euacde COUNCIL FOR DOCTORAL EDUCATION

Building the Foundations of Research

A Vision for the Future of Doctoral Education in Europe

June 2022

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Foreword

The foundation of the EUA Council for Doctoral Education (EUA-CDE) was driven by a vision of the nature and needs of doctoral education and research training. This vision had been embodied in the Salzburg Principles as a part of the Bologna Process for the reform of higher education in Europe. At the heart of the Salzburg Principles was a clear acknowledgement of the centrality of original research, a recognition that a widening range of career paths is available to doctoral candidates and an understanding that it is the responsibility of institutions to provide the necessary structures and environment to support doctoral researchers, albeit in diverse ways.

Almost two decades later these basic principles remain at the core of what we do but the world has changed, as we shall argue, both in the external environment in which universities operate and in the ways that universities organise themselves to deliver doctoral education. Some aspects of current practice were tested to the limit by the challenges of the pandemic. In what may well continue to be a highly challenging environment, the Steering Committee and Secretariat of the EUA-CDE felt that it was the right time to renew the vision so as to acknowledge these changes and to anticipate what more may be on the horizon.

We sought to harness the collective wisdom of our membership through a participative foresight workshop and extensive consultation. Our thanks are due to all of those who contributed. We hope that the results summarised in this paper and its concluding *Ways Forward* will provide a collective guidepost for our community to reassert the value of the doctorate as the foundation for research and researchers and to take doctoral education forward in the coming years.

LUKE GEORGHIOU
EUA-CDE Steering Committee Chair

ALEXANDER HASGALL
Head of EUA-CDE

Introduction

Europe can look back on two decades of significant progress in doctoral education. The Salzburg Principles,[1] established in 2005 as part of the Bologna Process, provided the basis for reforms of doctoral education. Since that time the European landscape for doctoral education has continued to develop. The ongoing reform process in doctoral education was taken forward in 2010 via the Salzburg II - Recommendations,[2] a seminal document that provided additional content and guidelines for a diverse landscape of doctoral schools and programmes.

Doctoral education is characterised by great diversity in the way the doctorate is pursued but is based on two common foundations: the role of research as the fundament of the doctorate and the recognition of doctoral candidates as early-stage researchers, envisioning a range of careers.

In this document, we seek to build on these principles and the heritage of Salzburg to formulate a vision for doctoral education in Europe for the coming decade. We write at a time when the continent has been shaken by two years of pandemic and amid a war in Europe, both deeply affecting the university sector. It is also a time when global challenges, above all the climate crisis and the need to build a sustainable future for our planet and our societies, combine with disruptive opportunities such as digitalisation to force universities to reflect on the path their institution is taking. These developments demand reflection on how to further develop doctoral education to be open, engaged, and faithful to key values of academia, including autonomy, democracy and freedom. Ultimately the responsibility of doctoral education is to equip the next generation of academics and other knowledge workers for the challenging roles they will need to play in their future careers.

For this vision we have been fortunate to draw upon the insights of our members, the largest community of academic leaders and professionals working in doctoral education and research training in Europe. This publication, led by the EUA Council for Doctoral Education (EUA-CDE) Steering Committee, is the outcome of several consultations with members of the EUA-CDE, including a Focus Group, organised in January 2022 with members from 24 European countries,[3] and a written consultation process in April 2022.

We gratefully acknowledge their continuing contribution to the conceptual and practical development of this paper.

1 Bologna Seminar on "*Doctoral Programmes for the European Knowledge Society– Conclusions and Recommendations"(2005)*, https://eua.eu/resources/publications/626:salzburg-2005-%E2%80%93-conclusions-and-recommendations.html All websites accessed 8 June 2022.

