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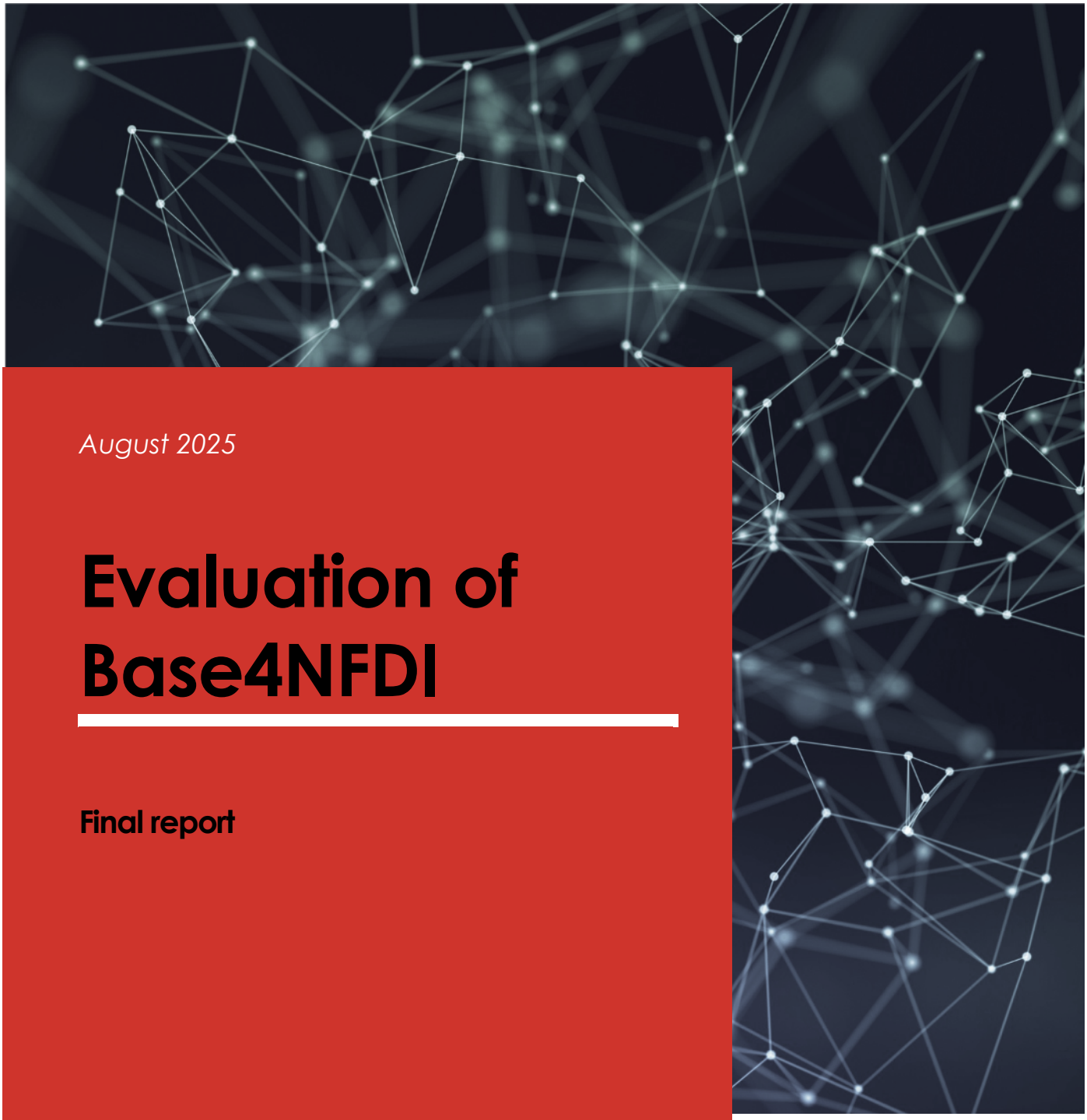

August 2025

Evaluation of Base4NFDI

Final report

Dr. Jan Biela, Dominik Obeth, Lennart Stoy, Patricia Scheiber, Niko Wilke, Dr. Florian Berger

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Executive Summary

Context of the evaluation

Base4NFDI is a joint initiative of all consortia of the German National Research Data Infrastructure (NFDI) to develop basic services that are potentially relevant to all consortia as well as the wider scientific community. Base4NFDI was launched in 2023 and is currently being funded by the German Research Foundation (DFG) for five years until 2028. The project was approved during the third and final DFG funding round for the NFDI. Base4NFDI aims to provide a transparent and inclusive framework for proposing, developing, and implementing interoperable basic services that support a federated NFDI data infrastructure. The initiative emphasises community-driven co-design, ensuring broad, interdisciplinary participation across all NFDI consortia as well as long-term integration within both the NFDI and international initiatives such as the European Open Science Cloud (EOSC). Central to Base4NFDI are the five NFDI sections, where interdisciplinary working groups identify cross-cutting topics and submit proposals for basic services. These basic service submissions undergo a structured, three-phase development process—initialisation, integration, and ramp-up. Each phase has defined criteria, and proposals are evaluated by the Technical Expert Committee (TEC) for coherence, scalability, and robustness. The TEC provides recommendations to the Consortia Assembly which is composed of the consortia spokespersons and holds the final vote on the progression of the basic services. Approval thresholds from the Consortia Assembly increase with each development phase. Prior to entering the ramp-up phase, approval by the NFDI Senate is also required. Basic services that need to drop out of integration or ramp-up phase (e.g. for technical reasons or because they are not relevant to a sufficiently large number of domains) remain in a "tool pool" and may be pursued with alternative funding sources outside of Base4NFDI. The development process is supported by the Base4NFDI team, which consists of four Task Areas (TAs), including Section Liaison Officers (SLOs) who monitor and coordinate work within the sections. In addition, Service Stewards (SERs) accompany and support the developer teams throughout the basic service development process. As of July 2025, there have been eight fully completed submission rounds for basic services. At this time, four services are in the initialisation phase and four are in the integration phase; none have yet entered the ramp-up phase.

Scope of evaluation

Since the project Base4NFDI is still ongoing and none of the basic services have yet reached the final development stage, the main focus of this evaluation is on the processes, the project structure of Base4NFDI, and its relevance to its stakeholders. The evaluation is structured across three levels. Level 1 focuses on the internal structure of Base4NFDI, including the roles of project members, work organisation, and collaboration within the team (TAs, SERs), with the aim of assessing project structure, goal achievement, and resource efficiency. Level 2 addresses the decision and development process for basic services, including the submission process (within consortia, sections, working groups), evaluation and decision-making (in the Technical Expert Committee, Consortia Assembly, and consortia), and the development and deployment of services (three-stage development and activities for promoting and deploying basic services). Level 3 focuses on the relevance of developed basic services for the NFDI community and on strategic aspects of Base4NFDI. The levels are interlinked, with overlapping actors and processes across them. For each evaluation level, specific questions regarding relevance, coherence, effectiveness, and efficiency were developed and addressed.

Concept and methodology

This evaluation involved a wide range of actors and stakeholders across multiple levels, including the Base4NFDI team, members of consortia, sections, developer teams, the TEC, and strategic bodies such as the International Advisory Board (IAB) and NFDI Scientific Senate. To capture these diverse perspectives, a formative, sequential evaluation was conducted, comparing internal views with external ones.

The evaluation employed a mixed-methods approach to capture a comprehensive perspective on Base4NFDI's activities and impact. Key methods included interviews with a broad range of stakeholders and actors, such as representatives from Base4NFDI, developer teams, consortia spokespersons, sections, and TEC members. Two online surveys were carried out: one for individuals affiliated with NFDI consortia, and another for members of developer teams. These were complemented by further interview deep-dives and four focus groups, which explored selected topics requiring deeper investigation with a range of stakeholders. The findings were subsequently validated in a final workshop involving members of the Base4NFDI team.

Key results: Internal structures (chapter 3)

The evaluation finds that Base4NFDI's internal structures (Task areas with Section Liaison Officers and Service Stewards) are generally effective, with the four TAs as well as the SERs sufficiently resourced and capable of delivering on their tasks and responsibilities. Collaboration within Base4NFDI is very strong as teams support one another effectively and work well together on overlapping tasks across TAs. However, some tasks outlined in the initial proposal were overly broad or lacked detail, requiring coordination and initiative from the team. Early staff turnover and ongoing vacancies temporarily limited capacity in a few areas, particularly in supporting and monitoring activities across sections equally. Nevertheless, the commitment and collaboration of the entire team mitigated the impact of these challenges. Staff consistently showed high motivation and a willingness to take on responsibilities beyond their formal roles. As of the evaluation, all staffing gaps have either been filled or are in the final stages of recruitment

Internal communication within Base4NFDI functions well overall, with team members coordinating tasks efficiently and delivering on their responsibilities. However, coordination with and among the Co-Spokespersons remains a challenge. While this has not prevented the successful execution of core tasks, there is a recognised need for stronger coordination mechanisms at the working level. In particular, some decision-making processes within individual Task Areas are perceived as slow, which has, in certain cases, hindered timely implementation. Empowering specific team members to assume coordination responsibilities independently – such as through the appointment of task leads – could clarify responsibilities.

Job profiles within the project are demanding, reflecting the complexity of Base4NFDI's multi-stakeholder, bottom-up structure. While this model supports the relevance and acceptance of basic services, it places high demands on staff, especially in terms of project management capabilities. This complexity also poses onboarding and coordination challenges, particularly for less experienced colleagues. Strengthening project management skills through targeted training and mentoring would improve overall team effectiveness.

External stakeholders report generally good collaboration with the Base4NFDI team but express a need for more streamlined communication and clearer coordination structures. In particular, they highlight the benefit of clearly defined contact points, such as a single point of contact for specific enquiries. Intersections in responsibility between certain TAs exist due to the multi-phase project structure – for example, when a service transitions from initialisation to

integration, or during joint processes such as proposal writing in the sections. Similar overlaps exist between TA3 and TA4 in areas like service monitoring and reporting. Although stakeholders typically succeed in identifying the correct contact person, these intersections can cause temporary confusion. Addressing this through improved coordination and clearer communication channels would enhance overall clarity of contact points for stakeholders.

Key results: Processes for developing basic services (chapter 4)

The process for developing basic services includes the submission process (identification of potential basic services within the NFDI sections and the submission of proposals for the development stages) as well as the evaluation process conducted by Base4NFDI and the TEC, the decision-making process within each consortium and voting in the Consortia Assembly. Furthermore, it entails the development process of the services by the developer teams and the support provided by Base4NFDI.

Common needs for basic services are mainly identified in section working groups, which offer a flexible and agile forum for proposing and discussing basic services. The bottom-up process enhances acceptance and is very popular among the stakeholder groups. Sections are a repository of knowledge and expertise and enable collaboration on cross-cutting topics across institutions. However, there is a widely recognised need to strengthen the connection between the consortia and the sections. Furthermore, the activities and outcomes of section working groups are not always transparent to all stakeholders. Especially consortia from the third NFDI funding round – which began their work after the sections were already established – have expressed a desire for better oversight and visibility into section activities. Improved communication and inclusion across sections and consortia would foster greater coherence, traceability, and a unified strategic approach to developing basic services. However, this concerns broader NFDI governance and lies beyond Base4NFDI's direct remit.

The criteria used to evaluate basic service submissions are generally appropriate given the diversity of services. However, the weighting of criteria could be communicated more clearly. Using "Technology Readiness Level" (TRL) as a criterion can be unclear for non-technical teams, which led Base4NFDI to work on introducing the concept of "Maturity" as a more inclusive alternative. The quorum thresholds in the Consortia Assembly for each submission stage (25 % for initialisation, 50 % for integration and 75 % for ramp-up) are appropriate overall, though some adjustments – e.g. higher thresholds for initialisation, lower for ramp-up could be considered. The expressed support of consortia for basic service submissions suggests that all proposals would have passed the initialisation and integration phases if the TEC had not recommended otherwise. Consortia tend to vote in favour of submissions to avoid blocking development, even though their actual commitments to the submissions vary significantly and are sometimes vague. This underscores the essential role of the TEC as an independent evaluation body, helping to prevent a 'first come, first served' dynamic. Stakeholders generally recognise the need for this function. Overall, the TEC's expertise is largely complementary, and external reviewers are engaged when specific expertise is required. Nonetheless, certain recommendations made by the TEC have been met with criticism from segments of the NFDI community. In such a case, it could be helpful to communicate how external reviewers are involved in its decisions and to establish a more systematic approach to include reviewers to improve the acceptance of the TEC. Moreover, a "pitch"-format where applicants can pitch and defend their submission in front of the TEC could help to overcome potential misunderstandings and criticism.

The three-phase funding model is widely accepted by stakeholders and provides a clear structure, enabling developer teams to promote their basic services and build acceptance. However, the timeline and deliverables in the initialisation phase are often seen as too rigid,

limiting the flexibility needed for efficient development. New requirements – such as integration with EOSC – and the time required to assemble development teams have highlighted that proposals for the integration phase are often expected too early. Additionally, some of the new requirements were given on short notice and developer teams did not have enough time to prepare. Furthermore, some procedural elements could be streamlined. For example, requiring institutional signatures and authorisations from the developer teams' home institutions for each phase adds administrative burdens to the developer teams which could be avoided. Limiting this requirement to the initialisation phase – unless significant changes to the original submissions are proposed for the next round – would enhance agility.

Collaboration with Base4NFDI is generally viewed positively. Service Stewards play a vital support role and are increasingly helping to connect developer teams with consortia, despite the complexity of the stakeholder landscape. SLOs have taken on additional responsibilities, particularly during staffing shortages, and are essential for maintaining the input legitimacy of Base4NFDI.

Key results: Relevance of Base4NFDI to its stakeholders (chapter 5)

Base4NFDI has successfully enabled collaboration across consortia, and all basic services currently under development are considered relevant by their respective target groups. While some of these services are viewed by stakeholders as broadly beneficial to the NFDI community or to the consortia as a whole, others are seen as primarily serving the needs of more specific user groups. This reflects a central challenge: Base4NFDI must address a wide range of diverse requirements and expectations. Thus, there is a potential risk of misjudging the overall utility of Base4NFDI services if diverse perspectives are not fully considered. This suggests that the development process for basic services should be sensitive to the varying relevance of each basic service to different target groups. Additionally, the low perceived utility in complementing EOSC services prompts strategic reflection on whether Base4NFDI services should be directly integrated into EOSC, or rather strengthen NFDI's internal capabilities for participating in EOSC. These contrasting views highlight the need for a clearer, more unified understanding of what constitutes a basic service and what strategic role Base4NFDI should play within the NFDI ecosystem.

