA at the Lausitzring close to Dresden. For further advancement, two interdisciplinary Research Training Groups on scenarios, methods, evaluation and social acceptance of highly automated mobility will be established.

WATER RESEARCH Securing the supply of water is one of the world's greatest social challenges. The complex problems of water availability are drastically exacerbated by increasingly frequent and prolonged periods of heat, drought and heavy precipitation as well as by global population growth. The Centre for Advanced Water Research (headed by Prof. Krebs), jointly operated by TUD and the Helmholtz Centre for Environmental Research (UFZ) since 2013, will establish a new thematic focus **Smart Water Systems in an Extreme World**, in which the systems 'urban space' and 'hydrological catchment areas' will be holistically examined. Thus, it will be possible to develop optimised solutions for both systems. Big Data analytics, innovative sensor networks and real-time model and forecasting systems will provide the basis for a new generation of analysis, evaluation and management tools for controlling quantitative and material flows in catchment areas that adequately represent both the urban infrastructure and the natural environment. The internationally recognised expertise of TUD and UFZ, with in total 33 water-related professorships, represents an extraordinary potential. In order to attain an internationally leading position with the research focus 'Extreme Events in Systems', all chairs in the field of hydro-science that will become vacant over the next five years will be consistently geared towards this topic. UFZ will support this cooperation through its staff and outstanding infrastructure. To accelerate this development, **two** additional chairs – **Data Science** and **Artificial Intelligence in Smart Hydrosystems** – will be co-financed by TUD and the UFZ. This is supported by the joint establishment of a **Research Training Group** and a shared lab (cf. A.3.2.3., DDc Labs).

SOCIETAL CHANGE In recent years, substantial scientific activities were initiated at TUD to investigate the cultural manifestations and consequences of societal change processes, motivated by social and political developments at the national and international level (cf. A.2.2.1.). The continued poignancy and relevance of these issues are reinforced by the increasing digitalisation of society. For this reason, the research expertise already available in the EF **Societal Change** is to be boosted by the establishment of a **Chair of Digital Cultures.** It will deal with cultural-theoretical and media-theoretical foundations, cultural manifestations, communication change processes and the socio-political effects of digitalisation. In this way, the chair supports the strategic realignment of the School of Humanities and Social Sciences, which places a focus on the relevance of digitalisation

for questions of culture and societal change in the 21st century. Furthermore, it will play a key role in the envisaged master's degree programme Digital Humanities.

Life in the future will be enormously affected by far-reaching advances in digitalisation, technology and medicine. Due to our unique academic profile, TUD will shoulder the responsibility of reflecting and moderating this development and create a **Centre for Societal Impact of Disruptive Innovations (SIDI),** which is organisationally allocated to the University Executive Board. Complementing TUD's research efforts aimed at efficient and safe innovations, this Centre will analyse the societal changes and stresses brought about by disruptive technological and scientific developments. Benefiting strongly from the reflexive skills of the School of Humanities and Social Sciences, SIDI is located at the interface between the five academic Schools, and strongly cooperates with our DDc partner institutions. One of its pillars is the successful Boysen-TUD Graduate College 'Mobility in Flux' (Profs. Hurtado, Hagen, Möst). In addition, four new independent junior research groups will be established with a focus on the ethical, normative and cultural conditions of scientific developments, the assessment of social consequences, risk management and risk communication. Selection of the research group leaders will be according to the Open Topic approach (cf. A.2.1.). In addition to academic excellence, connectivity to TUD´s ERAs and EFs is required. The SIDI will be based in the new Project House Future, which offers ideal conditions for the exchange with society, business and politics (cf. A.3.2.5.SPIRIT, A.3.2.4.IMPACT).

P2 - Digitalisation as an innovation driver

Digitalisation, as a process with enormous technical and societal impact, poses significant challenges that require TUD's full breadth of academic competences. The University has considerable expertise in the use of and research into digital processes. This potential is to be exploited in a targeted manner by the Synergy of Systems Centre, the Lehmann Centre and by filling the key strategic chairs in the three EFs of RPAs 4/5, with a particular focus on data science and artificial intelligence.

With the founding of the **Centre for Synergy of Systems** (founding director Prof. Aßmann), TUD is focusing on the ongoing digitalisation of living environments and their dependence on digital systems. The question of how independently designed digital or cyber-physical systems and digital or non-digital psychological, biological, social, linguistic and cultural systems can work together, and what effects and limitations they have, challenges the very idea of the University in a fundamentally new way. This Centre will open up various fields of application for artificial intelligence and data science in technical, urban, health-relevant and social spaces with an integrated approach. In order to develop key skills across scientific disciplines, four chairs will be created to catalyse changes in areas, in which the potential of digitalisation has not yet been sufficiently

exploited, to develop IT core skills for interdisciplinary contexts and to unite the digitalisation-related activities of the respective fields in the Synergy of Systems Centre. Located in the Lehmann Centre, where TUD's information technology expertise will be grouped, it acts as a platform, where local digitalisation expertise comes together in the form of Living Labs. Existing and future professors working in the Synergy of Systems Centre will be affiliated to relevant Faculties but also co-opted to the Faculty of Computer Science. As a result, previously distributed expertise will be combined and interdisciplinary projects initiated. Professors and staff of the Centre contribute to teaching with topics on data science and artificial Intelligence, within the framework of new interdisciplinary and research-oriented courses (cf. A.3.2.1.TALENT).

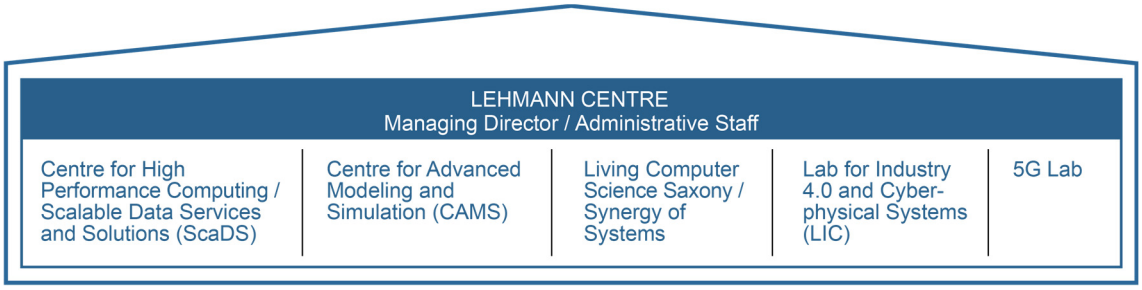


Fig. 13: IT-related units bundled in the Lehmann Centre of TUD

With the **Lehmann Centre** (founding director Prof. Nagel), TUD addresses the fields of digitalisation, digital architectures and software in a highly visible synergetic approach. This Centre (cf. Fig. 13) will integrate various research groups in a new building for approx. 600 scientists (cf. A.2.2.1., Fig. 9). It will promote scientific cooperation, bundle research expertise, improve support services and bolster the general attractiveness of the University. Supported by a contact office and shared working spaces for industry, SMEs and other partners, application-orientated digital solutions are to be developed and spin-offs established in cooperation with the Centre for Transfer and Entrepreneurship CTE (cf. A.3.2.4.IMPACT).