2 EUA Council for Doctoral Education (2010), "*Salzburg II – Recommendations: European universities' achievements since 2005 in implementing the Salzburg Principles*", https://eua.eu/resources/publications/615:salzburg-ii-%E2%80%93-recommendations.html

3 EUA Council for Doctoral Education, *EUA-CDE Focus Group: Doctoral education in Europe: Where are we heading?*, https://eua.eu/events/215-eua-cde-focus-group.html

Facts and figures

In 2018, according to Eurostat data, the EU27 had 660,000 doctoral candidates, with a further 153,000 in other European countries.[4] The countries with the highest number of doctoral candidates in relation to their student population include Germany, the United Kingdom, France and Switzerland. The doctorate is not a mass phenomenon at European universities; the proportion of doctoral candidates is 3.8% of total student numbers and for some countries it is as low as 1%. It is a growing population: the number of new doctorate holders rose by 56% between 2000 and 2012.[5]

Data from several sources confirm a complex organisational framework for doctoral education in Europe. In 2017/2018, EUA-CDE published a survey report[6] that provided several insights into the current landscape of doctoral education in Europe.[7] It confirmed that in around three-quarters of universities doctoral education is organised in programmes with specific elements such as taught courses, milestones and mobility options. In six out of ten universities doctoral education is managed through an organisational unit, the "doctoral school" which, among other things, oversees the development of programmes, ensures quality, and develops regulations and guidelines. For 10% of institutions, doctoral education is organised jointly with other universities. Only 5% of European institutions declared that their doctoral education functions without institutional oversight. For many this means that what was previously an exclusive relation between supervisors and supervisee has de facto become a partnership between supervisors, doctoral candidate, and the institution.

Other key aspects show more divergence in conditions. The funding of doctoral education, for instance, is mixed in different proportions between national funders, university employment, contributions from the non-academic sector, and self-funding, also reflected in a wide diversity of status. Two thirds of candidates complete their doctorate within six years though there is substantial variation between countries. Supervision is organised in different ways: half of European universities have a supervisory team while the others rely on a single supervisor. Also, the specific activities of doctoral candidates are diverse; around seven out of ten European universities have regulations concerning the definition of required courses, assessment of training activities, course contents, or credits.

This organisational diversity should not obscure the fact that a substantial degree of commonality exists in many areas. In keeping with the principles that we have already stated, the central foundations are: research as the basis of the doctorate, and the understanding that doctoral candidates are highly skilled knowledge workers who will be the future of academia and a wide range of other professions. Doctoral candidates are thus significantly different from students in the first and second cycles, irrespective of their status.

4 Eurostat, "*Education and training in the EU - facts and figures*", https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Education_and_training_in_the_EU_-_facts_and_figures

5 Organisation for Economic Co-operation and Development (2014), "*Who are the doctorate holders and where do their qualifications lead them?*", in Education Indicators in Focus, No. 25, https://doi.org/10.1787/5jxv8xsvp1g2-en

6 Hasgall, A., Saenen, B., Borrell-Damian, L., et al. (2019), "*Doctoral education in Europe today: approaches and institutional structures*", https://eua.eu/resources/publications/809:doctoral-education-in-europe-today-approaches-and-institutional-structures.html

7 A follow-up publication to this survey report: Hasgall, A., Peneoasu, A., (2022), "*Doctoral education in Europe: current developments and trends*", https://eua.eu/resources/publications/1017:doctoral-education-in-europe-current-developments-and-trends.html

The key role of doctoral education in today's world of research

Doctoral education has two closely intertwined outcomes – qualified people in the form of the doctoral graduates and the knowledge which results from the research they have conducted. Doctoral candidates play a central role within research projects. A substantial proportion of the scientific endeavour would not be possible without their contribution. The doctoral journey itself is a professional research experience that marks a transition from having been a student to being an independent worker and researcher. Research is a key resource for societies to reflect on where they come from and where they are going, to assess the present and address the challenges of the future.

However, having research as the basis and the outcome of doctoral education does not mean that the doctoral journey is confined to research activities and writing a doctoral thesis. Doctoral candidates, like all researchers, are involved in a variety of activities. These include proposal writing, teaching, engaging in data collection and management, scientific collaboration and publishing, which are now all part of being a researcher. Doctoral education is also situated within the context of current research policies. Hardly any of the major issues that face research (including Open Science and Research Integrity) can be tackled without specifically addressing doctoral education and the situation of early-stage researchers.