Sustainability of basic services presents a "chicken-and-egg" problem: consortia require confidence that services will reach completion before committing long-term support, while development teams need binding commitments from consortia to justify continued investment. In most cases, reliable assessments of sustainability can only be made once a service is fully developed. Hence, it is important to emphasise that Base4NFDI remains an ambitious initiative. Efficiency gains and strategic value can still be demonstrated even if a basic service is adopted by a smaller community – provided that it serves a clear purpose – even if used by fewer than 75 % of the consortia (vote threshold for ramp-up phase). To ensure long-term sustainability, basic services must align with the strategic frameworks of existing institutional infrastructures. Yet, another concern is that individual researchers' perspectives remain underrepresented in the current structures. While this may reflect the nature of certain "background" basic services being more relevant to providers, consideration should be given to how researchers' input can be more effectively integrated into the submission process.

Integrating EOSC requirements into Base4NFDI processes shows its ability to respond strategically to evolving priorities. As international cooperation becomes more important, service development is expected to align more closely with international scientific infrastructure trends. At the same time, community needs should continue to be addressed through the established bottom-up submission process.

Recommendations for action

1. **Strategic project level: Establish clear and differentiated funding pathways** to ensure long-term sustainability. Given the diversity of services, a one-size-fits-all model is unlikely to be effective. Instead, three complementary funding tracks could be articulated in greater detail:
   i) Create dedicated institutional funding for core services critical to NFDI and EOSC.
   ii) Encourage or require consortia to commit to services early through transparent adoption roadmaps.
   iii) Clarify the purpose and support mechanisms for services that do not advance to full implementation (tool pool).
2. **Strategic project level: Re-evaluate the current three-phase model**:
   i) If the goal is to ensure that most selected basic services reach an operational stage, a two-stage process could be more adequate.
   ii) If the three phases are retained, consider extending the initialisation phase to shift some administrative burdens to later phases.
3. **Strategic project level: Refine evaluation criteria**: Consider replacing the Technology Readiness Level criterion with "service maturity" to better reflect diverse basic service types and communicate transparently how different criteria are weighted.
4. **Strategic project level: Balance bottom-up processes with strategic alignment**: Base4NFDI should maintain its inclusive, community-driven approach while ensuring that basic service development supports the overarching NFDI architecture and alignment with EOSC.
5. **Project context: Improve coordination and input legitimacy within NFDI's bottom-up model:** Ensuring input legitimacy requires a more coordinated approach across consortia, sections, and NFDI governance bodies. Therefore, transparency, communication and accessibility of section activities should be further increased. Strategic coordination mechanisms, operational links (e.g. designated contact persons). Clarifying the definition and scope of basic services could further support this process.
6. **Operational project level:** To improve the **development process** and **ease administrative burdens** on developer teams, it should be considered to remove the requirement for rector or institute head signatures for integration and ramp-up application phases. Instead PI-level authorisations should be accepted where appropriate. In addition, announcing template changes well in advance would reduce administrative challenges and allow sufficient time to prepare. A careful assessment of essential administrative tasks could help streamline processes.
7. **Strategic/operational project level:** To improve the evaluation process, the evaluation recommends to introduce **brief online pitch presentations in front of the TEC** to improve communication between the TEC and proposal/developer teams. Furthermore, the role of the TEC and its recommendations could be clarified.
8. **Operational project level:** To improve **internal structures** within Base4NFDI, it is suggested to strengthen operational-level coordination by **appointing task leads** to clarify responsibilities, streamline communication through designated points of contact, establish structured feedback and appraisal processes, reinforce the roles of Section Liaison Officers and Service Stewards by clarifying their functions, and consider referring to Task Areas by their function name. In the middle- to long-run, it can be considered to merge TA1 (Service Initialisation) and TA2 (Service Integration and Ramping up for Operation), as well as TA3 (Service Coherence Processes and Monitoring) and TA4 (Project Governance).

1 Context and goals of the evaluation

1.1 Genesis, goals and structure of Base4NFDI

The Joint Science Conference (Gemeinsame Wissenschaftskonferenz, GWK) decided in 2018 to establish the German National Research Data Infrastructure (Nationale Forschungsdateninfrastruktur, NFDI), following a recommendation by the Council for Information Infrastructures (Rat für Informationsinfrastrukturen, RfII). The aim is to make research data usable in accordance with the FAIR principles (Findable, Accessible, Interoperable, Reusable) and to provide comprehensive services for the reuse of data. To support the NFDI, the German Federal Government and the federal states (Länder) are making up to 90 million euros available annually from 2019 to 2028. NFDI is intended not only to ensure the long-term availability and quality of research data, but also to establish uniform standards and support services for research data management in Germany. This is intended to lay the foundation for improving scientific collaboration, fostering innovation, and increasing the efficiency and international competitiveness of the research system. At the European level, the NFDI represents Germany as a mandated member of the European Open Science Cloud Association (EOSC), promoting the exchange and reuse of research data across disciplinary, institutional, and geographical boundaries. The NFDI is also actively involved in the internationally operating Research Data Alliance (RDA).

Currently, 26 subject-specific consortia are active within the NFDI, representing the humanities and social sciences, engineering sciences, life sciences, and natural sciences. These typically consist of a lead applicant institution, co-applicants, and participants who are involved to varying degrees in the work of the consortia. Additionally, there are supporters of the consortia who are not formally part of the NFDI consortium but support its work. The consortia comprise research organisations, universities, non-university research institutions, infrastructure providers, libraries and archives, as well as academic societies and associations. The consortia develop solutions to optimise research data management in their respective disciplines. To date, more than 300 institutions are members of the NFDI.

Furthermore, "Base4NFDI – Basic Services for NFDI" (Base4NFDI) was launched during the most recent funding round of the German Research Foundation (DFG) as a joint initiative of all NFDI consortia and is currently being funded by the DFG for five years, from 2023 to 2028. At its core, Base4NFDI operates under the following mission statement: [1]

"Base4NFDI serves as a framework to support the development of a basic service portfolio to meet the needs of the scientific community. Base4NFDI supports the NFDI Sections in identifying basic service candidates, involving relevant stakeholders and existing services, and ensuring their suitability and adoption. It accompanies the development and consolidation of the services in three successive development phases, at the same time leveraging synergies between the NFDI consortia. With a long-term perspective, Base4NFDI contributes to the evolution and innovation of the service landscape."

To achieve this mission, Base4NFDI pursues the following key objectives:

[1] Base4NFDI: Mission statement. Online: https://base4nfdi.de/about/mission-statement [last accessed: 04.07.2025].

- Providing a fair, transparent and coherent framework for the NFDI community to propose, develop and implement potential basic service candidates which can be used by potentially all NFDI-consortia and the wider NFDI-community
- Establishing basic services that are interoperable and contribute to a federated NFDI data infrastructure
- Encouraging community-driven co-design of basic services and support the active participation of the entire NFDI community in the identification, development, and implementation of basic services
- Beyond 2028: Being firmly embedded in NFDI and its international activities (e.g. European Open Science Cloud (EOSC))

Key actors in Base4NFDI are the NFDI sections[2], which have the opportunity to submit proposals for the development of basic services. There are a total of five sections in which cross-cutting topics are discussed that affect either all or many consortia. Within the sections, specific working groups address relevant issues that are important across several or even all disciplines. These working groups consist of members from various consortia and work jointly on the further development of these cross-cutting themes.

The development of basic services follows a three-stage, participatory process – from initialisation, to integration, and finally to full implementation (ramp-up). At each stage of development, the Technical Expert Committee (TEC) evaluates progress and provides a recommendation for decision to the Consortia Assembly, which is composed of the consortia spokespersons. Approval from the Consortia Assembly is required for each development stage, with the threshold for approval increasing at each stage. Phases 1 and 2 of this process may be passed through multiple times by project submissions until the necessary criteria for the next stage are met.

The core team of Base4NFDI consists of four Task Areas (TAs) and Service Stewards (SERs). The four TAs cover the following areas: service initialisation (TA1), service integration (TA2), service coherence and process monitoring (TA3), including Section Liaison Officers (SLOs), and project governance (TA4). The co-spokespersons of the TAs form the Executive Management Committee (MC).

As of July 2025, there have been eight fully completed submission rounds for basic services and the ninth is under review. The table below shows the basic services currently in development.

[2] NFDI: Sections (s.a). URL: https://www.nfdi.de/sections/?lang=en.

Table 1 Basic services under development at Base4NFDI

Service	Description	Phase
IAM4NFDI	Provides identity and access management.	Integration
TS4NFDI	Focuses on the harmonisation and mapping of terminologies	Integration
PID4NFDI	Establishes persistent identifier services for the sustainable identification of research data.	Integration
Jupyter4NFDI	Implements a central JupyterHub for the NFDI community.	Initialisation
DMP4NFDI	Supports the creation of data management plans for research projects.	Integration
KGI4NFDI	Develops infrastructures for knowledge graphs.	Initialisation
nfdi.software	Creates a marketplace for NFDI research software.	Initialisation
RDMTraining4NFDI	Research Data Management Training for the NFDI.	Initialisation

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1.2 Goals and context of the evaluation

To evaluate Base4NFDI effectively, it is crucial to consider the current state of its three-stage funding model for developing basic services. Since its inception in 2023, eight submission rounds for basic services have taken place until July 2025. As of this date, four basic services have progressed to the second development phase (integration), while four additional services are in the first stage (initialisation).[3] Notably, none have yet advanced to the final ramping-up phase.[4] In addition, the evaluation must account for the high level of heterogeneity among stakeholders who represent a wide range of research disciplines. This complexity is further compounded by the staggered launch of NFDI consortia across three distinct funding periods between 2020 and 2023. Whilst some consortia are already fully operational, others remain in their early stages of development. Finally, it is important to acknowledge that Base4NFDI itself was established during the last funding round in 2023 and was required to develop its processes and internal structures in the course of ongoing operations.

Since the project Base4NFDI is still ongoing and none of the basic services have yet reached the final development stage, the main focus of this evaluation is on the processes, the project structure of Base4NFDI, and its relevance to its stakeholders.

Besides the evaluation of Base4NFDI[5], several other evaluations and studies are currently being carried out in the NFDI environment: The structural evaluation of the NFDI is conducted by the German Science and Humanities Council (Wissenschaftsrat, WR).[6] Additionally, the German Research Foundation (DFG) assesses the work of the individual consortia. Complementing these efforts, the DZHW carries out accompanying research for Base4NFDI, focusing on a systematic impact assessment.

Figure 1 illustrates the goals of the evaluation. Overall, the evaluation seeks to evaluate the efficiency and effectiveness of the project structure of Base4NFDI and its established processes.

[3] As of July 2025, the ninth submission round is under review.

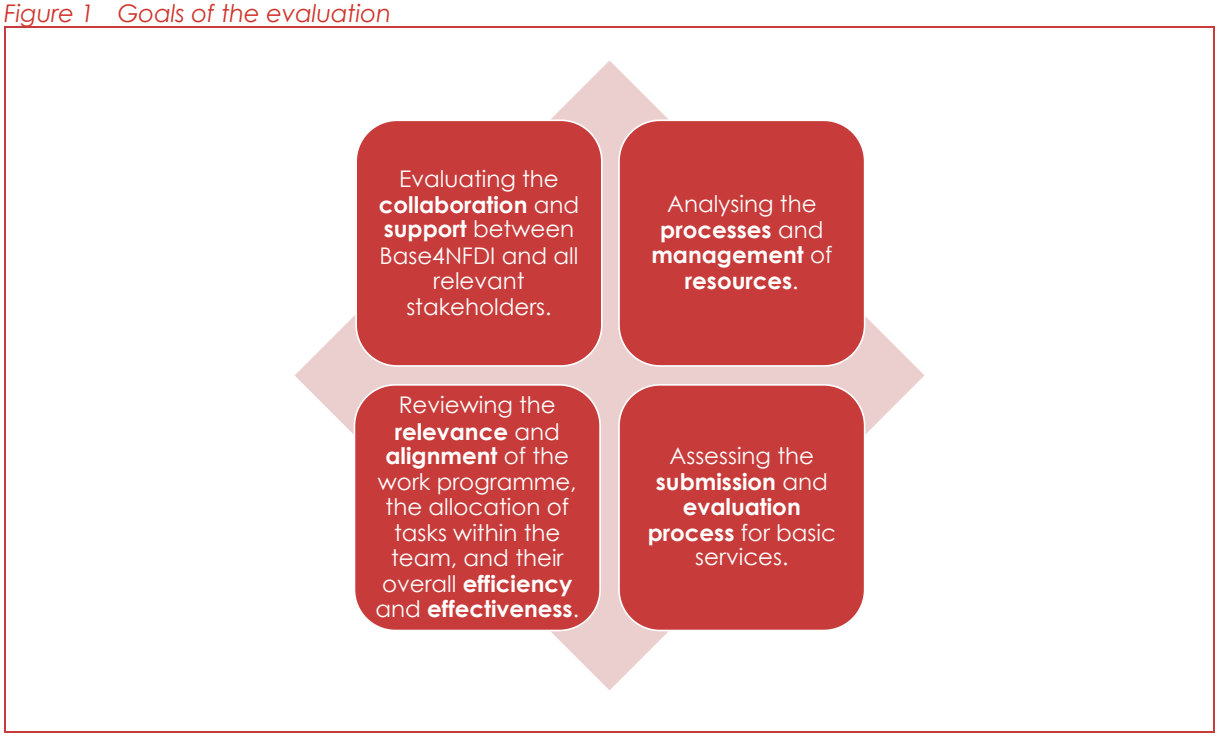
[4] The Base4NFDI proposal forsees that services enter the ramping-up phase in the fourth year of development.

[5] The evaluation was funded by DFG as part of NFDI. Grant Number 5521463400.

[6] Wissenschaftsrat (2025): Strukturevaluation der Nationalen Forschungsdateninfrastruktur (NFDI). URL: https://www.wissenschaftsrat.de/SharedDocs/Pressemitteilungen/DE/PM_2025/PM_1325.

Furthermore, the evaluation examines the relevance of the developed basic services for the consortia members in the NFDI community.

Figure 1 Goals of the evaluation



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This evaluation report is structured as follows: Chapter 2 presents the evaluation approach where we present our understanding of the impact logic of Base4NFDI as well as the evaluation questions and the scope and analytical levels of the evaluation. Furthermore, the evaluation concept and data collection methods are presented. In Chapter 3–5, we present the empirical results of the evaluation covering the internal structures of Base4NFDI, the process for developing basic services and their relevance to its stakeholders. Each of these chapters concludes with a sub-chapter, where we provide answers to the respective evaluation questions. In Chapter 6, we provide recommendations for actions to further optimise Base4NFDI.

