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A handbook on research management best practices

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Research management best practices

Handbook

What is the purpose of this handbook?

One of the main goals of the LEARNVUL project was to enhance institutional research management support and scientific visibility of researchers from the West University of Timișoara. Throughout the project implementation, members of the Timișoara team involved in the LEARNVUL project have organised several mentorship activities, staff exchanges, workshops, and an expert meeting which offered the possibility to interact with and learn from top-tier researchers from leading universities. Therefore, through this handbook, we intend to share the accumulated knowledge and provide recommendations that could potentially increase the expertise of researchers activating at the West University of Timișoara. We will discuss detailed guidelines for strategies that could be of service to individual researchers but also some that departments and universities could adopt to create an environment where the implementation of these strategies by individuals will be fruitful.

Rather than providing a complete source of research management techniques, we designed this handbook as a solution for researchers from the West University of Timișoara to reach their zone of proximal development. More precisely, we will discuss aspects and practices that typically hinder the research process in the context of the West University of Timișoara. We will then offer solutions related to the organisation of laboratory research teams, open science, ethics, digital tools that support the research process, and institution-level strategies to support research.

I. External and internal factors that impede good research

According to the literature, there are currently two main pressing issues that impede the quality of research: low reproducibility and replicability of science (Eisner, 2018; National Academies of Sciences & Medicine, 2019) and low well-being of PhD students (Dhirasasna et al., 2021; Sverdlik et al., 2018). There are several causes of these issues, which have personal, financial, professional, and/or organizational connotations, presented in brief in this chapter.

The reproducibility crisis

A recent research initiative conducted by multiple researchers from various fields has shown that a vast majority of research could not be replicated, and some couldn't even be reproduced (National Academies of Sciences & Medicine, 2019). When following the same procedures as the original authors, different results were often reached. Additionally, when using the data provided by the authors and following the exact same analytical guidelines, researchers obtained different results than those mentioned by the original authors. On average, only about one third of the studies that were successfully reproduced or replicated. In Table 1 and Table 2 are present summaries of these results in different for different disciplines. A more extensive and in depth presentation can be found in the book Reproducibility and Replicability in Science available online in PDF format.

> ***Reproducibility*** is obtaining consistent results using the same input data; computational steps, methods, and code; and conditions of analysis.
> ***Replicability*** is obtaining the same results after conducting a second study while following the procedure of the original study.

Table 1. Summary results from several reproducibility studies

Field	Number of studies	Reproducibility
Biology (oncology, women's health, cardiovascular health)	67	25% were reproduced
Biomedical	441	267 did not include a link to a full study protocol, and none provided access to all the raw data used in the study
Computational physics	307	50.9% of the articles were impossible to reproduce, 6% of the articles made artifacts available in the publication itself, 36% discussed the artifacts (e.g., mentioned code). 298 authors who were emailed with a request for artifacts, 37%

		did not reply, 48% replied but did not provide any artifacts, and 15% supplied some artifacts.
Cross-disciplinary, computation-based research	204	24 articles had data, and an additional 65 provided some data when requested
Economics	67	50% were reproduced
	9	Data were available for 72%-78%, two were reproduced successfully, three “near” successfully, and four unsuccessfully.
	-	In 27 of 333 economics journals, more than 50% of the articles included the authors’ sharing of data and code
Political science	116	8 were reproduced on the first attempt
Artificial intelligence	400	In a survey of 400 algorithms, 6% of the presenters shared the algorithm’s code; 30% shared the data they tested their algorithms on; and 54% shared “pseudocode”—a limited summary of an algorithm.
Imaging	-	From all articles published in Transactions on Imaging Journal in 2004, 9% reported available code, and 33% reported available data.
Computer systems	231	The software could be built for less than one-half of the studies for which artifacts were available (108 of 231).
Data work funded by the National Institutes of Health	235 000	12% mention the availability of datasets in repositories, while 88% had invisible datasets
Multidisciplinary	-	20% of the articles published in PlosOne in 2016 had data or code in a repository; 60% of the articles have data in main text or supplemental information; and 20% have restrictions on data access

Table 2. Replication results of studies from different research fields

Field	Number of studies	Replication results
Experimental Philosophy	40	70% were replicated

Behavioral Science, Personality Traits Linked to Life Outcomes	78	87% of the replication attempts were statistically significant in the expected direction, and effects were typically 77% as strong as the corresponding original effects.
Behavioral Science, Ego-Depletion Effect	-	Meta-analysis of the studies revealed that the size of the ego-depletion effect was small with 95% CI that encompassed zero (d = 0.04, 95% CI [−0.07, 0.15]).
General Biology, Preclinical Animal Studies	67	Published data were completely in line with the results of the validation studies in 20%-25% of cases.
Oncology, Preclinical Studies	53	11% replicated
Genetics, Preclinical Studies	18	2 replicated; 6 partially replicated or showed some discrepancies in results; 10 not replicated
Experimental Psychology	36	77% replicated
	28	54% replicated
	100	36% replicated
	100	77% replicated by comparing the original effect size to an estimated 95% CI of the replication.
	21	62% replicated
Empirical Economics	9	2 replicated, 3 “near” successful, 4 unsuccessful
Economics	167	66% were unable to confirm the original results; 12% disconfirmed at least one major result of the original study, while confirming others.
	18	61% replicated
Chemistry	13000	27% of papers reporting properties of adsorption had data that were outliers; 20% of papers reporting carbon dioxide isotherms as outliers.
	-	33% experiments had data problems
Biology Reproducibility Project: Cancer Biology	29	The first five articles have been published; two replicated essential parts of the original papers, one did not replicate, and two were uninterpretable.

Psychology, Statistical Checks	16695	49.6% of the results of the article contained at least one inconsistency, and 12.9% contained at least one gross inconsistency.
Engineering, Computational Fluid Dynamics	4	Three studies replicated
Psychology	10	3 of 10 replicated, but when following the same procedure all studies replicated
	10	10 of 10
	17	None of the studies replicated the result at $p < 0.05$.
	17	In the first attempt, none of the studies was replicated, but all studies were replicated in the second replication attempt by another team of researchers who followed the initial procedure exactly.
	1	Thirty-one labs replicated the original study. The effect size was much more significant when the original research was replicated more faithfully (the first set of replications inadvertently introduced a change in the procedure).

What research practices are linked to low reproducibility and replicability?

Such low quality of research is attributed to different counterproductive research practices (Eisner, 2018) adopted by researchers, journals, and institutions that are often driven by the "publish or perish" approach to scientific research. These practices include publication bias, inadequate statistical power, p hacking, HARKING, and inadequate record keeping.

