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DMPs as Management Tool for Intellectual Assets by SMART Metrics

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Abstract

Data Management Plans (DMPs) are vital components of effective research data management (RDM). They serve not only as organisational tools but also as a structured framework dictating the collection, processing, sharing/publishing, and management of data throughout the research data life cycle. This can include existing data curation standards, the establishment of data handling protocols, and the creation, when necessary, of community curation policies. Therefore, DMPs present a unique opportunity to harmonise project management efforts for optimising the formulation and execution of project objectives.

To harness the full potential of DMPs as project management tools, the SMART approach (i.e., Specific, Measurable, Achievable, Relevant, and Time-bound) emerges as a compelling methodology. During the initial stage of the project proposal, drafted SMART metrics can offer a systematic approach to map work packages (WPs) and deliverables to the overarching project objectives. Then, the Principal Investigators (PIs) can ensure the consortia that all the project potential intellectual assets (i.e., expected research results) were considered properly, as well as their necessary timelines, resources, and execution. It becomes imperative for data stewards (DSs) and governance policymakers to educate and provide guidelines to researchers on the advantages of developing well-curated DMPs that align results with SMART metrics. This alignment ensures that every intellectual asset intended as a research result (e.g., intellectual properties, publications, datasets, and software) within the project is subject to rigorous drafted planning, execution, and accountability.

Consequently, the risk of unforeseen setbacks and/or deviations from the original objectives is minimised, increasing the traceability and transparency of the research data life cycle. In addition, the integration of Technology Readiness Levels (TRLs) into this proposed enhanced DMP provides a systematic method to evaluate the maturity and readiness of technologies across scientific disciplines. Regular TRL assessments will allow PIs: (1) to monitor the WP progress, (2) to adapt research strategies if required, and (3) to ensure the projects remain in line with the drafted SMART metrics in the enhanced DMP before the project started. The TRLs can also help PIs maintain their focus on project milestones and specific tasks aligned with the original objectives, contributing to the overall success of their endeavours, while improving the transparency for the reporting and divulgation of the research results.

The current paper presents the overall framework for enhancing DMPs as project management tools for any intellectual assets using SMART metrics and TRLs, as well as introducing suggested support services for data stewardship teams to assist PIs when implementing this novel framework effectively.

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Introduction

The ongoing global adoption of Open Science (OS) practices has underscored the critical need for robust Data Management Plans (DMPs). Beyond their mandated role by funders, DMPs can emerge as versatile tools (Science Europe, 2021), offering a distinctive perspective on research data management (RDM). This paper advocates for a novel approach, positioning DMPs as comprehensive management tools for intellectual assets throughout the research project.

A novel framework emerges if DMPs transcend their conventional reporting role, encompassing a broader range of intellectual assets beyond research data, including software, patents, and data spaces. This expanded scope can empower Principal Investigators (PIs) to intricately design, develop, and/or deploy these assets, aligning them with predefined Technology Readiness Levels (TRLs) akin to the standard developed by the National Aeronautics and Space Administration (Mankins, 2009).

The SMART approach (Ogbeiwi, 2017) allows the description of goals as specific, measurable, achievable, relevant, and time-bound. They can facilitate the integration of project objectives, work packages (WPs), and deliverables with the emerging planned TRL-defined intellectual assets, resulting in SMART metrics to be assessed during and after the project. Early drafted SMART metrics aid PIs in the estimation, evolution, and assessment of TRLs, providing valuable insights at the proposal stage and throughout the project. These metrics can also enable the precise mapping of objectives into DMPs, aligning deliverables with the expected TRLs and the required enriched metadata for FAIR principles (Wilkinson et al., 2016), i.e., requirements for machine-to-machine communication to make data findable, accessible, interoperable, and reusable.

The PIs and their consortia can explicitly detail a list of intellectual assets and, at any stage of the project, adjust them by updating their DMP between milestones, adapting objectives, if necessary, when providing comprehensive insights into the project timeline that will be extremely valuable during the final reporting stage.

Furthermore, DMPs as management tools allow PIs to better budget activities, acknowledging the intricacies of RDM tasks during the project life cycle. By focusing efforts on defining the project management aspects during the proposal stage, PIs gain a better understanding of the resource requirements. The proactive incorporation of the FAIR principles into the core assets procedures further enhances the utility of DMPs as management tools. This holistic approach aids PIs in project planning, execution, and knowledge dissemination. It empowers all researchers involved to leverage the versioning of the project DMP as a traceable log of the research process, including the research data life cycle and any other research results and outcomes.