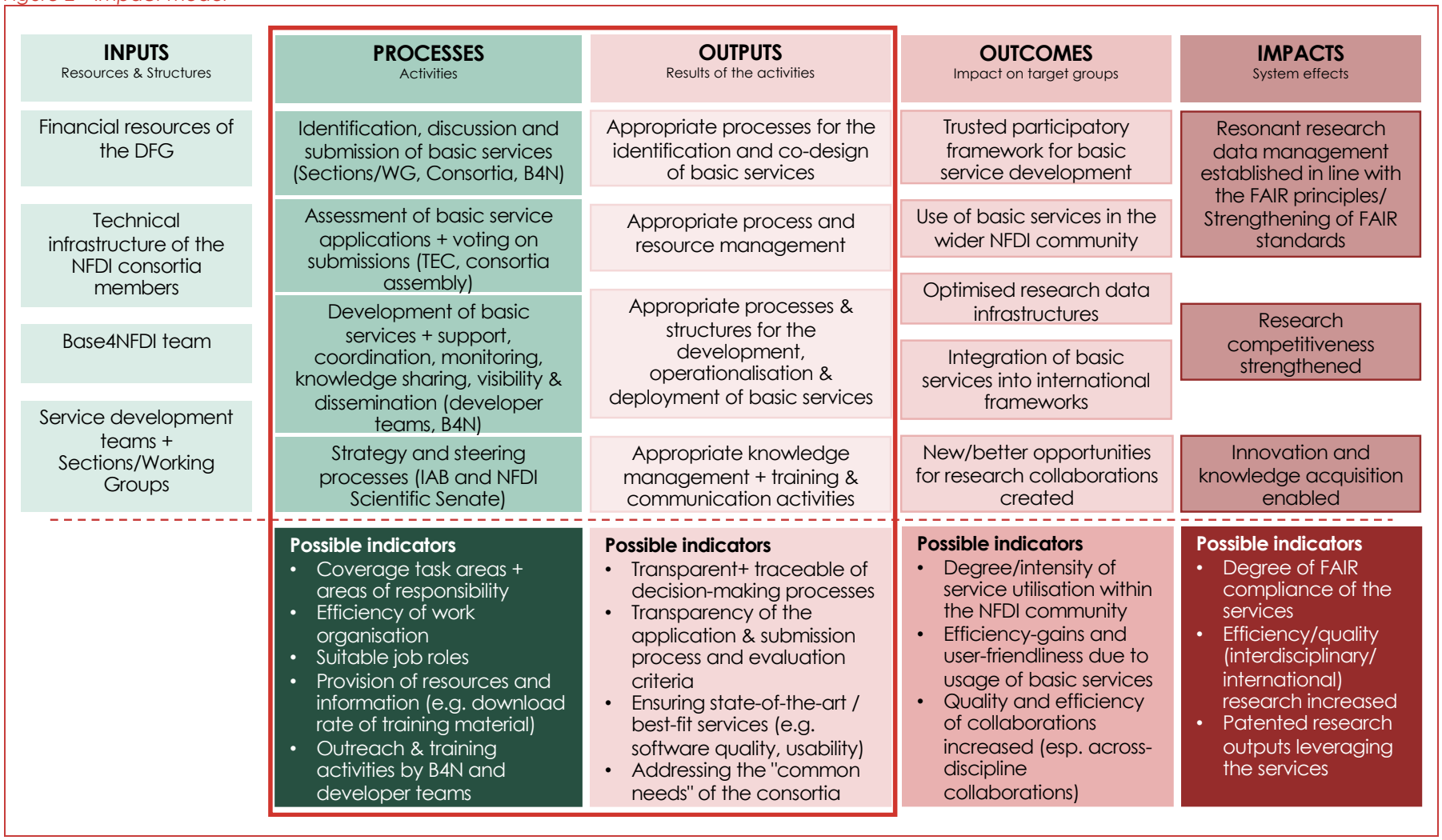
2 Evaluation approach

2.1 Impact model

Figure 2 illustrates our understanding of the project's impact logic, which forms the foundation of our evaluation approach. The impact model is structured into inputs (resources and structures), processes, outputs (direct results of inputs and processes), outcomes (effects on the target audience), and impacts (long-term systemic effects). At the **input** level, key elements include the financial resources provided by the DFG to fund Base4NFDI, the technical infrastructure supplied by NFDI consortia/members for service development, and the work undertaken by the sections and especially the development teams and the Base4NFDI team. The **processes** encompass identifying, discussing and proposing basic services for development as well as processes for assessing and voting on such proposals. The technical

development processes are accompanied by activities to promote the visibility and deployment of basic services in the consortia (e.g. outreach, training, knowledge sharing). Furthermore, overarching strategic and management processes support the project. At the **output** level, the impact model aims for adequate collaborative processes for identifying, developing and deploying basic services while ensuring adequate process and resource management and conducting adequate training and communication activities. The **outcomes** for the NFDI community include a trusted participatory framework for developing basic services which serves as a basis that the developed services are deployed and used in the (wider) NFDI community and integrated into international research data frameworks such as EOSC. Further outcomes include optimised research data infrastructures and (cross-disciplinary) research collaborations. As a long-term systemic **impact**, the goal is to establish sustainable research data management aligned with the FAIR principles, thereby enhancing research competitiveness and fostering innovation. Given the current developmental stage of the services, the **evaluation primarily focuses on the processes and outputs** (highlighted in red).

Figure 2 Impact model



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2.2 Evaluation questions and analytical levels of the evaluation

The key questions for evaluating Base4NFDI can be clustered into **three different levels** (see Table 1). **Level 1** addresses the **internal structure** of Base4NFDI and examines the roles of project members, the work organisation and the collaboration within the Base4NFDI team (meaning Task Areas (TAs) and Service Stewards (SERs)). Here, the aim is to assess how well the project structure works, whether the objectives defined in the project proposal are being achieved and whether the available resources are being used efficiently.

Level 2 aims at the decision and **development process** for basic services and can be sub-grouped into:

- **Submission process**: the processes for discussing, identifying and proposing basic service candidates (in the consortia/sections/working groups)
- **Evaluation and decision-making process** for basic service candidates (decisions in the Technical Expert Committee (TEC), the Consortia Assembly as well as in the consortia)
- the **processes for developing and deploying basic services** (three-stage development process, activities for promoting and deploying basic services

Finally, the **relevance** of the developed basic services for the NFDI community and **strategic aspects** of Base4NFDI are addressed in **level 3**.

Several **interlinkages between the levels** exist. For instance, actors which are involved in level 2 are supported by the Base4NFDI team, stakeholders which are the target group of level 3 (consortia members) might also be involved in processes of level 2.

Table 2 Levels of the evaluation with evaluation questions

Level 1	Key questions
Level 1: Internal structure, roles & areas of responsibility	• Are the Task Areas defined in the proposal adequately staffed and covered? (Relevance) • Are all the responsibilities mentioned in the proposal adequately addressed? (Effectiveness) • Do internal communication and organisational workflows function efficiently? (Efficiency) • Do the job profiles align with the project's requirements, and are tasks clearly communicated? (Efficiency) • Are there tasks that cannot be completed due to a lack of resources? (Efficiency) • Are all necessary resources and information provided to the relevant stakeholders? (Efficiency)
Level 2: Basic services development	• Are the reasons for adjustments, such as costs or new/unanticipated tasks, comprehensible? (Effectiveness) • Are the decision-making processes and the subsequent allocation of funds, transparent and understandable for stakeholders? (Efficiency) • Is the proposal submission process transparent and fair? (Coherence) • Are the criteria for evaluating incoming proposals clearly communicated? (Coherence) • Does the technical expertise within the TEC (Technical Expert Committee) complement each other in evaluating proposals? (Coherence) • Does the process ensure that the "common needs" outlined in the proposal are identified and addressed through basic services? (Effectiveness) • Are NFDI structures sufficiently involved? (Effectiveness) • Is the development process regularly analysed and improved? (Efficiency)

	• How do various external stakeholders assess cooperation with Base4NFDI, particularly with the Service Stewards and Section Liaison Officers? (Relevance)
Level 3: Relevance of the project for the NFDI community	• Is Base4NFDI achieving the objectives set at the time of evaluation, in line with the work programme and stakeholder expectations? (Relevance) • Has the work programme been adapted to meet any emerging needs? (Effectiveness) • Does the process ensure that the basic services are state-of-the-art and best suited to requirements, while also guaranteeing integration into international initiatives? (Effectiveness, Coherence)

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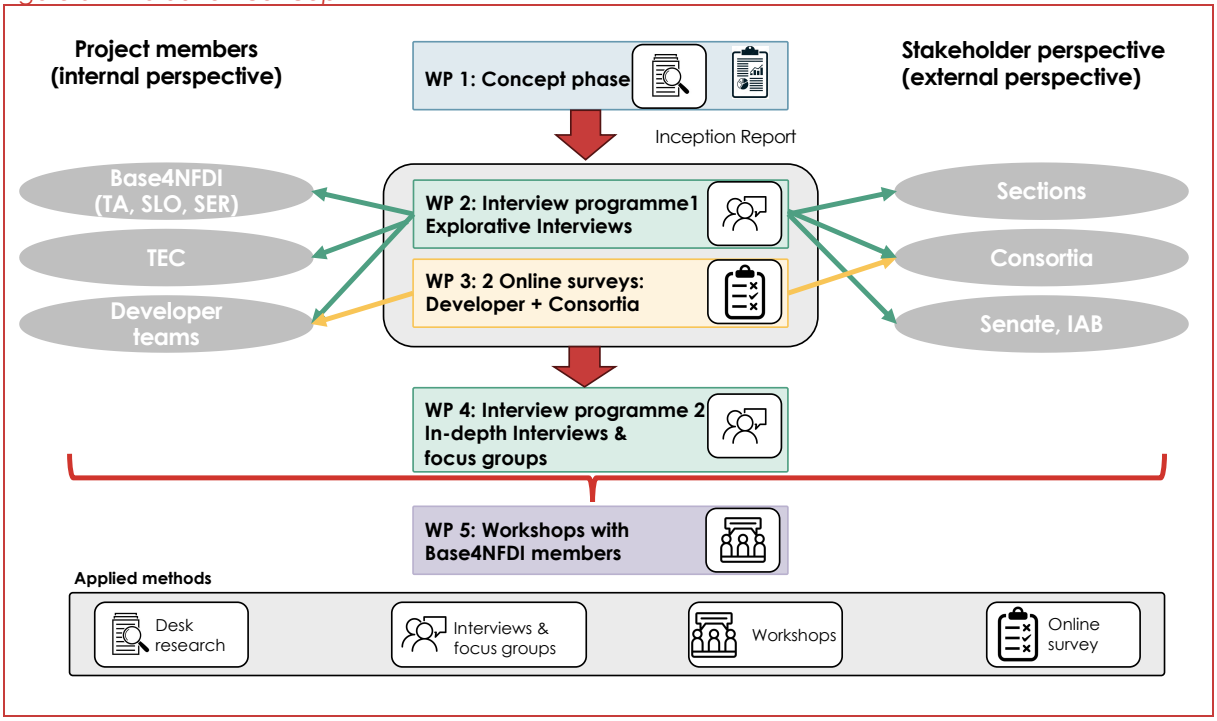
2.3 Evaluation concept

Overall, Base4NFDI has **many different groups of actors and stakeholders** which are relevant for multiple levels of the evaluation. These include the NFDI consortia and sections, the basic service developer teams, the TEC and the Base4NFDI team. In addition, several strategic bodies are relevant for the project, e.g. the NFDI Scientific Senate, the International Advisory Board (IAB), the Rat für Informationsinfrastrukturen (RfII) and the Wissenschaftsrat.

In order to adequately and comprehensively consider these different perspectives and to examine them in more depth at appropriate points, we conducted an **evaluation with a formative character,** which **sequentially examined and compared the perspectives of actors involved in the process and other stakeholders** to identify potentials for optimisation. To this end, the **internal perspectives of the project participants** who are directly involved in the Base4NFDI (Base4NFDI Team, TEC, developer teams) are contrasted with the "**external perspectives**" of those stakeholders who identify potential basic service candidates (sections) and those who are meant to use it (members of the NFDI consortia) or strategically advise the project (e.g. IAB, Scientific Senate of the NFDI).

By comparing these perspectives, the strengths, divergences and needs for action could be systematically identified for the project. Based on this comparison, we carried out an **in-depth analysis** to shed light on existing differences in more detail and to identify possible solutions. The insights gained from the sequential survey of views were then brought together and finally reflected on and discussed with the Base4NFDI team. Based on this, recommendations for action for the further development of the Base4NFDI framework were developed. The evaluation concept is presented in Figure 3.

Figure 3 Evaluation concept



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2.4 Data collection and methodology

We used a **mix of qualitative and quantitative methods** to operationalise the key questions of the evaluation appropriately. Therefore, we conducted an interview programme, in which we gathered insights from various internal and external stakeholders of Base4NFDI. Furthermore, we conducted two online surveys – one with the developer teams of Base4NFDI basic services and another one with persons involved in the NFDI consortia who are familiar with Base4NFDI and its basic services. Based on the preliminary results, we identified four broader topics (internal structures of Base4NFDI, the development process of Base4NFDI, evaluation and decision-making processes, sustainability of basic services) which we discussed in in-depth focus groups with various Base4NFDI actors. Moreover, we conducted a smaller, second interview programme on Base4NFDI incubator projects. Finally, we discussed our findings with members of Base4NFDI in a validation workshop.

2.4.1 Interview programme

Guideline-based interviews are a key component of all areas of analysis, covering internal structures of Base4NFDI, the development process including evaluation and decision-making on basic service submissions as well as the relevance of basic services.

The interviewees were identified based on programme documents and desk research, in coordination with the client. The interviews were conducted in a semi-structured manner using an interview guideline that was also agreed upon with the client. The guideline can be found in Appendix B. Most topics of the guidelines were largely applicable across many target groups, allowing the areas of investigation to be considered from different perspectives. The emphasis placed on certain topics and any omissions of questions for specific target groups are marked in the guideline.

The interviews were generally conducted by video conference and lasted between 45 and 60 minutes. They were documented in written form and entered into an analysis matrix for

systematic evaluation. Interviewees were not cited by name. Table 3 provides an overview of the interviews conducted and their distribution across target groups.

During our main interview programme, which was conducted in March 2025, we spoke to various internal and external Base4NFDI stakeholders. Examining the internal perspective, this involved interviews with at least two persons of each Base4NFDI TA (including SLOs) – covering the spokespersons' and members' perspective, a group interview with SERs, members of the TEC and Principal Investigators (PIs) of the developer teams. To explore the external perspective, we interviewed members of the International Advisory Board (IAB) of Base4NFDI, spokespersons of all five NFDI sections as well as consortia spokespersons/coordinators of the three different NFDI funding rounds. It is important to note that some interviewees are involved in multiple areas of Base4NFDI and hence represent multiple perspectives on the project.

In total, we interviewed 31 people involved in Base4NFDI in our main interview programme, in addition to four scoping interviews.

