

DESIGN RESEARCH ESSAY

Evaluating research excellence in architecture: A view from German technical universities towards a European perspective

Martin Luce,¹ Mieke Pfarr-Harfst,² Judith Reeh,³ Jörg Schröder,⁴ Oliver Tessmann²

1 Technical University Munich, DE

2 Technical University Darmstadt, DE

3 Karlsruhe Institute of Technology, DE

4 Leibniz University Hannover, DE

Corresponding author: Martin Luce (luce@tum.de)

Abstract

From the perspective of the architecture departments in nine German technical universities, this essay argues that the positioning of architecture as a research discipline requires adapted evaluation standards to fulfil its promise of generating new knowledge. Evaluation processes depend on and also influence their funding context, plus they are strongly linked to a categorisation of research practices and topics. The essay argues for widespread recognition of discipline-specific research methods, as well as specific outputs and publication practices. It provides empirical evidence of new European standards for peer-reviewed assessment of architectural research in line with subject-specific approaches. Suggestions are made for opening up excellence funding lines to design-oriented and practice-based research. The essay thus calls to work together to improve evaluation and funding frameworks. Its conclusions support the goal of the Coalition for Advancing Research Assessment (COARA) to maximise the excellence and impact of research by reforming assessment practices.

Keywords:

Integrated research, transformative research, design-led research, practice-based research, architecture-specific research, qualitative evaluation, publication cultures, research assessment

Introduction

The perspective of this article on research evaluation in architecture originates from the context of the German technical universities and recent changes in the research funding framework in Germany. Assessment of research excellence focuses not only on the quality of research, but also on the competition for funding through the excellence strategy of the federal government and the sixteen federal states [1]. In this context, architecture needs to clarify, develop, and argue its specific research practice in order to raise the profile of architecture as a research discipline and not solely as a profession.

Three aspects need to be considered: the positioning of architecture as a research discipline within academic institutions; the ability to expand the capacity for interdisciplinary collaboration with society and policy-makers on the high value of research in architecture; and providing arguments for use in communication with funding agencies and research policy-makers. In this context, it is important to discuss evaluation schemes and criteria, and in particular to argue the differences from the engineering sciences, as architecture is subsumed under this major domain within the German higher education funding frameworks.

We believe that the ongoing debates and actions that are focused on strengthening the quality of research in architecture and its evaluation in Germany can also be of interest to a wider academic community in Europe and hopefully contribute to discussions on how to improve research evaluation in general.

Architecture and societal challenges

In recent political debates, approaches for dealing with current societal challenges – climate change, social inequality, resource consumption, digitalisation – are increasingly linked to social and economic factors. For instance, the New European Bauhaus movement, initiated by the European Commission, links the ‘Green Deal’ more closely to the spatial qualities of architecture and the built environment, advocating sustainability to the many actors, movements, and policies involved in this field. It can be argued that by working on the reconfiguration, transformation, and even reinvention of the built environment, the profession and academic discipline of architecture contributes significantly to cultural change, to new perspectives in culture and creativity, and to inclusiveness in our changing societies. From an architectural perspective, therefore, the transition towards sustainability and resilience must start with the question of how we want to live in the future – i.e. how cities and buildings can provide space for living, working, culture, community, and mobility, and how we should shape and organise change. The contribution of architecture, urban design, and planning to these societal challenges is being addressed in European and national policies not just in the context of the ‘Green Deal’, but also in the current emphases on building renovation, energy efficiency, and circular economy policies, and, furthermore, is anchored in UN Sustainable Development Goal SDG–11 ‘Sustainable Cities and Communities’. Yet, notably, it is not an integral part of European and national research policies. Nevertheless, we believe that in the coming years, architecture and research in architecture will come to play an essential role in mitigating the effects of climate change, in the ecological transformation of the building sector, and in more sustainable urban development.

A special relationship between research and innovation

Against this background, architectural departments at technical universities in Germany not only have the opportunity to argue for the value of architecture in society and to educate talented young architects about sustainable design, but also to position architecture as a field with significant potential for research and innovation. This character as a research discipline which can address great societal challenges is captured at the European level by the European Association for

Architectural Education (EAAE) in its Charter on Architectural Research [2]. The importance of research skills for professional qualification and the need for the discipline to be re-energised in terms of research and innovation, as has been emphasised by Flach and Kurath [3], is being highlighted by recent studies into the role of research within a changing world of professional practice, such as by Anne Dye, Michael Hensel and Fredrik Nilsson [4; 5]. Research-based approaches to teaching are becoming more widespread in European universities, especially in terms of reflections about research methods and concepts, as highlighted by Silberberger [6; 7]. The specific relationship between research and practice in architecture and its multi-stakeholder innovation systems has thus been discussed by academics on the basis of offering new theoretical paradigms, such as Buchert’s idea of ‘reflexive design’ [8]. Numerous academic publications and conferences in recent years have urged a reorientation of the understanding and methods of architectural research to strengthening its role in design processes, as explained by Oya Atalay Franck [9]. In parallel, the embedding of creative components and paradigms into research and innovation processes has been explained by Jörg Schröder [10]. However, these discussions have not yet been effectively shared with the wider academic environment, with professional organisations, policy-makers, funding bodies, or society at large, as an effort to promote the understanding of architectural research and the actions required to enable it.

Issues with categorising research in architecture

In the context of a major funding programme titled ‘Excellence Strategy’, the architectural departments in German technical universities have been forced to discuss the categorisation of their research practices, given that the funding focus is on basic research. To date, the funding of basic research in architecture in Germany has focused exclusively on the engineering, historical, or social science sub-fields, and has thus not included design-orientated research. Narrow definitions of research, combined with an established culture of defining basic primary research as being engaged in discovering new theoretical knowledge, distanced from any notion of application, have effectively excluded architecture from high-level funding in general and from the ‘Excellence Strategy’ in particular. Given the specific close relationship between theory and practice within architectural research, however, it can be argued that this situation in Germany

creates a clear obstacle to the development of both new knowledge and innovation. It is all the more problematic as the idea of a clear separation between basic and applied research is increasingly being called into question in general debates on research funding, not only in architecture. In their essay on 'Cycles of Invention and Discovery', Narayanamurti and Toluwalogo [11] demonstrate how the search for knowledge and creative problem-solving needs to be combined in what they call cutting-edge 'integrated' research practices – a clear sign that there is also a struggle with segregated research funding in the USA. Now, in Germany, a discussion is beginning to open up about the existing funding formats for transformative research and open science, initiated by the German Science and Humanities Council (Wissenschaftsrat, WR), which believes that 'further flexibility and opening up of existing funding formats is necessary in order to promote dynamic research orientation and a broad understanding of application orientation' [12]. Even if integrated research projects, that combine basic and applied research, were funded and carried out, architectural departments in Germany would still have to contend with the strict statistical categorisation into basic research, applied research, and experimental development that was set out in the Frascati Manual [13], and was subsequently incorporated in statistical frameworks at federal, state, and university level.

This issue is becoming ever more relevant because the allocation of university funding in general in Germany is increasingly based upon research performance, especially in basic research. In this context, the Frascati Manual can be seen as a prominent example of frameworks – in this case not even academic, but economic – that profoundly influence the academic context of architectural research. In all its 402 pages, the Manual does not mention architecture once, plus it excludes design from being defined as a research activity (since it cannot deal with uncertainty) and also excludes artistic research (since it would only seek new forms of expression, but not new knowledge). A recent initiative by the EAAE, together with other arts organisations, pledged to change these – clearly wrong – research categorisations [14]. What it means is that architectural departments have to clarify, define, and communicate much more clearly the characteristics of their research work and explain how it corresponds to general criteria such as those defined in the Frascati Manual – i.e. that it is aimed at new knowledge (novel); based on original, non-obvious concepts and hypotheses (creative); uncertain about the final outcome (uncertain); planned and budgeted (systematic); leading

to results that could potentially be reproduced (transferable and/or reproducible), while from an architectural perspective to share and disseminate it in much more ambitious ways than before.