The rest of the paper is structured as follows: section Enhanced DMPs explores its benefits as management tools. Section The SMART Approach introduces it for DMP drafting by intellectual assets mapping and presents an example. Section Technology Readiness Levels delves into NASA's TRL standards, offering insights into project assessment by enhanced DMP for PIs. Section Open Research Data-Related Support Services introduces data stewardship efforts and outlines a novel set of support services to aid researchers in adopting this enhanced DMP-driven project management framework. Finally, the last two sections tackle on potential further work and general conclusions.

Enhanced DMPs

The overall summary of the framework is presented in Figure 1. The DMPs play a crucial role in RDM. Originally, DMPs were considered formal documents that outlined how research data were collected, organised, stored, shared, and preserved throughout the project's research data life cycle. However, by including SMART metrics that are presented and detailed in the following sections and considering the TRLs for each potential intellectual asset (also detailed in the following sections), the DMPs can be enhanced to become project management tools, especially in current efforts to create standardised machine-readable DMPs (Diederichs et al., 2024).

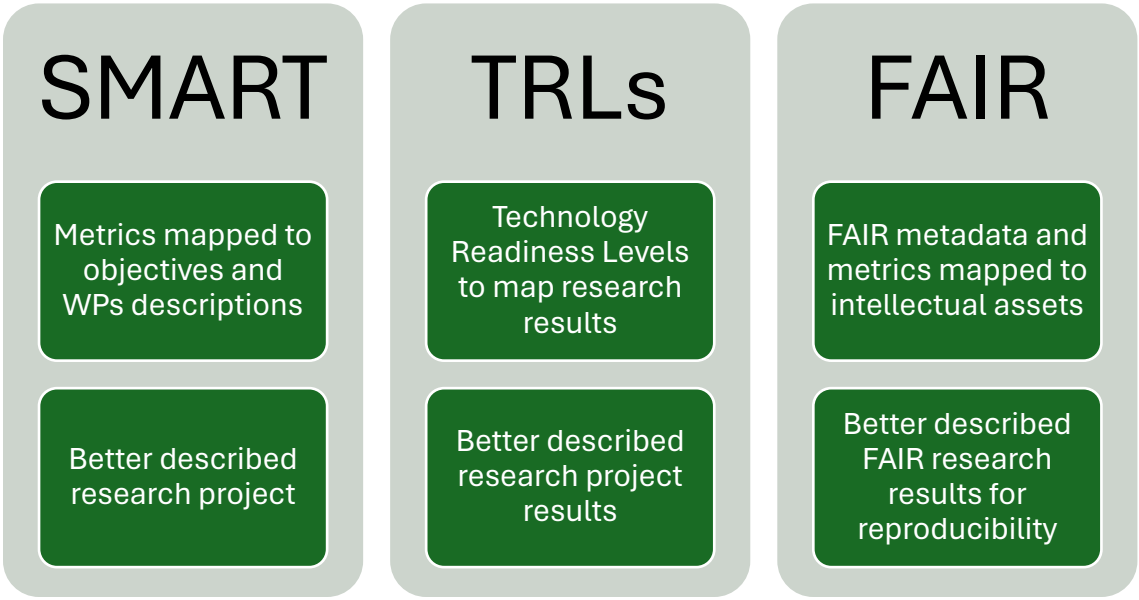

Figure 1. Summary of novel approach to DMPs as intellectual assets management tools.

Related to their RDM efforts, PIs can align enhanced DMPs to any kind of intellectual assets (e.g., datasets, software, patents, procedures, and publications), finding agreement on how to develop the DMP as a transparency tool among the project consortia, composed of researchers and other interested stakeholders.

The following sub-section summarises the ten most significant benefits of using enhanced DMPs as versioned management tools for transparent RDM.

Description of Benefits of Enhanced DMPs as Management Tools

The following list presents the ten most significant benefits for PIs by embracing enhanced DMPs:

1. Data organisation and research description:

- Detailed description of the data types to be collected and/or generated, including specifications on formats, files/folder structures, and metadata standards;

- Harmonised terminology for well-structured DMPs enhances research documentation and reporting, making it more understandable and potentially easy to reuse;

- Curated objectives and milestones mapped into research results, delineating intellectual assets to be thoroughly researched, developed, and/or deployed during the research process.