False positive = falsely claiming a result **is** significant
False negative = falsely claiming a result **is not** significant

Inadequate statistical power = depending on the analysis that the researchers plan to perform, an adequate number of observations is required to detect a significant effect. Often the number of needed is determined by arbitrary or contextual factors (i.e., the accessibility of the sample). For example, a underfunded research project will be limited in its possibility to reach a high enough sample size to detect a small but true effect, or in other words, will obtain a *false negative* result. On the other hand, a project that has access to funding could easily obtain high enough sample power to obtain a significant effect for

very small effects – a *false positive* result. Consequently, attempting to replicate a significant effect with a sample size adequate for the envisioned effect size will most likely lead to an unsignificant p value.

p-hacking = stopping data collection when the envisioned effect becomes significant. A p<.05 denotes a probability of 5% that the effect was observed by chance. Repeatedly resuming data collection increases the probability of getting a p<.05 even if there is no real effect (i.e., false positive results).

publication bias = researchers tend to report only significant results and disregard negative ones (those that do not support the initial hypothesis).

HARKING = "HypothesisING AfteR the facts are Known" can lead to loss of unsignificant but otherwise important research results. Researchers that are focused on obtaining significant p values change the hypothesis in such a way that it appears that the significant effects are those that were initially envisioned.

inadequate record keeping = original research does not record relevant details of the research procedure or reports only the more desirable aspects hindering the possibility to reproduce or replicate the study.

Low well-being of PhD students

Well-being is a vague term that lacks any precise definition. Generally, it refers to the individual's perception of his or her health (Schmidt & Hansson, 2018). According to multiple studies the relationship with the supervisor is the most important aspect of the PhD experience (Dhirasasna et al., 2021; Juniper et al., 2012; Sverdlik et al., 2018), because it can impact other aspects related to well-being. For example, an inefficient communication between the student and the supervisor can make it difficult for the student to progress with the PhD project which will affect his/her motivation, self-efficacy and will increase stress levels. The well-being of PhD students can be influenced by a plethora of factors summarized in Table 3.

Table 3. Factors influencing PhD students' well-being

External factors	
Supervision	The most influential factor in the doctoral experience is considered the relationship between the supervisor and the student. Open, supportive, and frequent communication was found to be essential for student success and satisfaction.
Consensus among supervisors	Direct communication between students' supervisor will ease pressure on PhD students to moderate different opinions and will provide students a clearer direction.

Other academic-related work	Research assistant and teaching-related tasks may help advance PhD student's career. However, these activities typically are not designed to help ensure high quality learning for the students, but rather to serve the faculty's need.
Departmental structures and socialization	Although socialization is a rather personal matter, departments can create opportunities for students to interact with their peers and older colleagues and help students perceive themselves as a valuable member of their scholarly communities.
Offered facilities by university	Access to research facilities such as an own desk, a personal computer, printing, as well as lab access with sufficient equipment and materials and, access to required data and information.
Financial stability for private and research-related expense	PhD students have financial resources to cover personal expenses, tuition fees, conference fees, and so on.
Financial Opportunities	Access to research funds is associated with greater satisfaction, persistence, and lower attrition.
Personal/Social lives	Doctoral students often report low engagement in leisure activities and high levels of burnout, depression, and low well-being. Students often end-up isolating themselves to spend more time on academic work.
Family/friends/peer support	Emotional support from family, friends, and other PhD students plays a positive role during the candidature. However, it does not prevent them from dropping off because family/friends/peers do not contribute to the PhD project progress.
Housing security	Living arrangement contribute to the PhD student's well-being (e.g., renting of owning an apartment vs living in a student dorm)
Extra non-curricular commitments	Extra activities such as family commitments, caring roles, and unrelated-academic work can add workload to PhD students.
Internal Factors	
Motivation	Students who pursue their degrees for intrinsic reasons report better satisfaction and well-being during their studies
Academic Identity	Involvement in academic activities contributes to the development of an academic identity (e.g., writing, conferences, research, peer interaction, etc.)

Self-worth	A sense of unworthiness to participate in doctoral studies was suggested to be at the heart of students' struggles.
Self-efficacy	Research self-efficacy is correlated with interest in research and research productivity, while low self-efficacy is linked to self-handicapping behaviors.
The feeling of PhD project is moving forward	The feelings of PhD students that their projects make sense, and it is progressing.
Stress levels	Anxiety, depression, burnout, emotional exhaustion, feeling of strain and pressure, usually caused by imbalance between the individual and one's environment.
Writing skills and regulatory strategies	Collaborative writing is associated with more optimal self-regulation, higher motivation, more positive emotions, better writing quality, and higher completion rates.
Quality of sleep	Quality of sleep is related with stress and academic performance.
Physical health	Physical health and absence of ill health.

West University of Timisoara research audit

In November 2022, a team of experts from Ghent University and University Milano-Bicocca visited the West University of Timișoara to perform an audit of the research activities. We present an overview of the main identified problems.

a) *Time available to do research*. Ph.D. students are requested to teach from 6 to 12 hours a week per semester, mostly in laboratories or similar small-group teaching activities. Taking also into account the preparation time, it means that, on average, 2/3 of working hours are focused on activities other than their Ph.D. research project. It follows that for the average Ph.D. student, at least in Psychology, preciously little time is available for research, forcing them to work extra hours and weekends if they want to progress with their research. For staff members, the situation is also problematic. Their teaching and administrative load are substantial, and their basic salary is not commensurate with the importance of their work.

b) *Office and research space*. Currently, there are few offices that are shared by multiple persons. This is suboptimal for conducting research because of the risk of being continuously interrupted or otherwise distracted by the presence of other people. This problem is currently present for PhDs, post-docs, and staff members.

c) Research support. There is little support in helping researchers program experiments and use sophisticated specialized instruments. It is understood that the skills to do so should be acquired by the researcher

(Ph.D., Post-doc, or staff member) who is interested in doing a certain type of study. While this can be a positive feature, at the same time, it can also limit the set of skills that researchers could acquire.

d) *Research mindset*. The three aims of an academic institution include teaching, research, and socioeconomic contribution to society. Unavoidably, this three require a lot of administrative work to be achieved. Achieving and maintaining a balance between the three main missions is an important challenge. Currently, research is not seen as a priority, but something that can be done after other priorities have been fulfilled. What is needed is a shift in mindset where also research is seen as a priority so that more attention is given to finding opportunities to reduce the time and effort spent on education and administration.

The remaining of this handbook will be organized into three levels: (i) the lab level; (ii) the departmental level; (iii) institutional (university) level. We will provide suggestions for good practices, including the required information or recommendations to enhance research and research support at each level.

II. Research best management research practices at different levels of the organization

We believe that high quality research is a result of good practices implemented by skilled researchers in an environment that answers their needs. For example, we can expect that an individual PhD's student research efforts to be more fruitful at a university that offers fundings for PhD students to use in their research and has an open and supportive relationship with his/her supervisor, than in an environment where these needs are not met. Therefore, we provide suggestions of good research practices that can be adopted by individual researchers or laboratories and recommendations that are aimed at the higher levels of the organization (department and university levels).