Table 3 Interview programme: Number of interviews per stakeholder group

Stakeholder group	**Number of interviews**
Base4NFDI TAs and SERs:	10
TA1 (Service Initialisation)	(2)
TA 2 (Service Integration and Ramping up for Operation)	(2)
TA 3 (Service Coherence Processes and Monitoring), including SLOs	(2)
TA 4 (Project Governance)	(3)
Service Stewards	(1, group interview)
PIs of developer teams	6
Section (co-)spokespersons	5
Consortia spokespersons/coordinators	5
TEC members	3
IAB members	2
Total	**31**

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2.4.2 *Online surveys*

Parallel to the interview programme, we launched two online surveys to quantitatively back our qualitative findings from our interviews for both the internal perspective (developer teams) and the external perspective of Base4NFDI (consortia members). Charts which are coloured in blue in this evaluation report denote results from the developer teams survey and charts in red indicate results from the consortia survey.

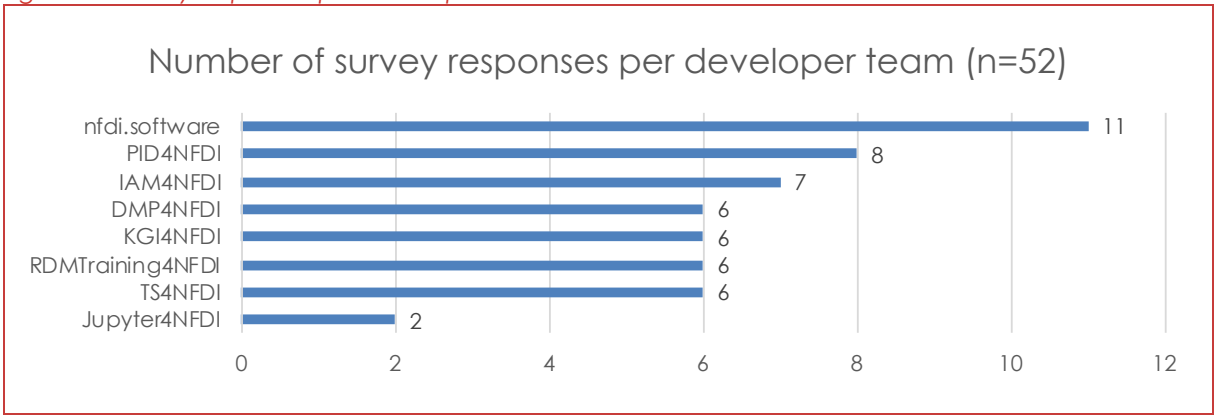
2.4.2.1 Survey of developer teams

Regarding the internal perspective, we surveyed the eight developer teams of Base4NFDI basic services, which had already begun service development before the evaluation started in December 2024. Figure 4 shows the survey responses per developer team. All people that were listed as members of the developer teams received a personal invitation link for the survey. The online survey started in mid-March 2025 and was online for about four weeks. Two reminders were sent to the participants.

Respondents were asked to confirm if they are indeed members of a developer team: Three persons indicated that they are not part of any developer team and therefore were excluded from the survey. Excluding those, 101 persons were invited to the survey, 38 answered the survey completely and 14 partially. This results in a response rate of 51 % for all answers and of 38 % for fully completed responses which can be considered a high response rate compared to other evaluations.

A very small fraction of respondents is involved in multiple developer teams. They were asked to choose for which basic service they would like to answer the survey. Since the developer teams are of different sizes, the opinions of some services might be overrepresented in the survey. However, members of all eight developer teams responded. Figure 4 shows the responses per developer team.

Figure 4 Survey responses per developer team



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Furthermore, survey respondents have been asked several questions about how they are involved in NFDI structures and for how long they have been working in the developer team. 40 % of respondents indicate that they are not involved in the work of consortia while the remaining 60 % are involved in at least one NFDI consortium. Respondents are particularly active in NFDI4ING (15 %). Overall, respondents are active in a total of 16 distinct consortia. Most of the respondents have already been part of the developer team for a longer period – most likely since the start of the development process. 44 % state that they are part of their developer team for over a year, while 27 % answer, respectively that they are part of the developer team for 6-12 months or less than half a year.

2.4.2.2 Survey of consortia

We conducted another survey with respondents from NFDI member institutions who are involved in any of the 26 NFDI consortia to represent the external perspective of Base4NFDI. As no complete contact lists are available, we contacted the consortium coordinator of each consortium and asked them to distribute the survey with persons in their consortium who are aware of the Base4NFDI project and the types of services being developed there. We asked them to distribute the survey to at least 25 people in their consortium. However, several consortia coordinators responded that the number of suitable respondents for this survey in their consortia would be far below the target number of 25 respondents, resulting in a far lower sample size than originally envisioned. To document response behaviour in each consortium, we used unique survey links which allowed us to track if the survey had been distributed in all

consortia and to assign each respondent to a consortium.[7] The online survey started in mid-March and ended in mid-April. Two reminders were sent to each consortium coordinator, including information on the current number of respondents from their consortium. This allowed the coordinators to track how many individuals from their consortium had participated.

Respondents were also asked to confirm they are part of the attributed consortium or if they would like to answer the questions on behalf of another consortium (e.g. if they are part of multiple consortia). 10 respondents indicated that they are not aware of Base4NFDI which led them directly to the end of the survey. Out of the remaining 201 respondents, two thirds answered the survey completely and one third partially. However, the data is not equally distributed across consortia, the four NFDI scientific disciplines and the three NFDI funding rounds. Almost half of respondents are part of a consortium of the first funding round, 34 % from a second-round consortium and 17 % of a third-round consortium. Table 4 displays the number of respondents by funding round.

Table 4 Number of consortia survey respondents by funding round

NFDI funding round for consortia	Number of respondents (fully completed survey responses in brackets)	Share (share of fully completed survey responses in brackets)
Funding Round 1	94 (63)	47 % (47 %)
Funding Round 2	68 (45)	34 % (34 %)
Funding Round 3	35 (24)	17 % (18 %)
Not assigned	4 (2)	2 % (1%)

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Table 5 shows the number of respondents by scientific discipline. 35 % of respondents belong to a Life Sciences Consortium, almost 30 % to a consortium from Natural Sciences, Humanities and Social Sciences are represented by almost 20 % of respondents and Engineering by around 14 %. On average, around 7 persons answered per consortium (Median: 6). The lowest number of responses of a consortium is 2. The highest number of respondents came from the following consortia: NFDI4Chem (22), NFDI4Health (19), and NFDI4Biodiversity (17). The presented numbers suggest that third-round consortia and the Engineering field might be underrepresented in the survey. However, the actual population data is not known, and it could also be possible that third-round consortia and Engineering sciences are yet involved to a lesser extent in Base4NFDI. Despite that, members of all consortia participated in the survey.

Table 5 Number of consortia survey respondents by scientific discipline

Scientific discipline	Number of respondents (in brackets: fully completed survey responses in brackets)	Share (in brackets: fully completed survey responses in brackets)
Life Sciences	71 (43)	35 % (32 %)
Natural Sciences	60 (45)	30 % (34 %)

[7] A small number of less than five respondents could not be assigned to any consortium. In some cases, respondents could be attributed to a scientific field based on the institution they indicated they work for. The respondents were kept for the aggregated survey analysis but were excluded from disaggregated analyses by funding round or scientific field.

Humanities and Social Sciences	40 (32)	20 % (24 %)
Engineering	28 (13)	14 % (10 %)
Not assigned	2 (1)	1 % (1%)

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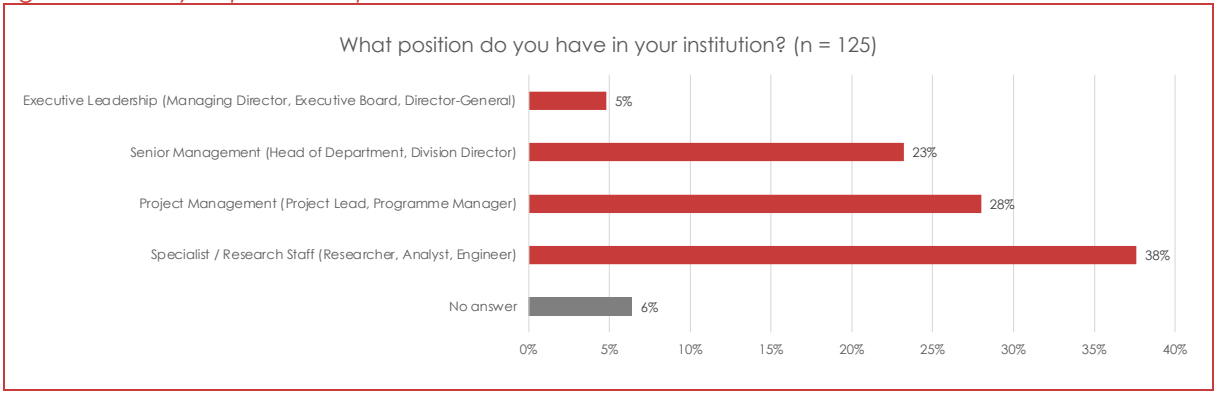
The majority of respondents were specialists or research staff (38%), followed by project managers (28%) and senior managers (23%). Executive leaders accounted for 5% of responses, while 6% did not indicate their role.

Figure 5 Survey respondents' position at their institutions



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2.4.3 *Deep-dive interviews, focus groups and validation workshop*

After conducting the interview programme and the online surveys, we identified four key topics which required closer examination in focus groups that bring together various stakeholders involved in the respective topic. The four identified topics for the focus groups were:

- internal structures of Base4NFDI,
- basic service development,
- evaluation and decision-making on basic service submissions and
- the sustainability of basic services.

The goal of the focus groups was to validate and challenge initial findings from the surveys and interviews. Furthermore, the focus groups aimed at exploring underlying reasons and motivations for the preliminary findings, clarify ambiguities and understand stakeholder perspectives in greater depth. Moreover, ideas and solutions to address the identified problems or gaps were discussed.

Each focus group was scheduled to last 1 h 45 min. After a short input from the evaluation team on the preliminary findings of the evaluation, the focus group participants discussed the respective overarching topic along a set of guiding questions. Table 6 gives an overview of the topics discussed per focus groups and the set of participants in each focus group.

Table 6 Focus groups

Date	Topic / Participants (stakeholder groups) / No. of participants	Guiding questions
20.05. 2025	**Basic service development** Participants • SER • TA3 • Developer teams Number of participants: 6	• How can administrative burdens on developer teams be effectively reduced, particularly during critical phases of basic service development? • How can the development and implementation processes be made more flexible to better support diverse service needs and improve planning security? • How clear and effective is the communication with Base4NFDI for developer teams – particularly regarding responsibilities, support roles, and points of contact such as Service Stewards and Section Liaison Officers? How can communication be improved? • Are the evaluation criteria for basic services appropriate, fair, and transparent – and do they adequately reflect the diversity of services being developed? If not, how should adequate criteria look like?
22.05. 2025	Topic: **Evaluation and decision-making process** Participants • TEC • Consortia/Consortia assembly • NFDI senate • TA4 Number of participants: 5	• How do you define a basic service? What purpose should they serve? Which are the target groups of basic services? • What criteria should be most relevant to evaluate basic services? • Should basic services be proposed using a bottom-up approach or rather a top-down strategic perspective? How can both approaches be consolidated effectively? • How do you consider the evaluation process and the actors involved (Consortia Assembly, TEC, senate) – what role should they play in the process? • Should decision-making processes within consortia be harmonised?
22.05. 2025	**Internal structures** Participants • TA1 – TA4 • SER • SLO Number of participants: 6	• How well does internal coordination work from your point of view? Where do you see room for improvement? • How should roles be allocated between team members and spokespersons? • How should they be allocated between TAs, SLOs and SERs? • How should staff resources be allocated? Does the current structure sufficiently allow for a flexible allocation of staff resources? • How can the application/submission process for basic services be improved? • How can administrative burdens for developer teams be reduced? How should the administrative process look like? • How can Base4NFDI help to increase the visibility, transparency and accessibility of the sections?
28.05. 2025	**Sustainability of basic services** Participants • TA1 / TA2 • Consortia • Sections • Developer teams • NFDI Office Number of participants: 8	• Which are the target groups of basic services, both within and beyond NFDI? • How can Base4NFDI support in securing the long-term sustainability of basic services? What role should other actors play (e.g. NFDI, sections, consortia infrastructure providers etc.) • How can long-term development, maintenance and operation of basic services be secured? What funding models are imaginable? What is needed to get to a sustainable funding model? • How can Base4NFDI projects secure firm commitments from consortia when the financial sustainability and the operational specifications of the services are still uncertain? • How should the Base4NFDI tool pool be designed? What can/should happen to services that do not reach the final development phase? • How can third round consortia be better integrated in the process?

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Besides, we conducted 4 further interviews with incubators from IAM and TS4NFDI. For each basic service, we interviewed one member of the developer team and one person which was responsible for implementing the incubator project in their consortium/home institution. The interviews focused on the current state of the incubator projects and the lessons that can be learned for future initiatives. The interview guide can be found in appendix B.

Eventually, the results of the evaluation were discussed in a validation workshop with members of the Base4NFDI team. Members and/or co-spokespersons from each TA participated in the workshop, as well as several service stewards. The goal of the workshop was to validate and discuss our empirical results and to discuss recommendations for action which were developed by the evaluation team.

3 Internal structures of Base4NFDI

3.1 Internal structures and collaboration

To guide and support the development of basic services, four Task Areas (TAs) were established. Each TA consists of three Co-Spokespersons and staff members. The Co-Spokespersons are infrastructure experts and employ staff members through their research organisations. The employees are predominantly employed full-time.

TA1 (Service Initialisation) and TA2 (Service Integration and Ramping up for Operation) support the basic services as they go through the different development phases. TA3 (Service Coherence Processes and Monitoring) is responsible for setting up coherent processes and monitoring the progress of all services. TA4 (Project Governance) is the main coordinating point for all involved stakeholders within Base4NFDI and the NFDI and is also responsible for the overall project management and communication.

It is important to note that Base4NFDI was established within a complex environment and had to be integrated into ongoing operational processes. At its inception, some consortia were already fully operational, while others were only beginning their activities. At that stage, activities in the sections were still in their infancy and considerably less developed than they are today. Furthermore, Base4NFDI introduced an entirely new model of collaborative service development. Consequently, Base4NFDI deliberately defined certain tasks and processes broadly, allowing procedures and structures to adapt to emerging needs. Additionally, new and complex roles, such as Section Liaison Officers and Service Stewards, were established. The Service Stewards were intentionally appointed as a self-organising team, independent of Co-Spokespersons or higher authority, to encourage broad participation from diverse organisations. Because these positions were new, their roles and responsibilities had to be developed and clarified in the course of the process. At the same time, significant pressure to succeed existed, as no preparatory phase preceded the first call for basic service submissions. As a result, many areas had to be developed in parallel with the first basic service projects undergoing their development phases. This parallel progression was particularly challenging during the initial submission rounds, which encompassed all processes critical to service delivery. Although many processes have now been established, this process is still ongoing. As of July 2025, the first ramp-up phase is set to begin, requiring all associated processes and content to be fully established.