2. Data collection and handling:

- Enhanced DMPs can establish the foundation for research guidelines, outlining how data must be collected, curated, and managed throughout the project;
- Encompass details on methods, instruments, setups, standards, and procedures (with their corresponding persistent identifiers) for data quality, as well as validation and verification of the research results;
- Planned and recorded data security and ethical considerations (e.g., informed consent forms), ensuring responsible data collection while addressing all relevant requirements related to sensitive data.

3. Data storage and backups:

- Enhanced DMPs can delineate strategies for data storage and backup, providing a roadmap for researchers to safeguard their data;
- Researchers can specify the location and type of data storage, taking into account considerations for data security and access control methods;
- This proactive approach helps mitigate the risks of data loss and unauthorised access, with explicit protective measures for sensitive data already at the proposal stage.

4. Data sharing and accessibility:

- Enhanced DMPs can cover data sharing and accessibility profiles by enriching metadata that follow FAIR principles (Wilkinson et al., 2016);
- Researchers can define access parameters to specific profiles, detailing who can access what data storage and under what conditions during (for peer-researchers and/or reviewers) and after the project (for reusability and/or reproducibility efforts);
- Detailed data embargo periods and/or release schedules can be drafted and updated in the versioned enhanced DMPs, aligning with publications and/or other project milestones, as well as effectively considering any other interests and/or governance requirements of the consortia members at the institutional level.

5. Data preservation and archiving:

- Enhanced DMPs can incorporate explicit plans for storage of the research results after the end of the project, as well as long-term archiving intentions for all relevant assets;
- Researchers can detail the methods, formats, and procedures by which intellectual assets will be stored for a defined period after the project ends, as well as the long-term archiving efforts towards alignment with institutional and/or funding agency policies;
- Included archiving details can ensure longevity and accessibility for intellectual assets for future use, as well as reproducibility efforts.

6. Compliance and ethics:

- Enhanced DMPs can help research projects adhere to legal and ethical standards;

- Researchers can find details on data anonymisation tools, informed consent procedures, and compliance with data protection regulations at local and international levels, as drafted by the PI during the proposal stage as well as any needed updates by the consortium;

- This mechanism of recorded standards for compliance safeguards the rights and privacy of research participants while ensuring the most impactful ethical research practices.

7. Resource planning:

- Enhanced DMPs can facilitate resource planning by outlining the necessary equipment, software, personnel, and any other additional asset to be budgeted during the proposal stage for research and data management;

- Planned requirements for the design, development, and/or deployment of the proposed research results as intellectual assets;

- Allows the consortium to discuss and agree on allocated resources efficiently and effectively budget during the proposal stage of the project.

8. Project transparency, traceability, and reproducibility:

- Enhanced DMPs mainly become a living record of how research projects are planned and updated, providing an overall guide for reproducibility, as well as presenting a traceable and transparent RDM;

- Versioned DMPs allow other researchers to understand better, replicate, or reuse research results and any other intellectual assets, promoting scientific rigour and accountability;

- Fully detailed internal traceability reports on each publication and/or any other deliverable can also be the guideline for the improvement in the internal and/or external reproducibility of science.

9. Funding agency requirements:

- Many funding agencies and institutions require researchers to submit DMPs as part of grant applications and/or initial project documentation; however, enhanced DMPs can be helpful for the funders and the research consortium;

- Meeting the funder's DMP requirements is essential for securing research; however, it also means an overall time saving benefit for the funder and PIs during the reporting stages of the project;

- Harmonised reporting by standardised DMPs with well-defined terminology can become machine-actionable Open Science (OS) metrics to aid project reviewers (Miksa et al., 2019).

10. Data management best practices:

- Enhanced DMPs can encourage PIs and other researchers to follow RDM best practices, fostering good data stewardship habits in young researchers;

- This can also include good practices, such as version control for software, datasets, and setups. Enhanced data documentation can comply with FAIR principles, and research

results have machine-actionable validation and verification procedures when ensuring data quality;

Establishing the development of enhanced DMPs during the drafting of versioned DMPs into good practices (e.g., during the proposal stage, updating, and the project) can save a significant amount of time for future generations of researchers. Enhanced DMPs are not presented in this paper as a requirement for funders today, but as valuable tools for RDM, as they can help researchers optimise the planning, documenting, and execution of OS activities, ensuring that research data are properly collected, stored, and shared when meeting legal, ethical, and funding agency requirements.