Laboratory level

Preregistrations

Preregistration is the practice of declaring key aspects before conducting the study. Typically, researchers specify in a preregistration the sample size required for a minimal effect size of interest, their main hypotheses, participants exclusion criteria, research design, the data analysis they plan to perform. Currently preregistration is viewed as one of the main solutions for increasing the reproducibility and replicability of science as it helps prevent counter-productive research practices that lead to the low rates of reproducibility and replicability discussed in the first chapter. For example, declaring the sample size a priori will not allow the usage of p-hacking as the collection of a larger sample size than the pre-registered one will require justification. Additionally, preregistration will help reduce the rate of both false negatives and false positives as one of the key elements of preregistration is a priori power analysis. Knowing the exact required sample size will exclude the possibility of obtaining a false unsignificant effect size due to a small sample or having a false significant effect due to a sample that is too large. Preregistration can also help reduce publication bias**publication biaspublication biaspublication bias** and prevent HARKING as researchers are required to specify the initial hypothesis that the study started with. Finally, preregistration will improve the quality of record keeping as researchers are also required to specify details of the design.

Preregistration prevents:

- Inadequate statistical power
- P-hacking
- Publication bias
- HARKING
- Inadequate record keeping

Although true preregistration is considered the one that is done prior to data collection, preregistrations done during data collection or after data collection are also accepted. If it is done before the data is consulted, preregistration is acceptable. One of the most popular platforms for pre-registration is OSF Registries. Another

popular choice is AsPredicted which can be used for studies with simpler designs. However, the advantage of OSF is that it also provides an option for data repository, which is more convenient in case the researchers also want to make available to others the data, the data analysis syntax, and other materials related to the study.

Registered reports are a special type of preregistration that allows researchers to submit for publication a study plan. The journal decides to publish the article based only on the research idea and its possible implications. This strategy eliminates completely the risk of publication bias as the publishing decision is made regardless of the results. If a study plan is already accepted, researchers will be less motivated to adopt strategies that artificially lower the p-value, while journals will not be biased toward positive results. Unfortunately, there is currently only a limited number of journals that accept registered reports only in several areas. However, the list of journals accepting registered reports is ever-growing. OSF also offers the option to preregister registered reports. A comprehensive guideline for creating registrations and registered reports can be found here.

Could preregistration also improve PhD students' well-being?

Although this is not a commonly vehiculated idea, we believe that the practice of preregistration can have contributions beyond the improvement of reproducibility and replicability of research. The research process involves a lot of ambiguity which creates a lot of stress for the unexperienced PhD students. A pre-registration could reduce this ambiguity because it can also be considered a template for researching planning. Having all the essential aspects of the study thoroughly thought before the implementation will reduce the possibility of having to come up with solutions to problems discovered only after implementation.

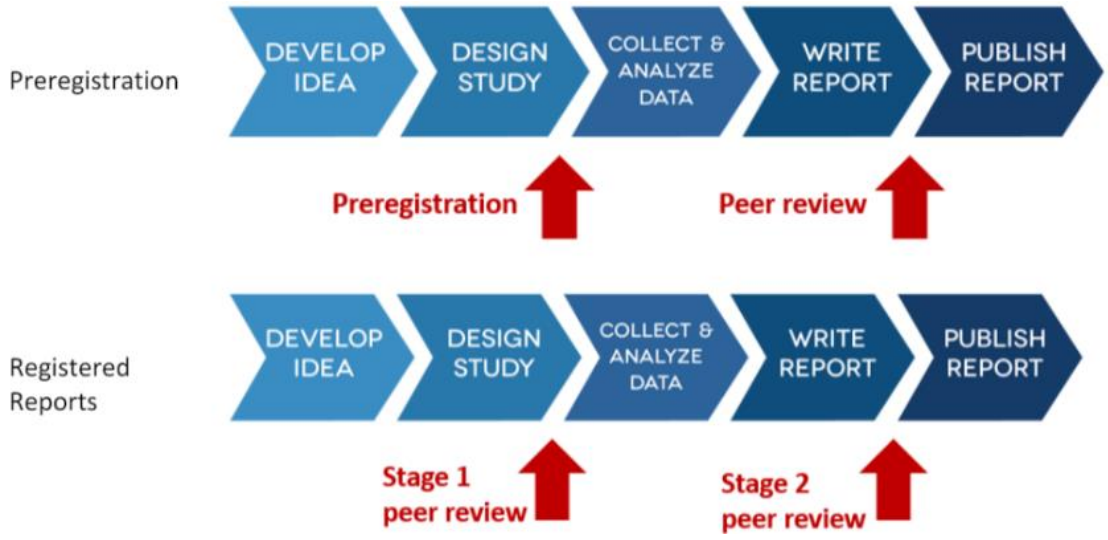


Figure 1. The steps of preregistration and registered reports (Henderson, 2022)

Misconceptions about preregistration

There can be no deviation from the preregistration – Pre-registrations should be viewed more as a record-keeping activity than a contract the researcher obliges to fulfil. Deviations are not prohibited, but if made, they should be written about and justified in the paper.

Only pre-registered hypothesis can be tested and reported – as already mentioned, deviations are not prohibited (and maybe in a way, are even required). Emitting new predictions after testing the initial ones is a natural step of the scientific method. Sometimes new hypotheses can be tested directly on the data that the researchers already have. Rather than constraining researchers from testing new hypotheses, pre-registrations help distinguish between *predictions* and *post-dictions*, that is, between hypotheses made before and after analyzing the data. In this way, important research results, which otherwise would be discarded because they are insignificant, are preserved.

Pre-registration is extra work – pre-registration is often perceived this way because it forces researchers to think about aspects of their study that would be otherwise postponed after the data is collected (e.g., what data analysis technique to use and when to stop data collection). In reality, pre-registration helps ensure that the study design is thought through and reduces the possibility of discovering design flaws only after data collection – when they could be potentially unresolvable. More than that, it is also possible to create open-ended pre-registrations by submitting a partially written introduction and methodology which can be used in the future manuscript.

FAIR data

Wilkinson et al. (2016) have proposed that one way to increase the quality of research is through increasing transparency and reusability and designed the FAIR data management principles. FAIR is an acronym for Findable, Accessible, Interoperable, Reusable.

FINDABLE = (meta)data should be easy to find by both humans and computers

F1. *(meta)data are assigned a globally unique and persistent identifier* – a persistent identifier is a code that remains unchanged and is unique to only one digital object (data file, manuscript, data analysis syntax and others). The most common persistent identifier must be the DOI. Another type of persistent identifier are Permalinks (permanent link). Each link to an OSF project is a Permalink because it remains the same regardless of the changes made to the page. Also, you can create Permalinks using **Perma.cc**.

F2. *data are described with rich metadata* – metadata can be defined as “data about data”. Researchers must provide detailed information about the deposited data to be easily findable in a repository.

F3. ***metadata clearly and explicitly include the identifier of the data it describes*** **–** metadata has to be linked to the data.

F4. ***(meta)data are registered or indexed in a searchable resource*** **–** data has to be indexed so it can be found automatically with a search engine such as Google.

ACCESIBLE = once found, the data must also be accompanied by information about how it can be accessed.

A1. (*meta)data are retrievable by their identifier using a standardized communications protocol*
the link to the data must also allow its download

A1.1 ***the protocol is open, free, and universally implementable*** **–** Anyone with a computer and an internet connection can access at least the metadata

A1.2 ***the protocol allows for an authentication and authorization procedure, where necessary*** **–** the author of the data should provide the exact conditions under which the data could be reused, while the repository should require users that access the deposited dataset to have an account

A2. ***metadata are accessible, even when the data are no longer available*** **–** even if the deposited data is lost, metadata should persist

INTEROPERABLE = data must be saved in an easily accessible format so it can be imported into any data processing program

I1. ***(meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation*** **–** do not store data in formats that can be accessed only by some programs or were widely used in the past but are obsolete now. Storing data in a .csv file Is typically the easiest way to ensure it's interoperable.

