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Open Science@NT5 - status and snapshots

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The N5T Open Science Task Force

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Aalto University CHALMERS DTU KTH NTNU

On February 9, 2024, the N5T Committee initiated the N5T *Task Force Open Science* with a two-year mandate. According to the Terms of Reference, the Task Force *should contribute to enhancing the Open Science development and Open Science practices in the N5T universities.* To achieve this, the Task Force shares experiences and best practices, share training materials, arrange joint webinars and workshops, and make all activities open to colleagues across functions and roles. As another activity along the lines of the mandate, the Task Force has performed a mapping of the status of Open Science at the member institutions which is presented in this report.

Current members of the Task Force.

Institution	**Name**
Aalto	Anne Sunikka, Tua Hindersson-Söderholm
Chalmers	Sverker Holmgren, Jessica Lindholm
DTU	Jitka Stilund Hansen, Jeannette Ekstrøm
KTH	Maria Haglund, Lina Andrén
NTNU	Hilde Røysland, Ingrid Heggland

Terminology

Acronym	**Definition**
CESAER	The non-profit association of universities of science and technology in Europe
CoARA	Coalition for Advancing Research Assessment
EOSC	European Open Science Cloud
FAIR	Findable, Accessible, Interoperable, Reusable[1]
N5T	Nordic Five Tech – the alliance of the five Nordic technical universities
Open Science	An inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community.[2]
Good scientific practice	Encompasses in broad terms responsible research practice and any related data (software, methods, ...) management practices for example rights to use and modify, GDPR, security, dual-use, and ethics.
RDM	Research data management

[1] https://www.go-fair.org/fair-principles/

[2] UNESCO Recommendation on Open Science https://doi.org/10.54677/MNMH8546 , p.7

Summary

In Europe, Open Science has been a priority for many years, since Open Science aims to improve research quality and integrity, digitalisation of research, collaboration and societal impact.

The work of the N5T Open Science Task Force has facilitated knowledge-exchange on different aspects of the Open Science and identified how different drivers may impact how the N5T institutions have approached the Open Science agenda.

The aim of this report is to inspire our institutions to continue and strengthen the discussions on how Open Science can support academic excellence at a technical university.

Our approach is to list different drivers and present a short status of Open Science actions at our institutions. Importantly, we highlight N5T best practices that serve as inspirational examples to overcome roadblocks for the Open Science agenda.

In conclusion, the N5T universities may benefit from integrating Open Science aspects in education and competence development at all levels, by including Open Science aspects in research assessment, and promoting a holistic view on support functions and services of relevance for handling research data and other digital resources and results.

Background

As in other parts of society, research (and education) is digitalized. New forms of research results and resources become central (data, software, databases, workflows and electronic notebooks, virtual laboratories, online instruments, etc). New opportunities for making research results searchable and sharable emerge, and new opportunities for setting up and working in research collaborations and projects are established. The changes have a profound reciprocal effect with the core of research (research quality, publication, merits, legal requirements) and influence the *modus operandi* of research processes.

The movement towards more digitalised research means that reproducibility and transparency of research more and more builds on proper management of digital research outputs. Thus, such activities are intertwined with the practicalities of almost every research process and project. Digitalization is also the fundamental enabler of an Open Science research system. The importance of Open Science in a societal context is, e.g., expressed in The UNESCO Recommendation on Open Science[3]: *Science, technology and innovation are of vital importance to respond to global challenges by providing solutions to improve human well-being, advance environmental sustainability and respect for the planet's biological and cultural diversity.*

In Europe, Open Science has been an important priority for many years. The national developments are in many cases initiated by EU policy development and implementation of Open Science aspects in research funding frameworks. At a national level, national frameworks and policies are major drivers when institutions decide on their approach to Open Science. Further, Open Science interacts with many important aspects of research, such as

- good scientific practice
- adherence to laws and external regulations
- digital research infrastructures and information security
- support and advisory services
- competences and education
- merits, research evaluation and internationalization
- participation in the research process by the public

In summary, many different drivers impact how the N5T institutions have or will approach the Open Science agenda. Strategic implementation of Open Science aspects can improve research quality and integrity, digitalisation of research, collaboration and societal impact.

[3] https://unesdoc.unesco.org/ark:/48223/pf0000379949

Aim of this report

The aim of this report is to inspire our institutions to continue and strengthen the discussions on how Open Science can support academic excellence at our technical universities.

. A general status of Open Science at the five universities is summarised, and selected individual achievements of inspiration are highlighted. Three areas of relevance for Open Science implementation are covered:

1. Policy and organisational anchoring
2. Support, services, training and infrastructure
3. Education, incentives and culture.

In the tables below, green colour reflects that significant action and attention are taken at an organisational level. Orange colour reflects that action and attention is partly taken or does not exist.

Open Science policy and organisational anchoring

Table 1: Open Science policy and organisational anchoring at the N5T institutions. Numbers refer to Best Practice examples below the table.