To react to the increasing importance of digitalisation for the entire University, TUD is modernising its IT governance. From 2020, the position of a full-time **Chief Information Officer (CIO)** will be established as a member of the Extended University Executive Board, replacing the previous CIO committee. The CIO will be responsible for strategic planning and control of all central and decentralised IT processes, incl. IT service management, as well as for the advancement of digital transformations in the University. She/he will be supported by an IT Change Advisory Board.

P3 - Promotion of research

To support the initiation of third-party funded **research projects** and to strengthen cooperation and profile-forming, TUD will expand the successful 'S**TUD**IO' event format (cf. A.2.2.1.):

- NETWORKING S**TUD**IOs are satellite symposia linked to important conferences in Dresden that allow participants to discuss topical and method-related challenges that will eventually lead to future projects. Supported by TUD's Research Directorate, networks will be fostered of local research stakeholders with leading international researchers and funding bodies.
- IDEA S**TUD**IOs support researchers from TUD and DDc partner institutions to develop competitive project ideas for specific funding programmes. Depending on the topic, stakeholders from other relevant organisations are invited.
- PROJECT S**TUD**IOs offer professional support to existing project consortia in order to efficiently develop effective, well-structured and legally correct grant applications.

In addition to the support of concrete applications for research funding, the further development of the University´s research profile also requires the flexibility to anticipate new advancements by providing appropriate incentives and funding instruments. Similar to the Support the Best Pool created within the ZUK framework, a **fund for strategic development** is to be set up to promote medium to long-term activities, particularly within the RPAs. 'High risk, high gain' projects are actively promoted and encouraged while at the same time ensuring research excellence through a strict evaluation procedure.

A.3.2.3. Collaboration

TUD is convinced that intensive and strategically focused collaboration between researchers from different career stages, disciplines and institutions is a prerequisite for overcoming pressing challenges in technology, environment, health and society. In this context, collaborative research is understood as a synchronised process of joint knowledge generation that goes far beyond the usual project cooperations. Such collaborations have a significant influence on TUD's academic profile and advance its scientific excellence. By strategically strengthening our research relationships, it is expected that the international visibility of TUD and our attractiveness to excellent researchers will increase even further. Two measures are intended to deepen existing research relationships – regionally and internationally – and to facilitate new collaborations in the future.

C1 - Further development of DRESDEN-concept

In recent years, TUD has been able to create forward-looking structures and initiate large-scale projects with DDc partner institutions that have led to internationally renowned research excellence. The DDc research alliance is both an opportunity and a responsibility for TUD, which offers ideal framework conditions for excellent joint projects and initiatives due to its state-of-the-art infrastructures, high density of expertise and willingness to cooperate. This is facilitated by short distances between laboratories and joint personnel (cf. A.2.1.). We will expand these already intense collaborations by focusing

on personnel, infrastructure and communication, with the aim to strengthen existing synergies as well as create new ones.

The **DRESDEN-concept Labs** leverage the potential of the Dresden scientific region to open up perspectives for the best Young Investigators and thus complete the TUD measures already outlined in A.3.2.1 (TALENT). In cooperation with at least one DDc partner institution, the very best TUD Young Investigators are offered a tailor-made package with personnel and operating budget as well as permanent employment at the Dresden science location (cf. A.2.1.). It is envisaged that 5-7 DDc Labs will be established on an 'evergreen' basis and re-staffed if the positions become vacant, e.g. after appointment of the previous Young Investigator to a professorial chair. Thus, the DDc Labs represent a model for responsible and transparent career paths.

The expansion of **technology platforms** for the joint use of TUD and its DDc partner institutions will provide established and up-and-coming scientists with even better access to highly specialised, state-of-the-art equipment and tailor-made services. Synergy effects are generated by the joint acquisition, use and development of large-scale equipment. The shared use of technology platforms will advance the formation of internal structures based on device-related research, significantly improve the availability and accessibility of equipment and laboratory infrastructure, minimise the duplication of costly equipment, share the burden of technology life-cycle management and improve technical and administrative support of facilities, thus offering ideal conditions for optimising investments. This will be accompanied by a paradigm shift in the provision of equipment e.g. in the case of new appointments: moving away from 'exclusive ownership' towards the allocation of technology platform capacities (e.g. time, technical support, running costs). The acquisition and replacement of expensive equipment will be scheduled strategically rather than haphazardly. Potential uncertainties and resistances that may occur particularly during the transition time will be moderated through intense communication, change management and standardisation, and considered in the various performance agreements.

Following several years of negotiation with Federal and State ministries, the DDc Genome Centre (headed by Prof. Bonifacio and Dr. Baines) was founded in 2018 as an Internal Partnership under Civil Law to ensure that a broad spectrum of genome analysis procedures and methods can be jointly used by researchers within the DDc network (cf. A.2.1). This arrangement is unique in the German scientific community and removes a major fiscal obstacle to collaboration. It will serve as a blueprint for further cross-institutional technology platforms that will be established within DDc. Related infrastructures will now be identified and developed into technology platforms with core facilities, such

as the technology platform of the Dresden Centre for Nanoanalysis, the DDc Technology Centre of EXC PoL, CMCB and MPI-CBG and the joint clean rooms of TUD and HZDR.

At the same time, the DDc partners use the **Teaching Synergies Programme** (cf. A.3.2.1.TALENT) to ensure that the next generation of researchers is familiarised with synergetic, cross-institutional cooperation early on.

To enable the DDc alliance to meet the increased demands of the member institutions, the **coordination and communication** activities of the DDc head office will be continued and intensified. This includes the development of comprehensive systems and processes for recording and evaluating cooperation outcomes as well as strengthening the DDc corporate identity and existing exchange and communication formats.

C2 - Expansion of international cooperations

TUD will continue to develop particularly successful project-based research partnerships into strategic long-term collaborations with an impact on teaching, studying and transfer. Appropriate support measures are coordinated by the Staff Unit Internationalisation**,** which identifies opportunities for collaboration, designs adequate formats for cooperation as well as allocates seed funds from the strategic development fund and supports the expansion of strategic partnerships. It is assigned to the Vice-Rectorate for Academic and International Affairs and works closely with the international offices of TUD's Schools, established during the past ZUK funding period.

The joint **transCampus** of TUD and King's College London (KCL) (Dean Prof. Bornstein, TUD) is an example of a particularly pronounced and strategically important research cooperation. Since 2017, it includes a DFG-funded international research training group in the field of metabolic diseases that is closely associated with the respective ERA in TUD's RPA 1 (cf. Fig. 7). The TUD-KCL transCampus cooperation model has proven its benefits not only in research, but also in the appointment of top scientists - some of the most successful transCampus professors could only be recruited by offering them the prospect of affiliation with two world-class universities. To further strengthen its research portfolio, TUD will extend the successful transCampus partnership with KCL beyond medicine to include the fields of materials science, microelectronics, and the humanities.