I2. ***(meta)data use vocabularies that follow FAIR principles*** **–** the metadata also has to be easily findable through search engines and have a unique identifier.

I3. ***(meta)data include qualified references to other (meta)data*** – the data should be linked to other datasets related to the same subject. This way, the findability of the data will also be improved.

REUSABLE = the contents of the data must be well described in a separate document

R1. (meta*)data are richly described with a plurality of accurate and relevant attributes* **–** the data publisher should provide not just metadata that allows discovery, but also metadata that richly describes the context under which the data was generated (e.g., experimental protocols).

R1.1. ***(meta)data are released with a clear and accessible data usage license*** **–** a data usage license is set of conditions under which the data can be used by others. Licenses range from being very permissive, where you allow others to use your data in any way they wish if they credit you, even commercially, to being very restrictive, where you allow others only to download and consult your data but not use it in any way.

R1.2. ***(meta)data are associated with detailed provenance*** – Who created the data and how has it been processed before making it available?

R1.3. ***(meta)data meet domain-relevant community standards*** – The creation of data and meta-data should be guided by domain specific standards.

How to make your data FAIR?

It might not seem this way but is easier to make your data FAIR than it looks at first glance.

Researchers must:

1. **Create a dataset and codebook in an accessible format**

   A codebook is a file that describes the variables in your dataset. It should contain a brief description for every variable in the associated dataset and information about value labels. The easiest way to ensure accessibility, is to save both the data and the codebook in Comma Separated Values (.csv) format. A CSV can be easily opened with any data program. Please see an example of a data and codebook deposited in a repository at https://doi.org/10.23668/psycharchives.5379.

2. **Find a repository that respects the FAIR principles on re3data.org or fairsharing.org**

   A repository that follows the FAIR principles should allow you to create detailed metadata, create a persistent identifier, to attribute a data usage license, make the data downloadable, and request credentials from those that download your data. Repositories can be domain-specific, but there are also those that can be used regardless of your discipline such as Zenodo. Once you've selected a repository, follow the template proposed by the repository to create the metadata and upload your data and codebook.

PhD student and supervisor relationship

There is often a mismatch between Ph.D. students' and supervisors' perceptions and expectations. For example, over 40% of Ph.D. students report little to no guidance from the supervisor, while only around 3% of supervisors report providing no support (Cardilini et al., 2022). Additionally, students report great discrepancies between expected and received supervisor support (Haksever & Manisali, 2000). We won't ever really know if these discrepancies result from inadequate student expectations or the supervisor's lack of involvement. Either way, we believe this aspect could be improved if supervisors would discuss with their new Ph.D. students what to expect from each other. Very often, at the beginning of a Ph.D. program, only scientific aspects are discussed, while matters such as frequency and style of communication are omitted. For example, some students can expect much more involvement from the supervisor than normally accepted, which is inappropriate considering that a Ph.D. student is supposed to become an independent researcher. Others, being overly confident in their autonomy, can have the expectation that the supervisor's involvement will be minimal, which is also inappropriate considering the lack of experience of a Ph.D. student. Cardilini et al. (2022) have studied student and supervisor's expectations an came up with a set of four recommendations that could help reduce the discrepancies between expectations and improve communication between Ph.D. students and supervisors.

(1) **Spend time early in candidature to discuss the importance of and align with each other's expectations.**

Differing uncommunicated expectations are known to be the basis for conflict in every area of life. It is important to discuss from the get-go what it means for the student to follow a Ph.D. program and what are the supervisor's expectations of a student. Below is a list of expectations that Ph.D. students and supervisors frequently have, according to Nasir and Masek (2015). These are only some examples meant to offer a general impression of what the expectations might be. Supervisors should learn the student's individual expectations and clearly communicate his/her own.

Supervisors' expectations of students:

- *To have a clear idea of what they would like to research on.*
- *To be self-motivated.*
- *To work consistently.*
- *To keep to appointments for meetings.*
- *To take responsibility for keeping notes of meetings.*
- *To work on the feedback given to them.*
- *To complete on time.*
- *To take ultimate responsibility for their own work.*

- *To be independent*
- *To be proficient in the language.*
- *To do their own or outsource editing and proofreading.*

Students' expectations of supervisors:

- *To read drafts before supervisory meetings.*
- *To be readily available when there is a need.*
- *To be collegial, open-minded, and supportive.*
- *To provide constructive feedback.*
- *To have a clear understanding of the research.*
- *To facilitate supervisory meetings that enable.*
- *To show a keen interest in the research that is being conducted.*
- *To be sufficiently involved in their success to help them get jobs.*
- *To be punctual for supervisory meetings.*

Nasir and Masek (2015) also propose a theoretical model for communicating expectations, based on supervisory styles (Aranda-Mena & Gameson, 2012) and Kolb's learning styles (Manolis et al., 2013), presented in Table 4 and Table 5. Knowing the predominant learning style of the student can help the supervisor adapt his supervising strategies. For example, an accommodating style of learning an indirect active style could be the most appropriate as individuals who are accommodating don't hesitate to engage in tasks but could forget to ask for the supervisor's feedback. Therefore, a non-directive approach accompanied with supervisor-initiated discussions on supervisee's plan of actions will be fruitful for this style. For an assimilating student that learn by merely mentally processing information but is not eager to step into action, a direct active style will be more suitable. In this case, the supervisor should be more involved in helping the student implement the research project, and less in planning it. It is also recommended to consider the stage in which the student is in. For first year students a more directive approach will be beneficial due to their lack of experience. As the student advances and gains experience, a more non-directive style should be considered to allow them to grow into independent researchers.

Table 4. Supervisory styles and learning styles

Supervisory styles	**Characteristics**
Direct active	Initiating, criticizing, telling, and directing.
Indirect active	Asking for opinions and suggestions, accepting, and expanding supervisee's ideas, or asking for explanations and justifications of supervisee's statements
Indirect passive	Listening and waiting for supervisees to process ideas and problem solving
Passive	No input and not responding to supervisee's input.

Table 5. Learning styles

Learning styles	**Learning using …**	**Strengths**	**Learning activities**
Converging	Abstract conceptualization and active experimentation	Find practical uses for the ideas and theories that they have learned, set goals solve problems, make decisions	Learn by experimenting, simulating, using practical application
Diverging	Concrete experiencing and reflective observation	Can look at the same situation from different perspectives, are imaginative and creative	Group activities, communication, feedback
Assimilating	Abstract conceptualization and reflective observation	Are logical, tend to systematically plan, organize, analyze, and engage in inductive reasoning	Reading, lectures, analyzing information mentally
Accommodating	Concrete experience and active experimentation	Implement plans, tasks, become involved in new activities, make decisions on intuition rather than on logic	From active involvement in new activities

(2) **Supervisors and candidates should agree to achievable goals that they work towards**

These should include both qualitative and quantitative outcomes. Although these do not need to be overly specific and may evolve over time, this communicates to the candidate that they are both working towards the same set of goals. We propose a template for an interview that the supervisor can use to assess his/her students' goals, positive and negative experiences, and well-being in Appendix 1. Holding this interview at least once a year should be enough to ensure that the students know what is expected of them and that they have a set of goals which will help them guide their activity.