The interviews with members of all TAs show that the **staff is overall content with the roles and distribution of tasks between TAs**. In general, there are no major changes on how tasks are completed compared to how it was originally intended in the project proposal. The clear distribution of tasks emerged in the course of the project which required individual initiative from the staff. Interviewed members of the TAs generally describe both their own TA members (coming from different institutions) as well as members of other TAs as highly committed and capable of organising themselves effectively to complete all assigned tasks. However, interviewees mention some **overlaps between TA1 and TA2** (e.g. when service reaches a new development phase) and **TA3 and TA4** (e.g. monitoring and reporting of services). To manage these intersections, ad hoc task forces have been established to coordinate efforts and ensure alignment across activities. All TAs report that the **workload is manageable** with the current staffing. However, at the time of the interviews, **not all positions had been filled** (e.g. SLOs, TA2), and vacancies were still being gradually addressed. Compounding these challenges, several staff departures occurred during the early stages of Base4NFDI. This understaffing caused delays in some tasks, leading to dissatisfaction among team members. Due to missing staff, TA2 was not fully able to support the preparation of basic service applications at the early phase

of Base4NFDI. The necessary requirements for basic service applications were misleadingly described in the application template. This created barriers for developer teams in the integration phase submission process. Furthermore, not all planned positions for Section Liaison Officers (SLO) could be filled initially. The first SLO started, as planned, at the end of 2023. Although further positions were filled in 2024, turnover delayed full capacity until early to mid-2025. Since each SLO is assigned to specific sections, the vacancies meant that not all sections could be monitored equally. During this period, the most critical TA3 tasks had to be prioritised, such as developing and updating templates. While efforts were made to monitor all sections equally, staffing vacancies meant some sections received less coverage than others, since each SLO is originally responsible for only a subset of sections. Despite that, SLOs were able to fulfil their core responsibilities and tasks, though limited personnel resources prevented them from reaching their full potential. Since then, all of these positions have been filled, or are in the final stages of recruitment. With the team now fully staffed, there is shared optimism that this potential can now be fully leveraged

Overall, Service Stewards (SER) are also satisfied with their tasks and roles. However, some wish for more resources to support the developer teams (e.g. also being involved in strategic discussions) – rather than focusing on bureaucratic tasks. Compared to the Task Areas, the SERs are not structured with co-spokespersons and formal members. In a group interview, they describe themselves as a self-organising team without designated leaders. They support, coach, and develop each other and report that the internal support works well and that onboarding of new SERs has been going smoothly.

The multi-stakeholder structure of Base4NFDI also demands project management skills at the operational level. Some interviewees note that this was particularly challenging for younger colleagues with less work experience and highlight the need for guidance. An onboarding process is in place for new staff members and has been continuously improved throughout the project. In particular, understanding the structures of NFDI and Base4NFDI requires time and support for new team members.

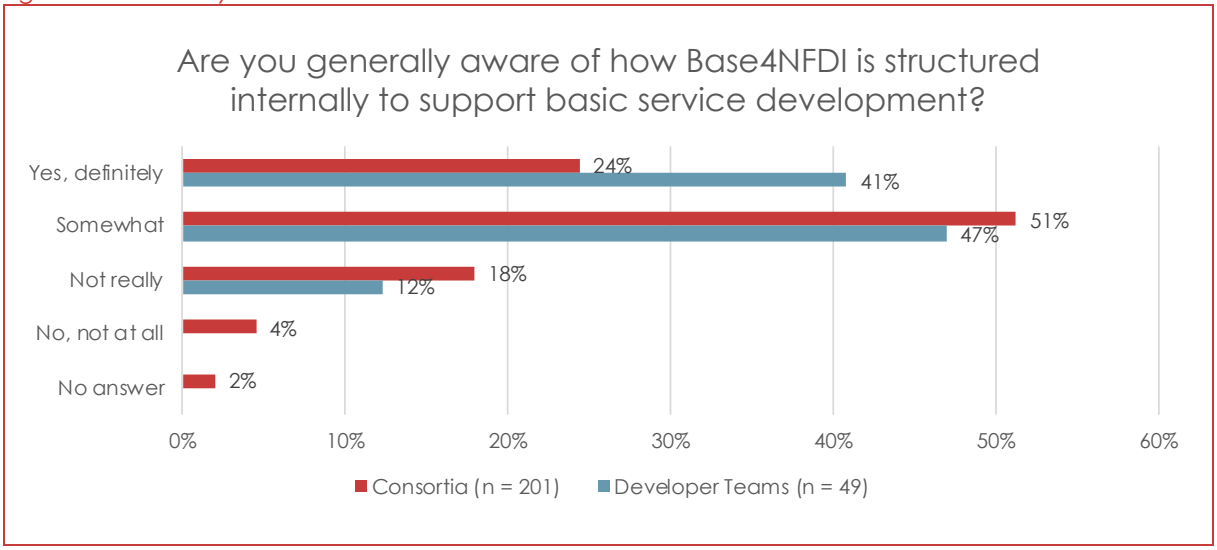
The staff members are generally satisfied with internal communication and collaboration, as expressed in the interviews. For collaboration and communication, the teams utilise several channels such as emails, OpenProject, Rocket Chat, and Google Drive. Interviewees describe the communication atmosphere as solution-oriented and collegial. However, **cross-institutional coordination within and between TAs remains challenging**, as limited steering options increase the effort required for coordination. Several interviewees note that the Co-Spokespersons have limited interaction with the TAs. In some cases, their involvement in multiple other projects restricts the time they can dedicate to Base4NFDI, which in turn delays decisions that require their input. While the Co-Spokespersons meet bi-weekly in the Management Committee for coordination and joint decision-making, the infrequency of these meetings can significantly slow down decision-making processes. If a decision is not reached during a Management Committee meeting, it may be delayed in some cases by another two weeks. However, the Management Committee is viewed positively for high-level coordination, but there is a **desire for more working-level coordination mechanisms** – for example, better coordination of tasks within individual TAs – since some decision-making processes take a long time. To address this, members of the TAs also suggest increasing the frequency of coordination and communication between Co-Spokespersons. Another recommendation was to empower certain team members to coordinate specific tasks independently, without needing authorisation from the Co-Spokespersons. Additionally, team members express a wish for feedback mechanisms from team members to Co-Spokespersons, such as employee appraisals, trainings, and project issue reporting.

3.2 Clarity of contact points with other stakeholders

The roles and task distribution within the TAs are generally clearly defined as described above. However, survey results from both the consortia and developer teams paint a more nuanced picture. While a majority in both groups report knowing whom to contact within Base4NFDI, a notable share – particularly within the consortia – still indicate uncertainty or lack of clarity regarding contact points.

As illustrated in Figure 6, the majority of respondents are (somewhat) aware of the Base4NFDI structures that support the development of basic services (75 % of consortia respondents and 88 % of developer teams). Additionally, 73 % of consortia respondents and 92 % of developer team respondents state that they have already been in contact with someone from the Base4NFDI team.

Figure 6 Familiarity with internal structures of Base4NFDI



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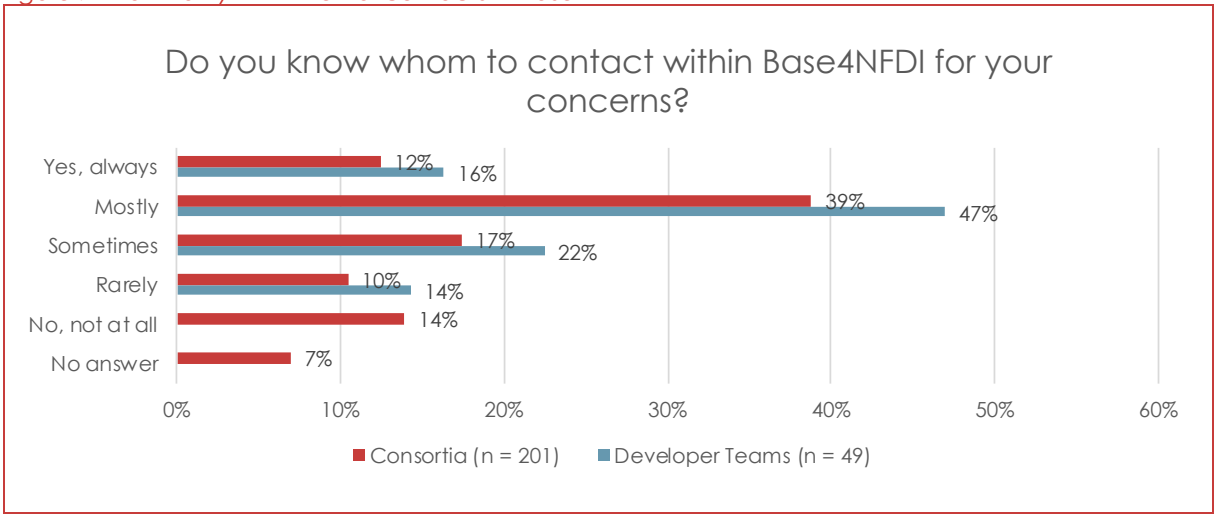
Furthermore, as shown in Figure 7, most respondents also report that they (mostly) know the appropriate contact person within the Base4NFDI team for addressing their concerns. Among the consortia, 51% indicate clear awareness, combining 12% who answered "Yes, always" and 39% who selected "Mostly". Developer teams show even greater clarity, with 63% responding either "Yes, always" (16%) or "Mostly" (47%). However, 24% of consortia and 14% of developer teams reported that they "Rarely" or "Never" know whom to contact, highlighting some remaining gaps in communication – particularly within the consortia.

Figure 7 Familiarity with internal contacts in Base4NFDI



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The interviews with the TAs reveal that the contact points to the Base4NFDI team are mostly – but not always – clear to consortia and developer teams. Some enquiries do not end up with the person responsible. However, requests are re-directed fast and efficiently between TAs. In this context, the survey shows that the developer teams mainly use their SER as a contact point. The SER then forwards enquiries to the responsible persons in the TA. Consortia use various contact points for their inquiries.

Interviews with the TAs – as well as survey results – reveal that the **points of contact within the Base4NFDI Team are generally – though not always – clear to consortia and developer teams**. Some enquiries do not initially reach the responsible person. However, requests are quickly and efficiently redirected within the TA.

Figure 8 and Figure 9 respectively show how consortia survey respondents and developer team respondents assess the clarity of contact points.

The survey responses indicate a somewhat fragmented communication landscape regarding basic service-related queries. While the Base Office (TA4) and SERs are frequently identified as key contacts – particularly for training (31 %) and outreach (30 %) – a significant number of respondents would contact someone they know without clarity on their role (up to 22 %). Members of the respondents' own consortia are also commonly approached, especially for queries on submission (23 %) and decision-making processes (25 %). Overall, the results suggest overlapping responsibilities in some respects. Several survey respondents commented that they do not consider it important to know the roles of all TAs, as long as their requests are processed – which they report is the case.

The developer teams survey indicates that they primarily use the SER as their main contact point (see Figure 9). The SER then forwards enquiries to the responsible individuals within the TA. The majority of respondents direct queries regarding the development process and support of basic services primarily to Service Stewards, with 55 % identifying them as their main contact. Service Stewards also play a significant role in outreach (50 %) and submission processes (38 %). The Base-Office (TA4) is notably involved in outreach (25 %) and training activities (31 %). A small proportion of respondents are unsure of whom to contact, indicating some uncertainty around roles. Contact with members of developer teams and other TAs is less common.

Interviewed Principal Investigators (PIs) from the developer teams highlight that **SERs provide good support as point of contact for the developer teams**. Whereas some consortia survey

respondents emphasise that they would like to have a clear point of contact to Base4NFDI. Furthermore, the **role of SLOs could be communicated more clearly**, particularly regarding their function as a contact point for specific sections. Participants in the focus groups with developer teams mention that it remains unclear whether SLOs also serve as contact points for the consortia. To improve the identification of responsible contacts, some survey respondents suggested naming the TAs according to their function rather than numbering them from 1 to 4. In fact, each TA has already been named after its function – in addition to being numbered. However, official communications primarily refer to TAs by their number rather than by name, partly for the sake of brevity. Additionally, several respondents from both surveys express a **desire for more streamlined communication**, as receiving requests and information from multiple TAs increases their workload.

Figure 8 Consortia survey: Clarity of contact points

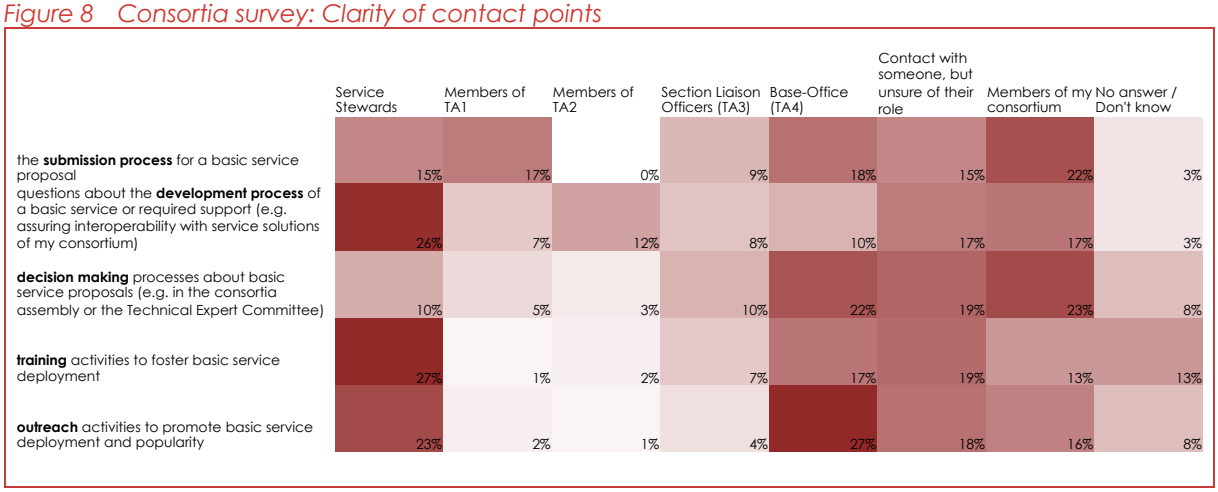

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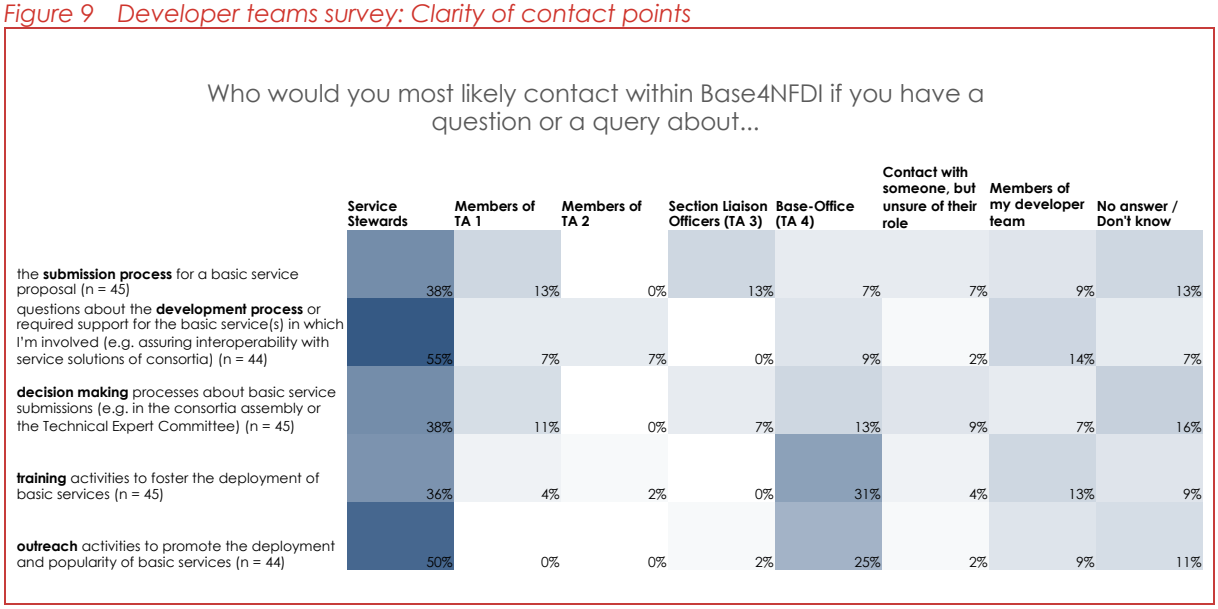
Figure 9 Developer teams survey: Clarity of contact points



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3.3 Overall assessment on internal structures

This section presents the conclusions of the evaluation for the internal structures of Base4NFDI. The results are presented along the evaluation questions (highlighted in red).