The translation of medical research into application is a fundamental component of the TUD-KCL transCampus. Jointly, we will now develop this into a global **transCelerator** in close cooperation with the Hebrew University of Jerusalem. The transCelerator will become an alliance of leading medical research institutions, clinics and health care organisations that aim to accelerate the translation of medical knowledge by pooling expertise and resources for optimisation, approval of medical innovations, training and start-ups.

TUD intends to duplicate the present transCampus concept in the collaboration with at least one additional partner university, preferably outside of Europe. Dedicated liaison offices at the selected partner university and at TUD will accompany and accelerate the formation of the **new transCampus**. The prerequisite for a transCampus partnership, in addition to the successful existing collaboration, is scientific excellence and institutional compatibility with at least one of TUD's Excellence Research Areas.

Cooperation formats within the transCampus will also be developed further, for example through annual **transCampus summer schools**. Within the framework of the **transCampus postgraduate training programme**, postdocs are offered short-term stays at the partner institutions to benefit from the available expertise and infrastructure for their research. The transCampus model also offers new solutions for research infrastructures: **transCampus technology platforms** will be designed to bundle and expand the technological know-how of the partner universities and thus set new standards. To avoid excessive delays in setting-up the platforms due to legal constraints, intense efforts will be invested in framework agreements at a very early stage, taking into consideration TUD´s experience with the DDc Genome Centre.

Another measure that will strengthen TUD's international cooperation and increase its visibility in the long term is the **Dresden Fellows programme**. The profile of this programme (cf. A.2.2.1), which was successfully introduced as part of ZUK, is to be sharpened and closely aligned with TUD's research and internationalisation strategy. Dresden Fellows can use their specialist expertise to advance EFs, initiate new research activities and accelerate their development. Key aspects for the success of their visit to Dresden are networking with colleagues from TUD and DDc, and the integration into University and city life. This is facilitated through a range of supporting offers, social and scientific meetings and support of partners and family. The Fellows are expected to be involved in seminars, the development of new teaching formats and research-oriented workshops, which in turn will have a positive impact on international teaching at TUD. At least half of the TUD Fellowships in each scientific area will be awarded to female academics. After returning to their home institution, the Fellows can keep in touch through the new TUD Alumni programme, which helps to establish long-term relationships between TUD and our Fellows. They should act as TUD multipliers at their home institution, promoting the exchange of students and providing opportunities for early career researchers to collaborate or prepare joint international funding proposals, as well as support the expansion of cooperations and strategic partnerships.

A.3.2.4. Impact

An important part of our overall strategy is to strengthen TUD´s impact on the development of all aspects of society. This is achieved first and foremost through the advancement of knowledge resulting from the research achievements of our scientists and scholars. Through committed, research-based teaching they also shape tomorrow's graduates, both professionally and personally. Furthermore, TUD strives to ramp-up its institutional visibility and contributions to business and society by developing its structures and support for transfer to a new standard. It will transform its scientific communication and intensify the discourse on relevant topics with society at large. TUD aims to achieve this multi-layered impact with the following measures:

I1 - Extending the Innovation Chain

Using the possibilities available with the funding of the Excellence Initiative, TUD has professionalised several of its transfer structures and activities in recent years (cf. A.2.1.). Based on this, we will now bundle the individual units, instruments, services and offers to provide professional support throughout the entire innovation process.

In creating the **Centre for Transfer and Entrepreneurship (CTE)**, entrepreneurial thinking and acting will be conveyed campus-wide, the transfer of research results into concrete applications will be strengthened, gaps in the support portfolio will be remedied and, last but not least, the shortcomings due to the fragmentation of different transfer services will be eliminated. As shown in Fig. 14, the set of measures bundled in the CTE covers the complete value-added chain at TUD from invention to innovation to business.

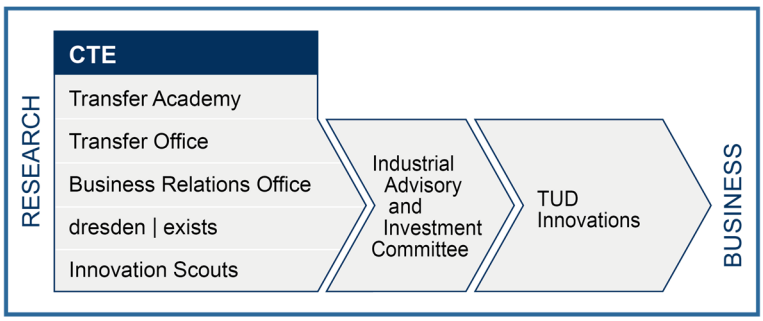


Fig.14: Organisation of transfer at TUD

TRANSFER ACADEMY The objective of the Transfer Academy is to consolidate and to extend existing transfer-related teaching and training activities. It will thus help familiarise undergraduates and postgraduates as well as academic and non-academic staff with topics relevant to transfer and entrepreneurship at an early stage, with the aim of enabling and motivating them to engage in their own entrepreneurial activities. At the student level, this will also be encouraged by embedding these topics in the curricula of all courses of study in TUD's STEM subjects.

TRANSFER OFFICE Established within ZUK, the Transfer Office (cf. A.2.2.b) will continue its comprehensive, demand-oriented range of offers with a high and reliable quality of service.

BUSINESS RELATIONS OFFICE The newly established Business Relations Office will be the central contact and coordination point for collaboration between TUD and businesses. It will be responsible for the professionalism of transfer-related communication, networking activities and company contacts. It will also prepare suitable cooperation and transfer opportunities for different target groups, simplify new contacts for external business partners by means of a new SME portal, and develop a portfolio of services for long-term cooperation and strategic partnerships.

dresden|exists By integrating the start-up programme dresden|exists into the CTE, the early support of start-up activities – which is an important element of the innovation chain – will be aligned with other transfer support efforts.

INNOVATION SCOUTS As a counterpart to the Project Scouts, who were successfully launched within ZUK to initiate new research projects, a team of Innovation Scouts will uncover exploitable research results at TUD. They will assist in finding adequate funding and act as facilitators to ensure that TUD stakeholders are involved early on in the transfer process. In close consultation with the researchers, the Innovation Scouts present promising findings to the Industrial Advisory and Investment Committee.

INDUSTRIAL ADVISORY AND INVESTMENT COMMITTEE This newly established interdisciplinary committee is comprised of experienced transfer professionals from TUD, TUDAG, TUD Innovations (see below), DDc institutions, as well as the business sector. It recommends suitable industry partners and other support options for the further development of a particular endeavour and advises on the validation, the business model as well as the management of the investment portfolio and IP rights. Subsequently, TUD entrusts the professional marketing and monetisation of selected IP rights to TUD Innovations.

TUD INNOVATIONS With TUDAG as the shareholder and using the expertise of the HighTech-Startbahn network, TUD Innovations GmbH will we founded to provide comprehensive professional support for spin-offs in the growth phase with its own dedicated team of experienced industry managers. The patent exploitation company aims to increase TUD´s licensing revenues and the value of its IP portfolio. Based on the highly successful model already in practice, the profits generated will in turn benefit research and teaching at TUD.