Integrated and transformative research

In this context, it is worth mentioning the category of 'orientated basic research' in the Frascati Manual as something which has not been followed up as yet in Germany, with the Frascati definition being that it is 'carried out with the expectation that it will provide a broad basis of knowledge likely to form the basis of the solution of recognised or expected present or future problems or possibilities'. In architectural research, an argument for 'orientation' can be put forward in several ways: for instance, in regard to the fact that contextualisation (in space, in social, economic, environmental and cultural relations) as well as concretisation (as lived and experienced space) play an essential role in the discipline, or in regard to its ability to highlight 'possibilities', referring to the cultural impulses on which research can be based. In fact, it can be said that in architecture, the identification of a problem – given that it is embedded in further, larger problematic entanglements between space and society, in the sense of the paradigm of 'wicked problems' described by Rittel and Webber [15] – must itself be part of the research process, calling necessarily for more open research questions. Thus, architectural research is able to gain new knowledge precisely by formulating problems as stimulators and drivers of the research processes. However, transferability and feedback to theory remain a challenge, as has been discussed in other disciplines such as economics when comparing problem-orientated research with theory-orientated research, such as by Lawrence [16]. An exclusive focus on 'orientated basic research' would deny architecture's significant potential for integrated research practices that can generate new knowledge and innovation by bridging what were hitherto separate categories of research: the latter is transformative both in the sense of transdisciplinary orientation towards impact, and in the sense of transforming theory.

A focus on evaluation systems

Arguing for the relevance of architectural research realising its high potential for generating new knowledge and addressing societal challenges is not enough to strengthen it within European and national academic environments. The assessment of research outputs, of researchers, and of research organisations, is what effectively identifies and recognises research – whether for funding purposes or in terms of added value for academia and society. Moreover, assessment should evaluate integrated and transformative research practices. Assessment is also reciprocally linked to funding, given that assessment systems and cultures so clearly inform and influence funding. However, calling for a single regular funding course is not the aim of this article. Instead, we believe that the example offered by the Netherlands, discussed below, is pioneering in its combination of block-funds not linked to research performance alongside a separate form of research assessment which is used to ensure and promote research quality.

However, the current situation in Germany is that, in a significant number of the 16 federal states that are responsible for universities, funding is at least partly allocated on the basis of the amount of external funding that the respective departments have been able to attract and on their research performance evaluation. In this way, worse conditions for fund-bidding and research environment are usually reinforced by performance-based systems applied to the allocation of university funds. We can state that from our experience the current practice in Germany of evaluating research performance quantitatively rather than qualitatively is causing an increasing imbalance in university funding for architectural departments. It is therefore timely and necessary to stake a claim from an architectural perspective about the relationship of research performance evaluation to funding, a topic that will no doubt continue to be an area of political debate in Germany's 16 federal states. Research evaluation is at the top of the DFG's agenda when it comes to funding basic research in the shape of individual research projects, as well as in the new funding mechanism, the 'Excellence Strategy', which now allocates federal funds to universities [1]. This direct linking of funds to excellence in basic research poses a major challenge for architectural researchers at Germany's technical universities, given that these organisations are at the forefront of the competition for this research funding. Here it is worth noting that of the TU9 alliance of nine leading technical universities – i.e. RWTH Aachen, TU Berlin, Tu Braunschweig,

TU Darmstadt, TU Dresden, LUH Hannover, KIT Karlsruhe, TU Munich, Stuttgart University, five of them (Aachen, Berlin, Dresden, Karlsruhe, Munich) are currently funded as 'Universities of Excellence' out of a total of 10 such 'Universities of Excellence' across the country.

Another challenge for departments of architecture in this competition for excellence funding is the fact that their participation in high-level research funding – as a reference for new projects – is currently quite low, both in terms of German national funding by the DFG (which only funds basic research) and European funding by the ERC (excellence funding) or the Horizon programme (relevance funding). The hypothesis of this article is that this situation is unlikely to be due to the low quality of research in architecture, but mainly to evaluation systems that are unfavourable to architecture and would need to be better adapted to the characteristics of the subject. Furthermore, it can be argued that the viability and quality of evaluation processes and outcomes indirectly influence the funding programmes. Finally, the use of adapted evaluation processes and criteria can support strategy development in schools of architecture and their positioning in universities by providing evidence-based information on status quo and progress. Strategy development is also crucial for community-building within departments and for communication within the university. This aspect is becoming increasingly important due to the second current trend that is related to the implications of the Excellence Strategy: the increasing autonomy of universities from state governments in terms of deciding on structural and financial allocations within their organisation. From the background already reported, it is clear that departments of architecture will have to argue for their research value. This challenge is even greater for departments of architecture in TU9 technical universities, where the academic environment is dominated by the paradigms of natural sciences and engineering.

Objectives and methods

Against this background and focus, the article aims to support excellence in architectural research and its strategic embedding and perception in the academic world by means of adapted evaluation procedures and criteria. It proposes standards for subject-specific evaluation procedures and criteria, as well

as instruments for strengthening and promoting research in architecture, based on the following three guiding questions:

- How can evaluation procedures and criteria be adapted to support the further evolution of research in architecture?
- What standards for evaluation procedures and criteria can support the evolution of research in architecture?
- What instruments can support the qualification of research results and improve the funding of research in architecture?

In order to answer these questions, the article undertakes a systematic analysis of the context and theories of the impact areas of research assessment, recent discussions on research assessment in general and recent discussions on research in architecture. This analysis is based on literature reviews, both of academic publications and policy documents, as well as the authors' own observations in their various departments of architecture at technical universities. In order to provide evidence-based results, the article first examines and compares established international good practice in research evaluation. Sources are current guidelines on procedures, evaluation criteria and evaluated materials (research outputs), as well as a literature review. In a second step, good practices of funding programmes for research in architecture are related to evaluation. In a third step, previous approaches to evaluating and measuring research in the TU9 departments of architecture are discussed on the basis of primary data, policy documents and qualitative interviews. Finally, the answers to the three guiding questions are synthesised from the perspective of the TU9 departments of architecture, but also as a contribution to debates and initiatives at the European level.

Impact areas and forms of research evaluation

Research evaluation and the associated definition of schemes and criteria is a relatively new field of research and a dynamically developing practice [17; 18; 19]. In the context of the objectives for the development of the European Higher Education System [20], an evidence-based approach should identify and promote the contribution of universities to innovation and research excellence, as well as the efficiency and effectiveness of the university system. The strategic

development of departments of architecture requires a systematic basis for the assessment of research quality, for internal decision-making and for university-wide communication and argumentation. In particular, access to high-level funding and the positioning of architecture research in relation to society and policy are required. Evaluations are often linked to performance-based funding systems which are used in various forms in almost all EU countries to allocate part of the funding to universities in order to strengthen research performance through incentives and/or to concentrate resources. Recent research examines the effectiveness of different methods of allocating funds and the occurrence of mis-performance (perverse incentives) [21; 22; 23].

The arguments in this essay are based on an overview of research funding practices in European countries. A report published by the European Commission identifies the following evaluation procedures for the distribution of funds: 11 countries with block funding and no evaluation procedures (including Spain), and special cases (Austria: target agreements; the Netherlands as a pioneer of block funding independent of evaluation) [22]. Then comprehensive quantitative indicator systems including bibliometrics (mainly Nordic countries; Belgium). And qualitative peer review systems, informed and supplemented by metrics (France, Italy, UK, etc.). This article focuses on qualitative peer review systems, as they are considered to best contribute to a discipline-specific and effective strategic development of research in architecture, and can be used for the full range of impacts. This focus on qualitative assessment will be further argued in the following analysis of discussions on research assessment and the characteristics of the discipline of architecture, as well as in the empirical analysis of good practices. Quantitative metrics can support peer review, in line with the guiding principles of the Leiden Manifesto [23].