Are the Task Areas defined in the proposal adequately staffed and covered?

Are all the responsibilities mentioned in the proposal adequately addressed?

Are there tasks that cannot be completed due to a lack of resources?

The resources allocated to the four TA are generally sufficient. Overall, team members are able to fulfil their tasks competently and in a timely manner. The activities outlined in the original project proposal could be carried out effectively through the collaborative efforts of the TAs, with essential support provided by the SER. However, it became evident during the course of the project that some of the tasks and responsibilities defined in the proposal were too broad or insufficiently detailed. This lack of specificity necessitated adjustments in several areas. As a result, the team was required to exercise significant initiative and engage in extensive coordination to ensure the execution of tasks. Compounding these challenges, several staff departures occurred during the early stages of Base4NFDI. Although efforts were made to recruit additional staff to fill these gaps, the replacement capacity proved not fully adequate. Consequently, certain tasks (esp. monitoring section activities equally in all sections) were either postponed or could not be completed to the originally intended extent. Despite these setbacks, the commitment and collaboration of the entire team mitigated the impact of these difficulties. Staff members consistently demonstrated a high level of motivation and a willingness to assume responsibilities beyond their formal roles. This flexibility and dedication ensured that no critical tasks were left unaddressed. Nevertheless, the continued presence of staffing vacancies has constrained the level of support that can be offered to consortia and sections. Addressing these gaps remains essential to optimise project implementation and ensure long-term sustainability of support.

Do internal communication and organisational workflows function efficiently?

The project team has established a well-functioning internal communication structure, making effective use of appropriate tools and communication channels. However, coordination with and among the Co-Spokespersons remains an area requiring improvement. As the Co-Spokespersons are frequently involved in multiple other projects, their availability to engage directly with the TA is therefore limited. This constraint occasionally leads to delays in decision-making and reduced responsiveness to operational needs. There is a recognised need for stronger mechanisms to support coordination at the working level. Specifically, some decision-making processes within individual Task Areas are perceived as slow, which has hindered timely implementation in certain cases. They also recommended empowering certain team members to take on coordination responsibilities for specific tasks independently, without requiring authorisation from the Co-Spokespersons.

Do the job profiles align with the project's requirements, and are tasks clearly communicated?

The job profiles within the project are demanding, primarily due to the complexity of the multi-stakeholder processes. For new team members, particularly those with less professional experience, the organisational structure of Base4NFDI can be difficult to comprehend initially. It often takes considerable time for them to familiarise themselves with internal procedures and to identify all the relevant contacts and to fulfil their roles effectively. This complexity is largely attributable to Base4NFDI's grassroots democratic structure. While this decentralised and participatory model can be challenging to navigate, it also offers significant benefits. It promotes broad stakeholder involvement and ensures that a wide range of perspectives are

integrated into the development of basic services. In addition to managing structural complexity, staff members are expected to have strong project management skills. It has become apparent that some younger or less experienced colleagues have some gaps in these competencies, which may limit their effectiveness without targeted support or mentoring. Enhancing these skills through training and internal knowledge exchange would significantly strengthen team capacity and contribute to improved project delivery.

Are all necessary resources and information provided to the relevant stakeholders? (Efficiency)

External stakeholders are, for the most part, satisfied with their collaboration with the Base4NFDI team. However, there is room for improvement in the clarity and efficiency of communication. Specifically, stakeholders have expressed a need for more streamlined communication, ideally through a clearly defined single point of contact. The current structure can lead to uncertainty when trying to identify the appropriate contact person for specific enquiries or issues. This challenge is compounded by existing overlaps in responsibilities between certain TAs. For example, overlaps between TA1 and TA2 can arise when a service transitions into a new phase of development, while similar issues occur between TA3 and TA4 in areas such as service monitoring and reporting. These overlaps make it difficult not only for internal coordination but also for external stakeholders to find the right points of contact. However, relevant information is generally readily accessible to external stakeholders. Improving coordination and collaboration between TA1 and TA2, as well as between TA3 and TA4, could help address this issue. Consolidating communication channels within these pairs of TA would enhance their ability to respond more effectively and efficiently to stakeholder enquiries. Additionally, using the TA names more prominently (rather than using numerical identifiers) to reflect their specific responsibilities could contribute to greater transparency and help external stakeholders more easily understand who is responsible for what.

4 Processes for developing basic services

4.1 Submission processes

4.1.1 Identification of basic services candidates in the sections

Since the official decision to establish the NFDI in 2018, it has been evident that cross-cutting topics would require structured spaces for interdisciplinary and inter-consortial dialogue. To address this need, five NFDI sections were created, providing a dedicated environment to discuss issues that transcend individual consortia. These sections serve as central platforms for identifying, shaping, and discussing broad topics relevant across the NFDI. One of their key roles is to provide a starting point for the development and coordination of basic services relevant to all or most NFDI consortia. Members of the sections are individuals affiliated with participating institutions in the NFDI. Importantly, individuals can register to sections via their home institutions, independent of any consortium affiliation.

While all sections are allowed to propose basic services, they are not obliged to do so. Although the process for developing and submitting basic service proposals is not strictly formalised, a general workflow has been successfully established in practice. Most sections operate through a set of dedicated working groups, each one discussing a specific cross-cutting topic. However, structures vary between sections. For example, the ELSA Section does not rely on permanent working groups; instead, it organises its activities around emerging, topic-specific needs. The proposal process often begins within a working group, where an initial idea is developed. In some cases, a basic service may even have its own dedicated working group, as exemplified by the Identity and Access Management (IAM) service. These groups often

consist of institutions already collaborating on thematically related topics, which naturally fosters the development of ideas for shared services. Ideas for basic services generally arise when several participants of a working group identify a gap where a basic service is needed or where several participants realise that multiple consortia work on similar topics. Once an idea gains traction, a proposal writing team is formed – either on a voluntary basis or through targeted invitations to relevant experts.

Draft proposals must then be presented and discussed within a section meeting. These meetings, which are held less frequently than working group sessions, serve as a more formal setting to evaluate proposals and test whether they have the necessary support. In some sections, there are defined requirements for proceeding – for instance, a proposal may need backing from at least six consortia to be eligible for discussion in a section meeting. Following these discussions, and once sufficient support is confirmed, a proposal can move forward to formal submission as a basic service.

Table 7 provides an overview of all basic service submissions by each section for the eight submission rounds that have been fully completed until July 2025.[8] Proposals are mostly supported by section-infra (7), followed by (section-metadata) (3), section-edutrain (3) and section-ELSA (1). Section-industry has not submitted any proposal yet. Out of 14 submissions for unique basic services, 8 have been accepted for the initialisation phase. Out of those, 4 services are in the integration phase as of July 2025. It also becomes visible that almost all accepted proposals have been submitted twice for the initialisation phase. Out of the services which have been accepted, only IAM4NFDI was accepted after its first submission. Some institutions lead the proposal for several submissions: e.g. TIB (3), FZ Jülich, GESIS, RWTH Aachen University, GWDG and ZB MED (each one 2 submissions).

Table 7 Overview of basic service submission for initialisation phase (submission rounds 1-8)

No.	Submission	Section	Lead institution	Current status	No. of submissions (for initial Phase)
1	HaDES (Harvesting and Findability Enhancing Services)	(Meta)data, Terminologies, Provenance	GESIS	Rejected	1
2	DMP4NFDI (NFDI Basic Service for Data Management Plans)	Common Infrastructures	ULB Darmstadt	Integration	2
3	IAM4NFDI (Basic Service for Identity and Access Management)	Common Infrastructures	DFN-Verein	Integration*	1
4	PID4NFDI (Basic Service for Persistent Identifier Services)	Common Infrastructures	TIB, GWDG	Integration	2
5	TS4NFDI (Basic Service for Harmonisation and mapping of terminologies)	(Meta)data, Terminologies, Provenance	TIB, ZB MED (co-lead)	Integration	2
6	KGI4NFDI (Basic Service for Knowledge Graph Infrastructures)	(Meta)data, Terminologies, Provenance	TIB	Initialisation**	2

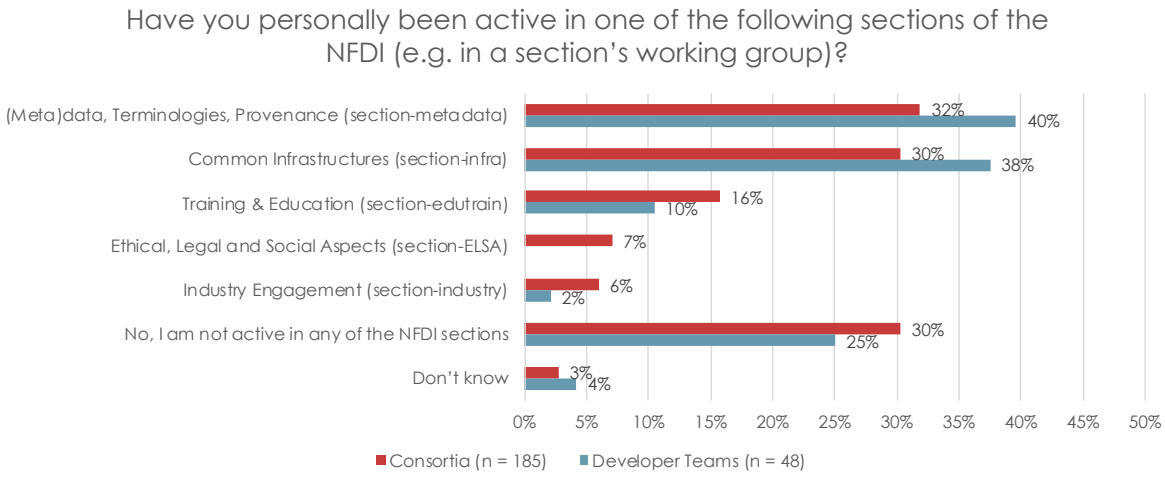
[8] As of July 2025, the ninth submission round was under review.

7	nfdi.software (NFDI Research Software Marketplace)	Common Infrastructures	GFZ Potsdam	Initialisation***	2
8	Jupyter4NFDI (A Central JupyterHub for the NFDI	Common Infrastructures	FZ Jülich	Initialisation****	2
9	RDMTraining4all / RDMTraining4NFDI (Basic Service for Competence Training for Research Data Management)	Training and Education	ZB MED	Initialisation***	2
10	MC4NFDI (A Multicloud Infrastructure for the NFDI)	Common Infrastructures	DESY, FZ Jülich	Rejected	2
11	DALIA4NFDI (Platform for Data Literacy Education and Training Resources)	Training & Education	RWTH Aachen University	Rejected	2
12	ASSURED (Service for the safe and ethical use of sensitive data for the research community)	Ethical, Legal and Social Aspects	GESIS	Rejected	1
13	Support4RDM (A federated helpdesk network and RDM support infrastructure)	Training & Education	ZALF, SLUB Dresden	Rejected	1
14	nfdi.architecture (Requirements of NFDI consortia towards an Overall Architecture)	Common Infrastructures	RWTH Aachen University; GWDG	Rejected	1

Technopolis Group. *Currently (submission round 9) in review for ramp-up phase. **Delayed for integration phase (submission round 7). ***Currently (submission round 9) in review for integration phase. **** Accepted for integration phase (submission round 8)

Respondents from both the consortia and developer survey, have been asked if they have been active in any NFDI section. Among the consortia respondents, the most commonly selected sections are (Meta)data, Terminologies, Provenance (32 %) and Common Infrastructures (30 %). Developer teams showed even higher involvement in these areas, with 40 % and 38 % respectively, while participation in Training & Education and other sections remains comparatively low. This reflects the sections from which basic services were primarily proposed to Base4NFDI.

Figure 10 Activity of survey respondents in sections



Technopolis Group. Multiple selections were possible.

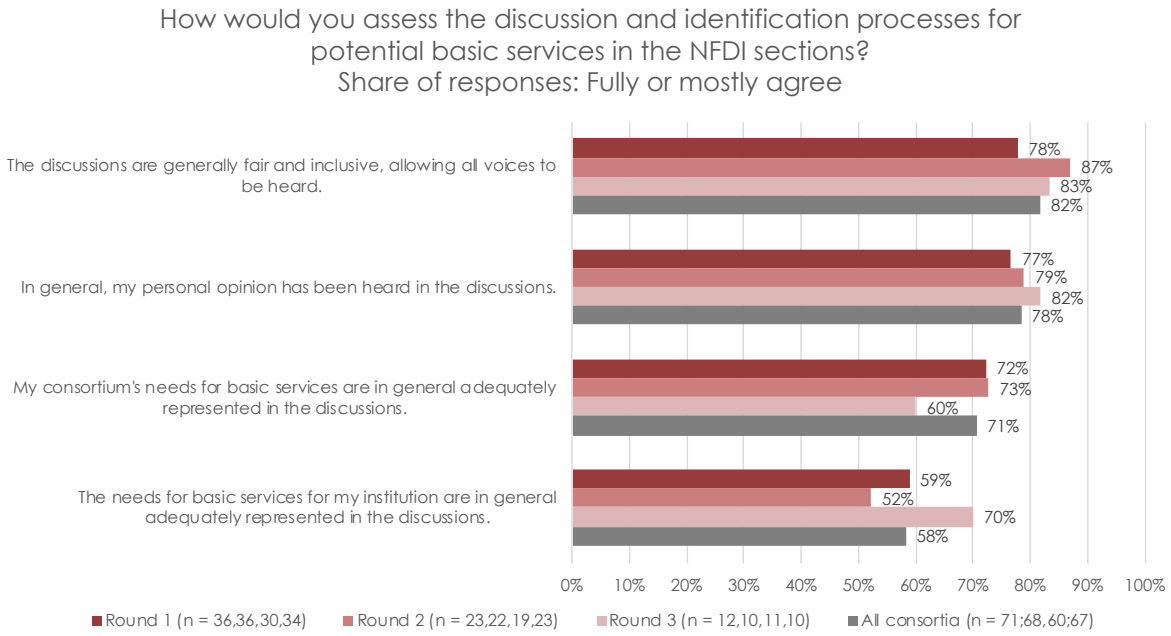
Figure 11 shows how respondents from the consortia survey assess the discussions about basic service proposals in the sections.[9] Around 60 % of those consortia survey respondents who are active in the sections state that they have also been involved in discussions about basic services (e.g. in a section meeting or in a working group).