The synergetic cooperation between CTE and TUD Innovations, and the professionalisation of marketing and business development that it entails, is expected to lead to a substantial boost in transfer activities in the near future. Success is to be measured by

the increase in commercial third-party funding, patent exploitation, spin-offs and jobs created regionally. This concept provides support throughout the entire value chain - from the initial innovative concept in the lab to a stable company.

I2 - Public outreach

In addition to technology transfer, an increase in the communicative impact of TUD's activities in the future is intended. Innovative, target-oriented and inspiring science communication is an important component of TUD´s overall strategy, since it has beneficial effects on profile-shaping recruitment efforts and the initiation of new collaborations with partners in science and business.

TUD plans to set up an agile **online communication team**, which will also involve the Schools' public relations officers, to develop and implement a digital communication strategy. Through this measure, TUD will furthermore overcome a prevalent barrier in internal communication by adopting the latest developments and by completely reforming and continuously updating the structures, channels and topics of our online communication. The aim is to adapt the quality, quantity and speed of TUD communication to the constantly rising expectations and dynamic digital behaviour of our target audiences. In order to suit the perspectives and the language of students – both current and prospective – TUD also supports the establishment and operation of a student communication team **TUD Young Communicators (TYCO)**, which will be involved in designing campaigns and engaged in social media activities, content marketing and dialogue formats. As communication consultants, students will gain valuable experience in science communication, which may be counted as credits (to a moderate extent) towards their degree.

TUD wants to sensitise its junior staff to the opportunities of successful science communication at an early stage. Therefore, the **Science goes Public** programme aims to qualify young academics to present their research in a way that is understandable to an audience outside academia. Projects are funded in which doctoral candidates and early postdocs communicate the results of their scientific work to the general public or enter into dialogue with them (e.g. through videos, newspaper articles, workshops with pupils, youth groups, associations or exhibitions). All successful applicants are advised and trained when preparing such projects with regard to science communication and may receive financial and technical support for their realisation.

In addition to Science goes Public, TUD is striving for more intense interactions with society by offering a range of **dialogue and participation formats**. Beyond merely passing on insights or 'showcasing' research, we want to create opportunities for dialogue-orientated knowledge transfer on par with society. TUD perceives the city and the Dres-

den region as a ‘scholarly arena’ in two respects: (i) science often needs society’s experiences, questions and impulses to move ahead; (ii) in certain contexts (e.g. societal change, digitalisation, mobility, healthcare), the city serves as an important laboratory where scientists and scholars do not merely observe, but also take on responsibility (e.g. through information, advice, expert opinions). In the future, TUD intends to increase its use of dialogue and participation formats (such as the already established Future Labs) to facilitate this mutual exchange. It is to be expected that the work of the Centre for Societal Impact of Disruptive Innovations (cf. A.3.2.2.PROFILE) in particular, as well as those of the research and excellence clusters, will attract a great deal of interest. They will offer guidance and will benefit in turn from this dialogue. Communication and offers for participation inherently bear the risk that they do not reach the entire target audience or produce adverse reactions. In our view, this is vastly offset by the potential benefits.

A.3.2.5. Spirit

For TUD, achieving true excellence is only conceivable in conjunction with enthusiasm and motivation, since without a spirit of community and emotional attachment, a university can neither produce extraordinary results nor have a sustainable impact on society. TUD’s development has always been driven by the commitment, pioneering spirit and vision of outstanding individuals and has been implemented through a creative, agile and open-minded interaction between all its members. This unique ‘Dresden Spirit’ was specifically acknowledged during the ZUK evaluations of 2011 and 2015, and forms the foundation for TUD’s success. We perceive our University culture as a central success factor and strive to promote it through comprehensive participation, transparent communication and spaces for exchange. It is essential to create opportunities, freedoms and an inspiring atmosphere for pioneering ideas in all our activities, and to open up multifarious opportunities for our members to assume responsibility for TUD by contributing to the University’s development.

S1 - Internal Participation and Communication

The strategy process that went hand in hand with the preparation of this document has once again sparked TUD’s forward-looking spirit of optimism. Based on this encouraging experience, we will continue to embed the expertise of all members of TUD in the formulation of our strategy and other aspects of University development. For this purpose, TUD will organise participatory processes in various formats with differentiated methods, such as the productive and motivating Future Labs (cf. A.2.2.). The digital platform for dialogue **TUD Impulse** shall introduce a form of participation that is trailblazing for German universities. On this internal platform, all University members will be able to submit and discuss their ideas for the development of TUD. Provided there is a sufficient number of

proponents, the ideas are then implemented subject to the available resources. By making innovative ideas visible, TUD Impulse serves as a networking tool for University members and will tap into the creative potential of the entire University.

The present strategy process prompted us to ascertain the values, profile-forming characteristics and performance indicators that make TUD unique. TUD will rejuvenate its **Mission Statement** through a university-wide participatory process. The results will be incorporated into the cyclical and integrated strategy and planning process (cf. A.3.3.). They will also provide crucial impulses for TUD branding and executive development.

Management plays a central role in strategic processes, shaping visions for the future and having a direct influence on the development and motivation of staff through its values and actions. A common understanding of values shared by all staff and a responsible approach to leadership are critical for an excellent University culture. Hence, TUD will introduce a **project on management and leadership culture** as part of its personnel and organisational development. The goal is to reach a coordinated and shared understanding of leadership on all management and career levels implementing measures to raise gender awareness and understanding. In qualification programmes, training courses, workshops as well as in team-building and networking events, a responsible, professional and tailor-made management is to be developed.

The success of strategic processes and the overwhelming sharing of the ‘Dresden Spirit’ are contingent on the quality of **internal communication** and on the related opportunities for participation and interaction. TUD has opted for a management approach that pools strategy and communication into a single organisational unit. On this basis, we will modernise and professionalise our external science communication and PR activities (cf. A.3.2.4.IMPACT), as well as our internal communication. The planned online communication team will be responsible for the University’s digital communication with all internal target groups and will expand the scope of interactive communication through the use of the intranet, social media and blogs. The diversity of TUD’s members is also reflected in their communication. In accordance with its diversity strategy, barrier-free design and English as the second language of communication will become the standard for all communication tools at TUD.

The **TUD Executive Board blog** will be a novel tool of direct communication, providing all University members with swift, target group specific, interest-based, first-hand information on decisions and developments that are pertinent to the University as a whole. In the coming years, it will be part of the innovative **intranet**, which is to be developed into a multifunctional, interactive platform for dialogue and communication - to foster a welcoming, motivating and creative climate as well as excellent performance.

S2 - Campus and Project House

The international campus of TUD is a physical manifestation of the ‘Dresden Spirit’. Here, people with the most diverse backgrounds and interests come together with the common aim of excellent teaching, learning and research. TUD embodies the diversity of its members by organising Diversity Days and introducing a barrier-free orientation system building on the innovative Campus Navigator tool. Our welcoming culture will be further accentuated by making the successful SprInt programme available to a higher number of internal target groups using new and more flexible formats.