Effective RDM with enhanced DMPs includes curation efforts during significant steps in the research data life cycle for the preservation of digital objects, as depicted in Figure 2 (Higgins, 2008).

This also contributes to the quality, integrity, and accessibility of research results (i.e., intellectual properties, publications, datasets, software, and patents), making the research process, including the research data life cycle, more transparent and sustainable by providing additional information while reporting results using versioned DMPs.

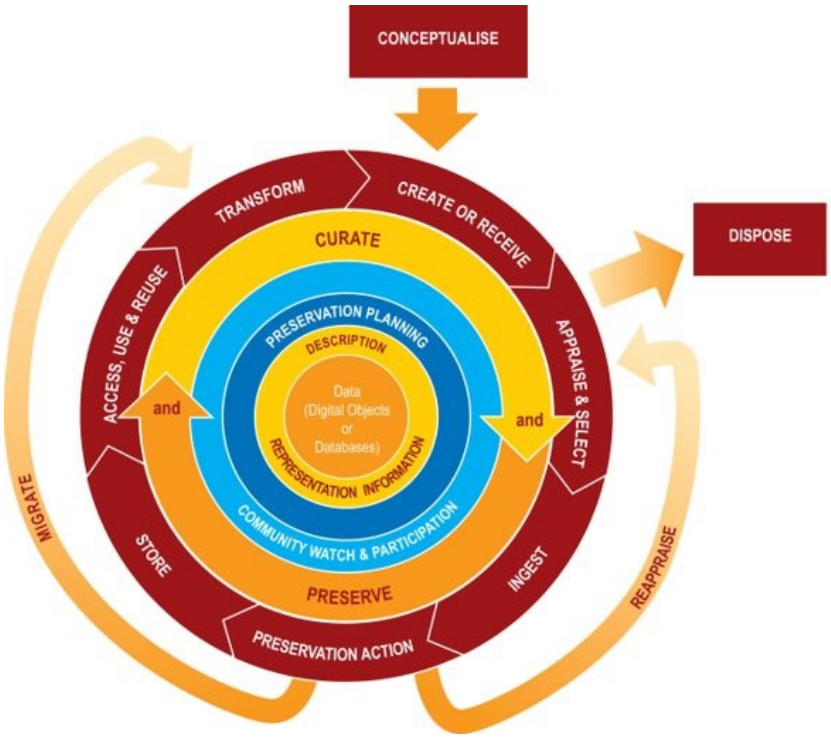

Figure 2. DCC Curation Lifecycle Model (Higgins, 2008).

The SMART Approach

The SMART approach (Ogbeiwi, 2017) can be highly beneficial when managing research results that are considered intellectual assets. Publications, datasets, software, patents, or any other digital asset planned as project results can be directly aligned to the project proposal's objectives, as well as the drafted WPs and deliverables.

The PIs can apply the SMART approach, detailed and summarised in Figure 3, to manage the expectations of the consortium about research results as intellectual assets, detailing SMART metrics in their enhanced DMPs:

- Specific: Clearly defining what the PIs want to achieve with their research, in terms of intellectual assets (e.g., publications, datasets, software, and patents);
- Measurable: Establishing measurable metrics or key performance indicators (KPIs) that allow the PIs, the researchers, and any other stakeholders to track the performance and effectiveness of the design, development, and/or deployment of an expected asset (as previously detailed);
- Achievable: Ensure that the project objectives are realistic and attainable, based on known available resources, competencies, and technology capabilities within the consortium;
- Relevant: Make sure that the project objectives align with the organisations involved in the consortium for an overall research strategic vision (long-term) and mission (short-term);
- Time-bound: PIs must specify timeframes, milestones, and deadlines within the timeframe of the project for achieving the defined intellectual asset as research results.

Drafting SMART Metrics for Research

One of the most significant new intellectual assets that most research projects have to deal with is data. Hence, a dataset (a specific intellectual asset) that is generated during a project entails the required OS strategy for open research data. This example aims to present a comprehensive example of the use of SMART metrics for the typically present new asset of open research results using datasets (i.e., open research data).