Overall, consortia respondents indicate that they are satisfied with how basic services are discussed in the sections. 82 % of respondents agree that discussions in the sections are generally fair and inclusive and 78 % think that their personal opinion has been heard in the discussions. Another 71 % consider the needs of their consortium represented in the discussion. However, a lesser extent of respondents thinks that their own institution is adequately represented in the discussions (58 %). Interestingly, respondents from third round consortia (who are active in sections themselves) more frequently agree that their own institution is represented in the discussion, but less frequently that their own consortium is adequately represented. However, these numbers have to be interpreted with caution, as the number of third-round respondents for this question is low (10-12 answers).[10]

[9] Only respondents who indicated that they have been active in any of the NFDI sections and have been involved in discussions about basic services (e.g. in a working group or section meeting) have answered this question.

[10] For this particular answer item on the representation of consortia in the sections, respondents from 6 third-round consortia answered. For one consortium, two respondents fully agree, and another two respondents agree partly or mostly disagree. For another consortium, one respondent fully agrees, and another one mostly disagrees. Three respondents from three distinct consortia fully or mostly agreed while another respondent from another consortium mostly disagrees. While the negative responses from third-round consortia are not driven by one particular consortium, the opinions within the consortia also seem mixed.

Figure 11 Assessment of consortia survey respondents of basic service discussions in NFDI sections



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Insights gathered from the survey responses reveal some areas for improvement or recurring concerns regarding participation in and the structure of the NFDI sections. A few respondents indicate that the discussion and coordination processes within the sections are perceived as too time-consuming, particularly in addition to their existing commitments within the consortia. This is seen as a limiting factor for more active involvement. The rapid introduction of a wide variety of services within relatively short timeframes is also noted as a contributing factor, as it often left little space for the specific needs of individual institutions to be addressed, with attention instead skewed toward consortium-level priorities.

Other survey participants who are active in section meetings – but not in working groups – express concerns about a lack of transparency in the proposal development process. They report that proposals are often presented at section meetings in a stage that is already well-developed, leaving limited opportunity for broader community input or influence. Earlier involvement in the process was seen as desirable to improve inclusivity and co-creation. Interviewees, especially representatives from consortia of the third funding round, highlight the lack of a centralised overview of section activities, noting that there is no comprehensive schedule of section meetings available on NFDI websites or internal communication tools such as NFDI chats. In addition, some working group meetings were held in person instead of virtually which is seen as potentially exclusionary, limiting participation from those unable to travel. Some interviewees also point to technical and structural barriers to engagement. A frequently mentioned issue is the absence of a shared file infrastructure, such as a central cloud platform accessible to all section members. Furthermore, establishing contact with section leads or members was described as difficult, due to the lack of mailing lists or visible contact options.

Beyond operational issues, some survey respondents express a desire for a more strategic, coordinated approach to identify basic services. While the bottom-up nature of the sections was generally viewed as valuable and necessary for encouraging community-driven initiatives, some respondents stress that this model alone is not sufficient to support the overall strategic coherence of the NFDI. They express the concern that some strategically important basic

services may be overlooked due to the absence of an active working group focused on the topic. One interviewee also points out that potential basic services that are less visible and rather operate in the background could be overlooked in the current process (e.g. basic services for monitoring, accounting or registry activities).

Also, the introduction of a clear framework to delineate the boundary between community services and basic services would be considered helpful. Such a framework could help clarify expectations, ensure appropriate prioritisation, and guide the overall development of service proposals more effectively.

4.1.2 Submission of basic service proposals

Respondents from both the consortia and developer survey, have been asked if they were involved in the submission of a basic service proposal. Those who have been involved were asked about their opinion on the submission process. Figure 12 shows how satisfied the developer teams are with the submission process and Figure 13 displays the satisfaction of consortium members who participated in the survey and were also involved in a proposal submission. Respondents from the consortia answered slightly more positively to this question, while the overall results are still roughly comparable.

Both figures show that the overall dissatisfaction with the submission process is low, while some aspects, most notably the flexibility of the submission process, leave some room for improvement. Over 60 % of the developer team respondents think that the submission process is clearly structured and that sufficient support is provided throughout the process, while less than 5 % disagree. 47 % consider the submission process to be sufficiently fast (in addition, 21 % partly agree) and 45 % agree that all necessary information is available (39 % partly agree). The submission process is viewed most critically in terms of its flexibility: only 30% consider it sufficiently adaptable to accommodate the specific needs and contexts of different basic service proposals.

Interviews with various stakeholders indicate that the requirements and timelines of the submission periods pose significant challenges for many of them. From a sections' perspective, it is challenging to align section meetings with submission rounds for basic services since basic service submissions are not the topic which is discussed during section meetings. From a consortium perspective, it is challenging to keep track of all basic service submissions and to collect both qualitative and quantitative feedback from within the consortium in time for each submission round. For the developer teams, it is challenging to meet a vast number of changing requirements during the initialisation phase, especially since new staff still need to be recruited, internal project management and detailed design processes are still being established, and coordination with partner institutions is not yet fully in place.

Figure 12 Satisfaction with submission process for basic services (developer teams)

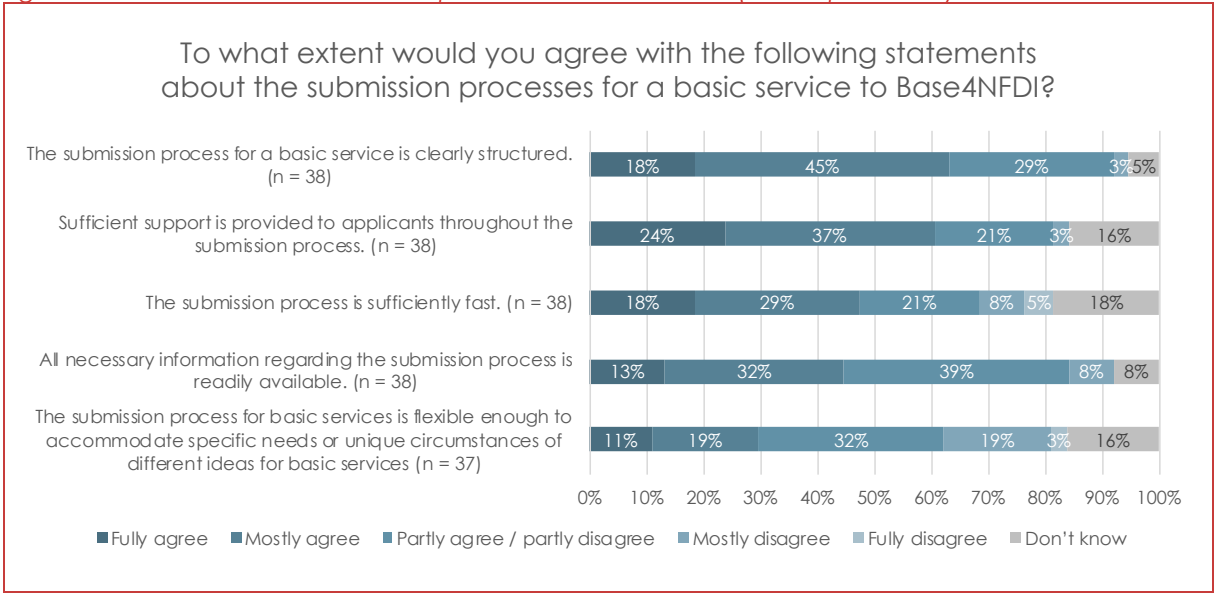

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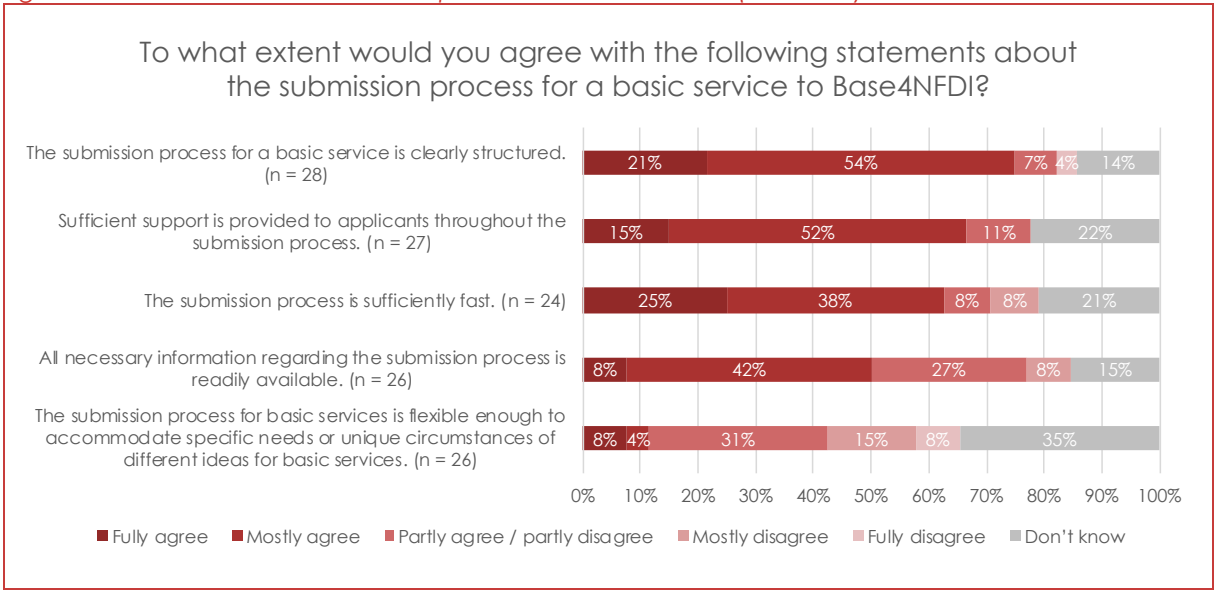
Figure 13 Satisfaction with submission process for basic services (consortia)



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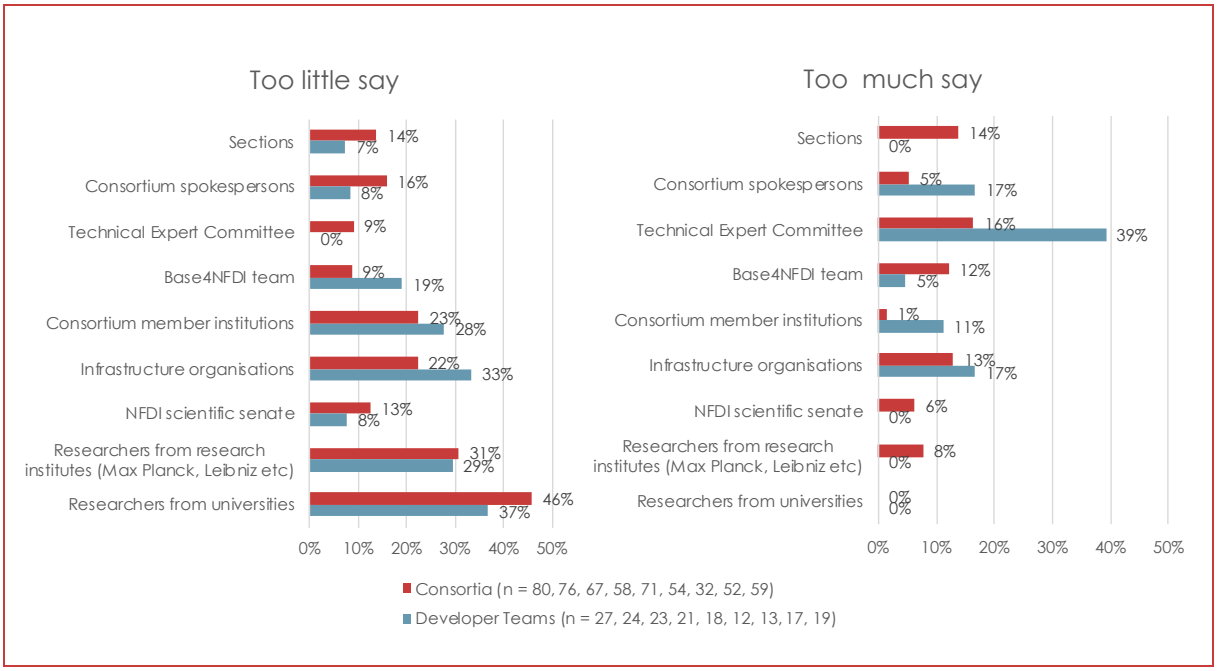
Overall, a wide variety of stakeholders and actors are involved in the submission process for basic services. Figure 14 shows how respondents from the consortia survey and the developer team survey consider the relative influence of various actors who are potentially involved in the process for basic service submissions. The vast majority of respondents thinks that sections and consortia spokespersons have an adequate say in the submission process. The TEC is seen more critically by the developer teams where 39 % think that the TEC has too much influence on the submission process. The role of the TEC is discussed in more detail in chapter 4.2.1. The Base4NFDI teams who develop the criteria for evaluating basic service submissions have an adequate say in the view of both the consortia members and the developer teams, although some respondents, especially of the developer team survey, consider the Base4NFDI team to have not enough say or no say. The picture is more mixed for consortium member institutions

and infrastructure organisations where a significant minority thinks that both have too little say. Furthermore, survey respondents believe that the NFDI Scientific Senate has an adequate level of influence overall, whereas nearly one third of developer team respondents feel it has little to no say in the process. In the view of around 30 – 45 % of survey respondents, researchers from universities and research institutes tend to have too little say, relative to the other actors. Moreover, further 20 – 30 % think that these actors have no say in the process. The results suggest a strong support for the concept of community-driven co-design of basic services. Furthermore, some survey respondents point out that the needs of the broader research community – which go beyond the member institutions in the NFDI sections and consortia – could be more systematically identified and incorporated into the process. The sentiment that researchers have too little say is particularly pronounced among consortia survey respondents from higher education institutions (HEIs): 60% believe that HEIs are underrepresented. Additionally, around 30% of respondents from both higher education and non-university research institutions feel that non-university researchers have too little say. These results should be interpreted with caution due to the small sample sizes (HEIs: n = 30, non-university: n = 18).[11] This chart was also discussed in a focus group. One opinion expressed is that the NFDI still primarily develops infrastructure-related solutions, which are currently of limited relevance to individual researchers. At present, NFDI is rarely a topic in everyday research practice. However, it is expected to become more important to researchers in the future.