To encourage personal exchanges, TUD will realise the hitherto insufficiently exploited potential of its campus by developing it into a cosmopolitan, diverse and stimulating environment for work and communication. The resulting rejuvenation of the main campus will be realised with the support of the Free State of Saxony, TUD, its members as well as its alumni, and is to be completed in time for our bicentenary TUD 2028. Our members are now encouraged to contribute to the masterplan for a campus design that will transform and enhance the existing open and green areas into inviting, attractive, multifunctional spaces. Buildings and open spaces on campus are to be harmoniously interwoven and shall entice members to spend quality time there. The free exchange of ideas is to be stimulated through outdoor meeting points and research exhibits as well as through free-zones with media connectivity. An additional goal of the redesign is to open up the campus in terms of culture and urban development, as it is located close to the city centre of Dresden. TUD will encourage the exchange between the University and the city’s population by organising concerts, exhibitions, discussion forums and other events. The space between the main lecture theatre and the Project House Future (see below) will be designed as a new forum, conveying and creating a sense of identity, right at the heart of our University.

Fig. 15: Architectural design of TUD Project House Future (design: Henn GmbH)

The **Project House Future** symbolises the persistent renewal of the 'Dresden Spirit'. This building, which has already been approved for funding by the Free State of Saxony, will create a new, central hub for the University to promote synergies by allowing students and academic staff at all career stages to collaborate in an interdisciplinary and flexible manner in order to develop solutions for the challenges of the 21st century. Its flexible, multifunctional utilisation concept and its integrated technology platform will offer a dedicated space for a vast variety of projects, initiatives and research centres. Inspired by role models such as MIT's MediaLab or the R&D centres of leading IT, software and automotive companies, the Project House Future should not only have a radiating impact on the University, but also on business and society. Our vision **TUD 2028** is physically manifested in this building, namely the **curiosity-driven research and the innovative strength of TUD researchers, their intrinsic drive to collaborate across academic disciplines and their eagerness to share their findings with students and colleagues in a truly synergetic University.**

A.3.3. Governance and management structures

Within the framework of its Institutional Strategy (ZUK), TUD has reorganised its governance structures and is optimising its administrative processes. These are prerequisites for formulating the University's overall strategy and for the planned measures. TUD's governance aims at increasing the readiness for assuming strategic and operational responsibility at all levels while at the same time promoting maximum freedom in research and teaching. In so doing, the guiding principle is that structures and processes for consultation, decision-making and monitoring should comply with academic requirements and expectations. Hence, support structures are constantly refined to reduce the administrative burden on academic staff and to provide them with more creative freedom for their work. Tried and tested research support measures and the reorganisation of central and decentralised administration processes will be continued and further optimised.

TUD acts autonomously as stipulated in higher education legislature and in the target agreements reached with the Saxon State Ministry for Higher Education, Research and the Arts. The University aims to expand its scope, in particular by assuming responsibility for planning, implementing and financing construction projects. According to the Saxon Higher Education Law, the University Executive Board, the Senate, the Extended Senate and the University Council are the central bodies of TUD. The Rector is the Head of the University (cf. C.7.).

Under the authority of the Extended Senate, which is elected by all members of the University, TUD has laid down the cornerstones of its governance in its by-laws. Major decisions and the associated regulations are initiated and prepared by the University Executive Board and passed by the Senate. TUD's Executive Board is also responsible for

the development and implementation of the overall strategy and the University of Excellence measures.

In 2017, a comprehensive reorganisation of governance was unanimously approved by the Extended Senate to re-allocate responsibilities in the University Executive Board, the Central University Administration and the Schools. Using the freedom provided by an experimental clause in Saxon Higher Education Law, TUD has created an exemplary structure for a German university of its size and portfolio, by bundling the 18 Faculties into 5 **Schools.** This structural change, which was accompanied by an intensive, university-wide discourse, led to a significant improvement in communication, coordination, cooperation and transparency between the individual Faculties as well as with the University Executive Board. Meanwhile, all relevant regulations have been adopted and the corresponding structures and processes have been successfully established. The Schools are provided with considerable delegated authority with respect to strategic planning and resource allocation. They are managed by a Committee of Deans with an elected spokesperson, and elect a School Council to safeguard the participation of the Faculties and their members. With input from the Faculties, the Schools draw up their own structural and developmental plans, and comment on the overall strategy, performance targets and funding arrangements agreed between the University and the Free State of Saxony. In accordance with the principle of subsidiarity, the Faculties themselves remain ‘the home’ of research and teaching.

From an organisational point of view, the formation of the Schools has intensified the Faculty-wide cooperation in teaching and research, and has realised synergy potential by bundling services and integrating them into university-wide process management. This successful path is to be continued by establishing new roles and responsibilities for process optimisation in the Schools and supporting them in the transition period. This also applies to the creation of technology platforms within TUD and between TUD and DDc partner institutions (cf. A.3.2.2.PROFILE, A.3.2.3.COLLABORATION, A.3.2.4.IMPACT).

As a consequent next step following the foundation of the Schools, an **Extended University Executive Board**, consisting of the spokesperson of the Schools and the CIO (cf. A.3.2.2.PROFILE), will be established as an advisory body to improve decision-making, communication and transparency across the whole institution.

In addition, the central academic units (in particular the research clusters and Clusters of Excellence) – which are directly assigned to the University Executive Board – are systematically integrated into the governance of TUD. The expertise and experience available in these units and clusters are taken into account through regular meetings with

the University Executive Board, their representation in the Senate and through the affiliation of the Principal Investigators with the relevant Faculties and Schools.

In its monthly meetings, the DRESDEN-Board advises the TUD Executive Board on strategic issues relevant to the development of the science hub Dresden, coordinates joint activities and exchanges relevant information on funding initiatives. In addition, TUD has appointed an **International Strategy Council** in which eminent academic leaders counsel the University on the implementation and development of its overall strategy. The International Strategy Council thus complements the legally mandated University Council, which supervises the University Executive Board with respect to operational aspects.

TUD will gradually introduce a **cyclical and integrated strategy and planning process** from 2020 onwards. Sub-strategies and action plans (e.g. appointments, personnel development, investments, IT), target agreements and budget planning are oriented towards this process. In this way, the principles of centralised and decentralised management as well as performance indicators for monitoring and controlling are continuously updated. In order to make the planning processes transparent and to coordinate objectives, measures and resource requirements, TUD will introduce an **annual planning conference** consisting of the University Executive Board and the heads of the administration, Schools and major central academic units. Long-term planning is based on strategic analyses and draws on quantitative and qualitative data (cf. A.3.4.). In addition, the experiences and perspectives of University members will continue to be collected in Future Labs (cf. A.3.2.5.SPIRIT). With its organisational structure, TUD attaches great importance to communicating different interests from the entire University to the various committees and evaluating them in an entirely objective manner. For the strategic and quality-assured development of the organisational structure, consideration of personnel development is indispensable. For this reason, the approach already pursued within ZUK of attracting, fostering and retaining the best minds as well as successfully accompanying change processes, will be strengthened by the establishment of a **Central Strategy Unit for Personnel and Organisational Development** (cf. A.3.2.1.TALENT).