The emergence of new types of evaluation

The advantages and disadvantages of qualitative peer review have been extensively analysed and discussed in recent years, as shown in the above-mentioned European Commission report. Among the risks identified are the need to establish sound mechanisms for selecting experts, to formulate appropriate guidelines, to consolidate panel evaluations for universities, and to ensure a comprehensive

exchange within the discipline and the academic community. Nevertheless, the wide dissemination of this tool in Europe can be seen as an advantage, facilitating continuous development and mutual learning. In addition, new types of 'informed peer review' and mixed models of peer review and metric evaluation are emerging [19], for which impact analyses are not yet available. Purely indicator-based quantitative evaluation, on the other hand, is viewed critically, and not only in the context of unease about the growing influence of quantification in universities in general, as argued by Collini [24]. Above all, the criticism is based on a theoretical background that assumes that any use of metrics must be understood and analysed as inherently 'evaluative' and 'incentivising' [25; 26]. Metrics thus have direct effects on research practices, such as tactical behaviour, goal setting, goal reduction, and include a potential bias towards interdisciplinary research. Empirical studies such as 'Metric Tide' [21] show distortions such as 'gaming', 'salami publishing', but also scientific misconduct and self-plagiarism in the context of metrics [22; 27]. On this basis, guidelines and tools have been developed for the targeted, reflective and critical use of indicators, with the essential aim of 'avoiding the creation of undesirable behavioural incentives' [22: p.11]. Another problem with indicator-based evaluations discussed in the literature is the influence of the characteristics and qualities of the information on which the research evaluation is based [19]. The preparation of data, which is usually done by the departments being evaluated, plays an important role in indicator-based evaluations, even more so than in peer review. Research Information System (RIS) systems are highly dependent on the quality of data entry and control and, critically, can also lead to superficial and potentially damaging 'unintentional' quantification.

The academic debate about architecture as research

Because buildings, cities, and the built environment as a whole are seen as concrete, contextual, long-term but also changing phenomena, discussions about research in architecture are complex. Research in the polytechnic tradition, from which the TU9 departments of architecture originate, has always laid the foundations for practice and has been developed in specific practice-based models: from the growing cities and industrialisation of the nineteenth century to the modernist movement, globalisation and urban renewal in the twentieth and twenty-first centuries. Indeed, important researchers such as Aldo Rossi or Rem

Koolhaas have also been practising architects. Recent research in the Horizon Europe project titled TACK [28] recognises that practice is a research component whose 'tacit knowledge' can be used to develop research methods, as Jeremy Till noted [29]; the specific relationship between research and architecture in general is theorised, for example, by Murray Fraser in the form of 'practice-based architectural research' [30].

The recent academic debate on 'architecture as research' is based on a paradigm shift: in contrast to the efforts to 'scientify' design in general and architectural design in particular as part of the modernist movement since the 1920s, the focus is now, as Nigel Cross puts it, on understanding design as a discipline:

It is a shift from the aim of creating a 'design science' to that of creating a 'design discipline'. The focus is now on understanding the design process through an understanding of design cognition, or the 'designerly' ways of knowing and thinking. [31]

The basic approach beginning in the 1990s to position architecture in a broader field of design disciplines and artistic research – what Christopher Frayling then called 'research in art and design' [32] – has since been honed towards design research in architecture. This has been suggested by Till:

The normal stretching of the field of architecture along the arts to science line (with the social sciences somewhere in the middle) results in each place along the line being researched according to a particular paradigm and methodology from the research spectrum. This ignores design, which is clearly an essential feature of architectural production; design cannot be so easily categorised as a qualitative or quantitative activity, but should be seen as one that synthesises a range of intellectual approaches. [29]

Likewise, Fraser argues:

Design research in architecture cannot however be conceived as synonymous with the immensely broad subject of architecture, or indeed of architectural practice; rather, it is a significant seam that runs through design work with a particular focus on the creation of new

insight and knowledge. Design research is able to blend into other more established research methodologies in the arts, humanities, and science, with no intrinsic antagonism. The issue of the methodology of design research as a contested site – in that it clearly opens up a new paradigm of research – is one of its real strengths. [33]

This line of thought places research in architecture directly within the performative and formative core of methods whose fundamental openness is actively used in the research process [34]. Between the as-yet-unacknowledged role of research-based design strategies and a new significance of design theory discourses, Buchert's concept of 'Reflexive Design' [7] refers to the implications of Reflexive Modernism, asks about the interaction between systematisation and creative processes as well as specific forms of knowledge acquisition, [35] and examines the role of intentions in architectural practice and research, for design and knowledge processes [36].

Inter alia, practices on design research in architecture have been established at the Faculty of Architecture and Landscape at LUH Hannover [8], the Bartlett School of Architecture at University College London [3; 33], the Faculty of Architecture at KU Leuven, [37] and the Faculty of Architecture and the Built Environment at TU Delft [38]. The pan-European ARENA research network has become a driving force for the development and dissemination of design research in architecture [39]. The ARENA Journal of Architectural Research (AJAR), initiated by this network, openly supports new research areas as well as trans- and interdisciplinary research areas. The vision of the journal is thus to combine innovative methods of design- and practice-based research with the discipline's traditional research methods.

Another area of discussion focuses on the orientation of doctoral programmes, which, on the one hand, aim at clarifying characteristics of architectural research within the framework of engineering, with an emphasis on design research, and, on the other hand, are linked to discussions in the humanities (especially art and music), with an emphasis on creative research, as advocated by Nilsson [40] and Atalay Franck [41]. Both perspectives stress the importance of practice-based research and call for a more consistent qualification of such approaches. The EU-funded CA2RE+ project is currently developing quality criteria for design-oriented doctoral training, in particular for subject-specific forms of peer review [42]. The reorientation of study programmes in the wake of the Bologna reform

has also provided an impetus to distinguish the specific acquisition of knowledge in architecture from engineering on the one hand and the arts on the other, and to define interfaces with design (product and media design). In a recent project on epistemic cultures in architecture, art, and design funded by the Swiss National Science Foundation (SNF) [43], the definition of design in architecture is conceived as an 'epistemic practice' from which cognition and genuine architectural knowledge emerge.

Aspects of research quality assessment emerge in these discussions, and in many cases they are the springboard for studies and definitions in the first place: for example, the studies developed in the Netherlands more than 10 years ago, prompted by the challenge to the departments of architecture, especially at the TU Delft, to define subject-specific criteria for national research assessment, in order to counter what Frank van der Hoeven [38] identified as an 'evaluation gap' to their disadvantage. The Royal Netherlands Academy of Arts and Sciences formulated it thus:

Scientists in design and engineering regularly encounter problems in the assessment of the quality of their research output, whether that assessment takes place within the context of an external evaluation, an academic appointment or promotion, or an application for funding. The quality indicators used in such situations are borrowed from the more basic sciences (publication in ISI journals, impact factors, citations, the h-index (Hirsch index) and are, in the eyes of these scientists, inadequate. [44]

As part of the 'ERiC - Evaluating Research in Context' initiative, the Rathenau Institute at the Delft University of Technology conducted a pilot study which examined the research concepts used there, developed evaluation criteria for them and then tested them [45]. Thanks to the broad discussion of the results [46; 47], including internationally, this work became a milestone in the development of professional performance criteria in architectural research and influenced the practice of the periodic national research evaluation Strategy Evaluation Protocol (SEP) in the Netherlands (see below). In the context of ERiC, the evaluation of the societal impact of academic research was also addressed [48]. As part of this intensive engagement with research in architecture, the Royal Netherlands

Academy of Arts and Sciences published guidelines for the quality assessment of research which stated that:

There is no stable publication pattern nor a core set of scientific journals to make a valid bibliometric benchmarking of architectural departments. Only a small sample of scientific journals is covered by ISI databases. Although these data can be included in an evaluation report, clearly for an assessment of the research quality of the programmes, information about the programme, other scientific outputs and good peer assessment will be required and are of more value. [44]

Based on our current experience at departments of architecture at technical universities, we agree with this statement. Evaluations based solely on publication records in Scopus, Google Scholar, Avery Index to Architectural Periodicals, or WoS only allow reliable statement about the overall picture of research performance for a very small range of (technical) sub-disciplines. In appointment procedures and for internal assessment, a wide range of research outputs are used to assess research quality and relevance, according to specific methodologies of that discipline: e.g. prototypes, artefacts, designs, research exhibitions, or innovations developed with stakeholders from society, business, culture, and local government. Criteria in such exercises are largely determined on a case-by-case basis, according to the differences between sub-disciplines.