Doctoral candidates are researchers who push the boundaries of knowledge. They follow the principles of scientific work. They are well versed in the requirements of their disciplines but are aware of the potential of interdisciplinarity. While the doctorate is usually concerned with basic research, doctoral candidates are also innovators who develop solutions to concrete problems and move within regional innovation ecosystems. Interdisciplinary thinking and practices are part of the doctoral experience, while disciplinary standards and rigour are still maintained. Doctoral candidates are involved in all the tasks that modern research entails, but institutions also strive to ensure that their focus remains on the advancement of knowledge through original research.

It is important to recognise that the majority of early-career researchers in universities (whether doctoral candidates or postdocs) will not have a long-term career in academia. For society this is an opportunity rather than a problem as the skills developed through research and innovation are key for a variety of sectors and roles in a knowledge-based economy. Many skills-needs of the future are not yet defined. The attractiveness of hiring doctoral graduates is based on their capacity to embrace uncertainties and their ability to tackle them. At the same time, research conditions and research environments need to be attractive for doctoral candidates and enable them to reach their full potential. Doctoral candidates, their supervisors and institutions need to openly address expectations, needs and prospects from the beginning to set the course for the career phase of the doctorate to reach successful completion.

Pathways to success

In thinking about the future it is helpful to distinguish between the effects of extrinsic trends and drivers of opportunities, expectations and challenges for doctoral education on the one hand, and on the other, intrinsic factors, pertaining to ways in which universities organise themselves to deliver that education. These are not two completely separate issues as some factors may span both categories. The world of research and academia has always been in constant movement, incorporating new technologies and changing societal demands, and following the inner dynamics of knowledge production. Today, climate change, the high speed of digitalisation, and the need to make the world more sustainable are global issues that also have an impact on the form and content of doctoral education. Doctoral candidates and those who work with them are also citizens and engage with these issues in that capacity. In practice, universities need to manage the tension between policy needs and external stakeholder interests on the one hand, and the holistic development of the individual doctoral candidate on the other.

We consider a series of such drivers in turn, seeking first to characterise the key issues they present, including the opportunities they create and any inherent challenges and threats, and then suggest ways forward, the pathways and principles by which doctoral education can progress in each particular context. The following ways forward will start with some of the key external factors that need to be considered, and then look at some key inherent elements of doctoral education.

Digitalisation transforming research and doctoral education

Digitalisation has already changed the face of doctoral education, impacting how it is organised, administered, and transmitted. Research is heavily digitised, and acquisition of digital skills – through dedicated training informally or through research practice – has become an essential for the candidate. These developments elevated digitalisation to become one of the key topics in the area of doctoral education. This refocusing has been accelerated by the Covid-19 pandemic, which caused a rapid replacement of on-site personal interaction with digital communication. It is likely that the long-run steady state will be a new combination of the two, retaining an increased digital element to enhance established means of interaction. While the use of such communication tools is one of the most visible manifestations of digitalisation, it is only one of its elements. In addition, the use of digital research infrastructures for the access, analysis, curation, and storage of data are necessary elements for doctoral candidates and offer them the means for sometimes dramatically increased research productivity. Candidates will face new career and job profiles opened up by digital skills. As with many innovations, digitalisation will bring both opportunities and threats. It can enrich and strengthen analogue and on-site activities but cannot simply replace them. The potential digital divide between institutions or countries, manifested in the ability to access equipment and digital infrastructure, can lead to new inequalities. Inappropriate use of digital tools may reduce human interactions and exchanges, possibly affecting the mental health of users. This is particularly significant for doctoral candidates, whose temporary precarious situation may multiply the effects of losing contact with the work environment, impeding their ability to build networks and social capital to support their careers.