(3) **Supervisors should play a stronger role in guiding the development of candidates' academic independence and collaboration skills.**

Both are critical to a successful Ph.D. and career. Supervisors may find that broadening the scope of their supervisory role to actively guide the candidate in developing these qualities will help the candidate maintain motivation and satisfaction over the course of their Ph.D. Supervisors and students should agree on a communication style that best fits both their needs and regularly evaluate and discuss the effectiveness of their communications. Communication should be constant; therefore, it is useful to have a schedule for regular supervision meetings with each student, at least once every two weeks. Even if the student did not progress with his work since the last meeting, they should still discuss what has hindered the progress and come up with solutions together.

Networking and outreach

An important part of any research career is the communication of the results of your work to the scientific community and the public. Dissemination of results lets you directly control the impact of your research as more people will be able to hear or read about it. Also, meeting and interacting with people who might be interested in your work can positively affect your motivation and boost your own interest. There are multiple ways through which you can make your work known to others and connect with other researchers from your field. You can start small by presenting your research locally during team meetings and gradually progress towards presenting at international conferences and sharing your ideas online with the large public on social media platforms such as Twitter, Mastodon, on your personal blog or even in the media. Communicating research through articles published in scientific journals is more precise and professional but is slow and rarely reaches people outside of the academic context. Therefore, researchers should also resort to other means of dissemination.

Team meetings

Research is meant to improve our knowledge of different phenomena and ultimately to be applied in practice. Besides the fact that it's not clear whether research done in universities has a societal impact or not (Bornmann, 2013), not engaging in dissemination activities and networking excludes the possibility of it having an impact completely. A first step in getting used to talking about your research (and about research in general) are presentations during team meetings. The goal of these meetings should be getting feedback, have a sense of unity, know what others are doing, think about other people's research, and offer to junior members an opportunity to learn. These meetings could take place weekly, and each member of the team should present at least once per semester. The best moment to present your research is before data collection in order to receive feedback at an early phase of your study. Also, you can just ask specific questions about your project if you are not ready for a full

presentation. In cases when no member of the team has announced the intention to have a presentation, meetings can be used to discuss research papers that are of interest to everyone. It is also helpful to have roles related to the organizational aspects of the meetings preassigned. For example, there can be a team member responsible for schedule, location, and notifying everyone about the topic of this week's discussion and who will present, and another person responsible for suggesting an article for discussion, etc.

Symposiums

More experienced researchers can also organise local ***symposiums.*** A symposium consists of a series of presentations by different speakers about different studies on the same topic. The advantage of a symposium over an individual presentation during a team meeting (or conference) is that during a symposium a subject can be discussed more in depth. Also, members from the department outside your team can be invited and therefore increase the outreach.

Expert meetings

Expert meetings are scientific events focused on one specific subject. Specialists outside the university are invited to present and discuss their work, participate in debates, discuss the field's future development, plan studies, and other research-related activities related to a specific topic. This kind of meeting offers the possibility for the members of the hosting university to enrich their research expertise and extend their network to other potential research collaborators beyond those affiliated with the hosting scientific institutions. For example, in 2022 the psychology department of West University of Timișoara has organised an expert meeting funded by the LEARNVUL Horizon 2020 project. Several experts were invited to present their work on the topic of individual differences in learning. A list of invited experts and the schedule is available online: LEARNVUL 2022 expert meeting.

Conferences

Attendance of scientific conferences is essential for maintaining ties with the scientific community. Conferences can be used as an opportunity to find potential research collaborators, speak with experts with similar interests as you, obtain direct feedback on your research and gain new ones. It is also essential to be able to distinguish legitimate scientific conferences from the so-called "predatory conferences". Predatory conferences are fake events that are usually advertised through direct e-mails to researchers asking for abstract submission and payment of a participation fee. To easiest way to ensure that your conference is a legitimate event is to follow the recommendations of your colleagues. You can also use allconferencealert.com or conferencealerts.com to search for a conference by research domain. Additionally, Lang et al. (2019) offer five simple rules to know if a conference is legitimate:

1. Ensure the conference is targeted towards specific areas of interest to you.
2. There are opportunities for networking.

3. There are well-known and respected plenary speakers.
4. There is an opportunity to present your work.
5. The conference has been recommended by others, or you have attended previously.

Social media

Researchers can use several online platforms to promote their work and enlarge their network. These platforms are an easy way to ensure that your research is visible and reaches the readers as fast as possible.

- **Twitter** – on Twitter, you can post short messages (280 characters) called Tweets. These may include information about your own research, papers you read, or research-related events (e.g., a conference or an expert meeting). The impact of your Tweet depends on the number of followers you have. It may seem difficult at first to raise your number of followers, but it can be achieved in time by using relevant #hashtags, sharing your Twitter ID, and following other people yourself. Hashtags are keywords that link your Tweet to a topic and all other Tweets that relate to it, allowing people to easily follow topics they're interested in.
- **Mastodon** – Mastodon is an alternative to Twitter, that has no centralized ownership. Instead, Mastodon is installed on thousands of computer servers, largely run by volunteer administrators who join their systems together in a federation. It is very similar in usage to Twitter as it is based on short concise messages called Toots that can contain hashtags to deliver to link your message to a topic.
- **ResearchGate** – is a social networking platform specifically designed for researchers to share their work and be notified about the latest publications in their area of interest.

Mobilities and summer schools

Finally, participating in long term mobilities (one month or more) and summer schools as PhD or postdoc students is another way to enlarge your network and learn about state-of-the-art advances in your field. During these events you can also find possible collaborators for future research projects.

Research identity

Very often we can observe in academia a conflict between teachers' identity and the idea of doing research. Many experienced university teachers are reluctant to engage in research activities as they don't perceive themselves as researchers, their main academic responsibilities revolving around teaching (Griffiths et al., 2010). If a teacher is interested in research, he or she must gradually adopt the researcher identity the same he or she adopted the identity of a teacher. This is easier to achieve if time is allocated daily or weekly for research activities. Allocating specific time for research in your schedule and following it, is an important aspect as very often teachers who want to try out research leave it for "when there's time" which might never happen with a busy academic schedule. Another way to build your research identity as an experienced teacher is to

engage in collaborations or simply communicate frequently with colleagues that have research as their main responsibility. In junior researchers (doctoral students and post-docs) this problem also exists but in a different way. Junior researchers don't have an established identity, but instead fear of accepting them being a researcher due to their lack of experience. Being a researcher involves a lot of autonomy and decision making. Although we cannot expect a doctoral student to be fully autonomous, he must gradually learn with the help of his supervisor to make decisions on his/her own. A junior research must move from being dependent on a supervisor towards identifying as a researcher.