Specific example for SMART metrics for open research data

An exemplary use of SMART metrics follows:

- S2, meaning "specific metric two": **S2.1**: Dataset(s) collected and shared between the consortium for paper 1 (i.e., **S1.1**) from WP1, Task1, Activity1, related to deliverable D1;
- Metric S2.1 entails that M2.x (i.e., measurable metrics for specific intellectual asset two) can be assigned as "M2.1: Data Set Quality Standards; M2.2. Data Set Formatting Standards, and M2.3: Domain-specific Repository Community Curation Policy";
- Directly related to M2.x, A2.x (i.e., achievable metric two for asset aligned with S2-M2) can be assigned as "A2.1: human resources required for S2.1; A2.2: machine resources required for S2.1". This can mean assigned researchers for data collection/curation for paper 1 (i.e., A2.1), as well as assigned setup/equipment for collecting raw data (A2.2);
- All defined metrics so far must be in alignment with institutional-level interests R2.x (i.e., the relevant metric for S2-M2-A2) can be marked as "in line with governance of member X, mission statement on Open Science of member Y and member Z long-term vision";
- Finally, metric T2.1 (i.e., time-bound for S2.1) to be "in line with WP1 timeline, specifically M0y-M0z of the overall project", ensuring that the related inputs/outputs from WP1, Task1, Activity1, related to deliverable D1 are synchronised to the overall efforts.

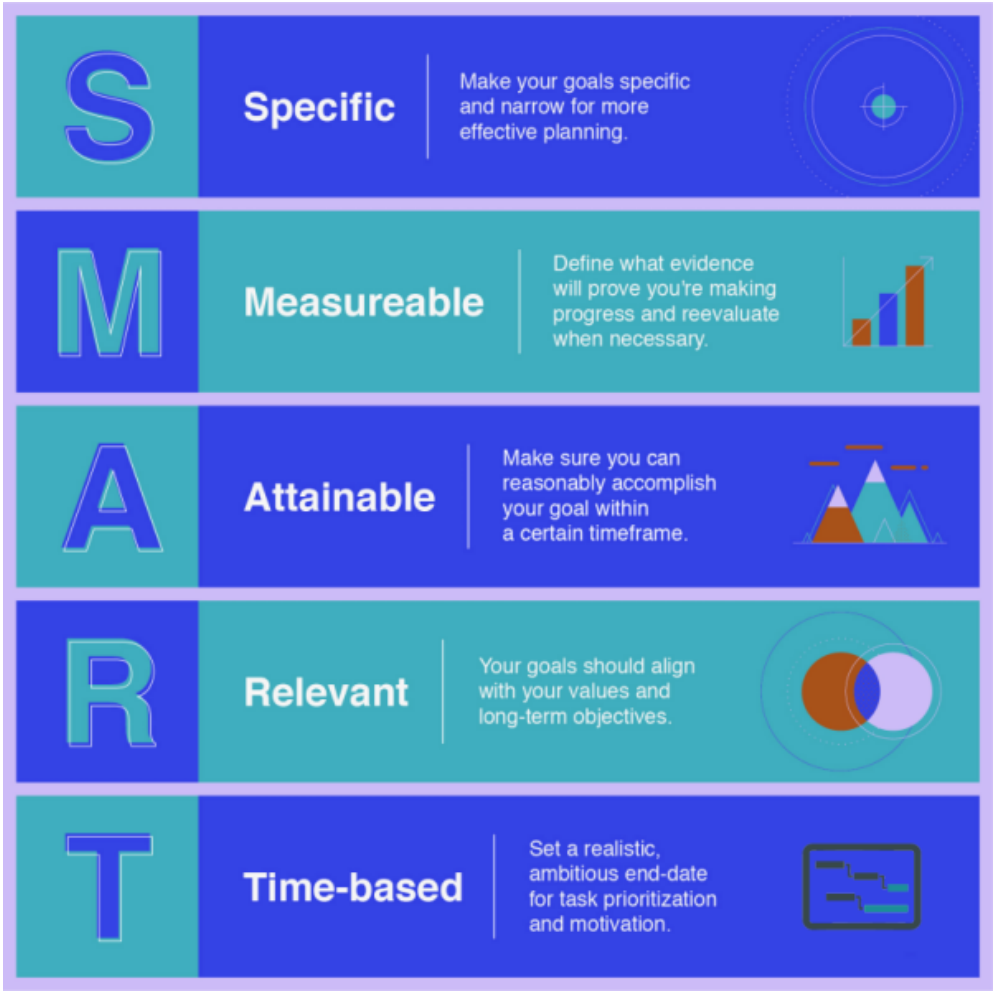

Figure 3. SMART approach explained (CFI, 2015).