Ways forward

Doctoral schools serve as a place where the opportunities and challenges of new digital technologies are embraced in the pursuit of research goals and in their own enabling frameworks. Beyond the practical use of today's tools, the widening scope of data science and artificial intelligence have implications for the progress of many fields of research, including the arts and humanities. Doctoral candidates are becoming aware of the technical possibilities and ethical use of these technologies as well as their potential pitfalls. Doctoral schools should take advantage of the opportunities afforded by digitalisation and explore both its potential and limitations, including virtual supervision and defence, while providing the training necessary to engage in advanced research methods. Doctoral education will provide a preparation for new career paths opened up by an increasingly digital world. Doctoral schools should be aware of new areas in which doctoral candidates need support – including access to research infrastructure, the storage of research data and the awareness of ethical, economic and societal challenges related to that data.

The Sustainable Development Goals

With the United Nations Sustainable Development Goals (SDGs), the international community has set itself a framework that points the way to a more sustainable and equitable development of the planet. SDGs have become an important priority and integral to the institutional mission of many universities. They address the societal, environmental, and cultural dimensions of a highly interconnected world in which universities and consequently doctoral education play an important role. In particular, greening and responding to climate change affect the agenda and funding priorities for research and the locus of future careers. Greater engagement with doctoral education in the Global South is also an important dimension highlighted by the SDGs. Even while recognising the continuing importance of global connectivity, the imperative to reduce carbon emissions has implications for the degree and means of mobility of doctoral candidates.

Doctoral education has become a place where greening and the other SDGs are regularly debated with the aim of contributing towards reaching these goals. However, there is a risk that such major global frameworks could be taken out of context, narrowing the scope and value of doctoral research through an excessive focus on thematic areas at the expense of some areas of fundamental research.

Ways forward

Universities should embrace the Sustainable Development Goals as a holistic framework providing a context for and supporting the delivery of doctoral education. Doctoral research, whether it is driven by purely academic motivations or inspired by societal challenges, has a major contribution to make to the technological, social and political concerns addressed by the United Nations Sustainable Development Goals. The SDGs challenge universities to demonstrate their purpose and public benefit. In addition, doctoral education should address the concerns embodied in the SDGs in shaping its own delivery. For example, it should seek to balance the mobility necessary to gain international experience and access vital research resources with a commitment to sustainable travel. Education, including acquisition of transversal skills, should strengthen the doctoral candidate's abilities to face a world that may differ significantly from the current one and to exploit the new opportunities.

Exchange with society

Doctoral education contributes to society primarily by producing research of scientific, cultural and socio-economic value and preparing the academics and knowledge workers of tomorrow. Doctoral candidates are ultimately bridge-builders between academia, research, and society, serving as the ambassadors of academia and vice-versa. Besides these interactions which lie at the basis of the doctoral endeavour, outreach and interactions with societal actors have become increasingly important, even during the doctorate. Communication and mediation activities may be targeted at wider audiences, for example through 'my thesis in 3 minutes' contests'. In addition, where doctoral research is conducted in collaboration with business, public or non-governmental organisations, doctoral candidates often serve as a glue for universities' collaboration with these sectors. Such interactions may strengthen regional anchoring.

It is important to emphasise that communication is not an end in itself. It stands rather for the importance of continuous exchange and co-creation of knowledge. Individual contexts and capacities of doctoral candidates and their research differ. Those who need to work part-time alongside their doctorate (including mature candidates undertaking lifelong learning) may have less time to spend on communication, but their work is itself an act of societal engagement. Public exposure of research is not completely risk-free, particularly when it exposes contested values and beliefs. Personal attacks on researchers, be they in social media or other fora, exist and can be particularly stressful for early-career researchers.

Ways Forward

Even when not connected to a specific mission, research and education at doctoral level contributes to the resolution of the environmental, demographic, socio-economic, and political challenges that Europe and the world are facing. The path to resolving these challenges may lie in addressing fundamental research questions where the application is not evident at the time.

To maintain societal relevance, doctoral candidates should maintain an open and regular exchange with society through a variety of activities which express a modern self-image of researchers. Reflecting different age-groups, candidates also bring the perspectives of the varied social experiences they acquired before the doctorate. Universities should give priority to their responsibilities in connection with communication and training and provide a dedicated support structure to enable these interactions. They should help candidates maintain contacts with societal actors beyond individual research projects. Assessment systems need to evaluate such activities positively. At the same time, institutions must protect the independence of early-stage researchers from external pressures and dependencies, upholding the values of academic freedom and scholarly rigour against any external intent to jeopardise these principles. A transparent division of roles and responsibility is key here in supporting a positive outcome.