Summary of laboratory level good research practices

1. Create pre-registrations and registered reports for every study
2. Make your data FAIR by uploading them in online repositories
3. Improve supervisor and PhD student relationships by:
    a. Learning each other's expectations from the start
    b. Have an annual interview to discuss PhD students' goals and well-being
    c. Have regular (at least once in two weeks), collective or individual supervision meetings
4. Disseminate your research and learn from others by organising/participating in team meetings, consortiums, expert meetings, conferences, mobilities and summer schools, and using social media platforms.
5. Build your research identity

Department level

Recruitment of postdocs and faculty members

The context of labor force in the Romanian academic sector is extremely heterogenous and less competitive in comparison with the situation in the western and central Europe. In some scientific fields such as computer science, economics, law there is a very tough competition with the non-academic sector for well-qualified youths. For a public university such as WUT, there is a huge disadvantage to compete with the business sector as the entry-level salary in the university, set at the national level by law, is 2 to 3 times lower than the entry-level salary in such competitive business fields. Luckily the situation is not as bad for the Psychology department, where the salary for an entry-level position in a non-academic sector is only slightly higher than the salary received in the academic sector, without including here potential additional revenues for extra teaching / doing research activities in a grant. For the Psychology Department, the most challenging aspects are that there are only four universities in Romania that provide top education in the psychological field (which means a reduced number of potential applicants) and that there is a very low mobility on labor workforce (very few people intend to change cities for a new employment opportunities). Because of these two factors, there is a high chance / risk to attract only people who are former alumni of our programs. This situation is not particular for the WUT, being rather a national feature for the academic jobs. Another contributing factor is that most educational programs are taught in Romanian, which is a linguistic barrier for attracting faculty members from abroad (Asia).

To overcome these barriers the department should think strategically solutions for each raised aspect: (i) develop at least one program that is taught in English in order to open up for potential faculty / postdoc applicants from abroad; (ii) make more use of the postdoc program facilities (i.e., that provide competitive scholarship) to attract young scholars from abroad; (iii) being more open to hire interested young applicants on temporary positions. The later measure is particularly useful since the teaching load of the current faculty members is so high that impedes the quality and quantity of research activities conducted, as it can be seen below.

Workload: teaching vs science vs administration

One of the biggest differences between the leading institutions from Ghent and Milano and the West University of Timisoara refers to the teaching load. In Ghent, for instance the amount of teaching for people who are conducting financed research (i.e., have a grant) is between 4 and 8 physical hours of teaching, while keeping 10% of the job workload for teaching and administration. In Milano, the yearly amount of actual teaching of a PhD student is limited to 40 hours of teaching per year (which in a regular semester means approximately 3 hours per week). In WUT, instead, the amount of teaching for PhD students is usually 12 hours per week if teaching activities

are conducted during the entire year (both semesters) and goes up to 24 hours per week if the teaching load is scheduled in a single semester. A similar workload is found for teaching assistants and assistant professors. The situation slightly improves for associate professors and full professors, in their case the teaching load being around 4 hours per week. Unfortunately, due to shortage of personnel, most faculty members have to teach almost double time then previously presented, because there is a current ratio of almost 1 vacant position for each 1 tenured or non-tenured faculty member.

Besides teaching, there is a significant amount of administrative work so that, most likely about 25 to 30 hours / week (up to 75% of the time) is spent on teaching and administrative tasks, drastically reducing the workload for research activities.

To overcome this significant issue, more efforts need to be invested in attracting new faculty members. Likewise, additional recommendations to reduce the amount spent on teaching are provided when discussing the situation at the university level, as this issue seems to be more general for the WUT and it does not impact only the Psychology department.

Tailored actions considering the needs of each faculty member

This section refers to *attempts to support inactive research staff to increase their research focus and output.* Actions could be taken to try to support currently inactive research staff members. It is understandable that in a complex organization not everyone is an active research staff member, perhaps because they have been hired some time ago primarily as a teacher or they are close to the end of their career without having been actively engaged in research during their career. It is also possible that some of the inactive research staff could increase their engagement in research if supported. Support actions could be devised at the university and the departmental level. Meetings could be held with them to understand their barriers and problems to engage in research, and actions could be devised to increase their engagement. Sometimes even apparently minor things such as being associated with active research groups can start a process of understanding what it entails to do research and of progressive engagement, if there is some motivation to do so. There is also merit in offering flexibility to academics regarding how much percentage of their time they devote to their three main duties (teaching, research, administration). Within legal boundaries, some academics might choose to focus more on teaching during some periods of their career whereas others might focus more on research. In this way, all teaching obligations could be covered by the department, while time is freed up for some to become more research active. Whereas legally, flexibility seems limited now, there might be opportunities to lobby for more flexibility in the future at national level.

University level

Faculty research support centers

Some universities have research support centers that operate to offer professional technical advice for researchers. These centers employ people experienced in technical aspects of research with advanced technical skills to offer consultancy for entry-level researchers. Topics that researchers will be able to solicit advice about could be:

- data processing
- data analysis
- programming
- technical support to use equipment
- digital platforms & tools
- grant applications
- pre-registrations open and fair science
- scientific integrity
- GDPR
- ethical aspects
- data management
- data storage and sharing
- running the schedule for and granting access to research rooms.

These researchers could be employed at the West University of Timișoara Scientific Research and Academic Creation Department (DCSCU) with the attribution of consulting early-stage researchers about technical aspects of their research. In order for these specialists to be able to offer relevant advice at least one consultant must activate for each faculty. Depending on the initial demand, additional people could be employed to reach the goal for one consultant per department. Initially it could be challenging to find experts that have a high enough expertise to be able to offer highly skilled technical research advice. Therefore, it will be necessary to maintain the initial employment targets low to one expert per faculty. Eligible candidates could be people with programming background that are also willing to learn research specific programming tools and software.

Financial research support

In the current section we propose a University Level resource allocation model to be used to regulate the evolution of domestic credits. In this model, capability indicators have the highest weighting in the resource allocation decisions, while achievement indicators have less weighting. Faculties evolve independently of each other, as transparently as possible. Currently at WUT resources are allocated only based on the capacity criterion, but we propose to introduce criteria based on output and alignment with university's strategy of the faculties. In this way we expect to stimulate the increase of faculties research output.

The ***capacity*** of a faculty to hold students should have a 80% weight in the resource allocation scheme. Of the 80%, 55% is represented by the number of students, including mobility students, and 45% by the number of researchers (approx.. 25% PhD students). The number of students and researchers should be monitored annually, at the end of the academic year. The ***output*** should have a 10% weight in the financing of faculties. Output refers to the number of publications at the end of the year (15%); number of bachelor PhD students that graduated that year (15%); income from industrial and non-profit contracts (15%); number of bachelor and masters' students that graduated that year (55%). ***Strategy*** refers to alignment of faculties with university level objectives and is attributed 10% in the financing scheme. For, example one of the current strategic objectives at WUT is internationalisation, which faculties can achieve by employing or inviting on different occasions (e.g., experts meeting, conferences) research experts from abroad. By succeeding to do so, faculties could be rewarded financially with funds that they can they further use as they will. Having resources allocated by strategy will help the university board have more influence over the evolution direction of each faculties and department.