TUD has established an effective system for internal resource allocation, which will be continually improved. The University, the Schools and selected central units have global budgets. Target agreements are used as tools for strategic management at various levels, from the University as a whole to the individual chairs. This ensures that resources are used effectively, long-term planning becomes possible and performance-orientated incentive systems are established. Individual target agreements acknowledging and rewarding the academic achievements of TUD’s professors are particularly noteworthy.

Funding from the Excellence Initiative has empowered TUD to realise momentous reforms over the past years. This ensures that the legal, financial, structural, infrastructural

and staffing conditions are met to successfully implement the overall strategy and the measures outlined in A.3.2.

A.3.4. Monitoring for quality assurance and success monitoring

In realising its overall strategy, TUD will significantly increase the level of its general performance, maintain and improve its position as a leading university, as well as expand its international visibility. Central to this are the further professionalisation of professorial appointment procedures and the establishment of additional Excellence Research Areas in all RPAs. The further development of the unique DRESDEN-concept cooperation structures is set to strengthen TUD and the scientific location Dresden.

Implementation of the suggested measures will be monitored by continuing and extending the existing quality assurance concepts. To this end, TUD emphasises the:

- Effective structure of its decision-making bodies and advisory bodies,
- Utilisation of target agreements as a proven instrument,
- Quality management processes for research, teaching and administration.

Similar to the implementation of TUD's overall strategy and the ZUK measures in recent years, University of Excellence projects will be coordinated by a central team for project management and organisational development that professionally plans and supports change processes.

In order to evaluate the effectiveness of the individual measures, TUD draws on data collected by institutional controlling and quality management for the various performance areas and areas of activity. We will expand our expertise in strategic and academic controlling through data-driven **Institutional Research**, and thus improve preparation, support and monitoring of management decisions. This includes, in particular, prospective analyses, e.g. of internal and external opportunities and risks, benchmarking and the observation of national and international developments and trends in relevant fields of science and application. As in the previous funding period, the University Executive Board will initiate a midterm evaluation by a group of external experts. Based on these findings and the centrally available data, TUD's Executive Board will then decide on the continuation, realignment or, if necessary, termination of individual measures.

D. Glossary and list of abbreviations

Glossary

Committees	***Gremien***
• University Council	• Hochschulrat
• Extended Senate	• Erweiterter Senat
• Senate	• Senat
• University Executive Board	• Rektorat
• Extended University Executive Board	• Erweitertes Rektorat
• International Strategy Council	• International Strategy Council
• School Council	• Bereichskollegium
• CIO Council	• CIO-Beirat
Faculties and Schools	***Fakultäten und Bereiche***
School of Science:	*Bereich Mathematik und Naturwissenschaften:*
• Faculty of Biology	• Fakultät Biologie
• Faculty of Chemistry and Food Chemistry	• Fakultät Chemie und Lebensmittelchemie
• Faculty of Mathematics	• Fakultät Mathematik
• Faculty of Physics	• Fakultät Physik
• Faculty of Psychology	• Fakultät Psychologie
School of Humanities and Social Sciences:	*Bereich Geistes- und Sozialwissenschaften:*
• Faculty of Education	• Fakultät Erziehungswissenschaften
• Faculty of Law	• Juristische Fakultät
• Faculty of Arts, Humanities and Social Science	• Philosophische Fakultät
• Faculty of Linguistics, Literature and Cultural Studies	• Fakultät Sprach-, Literatur- und Kulturwissenschaften
School of Engineering Sciences:	*Bereich Ingenieurwissenschaften:*
• Faculty of Electrical and Computer Engineering	• Fakultät Elektrotechnik und Informationstechnik
• Faculty of Computer Science	• Fakultät Maschinenwesen
School of Civil and Environmental Engineering:	*Bereich Bau und Umwelt:*
• Faculty of Architecture	• Fakultät Architektur
• Faculty of Civil Engineering	• Fakultät Bauingenieurwesen
• Faculty of Environmental Sciences	• Fakultät Umweltwissenschaften

• Faculty of Transport and Traffic Sciences ‘Friedrich List’	• Fakultät Verkehrswissenschaften „Friedrich List“
• Faculty of Business and Economics	• Fakultät Wirtschaftswissenschaften
School of Medicine:	*Bereich Medizin:*
• Faculty of Medicine ‘Carl Gustav Carus’	• Medizinische Fakultät „Carl Gustav Carus“
DRESDEN-concept (DDc)	***DRESDEN-concept (DDc)***
• DRESDEN-Board	• DRESDEN-Board
• Scientific Area Committee	• Scientific Area Committee
• Scientific Area Networks	• Scientific Area Networks
• Administration and Infrastructure Committee	• Administration and Infrastructure Committee
DRESDEN-concept Partners:	*DRESDEN-concept-Partner:*
• University Hospital ‘Carl Gustav Carus’	• Universitätsklinikum „Carl Gustav Carus Dresden“
• Fraunhofer Institute for Material and Beam Technology (Fraunhofer-IWS)	• Fraunhofer-Institut für Werkstoff- und Strahltechnik (Fraunhofer-IWS)
• Fraunhofer Institute for Photonic Microsystems (Fraunhofer-IPMS)	• Fraunhofer-Institut für Photonische Mikrosysteme (Fraunhofer-IPMS)
• Fraunhofer Institute for Ceramic Technologies and Systems (Fraunhofer-IKTS)	• Fraunhofer-Institut für Keramische Technologien und Systeme (Fraunhofer-IKTS)
• Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology (Fraunhofer-FEP)	• Fraunhofer-Institut für Organische Elektronik, Elektronenstrahl- und Plasmatechnik (Fraunhofer-FEP)
• Fraunhofer Institute for Transportation and Infrastructure Systems (Fraunhofer-IVI)	• Fraunhofer-Institut für Verkehrs- und Infrastruktursysteme (Fraunhofer-IVI)
• Helmholtz-Zentrum Dresden-Rossendorf (HZDR)	• Helmholtz-Zentrum Dresden-Rossendorf (HZDR)
• German Centre for Neurodegenerative Diseases Dresden (DZNE)	• Deutsches Zentrum für Neurodegenerative Erkrankungen Dresden (DZNE)
• DLR Institute of Software Methods for Product Virtualization	• Deutsches Zentrum für Luft- und Raumfahrt (DLR) – Institut für Softwaremethoden zur Produkt-Virtualisierung