Equality, diversity, and inclusion

The growing population of doctoral candidates opens a space for increased diversity and inclusion in terms of their origins and ultimately in the outcomes of their studies. Doctoral schools and programmes serve as meeting points, where candidates from different backgrounds come together and promote exchange. Diversity increases the quality of doctoral education, bringing varied perspectives and experiences to the table. The potential of this diversity in doctoral education is not always fully realised. Access to doctoral education from under-represented groups remains a problem. While overall gender parity has been achieved concerning entry to the doctorate, significant inequalities exist in certain disciplines and national contexts, and become far more marked when it comes to progression in further academic careers, with negative consequences for social mobility. A long duration of a doctorate can itself act as a deterrent, particularly for those from socioeconomically disadvantaged backgrounds or with caring responsibilities. Similarly, spending several years after graduation in an insecure or precarious employment context may discourage students from under-represented backgrounds who may have less access to alternative sources of support. Universities should be aware of biases in their recruitment and provide room for self-reflection. Widening their scope by enthusing underrepresented groups can be a way for universities to create more diversity in doctoral education.

Strict immigration policies can reduce the mobility of international doctoral candidates. While English has become a *lingua franca* in many disciplines, multilingualism opens new perspectives for research and is welcoming for candidates from other linguistic groups.

Ways forward

A diverse doctoral education must be sensitive to the different backgrounds that doctoral candidates bring with them. Doctoral education should encourage reflection on and the overcoming of any social, economic or cultural barriers. It should foster a diversity that goes hand in hand with excellence and a shared understanding of research quality. Institutions need to ensure that access to doctoral education is driven by talent rather than resources and be mindful of existing inequalities and individual situations. Flexible working hours, support networks and mentoring all have a part to play. There is a need to build opportunities to remain and pursue a career in the country of the doctorate-granting institution, for which appropriate support structures and funding should be provided.

Academic freedom

Academic freedom is not only the basis of a functioning system of scientific inquiry but is also inextricably linked to a prosperous and democratic society. It is the freedom of having a space for reflection, where burning questions can be asked in open debates. Academic freedom, independent of seniority or an academic's individual experience, is an inseparable part of doctoral education because no high-quality research can exist without it.

Closely related is the need for institutional autonomy that is fundamental to a democratic society. In this context, institutions require the freedom and flexibility to respond to the needs of a diverse group of doctoral candidates in the way they see best to meet research and education objectives.

Today there are many attempts to restrict this freedom, be it through direct attempts at pressure and threats, or through less overt attempts to steer the content and direction of research. The need for freedom also extends to research carried out with external collaborations, while also respecting the rights and responsibilities of partner organisations. Doctoral candidates can be particularly vulnerable as they do not always have the necessary networks that can provide them support and they are at a career stage where many lack professional stability.

Ways forward

Doctoral education should promote a dialogue about the different dimensions of academic freedoms and raise awareness about where any are at risk. It should create an open space for critical debate and the exchange of opposite views, while defending the rights of doctoral candidates to engage in these activities. Early-career researchers should be encouraged to communicate their research findings without fear, both within and outside academia. Doctoral schools should provide contact points where early-career researchers can turn for advice on issues of academic freedom, including in the context of the assessment and follow-up of collaboration with institutions within and beyond academia.

Diverse institutional dynamics and the role of the Doctoral School

In recent years the doctorate has often acquired an adjective or further definition. For example, in some institutional or national contexts, we have seen professional doctorates associated with a particular profession or work experience, doctorates of the arts describing an emphasis on taught content or industrial doctorates as one variant of a collaborative doctorate (in this case defined by a focus on a problem of relevance to the industrial partner). The precise taxonomy of doctorates varies across national and institutional contexts but the central tenet is to hold on to the core of the Salzburg principles which include that the core component of doctoral training is defined as the advancement of knowledge through original research, while embracing the diversity expressed in these variants.