80% Capacity	55% number of students 45% number of researchers
10% Output	15% publications, 15% PhD students, 15% contracts, 15% degrees
10% Strategy	Past 3 years contributions to university strategy realisation

Figure 2. Resource allocation model.

The suggested weights and criteria are only a preliminary approximation of what the alternative financial allocation model might look in the future. The main idea is to shift from financing faculties only based on capacity, but also take into account their performance. By including output-based criteria we will create a source of motivation for universities to grow. For instance, the more publications and graduations a faculty will have the higher the financing will be for the next year.

Reforming the assessment of researchers

In line with the newest trends such the Coalition for Research Assessment Reform (CoARA), which is an initiative that proposes a concrete support platform for all institutions, with an ultimate goal of contributing to the development of new research assessment methods and practices, a promising pathway would be implementing the CoARA principles and directions of actions in the assessment of research activities and results, in accordance with the strategic directions established by the European Commission as part of the New European Research Area (European Research Area - ERA). The reform calls on academic institutions to give up using only quantitative metrics (h-index, JIF) in measuring the productivity and performance of researchers for hiring and promotion purposes, in line with the San Francisco Declaration on Research Assessment (DORA).

WUT could adopt the four principles of responsible research assessment, that could be used for hiring and promotion of researchers.

Principle 1: ***Allow including other types of research outputs***. Besides journal articles, that will remain an important research output, we should also consider research contributions such as: (i) data sets; (ii) research software development; (iii) policy papers / recommendations; (iv) industry-related results (i.e., patents etc.).

Principle 2: ***Quantitative indicators have to be used responsibly***. They need to be adjusted to reduce their biased values (i.e., h-index favorizes more experienced researchers). Likewise, they only need to be used to establish a minimum threshold (and not interpreted in their absolute value, because they will encourage productivity and potential unethical practices over quality and impact). The time of *publish or perish* has come to an end, where quantitative indicators can be used only as an initial selection of a pool of candidates, and not in terms of their absolute value to rank the researchers / candidates.

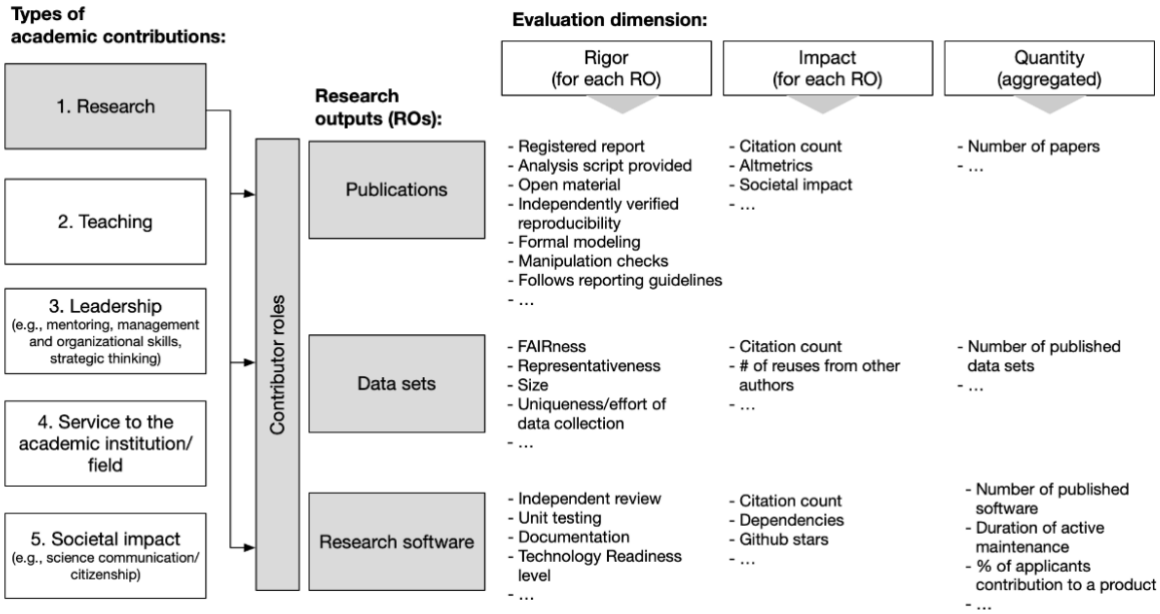
Principle 3: ***For any type of scientific output use a three-dimensional criterion to evaluate its quality***. The three criteria are: (a) quantity; (b) methodological rigor; (c) impact. Methodological rigor is a central aspect when judging the quality of an outcome, for instance looking whether a specific scientific article meet some reproducibility checks (preregistered, access to data and codebook, open access to the article). Those outcomes that meet the methodological rigor checks could be further analyzed by peers in terms of their innovation / ingenuity.

Once the methodological rigor has been assessed, the assessor can move to the impact criterion to evaluate for each scientific outcome its academic and/or societal impact. Whereas the academic impact is usually measured via acquired citations, societal impact is more qualitatively established by looking at the relevance of the research question and results for the change or benefit to the economy, society, public policies, and services (i.e., health, quality of life), therefore at the potential impact of the outcome beyond academic sector (see the UK Research Excellence Framework). Once the quality of an outcome has been established, we can look at the

quantity, while being aware of a confounding effect between the researcher age and his/her impact. Because of that, we can count the no of papers on average / year (including only those outputs that passed the methodological rigor).

Principle 4: ***Value quality over quantity and impact – progressive steps toward this aim.*** A legitimate aim of any university would be to hire and promote people that help the university improving its position in university rankings. However, such as desiderate should not encourage unethical behaviors such as cutting corners in terms of methodological rigor. That is why a quality-quantity trade off could be implemented, in order to discourage people with very high productivity and very low methodological rigor. The inclusion of quality-type indicators would be extremely beneficial particularly for early career researchers to let them see that their additional efforts (i.e., pre-registration, sharing data, writing reproducible codes, using open access outlets) are practices in accordance with ERA principles.

Likewise, research will not be the only assessment area, as other types of academic activities are valuable within an academic context (see the figure below, suggested by Schönbrodt et al., 2022).