Overall Benefits of SMART Approach

The use of SMART metrics enhances DMPs as effective project management tools in key aspects, such as clarity, accountability, and efficiency, improving the traceability and transparency of the research results as intellectual assets. In addition, drafting DMPs based on early planned SMART metrics allows PIs to adapt faster to unplanned changes during the project, as well as to have continuous monitoring and potential improvement in the ongoing research project.

They enhance DMPs as project management tools, translate research results into intellectual assets, and provide a structured framework for any required milestone towards objective management and performance monitoring. These are crucial for harnessing the full potential of advanced technologies, human competencies, and machine capabilities in research.

Mapping WPs and Deliverables to Enhanced DMPs

By mapping the project's WPs and deliverables to an ongoing draft DMP, PIs can integrate data management practices into project workflows, ensuring data and any other research results that are intellectual assets are handled effectively and comply with best practices for maintenance throughout the project's life cycle.

This approach of the ongoing versioning of DMPs also helps to optimise the design, development, and/or deployment of intellectual assets towards enhancing data-driven decision-making during the project, as well as in the final reporting stage.

The following section is a ten-step generalised procedure to map WPs and their corresponding deliverables to DMPs to research results as intellectual assets, following the initial project objectives and the drafted SMART metrics.

PART 1: Drafting DMP and project proposal

Step 1: Understand project objectives. Begin by linking the planned objectives to potential intellectual assets for achieving them;

Step 2: Draft SMART metrics for enhanced DMP. Develop an initial comprehensive DMP outlining data collection, processing, storage, and sharing procedures, aligned with the first draft of the SMART metrics, i.e., planned design, development, and/or deployment of research results as intellectual assets;

Step 3: Identify WPs. Divide the project into sequential WPs, representing distinct phases with specific tasks and correlated activities to map to the SMART metrics;

Step 4: Map DMP to WPs. Align DMP sections (e.g., data collection, processing, and storage) with relevant SMART metrics and the corresponding sequential WPs, marking the specific tasks involved;

Step 5: Define deliverables. Specify data-related and other research result deliverables within each WP, ensuring the relevancy of activities and compliance with the data management requirements, as defined by the project SMART metrics, to draft a list of deliverables that are consequential to the WPs and the project objectives.

PART 2: Updating DMP for project maintenance and accountability

Step 6: Assign responsibilities. Clearly assign responsibilities for the drafted assets-related tasks within each WP to specific project partners, ensuring an understanding of the roles and responsibilities, as well as human and machine resources, as detailed in the SMART metrics;

Step 7: Data documentation. Integrate data documentation and metadata creation tasks into relevant WPs to maintain traceability and transparency. Recorded quality of results, aligned with project objectives and FAIR principles, consequential to the project objectives and the drafted SMART metrics;

Step 8: Quality control. Include quality control and validation activities within the relevant WPs to meet data quality standards (e.g., ICH Quality Standard, 2024), as well as any agreed curation policies. Added validation and verification activities for planned intellectual assets that required them, like software modules, ensuring consequentiality from project objectives and SMART metrics;

Step 9: Data preservation. Determine how data preservation during and after the project aligns with specific WPs and long-term storage and archiving objectives from the initial DMP and institutional level policies, assigning roles and responsibilities across the consortium;

Step 10: Review and update. Regularly review and update the DMP with a representative group from the project consortium. The initial DMP version (1.0) can be reported and submitted as the state of the RDM within the project proposal stage. In contrast, subsequent versions (2.0–3.0) must reflect all significant changes in the scope and/or requirements during the project's progression. These versions should be annexes in the midterm and final reports, respectively.

Technology Readiness Levels

TRLs are a systematic way of assessing the maturity and readiness of a technology and/or systems for use in practical applications (Mankins, 2009). They can help PIs manage intellectual assets during the project.

Introduction of TRL Standards

The TRLs are a systematic method used by NASA and other organisations to assess the maturity and readiness of a technology or system for implementation in a specific project.

TRLs gauge how close a technology is to being fully researched, developed and operational, helping PIs, researchers, and other stakeholders make informed decisions about which technologies to use and when to incorporate them into a project. TRLs are typically defined on a scale from one to nine, with each level representing a different stage of development, as presented in Figure 4 (Mankins, 2009).

The TRL assessments are valuable for decision makers to determine when a technology is ready to be incorporated into a project and manage its risk. Different projects and industries may have variations in the TRL scale; however, the core concept remains consistent: to evaluate the maturity of technologies for practical applications.