Comparison of research-evaluation systems

In order to contribute to these discussions with an evidence-based study – and on the basis of the critical debate on research evaluation – the three largest EU countries after Germany were selected as case studies: France (HCÉRES), Italy (VQR), and the UK (REF; in the EU until 2020). The choice of case studies in Europe makes sense because of similar social contexts and science systems, and also in view of the common goal of a European higher education system. All three countries have developed and tested nationwide peer-review-based evaluation systems, which are continuously updated and agreed upon with the respective academic community, especially with regard to the research and publication culture in architecture. There is also a debate about the impact of these systems. In

particular, the Research Excellence Framework (REF), which was developed in the UK from the 1980s, has the status of an international benchmark [22] and is used in many countries for the further development of evaluation systems. In Sweden, for example, where previously only a purely indicator-based national evaluation had been used for performance-based resource allocation, a new procedure based on the REF was developed (although it was not ultimately implemented) [18; 26]. The fourth case study analyses the national evaluation system for university research in the Netherlands. The SEP has as its sole purpose the improvement of quality – and not, as in the other three cases, the distribution of part of the national research funds, since the Netherlands has opted for block funding of university research. The Dutch evaluation system is of great interest in the context of this study because of the particular commitment of Dutch research organisations to the subject of architecture. The comparison is based on an examination of recent policy and organisational documents for the four cases [49; 50; 51; 52; 53; 54; 55; 56; 57].

Expert panel peer review

In all four cases, the evaluation is carried out by expert panels, which in the Netherlands and France must include international experts. In the UK and Italy, subject-specific panels for architecture evaluate all subject areas nationwide; in the Netherlands and France, panels are set up specifically for individual departments (or subject units); in France, there are also nationwide expert panels for subject-specific definitions in the procedure. In France and the Netherlands, on-site meetings with the departments (or subject units) to be evaluated are also held.

Strategy development based on self-evaluation

In all four cases, the subject units prepare a self-evaluation report explaining the research performance and commenting on the extent to which the strategic objectives have been achieved, as well as a strategic plan for the next 5 or 6 years (with the exception of Italy). In all cases, the units receive an evaluation report from the expert panel. In this way, not only is the strategy development of the subject units regularly promoted, advised and evaluated by expert peers, but impulses are also given for the development of subject-specific research at the national level. In particular, by focusing on strategy development, thematic priorities and emerging fields can be developed and promoted in a targeted manner.

Evaluation systems and their different criteria

In all four cases, the criteria for evaluation are set out in the evaluation frameworks and then specified by the subject panels (UK, Italy) or the subject unit panels (Netherlands, France) on a subject-specific and, if necessary, case-specific basis. The REF specifies this as follows:

Within this single framework, differences in the nature of research across the disciplinary spectrum may justify differences in the detailed approach to assessment. Panels have consulted with their subject communities and with HEIs in doing so. [55: p.4]

The following criteria are used for research quality, which has the highest weighting in all four cases (research outputs, academic quality in the REF, research quality in the SEP, research products in the VQR, research products and activities in France):

- Originality (REF, VQR), knowledge gain (France).
- Significance (REF), scientific relevance (SEP, France), impact in scientific community (VQR).
- Rigour (REF), methodological rigour (VQR), quality (SEP).
- Academic leadership (SEP), impact in scientific community in international perspective (VQR).

In impact (non-academic impact in REF, societal relevance in SEP, third mission in VQR, integrated in research quality in France), the following criteria are used:

- Impact (SEP), social, economic, cultural impact (France, VQR).
- Reach (REF), uptake (SEP), added value for beneficiaries (VQR).
- Significance (REF), public engagement (SEP), relevance with regard to the reference context (VQR).
- Teaching-research-nexus (SEP, France; not in REF and VQR).

All four cases formulate an area for assessing the environment of the organisation (environment in REF, viability in SEP, context indicators in VQR, organisation and life of the unit in France). In SEP and France, the focus is on the unit's strategy (relevance of objectives, strategy and plans in SEP, project and strategy in France). In REF, vitality, sustainability, contribution to the wider discipline or research base

are addressed. In SEP, management, resources and the wider institutional context are assessed. The VQR uses indicators to assess resource allocation, researcher mobility, internationalisation, PhDs, and external funding. In France, leadership, spirit, organisation, gender and diversity, scientific integrity, hygiene and safety, sustainability, intellectual property, economic intelligence are assessed. In the SEP, additional transversal criteria also related to research quality are defined: Open Science, PhD policy and training, academic culture (openness, social security, inclusiveness), human resources policy (diversity, talent management).

Evaluation of subject-specific research outputs

The frameworks of the four cases provide formats for the research outputs to be evaluated; these can be further specified by the evaluation panels for individual subjects (UK, Italy) or subject units (Netherlands, France). For the subject of architecture, the procedures in all four cases open up the possibility of using subject-specific formats of research outputs for evaluation. An example of this is the following definition in the REF, which applies to all subjects:

In addition to printed academic work, research outputs may include, but are not limited to: new materials, devices, images, artefacts, products and buildings; confidential or technical reports; intellectual property, whether in patents or other forms; performances, exhibits or events; and work published in non-print media. An underpinning principle of the REF is that all forms of research output will be assessed on a fair and equal basis. Sub-panels will not regard any particular form of output as of greater or lesser quality than another per se. [55: p. 50]

There is a high degree of agreement between all four methods in terms of research outputs. For the discipline of architecture, it is particularly interesting that not only book and journal publications and conferences are evaluated, but also exhibitions, performances, material and digital artefacts and designs, which are important formats for the discipline and are an integral part of the professional methods of gaining knowledge. Explanations are provided for non-text-based research outputs, for which there are precise specifications [55: Annexe K].

Precise procedures for the assessment of impact

In all four cases, precise procedures have been developed for assessing impact. In the UK and Italy (Third Mission Evaluation), this evaluation is carried out only on the basis of activities selected for this purpose by the specialised units. In the Netherlands, indicators are used in addition to activities, whereas in France, only indicators.

Emergence of new patterns of informed peer review

In all four cases, a qualitative assessment is made of the publications, which are then aggregated for the subject unit. In the UK and Italy, all publications are evaluated; in the Netherlands, the subject units select for evaluation the best publications from their point of view, and in France, the subject units select the best 20% for in-depth evaluation. The selection of top products for more efficient evaluation is recognised in the international discussion as a trend for the further development of peer review processes [19].

It can be observed that the long-standing opposition of peer review and purely indicator-based evaluation is beginning to dissolve, with a growing number of evaluations combining both approaches, in particular through the inclusion of bibliometric and non-bibliometric indicators in peer review, in subject-specific combination models. Citation analysis is more commonly used in the natural sciences. In the social sciences, humanities and engineering, peer review plays a greater role in generating qualified statements about excellence, coherence and quality that cannot be achieved by indicators alone. In all four cases analysed here, the model of informed peer review uses indicators to inform experts to varying degrees, depending on their decision [19: p. 48].

In particular, citation data can be used as an indicator in the REF on a case-by-case basis for subject units, where available and meaningful. Guidance on the use of citation data is available from the Forum for Responsible Metrics [58]. The use of the journal impact factor is not allowed in the SEP and the use of individual citation data such as the h-index is strongly discouraged. Quantitative indicators of research activity may be used on a case-by-case basis where appropriate. Research is evaluated in the context of a research unit's self-defined objectives and strategy. 'Research units themselves determine which indicators they consider relevant for the evaluation of their research' [56]. In the VQR, citation data are used

only for articles from journals listed in Scopus or WoS. In France, the use of citation data and other indicators is left up to the individual review committees.