Question	Aalto	Chalmers	DTU	KTH	NTNU
Does your university have policy documents on any of the following aspects (policy documents refer to guidelines, policies, strategies, codes of conduct, recommendations, instructions):					
- Open science as a whole	1				
- Open access to publication					
- Open data, FAIR data and good RDM practice					
- Open educational resources					
- Open hardware					
- Open software					
- Open methods					
- Open peer-review					
- Good scientific practice					
- Citizen science/ citizens' participation in research					
- Meriting researchers for Open Science practices?					

Does the university have an active strategic function or person for Open Science in university management?					
Does the university have defined/clear responsibilities for Open Science (strategic, implementation, follow-up)?					
Does the university have a strategy for participating in national Open Science initiatives?					
Does the university have a strategy for participating in international Open Science initiatives?					
Is the university member of the EOSC association?					2
Is the university member of the Task Force Openness of Science and Technology in CESAER?					

Table 1 shows that Open Science is dealt with in different ways by the N5T institutions, and a slightly deeper analysis shows that national guidelines/polices and funder requirements play an important role here. Securing Open Access to publications is a well-established practice at all universities, and all universities have also implemented different functions for supporting this. For research data, requirements on adhering to the FAIR principles and publishing of data are often implemented in policy documents aligned with requirements by funders and national policies. However, for some of the institutions the underlying RDM support functions and infrastructures still might have to be further developed. Further actions towards implementing also other aspects of Open Science (educational resources, hardware, software, methods, citizen science) are so far often not implemented or even considered in a structured way. Also, even though most institutions have Open Science responsibility assigned to a person in the university management (Provost/Vice-President), there is a wide difference in how and if the university engages in the development of Open Science in a local, national and international setting.

Best practice examples

1: Based on the national Open Science and research policies and recommendations (Open Science and Research Policies | Open Science), Aalto decided to compile a "living" Open Science and research policy that collects the principles and guidelines of different areas of Open Science to researchers into one policy document. Small changes to the policy are allowed by the decision of the vice rector of research, bigger changes go through research steering group.

2: To vigorise our EOSC association membership, NTNU has arranged an internal workshop on EOSC, to explore opportunities for researchers in sharing and accessing research data.

Open Science support, services, training and infrastructures

Table 2: Open Science support, services, training and infrastructures at the N5T universities. Numbers refer to Best Practice examples below the table.

Question	Aalto	Chalmers	DTU	KTH	NTNU
Does your university have a strategy and/or dedicated function/dept. for developing and implementing OS support and relevant infrastructures for the whole organisation?	3	3		4	3
Does your university deliver services, support, training and/or infrastructures for any of the following Open Science domains?					
- Open publications					
- Open/FAIR data		5	5	5	
- Open educational resources					
- Open hardware					
- Open software					
- Open methods					
- Open peer-review					
- "Good scientific practice"					
- Citizen science/ citizens' participation in research					
- Meriting researchers for OS practices					
Does the university provide guidance on openness of research results (e.g. academic and data publications) and research security (e.g. dual-use, export control)?					6

An analysis of Table 2 shows that the support and services provided to research indeed are connected to that the institutional policies or steering documents are operationalized. It is only open publication and FAIR data that all institutions support, while other Open Science aspects are normally only supported if a comparable policy or steering document exist.

Currently, international and national security politic and associated legal aspects are increasingly more important to the N5T institutions. Accordingly, all N5T universities provide at least some level of guidance in navigating between the openness and security of research outputs.

Best practice examples

3: Aalto and NTNU have mandated support (one-stop-shops) functions for Open Science and good data management practices. Depending on the university, IT persons, legal experts

and data stewards are part of this entity. Aalto and NTNU organise this as a matrix function. Chalmers has firmly established support functions and services for Open Access and RDM within Chalmers e-Commons and the Library. The support and services are also integrated with e.g. the functions for Information Security, GDPR, and the Archive.

4: KTH Research data support is working together with Grant support to reach projects where there are Open Science or RDM requirements. Depending on type of grant and funder mandates, researchers are offered either to take part in workshops (i. e. on creating a data management plan) or offered more personalised support and coaching.

5: DTU and recently KTH have established institutional data repositories. DTU Data, experiences great uptake by DTU researchers. It is becoming embedded in daily research practices, supporting foremost data and software publication. Training in repository use also supports digital curation practices and FAIR awareness throughout the research life cycle, showing that repositories can be infrastructures important for doing Open Science in practice. Chalmers collaborates closely with the national infrastructure SND (Swedish National Data Service) and uses *researchdata.se* as an important publication channel.

6: The NTNU guidelines for Open Science integrate the security aspects of openness; “as open as possible as close as necessary, in three steps (shortened version):

1. Assess the data values
2. Secure what is needed (GDPR, sensitivity, dual use, export control, IP etc)
3. Share in a responsible manner

Open Science education, incentives and culture

Table 3: Open Science education, incentives and culture at the N5T universities. Numbers refer to Best Practice examples below the table.