The evolution of the institutional context of doctoral education has as its most visible trend the increasingly structured approach to doctoral education, manifested in the widespread, though not universal, adoption of doctoral schools as the main organisational framework. There remains some variety as to how these schools are embedded in university structures and the extent to which they have a disciplinary focus. They are staffed by an emergent professional group, whose specialisation has a clear focus on doctoral education. An important aspect of this trend is the channel that it provides for doctoral education to be given prominent and systematic attention among the many concerns faced by universities.

Preparation for a postdoctoral career has become an increasing preoccupation and many of the concerns of doctoral candidates remain relevant in this next phase. The support mechanisms provided by doctoral schools are increasingly being extended to the post-doctoral population.

Ways forward

Doctoral education needs to embrace the variety of formats which have emerged to meet specific needs but at the same time to ensure that the core principles, including the importance of conducting original research, remain integral to all of these. Structured approaches should be used as a means of ensuring that the voice of doctoral education is properly embedded in university structures. Such approaches provide clear channels for the delivery of support to supervisors and candidates and for the exchange of experience with colleagues and peers. Knowledge and exchange about the different disciplinary, institutional and national structures should be promoted in order to ensure successful collaborations.

Ensuring quality and fair assessment

There are many mechanisms for quality assurance (QA) in doctoral education, targeted at both the education and the research aspects of doctoral education. Not all are obvious at first glance. They can include institutional audit and programme accreditation systems, research assessment exercises, and evaluations by public institutions including funders. These institutional and national legislation systems shape quality assurance and development in doctoral education and hence result in significant differences between universities and countries.

Any quality assurance system that is too prescriptive runs the risk of limiting the imagination and creativity of doctoral candidates. The same is true for a one-size-fits-all approach, which does not consider the specific situation of individual doctoral candidates, but also of disciplines and institutions. At the same time, doctoral education needs also to subscribe to the basic principles of good scientific work leading to a high-quality doctorate. Supervision is itself a means to assure quality.

At the level of the candidate, fair and balanced research assessment is crucial, particularly in the disruptive environment of the transition to open science, which questions some assessment practices based upon publication hierarchies. Quality assurance and research assessment must primarily focus on quality and diversity practices engaged in by doctoral candidates. At the same time, the advantage of knowledge through original research should be maintained as a core component of doctoral education. Doctoral candidates and early-stage researchers must become protagonists in this process. This means they need to have voice in this process and be actively involved in assuring the quality of doctoral education.

Ways forward

A fit-for-purpose quality assurance system is essential but the overarching goal is the quality of research, not the use of a particular tool. The focus should go beyond administrative processes to also value the education and research content. That should include an understanding of core skills and values such as research ethics and integrity and the adoption of a critical approach to research assessment not confined to publication metrics. QA systems in doctoral education should not be set apart from the overall QA in the university. Over-assessment which becomes an unnecessary bureaucratic burden should be avoided. Doctoral schools should prepare doctoral candidates for a world where research assessment is not uniquely focused on quantitative, publication-based indicators such as the journal impact factor. They should develop a critical approach to assessment systems that enables them to become agents of change.

Skills fit for purpose

A doctorate can equip candidates with a multitude of skills that are not always fully visible, but which help them meet the modern demands of research and pursue different career paths within and beyond academia. Just because a doctorate does not explicitly appear in a job description does not mean that these skills are not important for a position. A large part of the skills of doctoral candidates is acquired by doing, closely related to the research practices of different disciplines. Doctoral skills include research activities, scientific and public communication, handling data, leadership and career planning. Many of these skills are genuinely transversal and cannot be seen as add-ons to research, but as a key element of doctoral training that has value for academic and non-academic positions. Identifying skills and aptitudes is important. They can vary greatly from person to person.