An important trend in all cases is the reflective and differentiated use of indicators, in line with the principles of the Declaration on Research Assessment (DORA) [59], which are explicitly used as a basis for evaluation procedures in the Netherlands and France. In addition to DORA, the report for the ERC [19: p. 50] recommends the principles of the 'Leiden Manifesto for Research Metrics' [23], in particular the principle that 'quantitative evaluation should support qualitative, expert judgement'.

Approaches to research funding in European countries

This analysis examines two categories of good practice in the funding of architectural research: firstly, regular access to funding through qualitative evaluation procedures appropriate to the discipline, and secondly, access through specific programmes that assess and promote excellence based on the characteristics of the discipline.

- France, Italy, Britain, The Netherlands: Funding of basic research in architecture is standard.
- The Netherlands: Specific funding for research through design.
- Italy: Funding of Industrial Doctorates for practice-based research approaches
- Sweden: Funding for artistic research as basic research.
- Austria: Funding for arts-based research as basic research.
- Germany, DFG: difficulties in funding research in architecture as basic research.
- Germany, Zukunft Bau: not considered as basic research.

It can be said that the funding of research in architecture as basic research is established as an international standard in Europe. It is systematically funded in the major countries on the basis of a qualitative assessment appropriate to the subject. In addition, the example of the Netherlands shows how specific programmes for research through design have been established. The funding of industrial doctorates in Italy addresses practice-based research by developing

targeted cooperation with municipalities and architectural and urban planning enterprises. In other countries, such as Austria and Sweden, funding programmes for artistic research also include architecture. By comparison, the current situation in Germany shows that the structures of the DFG are focused on a narrow definition of basic research, which effectively excludes design-oriented or practice-oriented research in architecture. On the other hand, relevant funding, such as that provided by the Federal Government's Zukunft Bau programme, is categorised as applied research in the statistics and in the way it is viewed within universities, rather than as (partly) basic research.

Current approaches to research evaluation in Germany

Overview of the use of evaluation procedures, research information systems, and performance-based budgeting

The analysis of previous approaches in the individual departments of the TU9 to the definition of criteria and indicators for research evaluation shows quite a wide range of different evaluation formats for reviews and strategic development, including in connection with the implementation of research information systems (RIS). Given the different framework conditions in the different federal states, there are considerable differences between departments. Overall, it can be said that research evaluation plays an increasingly important role in TU9 departments of architecture and that its role in strategy development is expanding beyond quality assurance. There is a clear trend towards the implementation of RIS. In the discussions in the department, the usefulness of RIS for communication and accessibility of research results is emphasised, as are architecture-specific characteristics. Since RIS systems differ between universities and between countries, the use of research-related criteria for budget allocation also varies. TU Berlin occupies an 'extreme' position in this spectrum, with its extensive use of quantitative indicators. In other countries, only smaller shares of the budget are allocated on the basis of simple indicators (usually the amount of third-party funding and the number of doctoral theses), and there are also examples of medium-term contracts with simple or extended quantitative indicators. In all cases of quantitative allocation, architecture is under-represented, either because of its lower level of third-party funding, or because it does not meet quantitative metrics which are focused on journal impact factors.

The importance of activity indicators for informed peer review

In order to make discipline-specific achievements visible, the architecture departments of the TU9 have independently developed sets of architecture-specific indicators in recent years. Although the concrete reasons for creating lists of indicators vary (strategy development, funding allocation, visibility), they are all inspired by the desire to develop an evidence-based basis for evaluating research performance in architecture departments. An exploration of the different approaches taken by departments leads to two observations. The first is that defining indicators only makes sense as part of qualitative evaluation processes and in relation to their purpose (research review, strategy formulation or resource allocation): a 'one-size-fits-all' approach to indicators would be counterproductive in terms of efficiency with regard to the overall objective of promoting research quality. Secondly, KPIs can only be used for a very small proportion of the (technically oriented) sub-disciplines in architecture. For the majority of sub-disciplines, and for architecture in general, qualitative assessments must be used. Indicators – especially in the context of the implementation of RIS – must be understood as 'activity indicators' that show research activities, make research results accessible and provide an evidence-based basis for assessing research quality through informed peer review. However, they do not provide a direct assessment, as there are no simple quantification and evaluation procedures for a large number of activities and research outputs in architectural subjects.

Three propositions

Based on the presentation and discussion of the results, the three research questions can be answered in a comprehensive manner:

How can evaluation procedures and criteria be adapted to support the further evolution of research in architecture?

A meaningful assessment of research performance in architecture can – as the empirical study of the European context shows – only be achieved through the establishment of qualitative peer review evaluation systems based on appropriate and subject-related evaluation criteria. A general system of qualitative research evaluation – as implemented in other major European countries – would be of high value for research excellence in Germany, counteracting the fragmentation

of responsibilities spread over 16 federal states. There is currently a gap between awareness and evaluation in architectural research in Germany. The conclusion to be drawn is to promote appropriate qualitative evaluation schemes to enable better research in architecture in various funding and assessment situations. In fact, such a change in research schemes – above all the excellence funding of the DFG – is a necessity for architecture departments due to the increasingly competitive academic and funding environment in Germany, which is strongly influenced by the natural sciences. Such an adapted assessment would enhance the quality of research in architecture and promote strategic development within faculties and in the competitive environment of autonomous universities. It would support visibility and networking for interdisciplinary collaboration and improve the opportunities for attracting third-party funding. Furthermore, it would contribute to a clearer perception of architecture as an academic research discipline in universities and society. Last but not least, improved evaluation is crucial for the positioning of German departments of architecture in competition with departments in other European countries that have in place appropriate and supportive evaluation systems.

What standards for evaluation procedures and criteria can support the evolution of research in architecture?

The empirical study demonstrates that qualitative peer review, based on subject-related criteria with appropriate evidence-based information, is the most appropriate evaluation procedure for architecture.

The four research evaluation systems studied in Europe (UK, France, the Netherlands, and Italy), all peer-review based evaluation systems, are established and tried-and-tested and are continuously updated. Whereas in the UK, France, and Italy, the peer review process is linked to a funding allocation system, in the Netherlands it is used purely to improve the quality of research. In all cases (except Italy), the evaluation procedures are linked to strategy formation and the development of a strategic plan over five to six years. The subject-specific criteria and the subject-specific research results are defined by expert panels in architecture. The focus on peer review in architecture is also in line with the recommendations of the German Science Council [60; 61], which argues that the evaluation of research performance can only be carried out by qualified peers on the basis of additional qualitative and quantitative information.

	Evaluation field	Method of qualitative evaluation	Criteria
1	Research quality	Summary evaluation of all products In-depth evaluation of highlights, (where informed by indicators, e.g. citation)	Originality of idea and approach International academic significance Methodological rigour
2	Impact (social, cultural, economic)	Evaluation of case studies (based on self-reporting)	Reach Significance Teaching-research nexus
3	Vitality	Evaluation (based on self-assessment report and informed by indicators)	Relevance of goals, strategy, and plans Sustainability Management quality Resources Wider institutional context Open Science PhD policy and training Academic culture, openness, inclusivity Human resources policy, diversity, talent management

Table 1: Proposed evaluation criteria for performance evaluation of research in architecture and departments of architecture (Source: Authors).

Table 2: Proposal for eligible research outputs for the performance evaluation of research in architecture (Source: Authors).

Categories for research outputs	Detailed definition	Further specification
Books (or part of books)	Books, parts of books, exhibition	PDF upload of photographic/visual record of output, or details of how it can be freely accessed (e.g. URL, DOI) and evidence of dissemination. Explanatory text to provide sufficient information to allow to assess the research question, process, insights, and evidence of dissemination.
	Editorship of volumes and special issues	
Journal articles	Journal articles (refereed)	
	Journal articles (non-refereed)	
Conferences	Contributions to conference publications (refereed / non-refereed)	
Exhibitions and performances	Research exhibitions	
	Performances	
	Reflection on / with artistic creations	
Physical artefacts	Devices and products	
	Visual media	
	Artefacts, prototypes	
Digital artefacts	Digital media	
	Data sets and databases	
	Software	
Designs	Designs	
Patents, licences, and transfer activities including entrepreneurship		
Other	Reviews	

The four international cases show comparable evaluation criteria and the suitability of subject-specific characteristics of architecture. On the basis of these role models, the departments of architecture of the German TU9 were able to define evaluation criteria (Table 1) and formats for research performance in the evaluation (Table 2), for an (ideal) model of general evaluation and as a contribution to the design of evaluation within universities and funding bodies in Germany.