The TRLs offer a structured approach to assess, plan, and execute research and development efforts for the design, development, and deployment of intellectual assets. The TRLs help PIs make informed decisions regarding technology readiness, resource allocation, risk management, and collaboration while ultimately contributing to the success of the project and the effective development of intellectual assets, according to several self-assessments during the project.

Benefits of Considering TRLs while Drafting DMPs

The PIs can assess the Technological Feasibility when setting realistic research objectives and properly allocating resources. In addition, the TRLs provide a framework for risk assessment during the project, making timelines and milestones easier to adapt while aiding PIs when deciding how to adjust collaboration within the consortium. Finally, the correctly recorded self-assessment of the expected and achieved TRL provides better reporting for funders while helping with the communication and divulgation of the research results as intellectual assets.

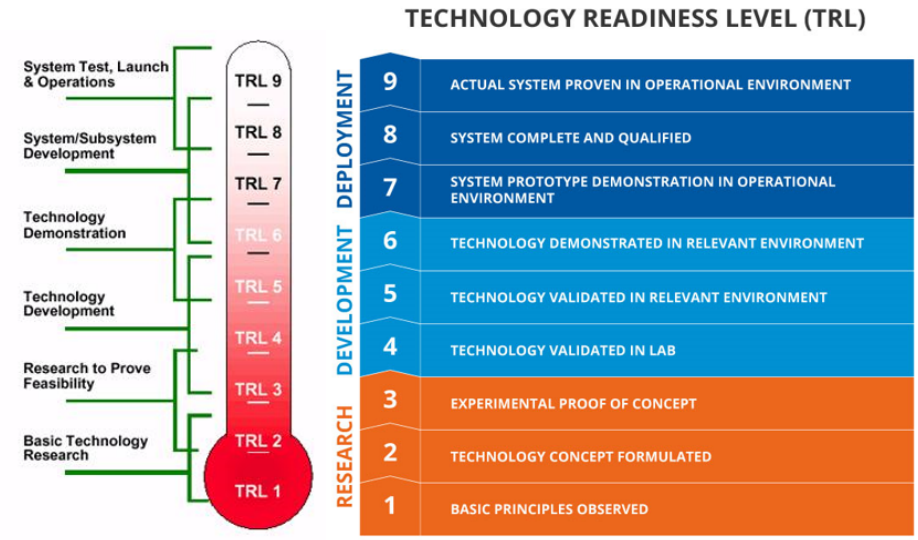

Figure 4. TRLs defined for research, development, and deployment (Mankins, 1995).

Open Research Data-Related Support Services

To finalise the overview of the proposed project management framework using enhanced DMPs, support services at OS and/or DS team levels are suggested. These support services entail seven potentially overlapping data stewardship activities aimed at all interested researchers.

Support Service 1: DMP Drafting

This provides guidance and assistance to PIs, researchers, and other stakeholders in the initial drafting of enhanced DMPs.

It emphasises the use of SMART and TRLs to draft a well-curated enhanced DMP version 0.x, during the project proposal stage.

Support Service 2: DMP Reviewing

Conducting thorough reviews of enhanced DMPs before submission of the project proposal (i.e., DMP version 1.0). It is aimed at ensuring that submitted DMPs align with the latest standards and best practices, as well as the expectations for research results by the consortium. The goal of this service is to confirm that the DMP version 1.0 is ready to submit.

Support Service 3: DMP and Intellectual Assets Updating

Support for ongoing versioning of enhanced DMPs (i.e., version 1.x) to represent the updated and refined RDM efforts on intellectual assets expectations towards a more realistic DMP version 2.0 as part of mid-project reporting documentation. In addition, this service includes updating a comprehensive list of intellectual assets to be expected by the end of the project.

Support Service 4: DMP Mid-Project Reviewing and Further Planning

Conducting a comprehensive review of the self-assessment of the SMART metrics and TRLs, according to the DMP version 2.0, as well as readjusting SMART metrics for the updated list of intellectual assets for reporting. In addition, it ensures that the enhanced DMP remains aligned with project objectives and that the listed intellectual assets have been updated and effectively mapped to current SMART metrics and TRLs, as presented in the mid-project reporting.

Support Service 5: DMP and Intellectual Assets Final Updating

Like support service 3, this service continues the evolution of the DMP (i.e., version 2.x) while updating the management of the intellectual assets list for the second half of the research project. This service aims to reach DMP version 3.0 as part of project final reporting.