Ways forward

Doctoral candidates must be equipped with the knowledge and skills to meet the modern demands of research and pursue their chosen career paths. At the same time, they need to map, visualise and verbalise their skills and communicate those capabilities to others. Doctoral education should develop both tacit and explicit skills. Transversal skills should not be seen as an add-on but as a key element of the doctorate, maintaining the essential role of original research as the key feature of doctoral education. Such skills have value for both academic and non-academic positions. Institutions should make the invisible and informal elements of doctoral education visible and communicate them to the outside world. At the same time, regulations and funding should ensure that training can be built into doctoral education. Core skills such as research integrity cannot be limited to training courses but need to be deeply integrated into the doctoral trajectory. Institutions also need to be sensitive to the high workloads of doctoral candidates and potentially contradicting demands, which could affect mental health.

Supervision: key but not a solo act

Supervision is one of the central elements of doctoral education. The success of a doctoral project depends on its quality. Supervision is tasked with supporting the doctoral candidates through the whole research endeavour, and – at least in some European countries – assessing the quality of the doctoral research. Supervisors transmit necessary skills to the next generation and are key contact persons in case of any issues that may arise. Supervision is a joint endeavour in which supervisors, supervisee and the environment/school need to contribute and function. While the tradition of the single supervisor is still prevalent, it is now equally common for them to be part of a team with co-supervisors and advisers from inside or even outside the institution.

Supervision also leads to several issues: there is an automatic dependency relationship between candidate and supervisor which cannot be easily overcome. Under good conditions, the relationship enriches doctoral education, but it can also lead to a variety of conflicts. These include questions of organisation of work, authorship and ownership of results, the work climate, and many more areas. Conventions on these questions vary between disciplines and countries. The work of a supervisor is increasingly complex, which leads to issues related to time and competencies. Engaged supervisors are confronted with the problems of doctoral candidates without always being able to contribute to problem-solving. They also have different, potentially conflicting roles. On the one hand, they have to ensure that work is done properly and timelines followed, and they put the workload on the candidates. On the other hand, they need to give candidates the time and freedom they need.

Ways forward

Supervision is crucial. Its form adapts to the needs and resources of an institution. Universities should invest in the training of supervisors, enabling them to embrace their roles fully and ensure that the doctoral school or environment plays its appropriate supportive role. Supervisory training starts at the doctoral level. Teaching experience and training for doctoral candidates is a good way to prepare for later experience as a supervisor. To avoid and deal with potential conflicts, key aspects of supervision should be previously agreed on and made transparent, without harming informal encounters, collaborations and relations of trust between supervisor and supervisee. In addition, universities should install bodies to which doctoral candidates and supervisors can turn in case of conflicts. Universities may also enable new forms of supervision, including joint and/or virtual supervision, as long as they are fit for purpose. Institutions also need to take care that supervisor and candidate find the appropriate research environment.

Funding adequate to underpin a successful outcome

To bring a doctorate to a successful conclusion doctoral candidates and institutions need appropriate resources underpinned by adequate funding. There are very substantial differences in Europe in both the means by which doctorates and doctoral candidates are funded, and the level of funding. These differences impact upon the ability of universities to provide adequate facilities and professional support and ultimately erode cohesion between research systems, or else drive a brain drain of the most able candidates. They also influence the status of doctoral candidates.

Monthly financing can range from several hundred to several thousand euros. This is only partly offset by differences in purchasing power. Disparities in terms of funding become very visible in the context of collaborations when doctoral candidates work on the same project but have different amounts of financing. Some institutions treat doctoral candidates as employees, or at least have a contractual relationship with them. Others register them as students who may be financed by a stipend or fellowship and may be subject to fees of widely varied levels. In many cases the level of financial support is inadequate, causing candidates to seek external employment which may not be relevant to their careers and detract from their studies. Financial worries are recognised as a major source of stress and mental health issues for doctoral candidates.

Even where it is externally-funded, financial support for doctoral candidates is often limited in time. Thus, while in most European countries completing a doctorate takes four years (or more) on average, funding is often limited to three years. This leads to the problem that doctoral candidates face a funding gap towards the end of the doctorate, endangering the success of a doctoral project at a critical phase. Doctoral education policies also need to take the interests of self-funded candidates into account and be aware of the specific needs of this group.