This proposed standard recommends evaluation to support the strategic development of research in architecture in three areas: research quality (in a discipline-specific range of outputs), impact, and vitality (environment). The orientation towards societal challenges and culture (transformative paradigm) inherent in the culture of the discipline and the creative, collaborative processes, including practice-based innovation processes with non-university actors (transformative / design-driven / practice-based research) suggest that both research quality and societal impact should be addressed as categories in the evaluation (output dimension). To support the strategic development of departments, structural issues need to be addressed (input dimension).

Qualitative assessment should be the core strategy for evaluating research performance. Supporting indicators provide information on subject-specific quantitative data. The SEP follows the DORA principles in the evaluation of publications, especially in the evaluation of citation rankings. Site visits and interviews also play an important role in the structured evaluation processes and in the development and updating of strategies in the evaluated subject units.

In order to assess the quality of research in architecture, subject-specific research outputs need to be evaluated and integrated into the evaluation procedures. Thus, different output formats for academic recognition need to be identified for the different components of architecture: in addition to journals (especially for engineering sub-disciplines), books – also as designed artefacts – prototypes, design studies, artefacts, exhibitions, and conferences play both knowledge-generating and knowledge-transferring roles. The reform of research evaluation in Europe addresses the disciplinary breadth of research outputs as a key objective: 'to recognise the diversity of research activities and practices, with a diversity of outputs, and to reward early sharing and open collaboration' [62].

Quantitative indicators can therefore only be used in a limited and specific way ('informed peer review'). A simple determination of research excellence based on journal and citation indices is not possible for architectural research. Evidence-based assessment requires direct assessment of (selected) research outputs. And while it is true that RIS can support the indexing of outputs, they cannot directly produce an evaluation architecture. Rather, they can provide information about research activity.

What instruments can support the qualification of research results and improve the funding of research in architecture?

The research for this study clearly shows that instruments to support the qualification of research in architecture and the improvement of funding need to be conceived, designed and addressed at several levels: not only for the departments of architecture themselves at the level of their universities, but also for a wide range of stakeholders outside academia and society, as well as for research policy and research funding.

Appropriate measures for departments of architecture and universities may include:

- Elaboration of development strategies based on evidence-based qualitative assessment of research performance;
- Qualified impact assessment;
- Actively influencing the development of research information systems to appropriately integrate subject-related output formats;
- Subject-specific methods and output formats need to be established in the academic context.

The last point requires first and foremost a qualification of outputs and implies a strengthening and expansion of publication output as a central form of measuring knowledge dissemination in general. In particular, using the digital transformation of publication mechanisms and markets to expand publication activities in the academic discipline of architecture (using open-access funding, establishing new publication series, making use of low-cost production options, practising co-authorship, expanding peer review networks, training researchers in academic reputation management and thereby sensitising them to co-authorship and active

citation); establishing specialist journals in Germany and cooperating to introduce international journals. At the same time, it is also worth pursuing a parallel strategy of promoting existing strengths in the publication of books and printed matter as designed objects, as a material dimension, and as an important part of the culture of the discipline. The digital twins of publications or media-centred online formats can offer new dimensions of dissemination. Moreover, architecture should engage in dialogue and collaboration with other disciplines – particularly in the humanities – that are advocating and developing books and non-standard digital formats that go beyond traditional-format journals.

Research policy and funding measures can influence programming, consultation and review in three areas:

- Ensure basic funding for research, preferably in the form of block funding (as in the Netherlands), so that evaluation serves only to improve the quality of research.
- Close the current gap in the funding of excellence in architecture in Germany by anchoring basic research in architecture into the framework of the German Research Foundation (DFG) and the excellence strategy of the Federal Government and the Länder.
- Establish dedicated research lines for design-oriented and practice-based research in architecture in collaboration with several public institutions and foundations.

Instruments for outreach to a range of non-academic and societal stakeholders should certainly focus on communication and raising awareness that research in architecture exists, that it provides new knowledge, and that it is highly relevant to societal challenges. Direct collaboration could include greater involvement of professional bodies to promote research (through prizes or grants, as for example the regrettably now defunct RIBA Research Awards) and to assist in communication. Furthermore, the multi-stakeholder set-up of many research projects already includes non-academic stakeholders who could be more involved in communicating and supporting research in architecture in general and thus act as multipliers.

Working together to advance architectural research

Research in architecture requires appropriate forms of evaluation in order to fulfil its promise of new knowledge and high societal relevance. At the same time, it is clear that evaluation is dependent on and influenced by funding contexts. Also, it is strongly linked to the categorisation of research forms and subjects. These observations – along with a strong commitment to subject-specific and qualitative peer review processes, criteria and materials – are a key conclusion of this essay. The consequent call for departments of architecture to engage in influencing evaluation and funding frameworks includes a demand for increased collaboration – between departments and with stakeholders outside the university – in order to produce change.

The same goes for cooperation at the European level. Even though evaluation, categorisation, and funding frameworks are perhaps not the most popular topics in the wider European academic community in architecture, we should nonetheless engage in these activities and extend cooperation beyond departments to professional, cultural, and civic organisations at both national and European levels. Also, beyond critically following good examples in peer review cultures to evaluate research, German departments of architecture should cooperate at the European level to influence frameworks, since it is noticeable that an increasing share of frameworks – such as the Frascati definitions, the ERC categorisation of subjects and evaluation, the topics and evaluation schemes in Horizon, to name the most important – are European. However, cooperation must not be limited to influencing frameworks: in order to achieve change, it is necessary to address existing beliefs, visions and cultural frameworks – both societal and political – to recognise architecture as a research discipline. Therefore, addressing society and politics and convincing others of the value of research in architecture should be a joint task for the larger academic community, as part of the collaborative positioning of culture and creativity.

Research in architecture in general and basic research in particular, design-oriented and practice-based, can take advantage of the wide range of architectural sub-topics from architectural design, construction and digital technology, urban design and planning, through interior design and landscape architecture, to product, service, media and communication design, linked to multidisciplinary references

in engineering, arts and humanities, and social sciences. Both the New European Bauhaus and the COARA initiative can become important drivers of change to position architecture within the wider academic context. COARA, formed in 2021 [62] to reform research assessment in Europe, published the 'Agreement on Reforming Research Assessment' in July 2022 [63], and this has now been signed by many pan-European and national organisations (such as the DFG) and individual universities, including Germany's TU9 Technical Universities. The agreement sets out a common direction for assessment practices for research, researchers and research organisations, with the aim of maximising the quality and impact of research. Signatories commit to recognising diverse and discipline-specific outcomes, practices and activities in assessment systems based on peer review and supported by the responsible use of quantitative indicators. The agreement calls for the abandonment of the inappropriate use of journal- and publication-based metrics, in particular the inappropriate use of Journal Impact Factor (JIF) and -index. Signatories agree to raise awareness of research assessment reform and to provide transparent communication, guidance and training on assessment criteria and processes and their use. For architectural research, COARA is good news. The core message of this article, a commitment to qualitative assessment, adapted to the strengths and characteristics of the discipline in terms of methods and outputs, and to the establishment of funding schemes for design-led and practice-based research, can be seen as a contribution to the COARA initiative and especially its call to review and develop research assessment criteria, tools and processes.

Competing Interests

The authors have no competing interests to declare.