Providing more quality time for conducting research

One of the most important observations based on Research Audit was that West University of Timisoara is not treating research as an actual priority, in line its overall scope (an university that provides advanced research and education). Whereas several financial stimulations were put into action to facilitate research activities, in terms of responsibilities research is placed third, to be devoted time after education and administrative services. Below we included a series of recommendations:

a) Provide incentives in terms of added time for research. There are already monetary incentives for research, related to the input (i.e., grant acquisition) and the output (i.e., publication) stages of research. What needs to be added, however, is something that will increase the time devoted to actual research. This was the most common problem mentioned by PhD, post-doc, and staff members. Possible non-monetary incentives are reduced teaching and/or administrative duties, as a function of achievements at the stage of research input and output. For the PhD students, it might be preferable instead to reduce teaching hours based on their supervisor's research achievements (see next point).

b) Reduce teaching hours for PhD students. We understand that teaching for PhD students mainly consists of lab activities with small groups of students, including the work needed to assess them. Our use of the term teaching in this context therefore refers to these teaching activities. Actions to reduce teaching can be undertaken both generally and selectively. In general, we recommend that the mandatory teaching hours are reduced for all PhD students, for whichever quantity will be considered feasible. In addition, the distribution of teaching could be shifted or also better balanced across years. We understand that PhD students are required to teach from the beginning of their first year, and to follow courses as part of their PhD program. Perhaps starting the teaching sometime after, for example in the second semester of the first year or at the beginning of the second year, could allow devoting more time for detailed planning of their PhD research project during the first year. As a form of selective reduction of teaching, PhD students could be given a reduction of their teaching load based on the publication output of their supervisor. We prefer to avoid linking a reduction in teaching directly to the PhD research output, as we fear that it could introduce a too-early focus on publishing at every cost, even during their first year, with a potential distortive impact on the quality and integrity of their research project work. We think that both general and selective reduced teaching measures should be considered for adoption, of course within the limit of what is feasible given the broader context. But we want to flag the importance of taking at least some steps in this direction.

c) Reduce teaching load for active research staff. Although we appreciate that reductions in teaching load can be costly and sometimes not feasible because of national or local constraints, it might be possible to introduce a targeted reduction for active research staff based on some criteria, such as grant acquisition. At the University of Milano-Bicocca a similar system is in place. Grant holders of important grants can ask for a reduction of the standard teaching load up to 30% for the duration of the grant, provided that it is justified by the nature and importance of the grant (e.g., it may not be given for small grants, it can be set at 30% only for large European grants). The university usually retains a percentage of the indirect costs of the grant. Part of this money can then be used, as a common good, to cover the possible costs incurred in reducing teaching load (e.g., to pay teaching hours related to externalizing some teaching activities). Details (e.g., threshold, amount) can be decided depending

on feasibility constraints. A measure such as this could represent a recognition of the importance and the time needed to do research, as well as an incentive in that direction.

d) Increase efficiency in teaching and administrative work. There is often room for even substantial improvements in the efficiency of teaching and administrative work. For instance, one could imagine the introduction of some courses based on blended or hybrid learning, that is teaching that integrates technology and digital media with traditional instructor-led classroom activities. If well organized, this form of teaching can be beneficial to both students, who can have more flexibility to customize their learning experiences, and teachers, who, given an initial investment in organizing the course properly, can reduce their classroom teaching hours. Another possibility is to consider the form of examination closely and introduce types of examinations that reduce marking or examining time while keeping good standards. Based on our experience, also administrative work can often be made more efficient, primarily by addressing inefficiencies in its organization. For instance, forms that need to be filled with the same information repeatedly, paperwork that needs to be digitalized after being handwritten instead of being all part of a digitalized chain, insufficient administrative support forcing staff to do extra administrative work that in principle could be better done by administrative staff, and so on. It should not be underestimated how much time could be freed, and hence available for research-related purposes, by gaining efficiency in teaching and, perhaps especially, organizing and reducing administrative work. Perhaps one practical way forward is to give someone, or a small task force, the task of reviewing teaching and administrative practices to provide a list of specific actions that can be implemented to improve their efficiency.

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Appendix 1

Template for supervisor-researcher reflection interview

During the reflection meeting, five themes are discussed, in particular:

- Positive work-related experiences
- Negative work-related experiences
- Personal ambitions and planning
- Guidance
- Team functioning

POSITIVE WORK-RELATED EXPERIENCES

- Are there any situations from the past weeks or months where you were completely absorbed in what you were doing and seemed to lose track of time around you?

  It could be a situation where you felt competent because what you did was successful, generating positive feedback, a situation where you felt you could be very much yourself and express your ideas, a situation where you developed a close bond. Have experienced with (one of) your colleagues, or for another positive experience.

- How does this experience align with your ideals or even dreams, the things you want to achieve in your work?

NEGATIVE WORK-RELATED EXPERIENCES

- Are there situations from the past weeks or months where you felt less well or even unwell?

  You may have felt like a failure, received negative feedback that you found difficult to place, unable to express your thoughts, had to do something you didn't want to do or experienced tension with colleagues, or it could be some other negative experience. To what extent do you experience this experience as a problem?

- Are there steps you could take to get a better grip on the above situation and, if so, which ones? How can guidance play a role in this?

PERSONAL AMBITIONS AND PLANNING

- What concrete goals would you like to achieve for the coming year?

  These can relate to the concrete daily work you do, but also to tinkering with certain work habits or certain work relationships.

- How do these goals match the (professional) ambitions and dreams you cherish?
- Do you see any obstacles in achieving these goals?

- How can the guidance support you in achieving these goals?

COACHING

- What do you find valuable about your coaching?
- What can be improved?
- Do you have certain expectations for your supervisor and/or other supervisors that we do not meet sufficiently?

  This may have to do with the style of accompaniment, its frequency, or something else.
- How can the guidance support you in your personal development and the realization of your dreams/ambitions?

GROUP FUNCTIONING

- How do you feel in the team/lab/department?
- What do you think is positive about our team/lab/department?
- What do you think could be improved? How could we make specific adjustments? What initiative would you like to take for this?

Appendix 2

QuOCCA

Quality Output Checklist and Content Assessment (Héroux et al., 2022)

This checklist is intended for peer-reviewed research papers. It should not be used for reviews chapters, editorials etc.

Manuscript Title:	
Manuscript Authors:	
Person submitting this form:	
Date:	

TRANSPARENCY:	N/A	YES	NO
1a. Were the study's hypotheses and analyses plans **registered** prior to the conduct of the study (i.e., pre-registered)?		☐	☐
b. If so, was the main conclusion reported in the abstract (or summary) based on the primary hypothesis/outcome?	☐	☐	☐
2. Are the primary data accessible to independent researchers on a public website?		☐	☐
3. In code used for the study available on a public website to allow for reproduction or analysis of data?		☐	☐
DESIGN AND ANALYSIS:	**N/A**	**YES**	**NO**
4. Was ethics approval obtained?	☐	☐	☐
5a. Was the sample size based on a formal sample size calculation done prior to staring the study?	☐	☐	☐
b. If so, was the planned sample size adhered to?	☐	☐	☐
6. Was data analysis blinded?	☐	☐	☐
REPORTING PRACTICES:	**N/A**	**YES**	**NO**
7. Are any reporting guidelines specified?		☐	☐
8a. Are all measures of variability defined in figures, tables, and text?	☐	☐	☐
b. Are any data summarised using standard error of the mean (SEM)?	☐	☐	☐
c. If the SEM is used, are sample sizes specified for all reported SEM?	☐	☐	☐
9a. Were any data excluded?	☐	☐	☐
b. If so, was a criterion given?	☐	☐	☐
10a. If null-hypothesis testing of significance was used, is a probability threshold specified for all statistical tests?	☐	☐	☐
b. If used, are exact probability values used throughout the report excluding figure legends?	☐	☐	☐
11. Are claims made for the importance or significance of results associated with a P-value greater than or equal to .05 (or other threshold) i.e., misleading spin of reported results?	☐	☐	☐