• Leibniz Institute of Polymer Research Dresden (Leibniz-IPF)	• Leibniz-Institut für Polymerforschung Dresden (Leibniz-IPF)
• Leibniz Institute for Solid State and Materials Research Dresden (Leibniz-IFW)	• Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden (Leibniz-IFW)
• Leibniz Institute of Ecological Urban and Regional Development (Leibniz-IOER)	• Leibniz-Institut für ökologische Raumentwicklung (Leibniz-IÖR)
• Senckenberg Natural History Collections (SNSD)	• Senckenberg Naturhistorische Sammlungen (SNSD)
• Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG)	• Max-Planck-Institut für molekulare Zellbiologie und Genetik (MPI-CBG)
• Max Planck Institute for the Physics of Complex Systems (MPI-PKS)	• Max-Planck-Institut für Physik komplexer Systeme (MPI-PKS)
• Max Planck Institute for Chemical Physics of Solids (MPI-CPfS)	• Max-Planck-Institut für Chemische Physik fester Stoffe (MPI-CPfS)
• Deutsches Hygiene-Museum (DHMD)	• Deutsches Hygiene-Museum (DHMD)
• Militärhistorisches Museum der Bundeswehr (MHM)	• Militärhistorisches Museum der Bundeswehr (MHM)
• Saxon State and University Library Dresden (SLUB)	• Sächsische Landesbibliothek – Staats- und Universitätsbibliothek Dresden (SLUB)
• Dresden State Art Collections (SKD)	• Staatliche Kunstsammlungen Dresden (SKD)
• University of Applied Sciences Dresden (HTW Dresden)	• Hochschule für Technik und Wirtschaft Dresden (HTW Dresden)
• Archaeological Heritage Office in Saxony (LfA)	• Landesamt für Archäologie Sachsen (LfA)
• Fraunhofer Institute for Manufacturing Technology and Advanced Materials (Fraunhofer-IFAM)	• Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung (Fraunhofer-IFAM)
• Fraunhofer Institute for Reliability and Microintegration-All-Silicon System Integration (Fraunhofer-IZM-ASSID)	• Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration-All-Silicon System Integration (Fraunhofer-IZM-ASSID)
• The Dresden Academy of Fine Arts (HfBK Dresden)	• Hochschule für Bildende Künste Dresden (HfBK Dresden)

• Technical Collections Dresden (TSD)	• Technische Sammlungen Dresden (TSD)
• Barkhausen Institute	• Barkhausen Institut
Research Priority Areas (RPA)	***Forschungsprofillinien (FPL)***
• RPA 1: Health Sciences, Biomedicine and Bioengineering	• FPL 1: Gesundheitswissenschaften, Biomedizin und Bioengineering
• RPA 2: Information Technology and Microelectronics	• FPL 2: Informationstechnologien und Mikroelektronik
• RPA 3: Smart Materials and Structures	• FPL 3: Intelligente Werkstoffe und Strukturen
• RPA 4: Energy, Mobility and Environment	• FPL 4: Energie, Mobilität und Umwelt
• RPA 5: Culture and Societal Change	• FPL 5: Kultur und Gesellschaftlicher Wandel

Abbreviations

A	
AAA	International Office
acatech	National Academy of Science and Engineering
ACQUIN	Accreditation, Certification and Quality Assurance Institute
AG	Limited company (Aktiengesellschaft)
AiF	German Federation of Industrial Research Associations
AllMeSa	Mechatronics Alliance Saxony
ALS	Amyotrophic Lateral Sclerosis
approx.	approximately
APR	Adaptive Particle Representation
ARWU	Academic Ranking of World Universities (Shanghei-Ranking)
AvH	Alexander von Humboldt
B	
BB-IA	Bio-Based Industries Innovation Action
B CUBE	Centre for Molecular Bioengineering
BioDIP	Biopolis Dresden Imaging Platform
BIOPOL	Biochemical and mechanochemical mechanisms in polarised cells
BIOTEC	Biotechnology Centre
BMAS	Federal Ministry of Labour and Social Affairs
BMBF	Federal Ministry of Education and Research
BMU	Federal Ministry for Environment, Nature Conservation and Nuclear Safety
BMVBS	Federal Ministry of Transport, Building and Urban Development
BMVI	Federal Ministry of Transport and Digital Infrastructure
BMWi	Federal Ministry for Economic Affairs and Energy
C	
C3	Consortium Carbon Concrete Composite
CADE	Conference on Automated Deduction
CAMS	Centre for Advanced Modeling and Simulation
CAWR	Centre for Advanced Water Research
CESAER	Conference of European Schools for Advanced Engineering Education and Research
CeTI	Centre for Tactile Internet with Human-in-the-Loop
cf.	confer (compare)
cfaed	Centre for Advancing Electronics Dresden
CIO	Chief Information Officer

CIPSEM	Centre for International Postgraduate Studies of Environmental Management
CMCB	Centre for Molecular and Cellular Bioengineering
CMOS	Complementary metal-oxide-semiconductor
CoMP	Coordinated Multi-Point
CRIS	Current Research Information System
CRC	Collaborative Research Centre
CRTD	Centre for Regenerative Therapies Dresden
CSBD	Centre for Systems Biology Dresden
ct.qmat	Complexity and Topology in Quantum Matter
CTE	Centre for Transfer and Entrepreneurship
D	
DAAD	German Academic Exchange Service
DB Schenker	Deutsche Bahn Schenker
DCMS	Dresden Centre for Computational Materials Science
DCN	Dresden Centre for Nanoanalysis
DDc	DRESDEN-concept
DEKRA	German Motor Vehicle Inspection Association
Destatis	Deutsches Statistisches Bundesamt (Federal Statistical Office)
DESY	German Electron Synchrotron
DFG	German Research Foundation
DIGS-BB	Dresden International Graduate School for Biomedicine and Bioengineering
DIU	Dresden International University
DKFZ	German Cancer Research Centre
DKTK	German Cancer Consortium
DLR	German Aerospace Centre
DMA	Dresden Microelectronics Academy
DRESDEN-concept	Dresden Research and Education Synergies for the Development of Excellence and Novelty (DRESDEN-concept)
DSP	Digital signal processor
DZD	German Centre for Diabetes Research
DZNE	German Centre for Neurodegenerative Diseases
E	
e.g.	exempli gratia (for example)
EF	Emerging Field
EGFR	Epidermal growth factor receptor

EHESS	École des Hautes Études en Sciences Sociales (School of Advanced Studies of the Social Sciences)
ENI-SEIS	European neighbourhood instrument - Shared Environmental Information System
EnvirVIS	Visualization in Environmental Sciences Workshop
ERA	Excellence Research Area
ERC	European Research Council
ERDF	European Regional Development Fund
ESF	European Social Fund
esiRNA	Endoribonuclease-prepared small interfering RNA
ESSDERC	European Solid-State Device Research Conference
ESSCIRC	European Solid-State Circuits Conference
ETTBio	Effective Technology Transfer in Biotechnology
EU	European Union
EXC	Cluster of Excellence
EXIST	Business start-ups
F	
5G	Fifth Generation of Mobile Communications
FAST	Fast actuators sensors and transceivers
FDSOI	Fully Depleted Silicon on Insulator
FET	Future and Emerging Technologies
FGSV	Road and Transportation Research Association
FhG	Fraunhofer Society
FhG IISB	Fraunhofer Institute for Integrated Systems and Device Technology
FhG IKTS	Fraunhofer Institute for Ceramic Technologies and Systems
FhG IPMS	Fraunhofer Institute for Photonic Microsystems
FhG IWS	Fraunhofer Institute for Material and Beam Technology
FhG IZI	Fraunhofer Institute for Cell Therapy and Immunology
Fig.	Figure
FIS	Research Information System
FONASO	Forest and Nature for Society
FOREL	Research and Technology Centre for Resource-Efficient Lightweight Structures in Electromobility
FOSTER	Funds for Student Research
FP	European Research Framework Programme
FTE	Full-time equivalents
FVZ	Vehicle test centre