Acknowledgements

This article is written in the context of an initiative on research assessment that was launched in 2020 by a working group of German TU9 architectural departments. The initiative resulted in a joint declaration that is now being used in Germany in discussions with funding bodies, with policy-makers, and within universities. However, the authors hereby state that this essay and its conclusions are entirely their own and not an official statement by their departments. The authors are

however grateful to their departments for also participating in the discussion and providing data and information for the study. The authors would also like to thank all those who helped with criticism, information, and discussion, and in particular, the editors and reviewers of AJAR.

References

1. Bundesministerium für Bildung und Forschung, Die Exzellenzstrategie. Available at: <http://www.bmbf.de/bmbf/de/forschung/das-wissenschaftssystem/die-exzellenzstrategie/die-exzellenzstrategie.html>
2. European Association for Architectural Education. *EAAE Charter on Architectural Research*. EAAE; 2022. Available at: <http://www.eaae.be/about/statutes-and-policypapers/eaae-charter-architectural-research/>
3. Flach A, Kurath M. Architecture as a research discipline: education between academisation and practice orientation. *Archithese*. 2016; 2: 73–79.
4. Dye A. *How Architects Use Research: Case Studies from Practice*. RIBA Publications; 2016.
5. Hensel MU, Nilsson F (eds.). *The Changing Shape of Practice: Integrating Research and Design in Architecture*. Routledge; 2016.
6. Silberberger J. *Against and for Method: Revisiting Architectural Design as Research*. gta Verlag; 2021.
7. Silberberger J. Architecture schools and their relationship with research: It's complicated. *Dimensions*. 2021; 1(1): 77–84. DOI: <http://doi.org/10.14361/dak-2021-0110>
8. Buchert M (ed.). *Reflexive Design: Designing and Researching in Architecture*. Jovis; 2014.
9. Atalay Franck O. Reflexions on the plurality of methods in architecture. *Dimensions*. 2021; 1(1): 55–62. DOI: <https://doi.org/10.14361/dak-2021-0107>
10. Schröder J, Cappeller R, Diesch A, Scaffidi F. *Circular Design: Towards Regenerative Territories*. Jovis; 2023.
11. Narayanamurti V, Toluwalogo O. *Cycles of Invention and Discovery: Rethinking the Endless Frontier*. Harvard University Press; 2016.
12. Wissenschaftsrat. Anwendungsorientierung in der Forschung: Positionspapier. Wissenschaftsrat; 2020; Drs. 8289-20. Available at: <http://www.wissenschaftsrat.de/download/2020/8289-20.pdf>
13. OECD. Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. OECD Publishing; 2015. DOI: <http://dx.doi.org/10.1787/9789264239012-en>
14. AEC, CILECT / GEECT, Culture Action Europe, Cumulus, EAAE, ELIA, EPARM, EQ-Arts, MusiQuE, SAR. Updates on Artistic Research: Joint Letter. 2022. Available at: <http://aec-music.eu/news-article/frascati-manual-updates-on-artistic-research/>
15. Rittel H, Webber M. Dilemmas in a general theory of planning. *Policy Sciences*. 1973; 4: 155–169.
16. Lawrence PR. The challenge of problem-oriented research. *Journal of Management Inquiry*. 2016; 1(2): 139–142. DOI: <http://doi.org/10.1177/105649269212007>
17. Thomas DA, Nedeva M, Tirado MM, Jacob M. Changing research on research evaluation: A critical literature review to revisit the agenda. *Research Evaluation*. 2020; 29(3): 275–288. DOI: <http://doi.org/10.1093/reseval/rvaa008>
18. Stern N. *Building on Success and Learning from Experience. An Independent Review of the Research Excellence Framework*. Department for Business, Energy & Industrial Strategy; 2016. Available at: http://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/541338/ind-16-9-ref-stern-review.pdf

19. Debackere K, Arnold E, Sivertsen G, Spaapen J, Sturn D. *Performance-based Funding of University Research: Mutual Learning Exercise [Horizon 2020 Policy Support Facility – final report]*. European Commission; 2018. Available at: <http://op.europa.eu/en/publication-detail/-/publication/bb1cad2a-bbba-11e8-99ee-01aa75ed71a1>
20. European Commission. *Communication on a renewed EU Agenda for Higher Education [COM(2017)247]*. European Commission; 2017. Available at: <http://eur-lex.europa.eu/legal-content/EN/TEXT/PDF/?uri=CELEX:52017DC0247&from=EN>
21. Wilsdon J. *The Metric Tide: The Independent Review of the Role of Metrics in Research Assessment and Management*. Sage Publications; 2015. DOI: <http://dx.doi.org/10.4135/9781473978782>
22. Jonkers K, Zacharewicz T. *Research Performance Based Funding Systems: A Comparative Assessment [JRC Science for Policy Report]*. European Commission; 2016. Available at: <http://op.europa.eu/en/publication-detail/-/publication/b0e081dc-4cbe-11e7-a5ca-01aa75ed71a1/language-en>
23. Hicks D, Wouters P, Waltman L, de Rijcke S, Rafols I. Bibliometrics: The Leiden Manifesto for research metrics. *Nature*. 2015; 520: 429–431. DOI: <http://doi.org/10.1038/520429a>
24. Collini S. *What are Universities for?* Penguin; 2012.
25. Dahler-Larsen P. Constitutive effects of performance indicators: Getting beyond unintended consequences. *Public Management Review*. 2014; 16(7): 969–986. DOI: <http://doi.org/10.1080/14719037.2013.770058>
26. Sivertsen G. Unique, but still best practice? The Research Excellence Framework (REF) from an international perspective. *Palgrave Communications*. 2017; 3 (17078). DOI: <http://doi.org/10.1057/palcomms.2017.78>
27. Gimenez-Toledo E, Mañana-Rodríguez J, Engels T, Guns R, Kulczycki E, Ochsner M et al. Taking scholarly books into account, part II: A comparison of 19 European countries in evaluation and funding. *Scientometrics*. 2019; 118(1): 233–251. DOI: <http://doi.org/10.1007/s11192-018-2956-7>
28. Schrijver L (ed.). *The Tacit Dimension. Architecture Knowledge and Scientific Research*. Leuven University Press; 2021. DOI: <http://doi.org/10.11116/9789461663801>
29. Till J. Architectural research: Three myths and one model. *Building Material*. 2007; 17: 4–9. Available at: <http://www.jstor.org/stable/29792323>
30. Fraser M. A British perspective on practice-based architectural research. *Architecture Australia*. 2018; 4: 73–74. Available at: <http://architectureau.com/articles/a-british-perspective-on-practice-based-architectural-research>
31. Cross N. From a design science to a design discipline: Understanding designerly ways of knowing and thinking. In: Michel R (ed.). *Design Research Now: Essays and Selected Projects*. Birkhäuser; 2012: 41–54. DOI: http://doi.org/10.1007/978-3-7643-8472-2_3
32. Frayling C. Research in art and design. *Royal College of Art Research Papers*. 1994; 1(1). Available at: http://researchonline.rca.ac.uk/384/3/frayling_research_in_art_and_design_1993.pdf
33. Fraser M (ed.) *Design Research in Architecture: An Overview*. Ashgate; 2013.
34. Fraser M. Preserving openness in design research in architecture. In: Nilsson F, Dunin-Woyseth H, Janssens N (eds.). *Perspectives on Research Assessment in Architecture, Music and the Arts: Discussing Doctorateness*. Routledge; 2017: 73–88. DOI: <http://doi.org/10.4324/9781315526652>
35. Buchert M (ed.). *Processes of Reflexive Design. Designing and Researching in Architecture and Landscape*. Jovis; 2018.
36. Buchert M (ed.). *Intentions of Reflexive Design. Designing and Researching in Architecture and Landscape*. Jovis; 2021.