Support Service 6: DMP Final Reporting Reviewing

A final review of the DMP version 3.0 after the end of the research project, during the 6 months when PIs can update the final reporting documents. It includes the suggestion of additional reporting options based on SMART metrics and TRLs, updating data collected along the project:

- Assessing FAIR (Findable, Accessible, Interoperable, Reusable) maturity of published research results;

- Final listing of intellectual assets with planned, evolved, and achieved TRLs;
- Evaluating project performance using versioned SMART metrics, TRLs, and DMPs.

Support Service 7: Overall Project Management Consulting/Tutoring

This service covers all previous services since it offers a wide range of consultancy and educational opportunities on various project management topics across the suggested project management framework:

- OS Concepts: Providing guidance and knowledge on OS (as open access and open research data) principles and practices;
- SMART approach and TRLs: Consulting services on implementing the SMART approach and using TRLs;
- Intellectual assets and knowledge valorisation: Advising on how to leverage intellectual assets to follow EU recommendations;
- RDM for FAIR results: Assisting with the continuous management of ORD to ensure their FAIRness (Wilkinson et al., 2016);
- FAIRification of research results and long-term archiving: Providing strategies for archiving and making research results compliant with FAIR principles for long-term accessibility and reusability.

The DSs providing these support services will be able to aid PIs before, during, and after their research projects when achieving more FAIR research results.

Further Work

The proposed paradigm shift must consider the current role of DMPs, and the mindset change for PIs and institutions. Achieving enhanced and standardised DMPs is a slow process.

The German National Research Data Infrastructure (NFDI) has proposed an overall generalisation of the DMP structure and terminology used for the DMP content (Diederichs et al., 2024). Following three leitmotifs (awareness, usability, and automation), DMPs as research process management tools will facilitate the planning and monitoring of projects, as well as uncover potential as OS strategy enablers (Science Europe, 2021).

A generic framework with flexible modular extensions seems to be the most appropriate way forward to develop DMP standards (Diederichs et al., 2024). In addition, further work at the data stewardship level must focus on this modularity since this can help existing OS teams and DSs to suit their tutorial efforts (e.g., how to series) to standardise drafting and reviewing DMPs before, during, and after the research project.

Finally, further steps for the development of the presented approach are needed. Taking into consideration the created SMART metrics and the expected TRLs (drafted before the project proposal is submitted), specific use cases could be tracked over time, aiding current efforts towards machine-readable DMPs while proving these novel research process pipelines to be good practice examples for enhanced DMPs (during and after the project).

Conclusions

The adoption of OS practices has made robust DMPs an imperative component of contemporary research. DMPs fulfil regulatory requirements and offer multifaceted utility as powerful tools in the RDM landscape. Hence, in this paper, an innovative perspective was introduced, advocating for the enhancement of DMPs as comprehensive management tools to oversee the research, development, and deployment of intellectual assets throughout the research process.

This approach broadens the scope of DMPs, extending their reach beyond the research data life cycle to encompass all potential intellectual assets (including software, patents, databases, and any other digital product). Hence, PIs gain the capacity to methodically design, develop, and deploy assets while aligning them with predefined TRLs. In addition, using SMART metrics, emphasising specific, measurable, achievable, relevant, and time-bound objectives, enables PIs to seamlessly integrate project goals, WPs, and deliverables to specific intellectual assets as research results.

These SMART metrics can operate as continuous estimation, evolution, and assessment of the planned TRLs and project outcomes while facilitating real-time adjustments and providing comprehensive insights into the project timeline. Drafted SMART metrics enable PIs to map objectives and assigned deliverables to specific research results and resources, considering their development at expected TRLs. Finally, the recorded evolution of the project by versioned DMPs can also provide indispensable information during the project reporting stage.

Moreover, enhanced DMPs can become an audit trail for resource allocation by acknowledging the intricacies of RDM tasks throughout the project's life cycle. By emphasising comprehensive planning at the proposal stage, PIs also gain a better understanding of resource requirements, aiding their efforts towards more efficient allocation while actively integrating FAIR principles into the core project procedures.

Enhanced DMPs can be seen as proactive tools for better planning, execution, and knowledge dissemination in research. Further work is required for the practical implementation of the presented approach, which aims to make enhanced DMPs the cornerstone of effective research project management, as well as ensuring the clear research, development, and deployment of intellectual assets while providing good practices for the advancement in OS practices.

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