Question	Aalto	Chalmers	DTU	KTH	NTNU
Are Open Science aspects included in BSc/MSc education?					
Are Open Science aspects included in PhD education?	7		7		
Are Open Science aspects included in leadership development programmes?					
Is "Good scientific practice" included in BSc/MSc education?					
Is "Good scientific practice" included in PhD education?	7		7		
Is "Good scientific practice" included in leadership development programmes?					
Has the university signed the CoARA (or similar) agreement or policies?					
Does your organisation work for promoting that Open Science is taken into consideration in assessments related to recruitment or career development or in other professional assessments?					8

Among the N5T institutions, very few structured initiatives seem to exist to introduce Open Science or good scientific practice in undergraduate education. However, this is difficult to track without a deeper investigation. At the PhD level, some more initiatives have been taken. However, although Open Science and good scientific practice are supported by existing policies, there are still few examples of systematic training, such as being part of the mandatory PhD education. Also, Open Science adoption is uneven between disciplines and research groups, therefore course content and awareness may vary a lot in different parts of the institution.

The adoption of Open Science in research communities is closely connected to and dependent on core aspects of merits, rewards, and research evaluation. Most of the N5T institutions have signed the CoARA agreement on advancing research assessment, however the practical implementation of the CoARA contents is still in its early stages. This could be a reason why neither Open Science, nor good scientific practice in a digital research system is part of leadership development programmes at any of the N5T institutions.

Best practice examples

7: Aalto has included Open Science and good scientific practice in their PhD education with an ECTS course, while DTU offers a short mandatory introductory course for new employees.

8: NTNU has established an "Open Science Development Plan" – an institutionalised effort to enhance Open Science practices also in assessment procedures and protocols. This is being implemented with the joining of CoARA. The NTNU competence matrix provides examples of competences that are relevant in applications for appointment, promotion and project funds. In the NTNU guidelines, Open Science is assessed in relation to the researcher's various contributions to the research process.

Roadblocks and Enablers

During the preparation of this report, some important roadblocks for the implementation of Open Science at the N5T institutions have been identified. It has also become clear that more often, these roadblocks are actively discussed within the universities. Eventually, the outcome of such discussions can initiate that the perceived roadblock in a natural way transforms into enabling actions firmly anchored in the institutions and research practices.

Some current roadblocks are found to be:

- Deep knowledge on Open Science and its impact on research practices and research quality is not widespread within research communities and institutional leaderships. Quite often, misunderstandings still persist and hinder further discussions.
- Open Science initiatives (local, national, and European) and funder requirements are sometimes considered as administrative burdens, arising from policymakers that are considered to be ignorant of established research practices.
- The connection between Open Science practices, merits, rewards, and evaluation of research is not deeply discussed, and implementation of e.g. CoARA is still in its infancy.
- Emerging requirements of research (and information) security are perceived to be contradictory to Open Science practices.
- There is sometimes a disconnect between research communities and existing support services. Some researchers use open practices, but these examples are not communicated further. Conversely, sometimes researchers do not engage in Open Science practices because of unawareness of existing support, if the support landscape is scattered, has missing elements, or even has competing initiatives with internal vested interests.

Summary and Conclusions

By adopting best practices from partners in N5T and other technical universities in Europe and globally, the roadblocks above can potentially be transformed into actions that sustain Open Science practices. Open Science actionscan create opportunities for further improvements of academic quality and efficient support functions. However, this transformation is dependent on further engagement and deepening of the knowledge of Open Science within both research communities and institutional leaderships. Some enabling actions would be:

- **Introduce structured Open Science education/training/competence development initiatives at all levels, from undergraduate education to top management. Here, the focus is on the impact on and opportunities for academic activities.** Some examples of structured education and training efforts at undergraduate, PhD, and senior researcher level exist among the N5T institutions, and further collaboration could be beneficial. Currently, there does not seem to be any structured efforts on competence development at the leadership level.
- **Make sure that discussions and guidelines on research/information security and Open Science are connected, and both focus on supporting academic excellence.** Academic leadership requires a span of integrated skills. For example, knowledge on handling data is increasingly complex, and today includes the ability to navigate data security considering the geopolitical situation.
- **Include relevant aspects of Open Science in discussions on advancing research assessment.** A strong national collaboration on Open Science as experienced in Finland and Norway has supported the Open Science implementation at Aalto and NTNU. This has already influenced evaluation and meriting practices at the universities, facilitating their CoARA implementation
- **Establish a support function that integrates a full span of support functions and services of relevance for handling research data**. Chalmers e-Commons is an example of an integrated function that drives the research data infrastructure and support development at the university. The matrix organisations at NTNU and Aalto are integrating Open Science services, data champions, IT and legal support, thus creating a common ground for advancing FAIR data and software practices at the universities.