G	
GA	Graduate Academy
GCG	GenderConceptGroup
GEMoaB	GEMoaB Monoclonals GmbH
GFDM	Generalised Frequency Division Multiplexing
GmbH	Private limited company (Gesellschaft mit beschränkter Haftung)
GMP	Good manufacturing practice
GO-Bio	Founding Initiative Biotechnology (BMBF funding programme)
GRK	Graduiertenkolleg (Research Training Groups)
GPPAD	Global Platform for the Prevention of Autoimmune Diabetes
GroundwatCH	Groundwater / Global Change
GSC	Graduate School
GWT	Society for the Transfer of Knowledge and Technology
H	
HBP	Human Brain Project
HDS	Saxon Centre for Higher Education Didactics
HE	Higher education
HGF	Helmholtz Association
HIRO	Heidelberg Institute for Radiooncology
HMGU	Helmholtz Zentrum Munich - German Research Centre for Environmental Health
HPC-DA	High-performance computer data analytics
HRK	German Rector's Conference
HRSK-II	High-performance computer memory complex
HTW Dresden	University of Applied Sciences Dresden
HZDR	Helmholtz Centre Dresden-Rossendorf
I	
i.e.	id est (that is)
ICT	Information and communication technologies
IEL	Integrated Railway Laboratory
IFL	Institute of Logistics and Aviation
IGEWeM	Institute of Intellectual Property, Competition and Media Law
IHI Zittau	International Institute Zittau
IJCAR	International Joint Conference on Automated Reasoning
ILK	Institute of Lightweight Engineering and Polymer Technology
IN2D	International Network on Diabetes and Depression
incl.	inclusive

IoT	Internet of Things
IP	Intellectual Property
IRTG	International Research Training Group
ISI	International Scientific Indexing
IT	Information Technology
ITM	Institute of Textile Machinery and High Performance Material Technology
IWAS	International Water Research Alliance Saxony
IWRM	Integrated Water Resources Management
J	
JRGL	Junior Research Group Leaders
JTI	Joint Technology Initiative
K	
KAtLA	Cooperative training in the technical teaching profession
KCL	King's College London
KIT	Karlsruhe Institute of Technology
L	
Leibniz IFW	Leibniz Institute for Solid State and Materials Research
Leibniz IOER	Leibniz Institute of Ecological Urban and Regional Development
Leibniz IPF	Leibniz Institute of Polymer Research Dresden
LIC	Lab for Industry 4.0 and Cyberphysickal Systems
LZR	Computing Centre of the Lehmann-Zentrum
M	
MeMo	Mechanics with Molecules
MIDEM	Mercator Forum Migration and Democracy
MIT	Massachusetts Institute of Technology
MITS	Centre for Metabolic-Immunological Diseases and Therapeutic Technology Saxony
MPG	Max Planck Society
MPI-CBG	Max Planck Institute of Molecular Cell Biology and Genetics
MPI-CPfS	Max Planck Institute for Chemical Physics of Solids
MPI-PKS	Max Planck Institute for the Physics of Complex Systems
MSA	Model Supervision Agreement
N	
n.s.	not specified
NaMLab	Nanoelectronic Materials Laboratory
NCRO	National Centre for Radiation Research in Oncology

NCT	National Centre for Tumour Diseases
NEURON	Network of European Funding for Neuroscience Research
NSFC	National Natural Science Foundation of China
O	
OLED	Organic light-emitting diode
OpARA	Open Access Repository and Archive
OpenFPM	Open framework for particles and mesh simulations
OTPP	Open Topic Postdoc Positions
OTTP	Open Topic Tenure Track Professorships
P	
p.	page
p.a.	per annum (per year)
PI	Principal Investigator
PIC	Patent Information Centre
PLID	Paul Langerhans Institute Dresden
PoL	Physics of Life
PolarNet	Principles of Polarity – Integrating genetic, biophysical and computational approaches to understand cell and tissue polarity
PROMI	Doctorate Included Programme
Q	
QA	Quality Assurance
QM	Quality Management
QS	Quacquarelli Symonds
QuantLA	Quantitative Logic and Automata
R	
R&D	Research and Development
RoSi	Role-based Software Infrastructures for Continuous-Context-Sensitive Systems
RPA	Research Priority Area
RPA 1	Research Priority Area: Health Sciences, Biomedicine and Bioengineering
RPA 2	Research Priority Area: Information Technology and Microelectronics
RPA 3	Research Priority Area: Smart Materials and Structures
RPA 4	Research Priority Area: Energy, Mobility and Environment
RPA 5	Research Priority Area: Culture and Societal Change
RTG	Research Training Group

S	
ScaDS	Scalable Data Services and Solutions
SCS	ServiceCentreStudies
SIDI	Centre for Societal Impact of Disruptive Innovations
SLUB	Saxon State and University Library Dresden
SME	Small and Medium-sized Enterprises
SNIP	Source-Normalized Impact per Paper
SprInt	Language and intercultural competence qualification programme
SrV	Representative traffic survey system
SSR	Sequence-specific recombinase
STEM	Science, Technology, Engineering and Mathematics
SWOT	Strengths Weaknesses Opportunities Threats Analysis
T	
T1D	Type 1 Diabetes
TEM	Transmission Electron Microscope
THE	Times Higher Education
TP	Technology Platform
TRAILS	Travelling Innovation Labs and Services
TU9	Alliance of 9 leading Universities of Technology in Germany
TUD	Technische Universität Dresden
TUDAG	TUD Stock Company
TUDIAS	TU Dresden Institute of Advanced Studies GmbH
TUD-Sylber	Synergetic Teacher Training in the Context of the Excellence Initiative
TYCO	TUD Young Communicators
U	
UFZ	Helmholtz Centre for Environmental Research
UKD	Carl Gustav Carus University Hospital Dresden
UN-CRPD	United Nations Convention on the Rights of Persons with Disabilities
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNU-FLORES	United Nations University Institute for Integrated Management of Material Fluxes and of Resources
UPTD	University Proton Therapy Facility
V	
VIP+	Validation of the Technological and Societal Innovation Potential of Scientific Research
W	

W3C	World Wide Web Consortium
WEIR	Wearable Interaction with Robots
WGL	Leibniz Association
WRC	WRocław Concept
WS	Winter Semester
Y	
YI	Young Investigator
Z	
ZET	Centre for Energy Technology
ZfI	Centre for Integration Research
ZIH	Centre for Information Services and High-Performance Computing
ZIK	Centre for Innovation
ZiLL	Centre for Interdisciplinary Learning and Teaching
ZIS	School of International Studies
ZLSB	Centre for Teacher Education and Educational Research
ZSM	Centre for Methods in the Social Sciences
ZUK	Institutional Strategy ('Zukunftskonzept')