Ways forward

The level of living support for doctoral candidates needs to take into consideration the relative attractiveness of the careers and the incomes of early-career knowledge workers in other sectors. This means that that the work of doctoral candidates should be appropriately rewarded. Duration of funding should be based on a realistic assumption of the duration of a doctorate. An increase in salaries or duration of the doctorate should not, however, be at the expense of the availability of doctoral positions. The increased need to tackle societal challenges with high-quality research demands the availability of such positions, but this should not lead to a reduction in other university services. The increased demand for additional training for doctoral candidates and supervisors makes it necessary to provide commensurate finance to equip institutions with the professionals who play a key role in the organisation of doctoral education.

Summary of ways forward

1. **Doctoral schools serve as a place where the opportunities and challenges of new digital technologies are embraced in the pursuit of research goals and in their own enabling frameworks.**

2. **Universities should embrace the Sustainable Development Goals as a holistic framework providing a context for and supporting the delivery of doctoral education.**

3. **Even when not connected to a specific mission, research and education at doctoral level contributes to the resolution of the environmental, demographic, socio-economic, and political challenges that Europe and the world are facing. The path to resolving these challenges may lie in addressing fundamental research questions where the application is not evident at the time.**

4. **A diverse doctoral education must be sensitive to the different backgrounds that doctoral candidates bring with them. Doctoral education should encourage reflection on and the overcoming of any social, economic or cultural barriers. It should foster a diversity that goes hand in hand with excellence and a shared understanding of research quality.**

5. **Doctoral education should promote a dialogue about the different dimensions of academic freedoms and raise awareness about where any are at risk. It should create an open space for critical debate and the exchange of opposite views, while defending the rights of doctoral candidates to engage in these activities.**

6. **Doctoral education needs to embrace the variety of formats which have emerged to meet specific needs but at the same time to ensure that the core principles, including the importance of conducting original research, remain integral to all of these. Structured approaches should be used as a means of ensuring that the voice of doctoral education is properly embedded in university structures.**

7. **A fit-for-purpose quality assurance system is essential but the overarching goal is the quality of research, not the use of a particular tool. The focus should go beyond administrative processes to also value the education and research content. That should include an understanding of core skills and values such as research ethics and integrity and the adoption of a critical approach to research assessment not confined to publication metrics.**

8. **Doctoral candidates must be equipped with the knowledge and skills to meet the modern demands of research and pursue their chosen career paths. At the same time, they need to map, visualise and verbalise their skills and communicate those capabilities to others. Doctoral education should develop both tacit and explicit skills. Transversal skills should not be seen as an add-on but as a key element of the doctorate, maintaining the essential role of original research as the key feature of doctoral education.**

9. **Supervision is crucial. Its form adapts to the needs and resources of an institution. Universities should invest in the training of supervisors, enabling them to embrace their roles fully and ensure that the doctoral school or environment plays its appropriate supportive role.**

10. **The level of living support for doctoral candidates needs to take into consideration the relative attractiveness of the careers and the incomes of early-career knowledge workers in other sectors. This means that the work of doctoral candidates should be appropriately rewarded. Duration of funding should be based on a realistic assumption of the duration of a doctorate. An increase in salaries or duration of the doctorate should not, however, be at the expense of the availability of doctoral positions. The increased need to tackle societal challenges with high-quality research demands the availability of such positions, but this should not lead to a reduction in other university services.**

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The EUA Council for Doctoral Education (EUA-CDE) was launched in 2008 at the initiative of the European University Association, responding to a growing interest in doctoral education and research training in Europe. An integral part of the European University Association, it is now the largest European network in this field, covering more than 260 universities and institutions working on issues related to doctoral education and research training in 37 countries.

Since its creation, EUA-CDE has been leading the transformation and strengthening of doctoral education in Europe. Building on the outcomes of EUA's work on doctoral programmes and research careers, EUA-CDE has been the driving force behind the implementation of the Salzburg Principles and Recommendations and the promotion of doctoral education as the main intersection between the European higher education and research.