37. Verbeke J (ed.). *Impact by Designing. Proceedings of the 3rd ARENA Annual Conference, 6th-7th April 2017 at KU Leuven, Faculty of Architecture, Campus Sint-Lucas, Brussels*. KU Leuven; 2017. Available at: http://arch.kuleuven.be/onderzoek/publicaties/copy_of_2018-proceedings-impact-by-designing-sec.pdf
38. van der Hoeven F. Mind the evaluation gap: reviewing the assessment of architectural research in the Netherlands. *arq: Architectural Research Quarterly*. 2011; 15 (2): 177–187. DOI: <http://doi.org/10.1017/S1359135511000595>
39. Fraser M. A New Deal for Architectural Research. *ARENA Journal of Architectural Research*. 2016; 1(1): 1. DOI: <http://dx.doi.org/10.5334/ajar.12>
40. Nilsson F, Dunin-Woyseth H, Janssens N (eds.). *Perspectives on Research Assessment in Architecture, Music, and Arts: Discussing Doctorateness*. Routledge; 2017. DOI: <http://doi.org/10.4324/9781315526652>
41. Atalay Franck O. Criteria for 'doctorateness' in the creative fields: A focus on Swiss architecture. *ARENA Journal of Architectural Research*. 2016; 1(1): 3. DOI: <http://doi.org/10.5334/ajar.11>
42. Pedersen CP, Zupančič T, Schwai M, van den Berghe J, Lagrange T (eds.). *CARE+² Strategies of Design-Driven Research: Collective Evaluation of Design-Driven Doctoral Training*. Aarhus School of Architecture/ Architectural Research European Network Association (ARENA)/ European Association for Architectural Education (EAAE)/European League of Institutes of Arts (ELIA); 2021. Available at: https://ca2re.eu/wp-content/uploads/2021/10/2021_10_03_CA2RE_STRATEGIES_screen.pdf
43. Hipp A. *Knowledge production in the field of tension between research and practice: Architectural education in the age of Bologna*. Doctoral dissertation. ETH Zurich; 2017. DOI: <http://doi.org/10.3929/ethz-b-000200793>
44. Royal Netherlands Academy of Arts and Sciences (KNAW). Quality Assessment in the Design and Engineering Disciplines: A Systematic Framework. Royal Netherlands Academy of Arts and Sciences; 2010. Available at: <http://www.knaw.nl/en/news/publications/quality-assessment-in-the-design-and-engineering-disciplines>
45. van der Meulen B, Daemen F, van Drooge L, de Jong S, Spaapen J, Wamelink F et al. *Pilot Study at Faculty of Architecture TU Delft*. ERIC Evaluating Research in Context; 2010; 1002. Available at: <http://resolver.tudelft.nl/uuid:f0a713f1-1564-4b79-be66-4f5299ebba2c>
46. van der Hoeven F (ed.). *Architecture and the Built Environment: Research in Context 2003–2009*. TU Delft Faculty of Architecture/OTB Research Institute/Berlage Institute; 2010.
47. de Jong S, van Arensbergen P, Daemen F, van der Meulen B, van den Besselaar P. Evaluation of research in context: An approach and two cases. *Research Evaluation*. 2011; 2: 61–72. DOI: <http://doi.org/10.3152/095820211X12941371876346>
48. Rathenau Institute. *Evaluating the Societal Relevance of Academic Research: A Guide*. ERIC Evaluating Research in Context; 2010; 1001. Available at: <http://resolver.tudelft.nl/uuid:8fa07276-cf52-41f3-aa70-a71678234424>
49. National Agency for the Evaluation of Universities and Research Institutes (ANVUR). *Bando Valutazione della Qualità della Ricerca 2015–2019 (VQR 2015–2019)*. National Agency for the Evaluation of Universities and Research Institutes; 2020. Available at http://www.anvur.it/wp-content/uploads/2020/09/Bando-VQR-2015-19_25-settembre_2020_signed.pdf
50. National Agency for the Evaluation of Universities and Research Institutes (ANVUR). *Documento sulle modalità di valutazione dei prodotti di ricerca Gruppo di Esperti della Valutazione dell'Area 08a, Architettura (GEV08a): Valutazione della Qualità della Ricerca 2015–2019 (VQR 2015–2019)*. National Agency for the Evaluation of Universities and Research Institutes; 2021. Available at: http://www.anvur.it/wp-content/uploads/2021/01/Documento_GEV08a.pdf

51. National Agency for the Evaluation of Universities and Research Institutes (ANVUR). *Elenco dei 180 Dipartimenti di eccellenza ammessi a finanziamento (2023–2027)*. ANVUR National Agency for the Evaluation of Universities and Research Institutes; 2017. Available at: http://www.anvur.it/wp-content/uploads/2022/12/ALLEGATO-NOTA-ANVUR_esito-180.pdf
52. High Council for Evaluation of Research and Higher Education (HCÉRES). *Principes d'évaluation de la Vague B (2020–2021)*. High Council for Evaluation of Research and Higher Education; 2019. Available at: <https://www.hceres.fr/sites/default/files/media/downloads/Hceres-Principes%20d%27évaluation%20vague%20B.pdf>
53. High Council for Evaluation of Research and Higher Education (HCÉRES). *Référentiel d'évaluation des unités de recherche: Campagne d'évaluation 2020–2021, Vague B*. High Council for Evaluation of Research and Higher Education; 2019. Available at: http://www.hceres.fr/sites/default/files/media/downloads/Referentiel_UR_Vague%20B_RECH%20UR_12nov.pdf
54. High Council for Evaluation of Research and Higher Education (HCÉRES). *Research Products and Activities: Template*. High Council for Evaluation of Research and Higher Education; 2019. Available at: http://www.hceres.fr/sites/default/files/media/downloads/Annex_4_Vague%20B_RECH%20UR_12nov2019.docx
55. Research Excellence Framework (REF 2021). *Guidance on Submissions: Research Excellence Framework 2014–20*. Research Excellence Framework; 2019; 01. Available at: http://www.ref.ac.uk/media/1447/ref-2019_01-guidance-on-submissions.pdf
56. Research Excellence Framework (REF 2021). *Panel Criteria and Working Methods: Research Excellence Framework 2014–20*. Research Excellence Framework; 2019; 02. Available at: http://www.ref.ac.uk/media/1450/ref-2019_02-panel-criteria-and-working-methods.pdf
57. Association of Dutch Universities (VSNU)/KNAW/NWO. *Strategy Evaluation Protocol 2021–27*. Association of Dutch Universities; 2020. Available at: http://www.vsnu.nl/files/documenten/Domeinen/Onderzoek/SEP_2021-2027.pdf
58. Responsible Metrics. Various online reports. Available at: <http://responsiblemetrics.org>
59. Declaration on Research Assessment (DORA). *Declaration on Research Assessment*. 2012. Available at: <http://sfdora.org/read>
60. Wissenschaftsrat. *Recommendations on the Specification of the Core Data Set Research*. Wissenschaftsrat; 2016; Drs. 5066-16. Available at: http://www.wissenschaftsrat.de/download/archiv/5066-16.pdf?_blob=publicationFile&v=1
61. Wissenschaftsrat. *Recommendations on the Assessment and Management of Research Performance*. Wissenschaftsrat, 2011; Drs. 1656-11. Available at: https://www.wissenschaftsrat.de/download/archiv/1656-11.pdf?_blob=publicationFile&v=3
62. European Commission (Directorate-General for Research and Innovation). *Towards a Reform of the Research Assessment System: Scoping Report*. European Commission; 2021. Available at: <http://data.europa.eu/doi/10.2777/707440>
63. Coalition for Advancing Research Assessment (COARA). *Agreement on Reforming Research Assessment*. 2022. Available at: http://coara.eu/app/uploads/2022/09/2022_07_19_rra_agreement_final.pdf

How to cite this article: Luce M, Pfarr-Harfst M, Reeh J, Schröder, J, Tessmann O. Evaluating research excellence in architecture: A view from German technical universities towards a European perspective ARENA Journal of Architectural Research. 2023; 8(1): 9. DOI: <https://doi.org/10.55588/ajar.364>

Published: 16 August 2023

Copyright: © 2023 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

ARENA

ARENA Journal of Architectural Research is a peer-reviewed open access journal published by the Architectural Research European Network Association (ARENA).

OPEN ACCESS 