Figure 14 Relative influence of Base4NFDI stakeholders and actors on the submission process for basic services



Technopolis Group. Question: If you look at the processes for identifying basic services in the sections and the submission process for basic services, how do you personally consider the relative influence of the

[11] Since the consortia survey was anonymous, not all respondents could be assigned to a specific type of institution. Only those who answered the question about their institutional affiliation could be categorised accordingly.

various actors involved?. Answer options: Too much say, adequate say, too little say, No say. Percentage values are calculated by excluding respondents who answered with 'don't know / no answer'.

4.2 Voting and decision-making processes

Various actors are involved in the voting and decision-making processes for basic service submissions for the initialisation, integration and ramping-up phase. For each submission round, a specific quorum threshold is defined, increasing across the three funding phases:

- Initialisation phase: 25% of consortia must vote in favour
- Integration phase: 50% threshold
- Ramp-up phase: 75% threshold, with additional approval required from the NFDI Scientific Senate

The initialisation and integration phases are designed to be iterative. A basic service candidate may reapply and undergo these phases multiple times if needed. After a proposal is submitted, it is evaluated by the TEC. The TEC currently consists of 12 infrastructure professionals appointed by the Consortia Assembly. External reviewers can also be invited to provide additional expertise in fields not extensively covered by the TEC. The criteria for evaluating basic services are developed by the Base4NFDI team in cooperation with the TEC and include factors such as technical quality, interoperability with existing solutions, suitability of the partner organisations suggested, and the financial calculations provided.[12] The TEC gives a recommendation to the Consortia Assembly for the basic service submissions.

In parallel to the evaluation of the TEC, the NFDI consortia evaluate the submission internally and may express their support for the proposal, based on their community's needs. Consortia can also express their support by providing Letters of Commitment (LoC), which demonstrate a level of engagement that goes beyond general support. Letters of commitment can be provided for different development phases and for different reasons, for example:

- a consortium dedicates funds for a specific contribution to a service (initialisation and integration)
- persons or institutions would like to contribute to the service while not actively participating (initialisation and integration)
- a consortium commits to use the service and provides clear steps towards this goal (integration)

The final decision in each submission round is taken in the Consortia Assembly, where the spokespersons of all consortia vote on the submitted basic services. The Consortia Assembly is not obliged to follow the recommendation of the TEC. At the time of the evaluation, however, the Consortia Assembly has always followed the TEC's recommendations. Services which do not reach the ramp-up phase (e.g. for technical reasons or because they are not relevant to a sufficiently large number of consortia) enter a so-called 'tool pool'. This means that consortia can still use and further develop these services. Any business model for these services will, however, need to be provided outside of Base4NFDI.

The following chapter examines the attitudes and opinions towards the TEC and the criteria for evaluating basic services, the decision-making process within the consortia and the voting in the Consortia Assembly as well as overall evaluation and decision-making processes.

[12] See also: Base4NFDI (s.a.): Criteria for Basic Services. URL: https://base4nfdi.de/process/criteria-for-basic-services.

4.2.1 *Evaluation processes in the TEC*

The role of the TEC in the evaluation process of basic service submissions is inherently complex. This complexity stems from several factors. First, decisions made by review panels often become a point of contention among applicants – particularly those whose proposals are unsuccessful. Second, the **TEC only provides a recommendation** regarding funding decisions. The final decision lies with the Consortium Assembly (i.e., the spokespersons of the NFDI consortia), which votes according to the established quorum for the respective submission round. In principle, the **Consortium Assembly has the authority to override the TEC's recommendations, although this has not occurred in practice**.

The composition of the TEC is generally viewed positively by the interviewed TEC members. With a broad membership of 13 individuals, the committee brings together a wide range of expertise. In cases where specific knowledge is lacking, external reviewers are consulted to complement the evaluation process. Generally, TEC members have two months to evaluate a submission round. Before issuing a recommendation on a basic service submission, the proposal is discussed internally by the Technical Evaluation Committee (TEC). A **two-thirds majority** is required within the TEC in order to formally recommend a service to the Consortia Assembly. To ensure impartiality, conflicts of interest are declared, and members refrain from participating in the evaluation of affected proposals.

The evaluation criteria developed by Base4NFDI – along with the overall support provided by the organisation – are considered helpful in guiding the assessment of basic service submissions. A critical appraisal of proposals is considered essential, particularly in light of limited availability of funding and the absence of binding financial commitments for consortia when voting in favour of submissions. Thus, TEC aims to **avoid a "first-come, first-served approach."**

Two main criteria are considered particularly important by the TEC in the assessment:

- Technical sophistication and **scalability** – Services with a high level of technical maturity are generally more scalable. However, scalability becomes more challenging when many individuals are involved. While this can pose difficulties, it may be deprioritised if necessary to favour other aspects of the proposal (e.g. if a non-technical service is submitted).
- **Utilisation of existing structures within consortia** – The presence of existing infrastructures and organisational frameworks within consortia can strengthen a service's feasibility and long-term potential. The relevance of **activities in the NFDI sections** has also become increasingly important. In the early stages of Base4NFDI, work within the sections was still in its infancy. However, in the current phase, some proposals explicitly reference existing work undertaken within these sections. As a result, this factor has gained significance in the TEC's evaluation process.

Sustainability aspects, while not the primary focus during the initialisation phase, are still taken into account (e.g. long-term funding and operating model). Although considered more relevant for the ramp-up phase, the potential for integration and further development across phases is evaluated even in early-stage proposals.

A key trade-off for the TEC lies in the necessity to evaluate proposals based on qualitative judgment rather than quantifiable metrics, as the services in question do not yet exist. Despite this inherent uncertainty, one interviewed member emphasised that the committee has developed a sound and informed understanding to support its assessments.

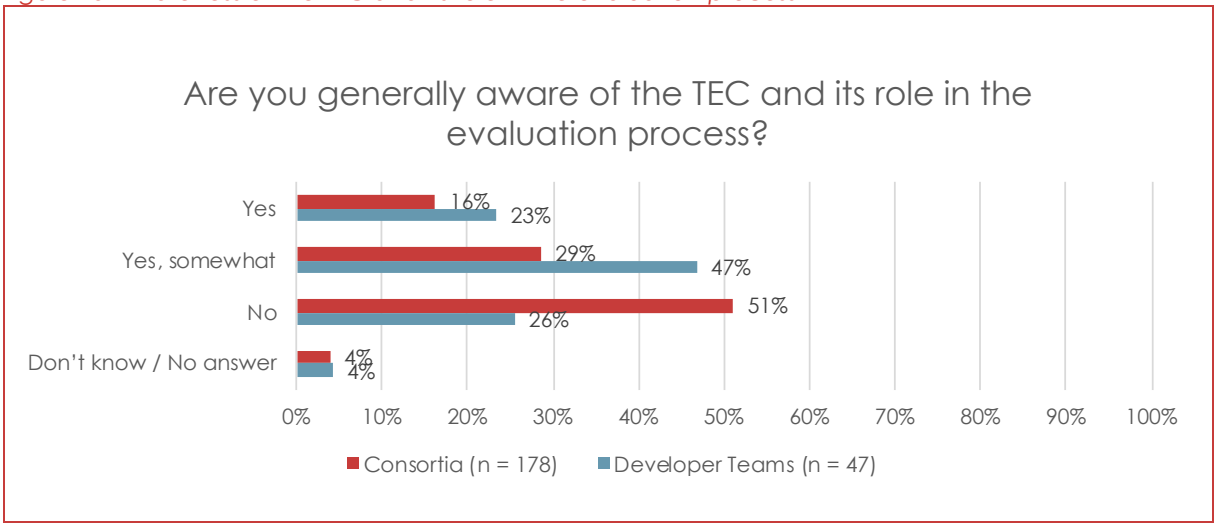
One underlying challenge is that different stakeholders may have diverging interpretations of the requirements for the initialisation phase. While this phase was originally designed to present relatively low barriers – allowing development teams to refine their concepts and build

consortium support – the TEC also factors in considerations regarding the long-term sustainability of the services when formulating its recommendations.

Stakeholder satisfaction with the TEC's role in the evaluation process appears to be somewhat mixed. This reflects the multifaceted and sometimes sensitive position the TEC occupies within the Base4NFDI framework.

45 % of consortia survey respondents are aware of the TEC, while 70% of respondents from the developer teams survey are generally aware of the TEC and its role in the evaluation process. Figure 16 shows how both respondent groups assess the TEC. While most survey respondents do not express outright dissatisfaction with the TEC, some areas for improvement were identified – particularly in the communication of decisions and the criteria applied during evaluations. Overall, respondents from the consortia survey evaluate the TEC more positively than the developer teams.

Figure 15 Awareness of the TEC and its role in the evaluation process



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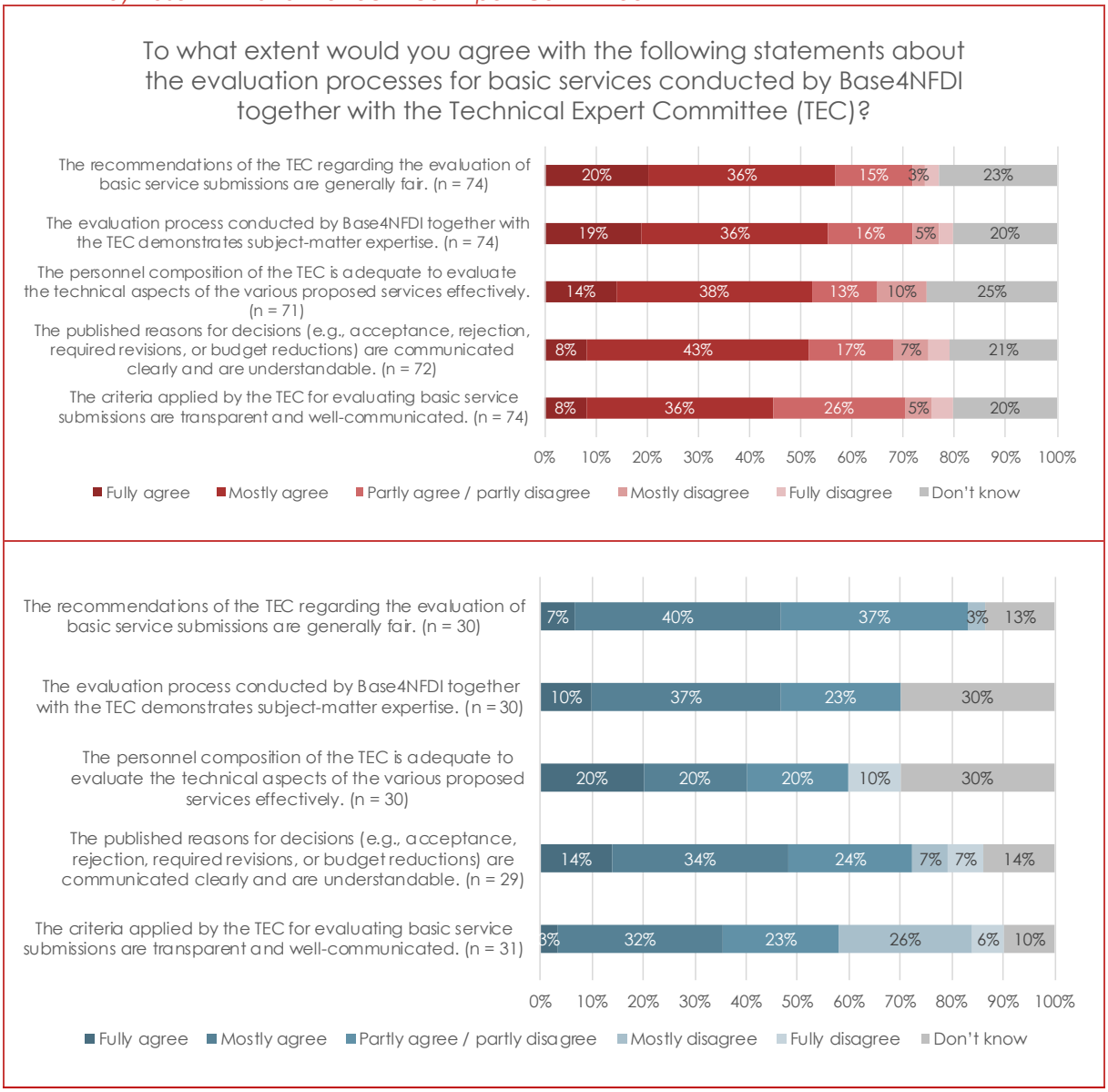
Approximately 55 % of consortia respondents consider the recommendations issued by the TEC to be generally fair. An additional 15 % partly agree with this assessment, while 6 % express partial or full disagreement. Over half of the respondents think that the published reasons are understandable and clearly communicated. 17 % partly agree and 11 % do not agree with this statement. 44 % of respondents believe that the criteria for evaluating basic services are transparent and communicated clearly.

The approval rates are generally lower for the developer teams. 47 % consider the recommendation of the TEC to be generally fair, 37 % partly agree with this statement while only 3 % disagree. 47 % of respondents think that the evaluation process conducted by Base4NFDI together with the TEC demonstrates subject matter expertise and 23 % agree partly with this statement, while no one disagrees. Between 40 and 50 % of respondents agree that the personnel composition of the TEC is adequate and that the published reasons for the TEC recommendations are understandable and communicated clearly. 20 – 25 % partly agree with those statements while 10 – 15 % (mostly) disagree. Only a third of respondents think that the criteria applied by the TEC are transparent and well-communicated, 23 % partly agree with this statement while about a third of respondents (mostly) disagrees.

Figure 16 Agreement with statements regarding the evaluation processes for basic services conducted by Base4NFDI and the Technical Expert Committee



Technopolis Group; Note: Throughout the report, results from the survey of the developer teams are presented in **blue**, while survey results from the consortia survey are depicted in **red**.

Some decisions of the TEC have been contested by parts of the NFDI community, most notably the submission of MC4NFDI (A Multicloud Infrastructure for the NFDI) which has not been recommended twice. Several interviewees note that a large majority of the consortia have supported the proposal, but the TEC and the proposal team were not able to develop a joint understanding of the proposal. One interviewee, however, also mentions it is challenging to remove bias from the TEC completely since every member is somewhat influenced by the respective home institution.

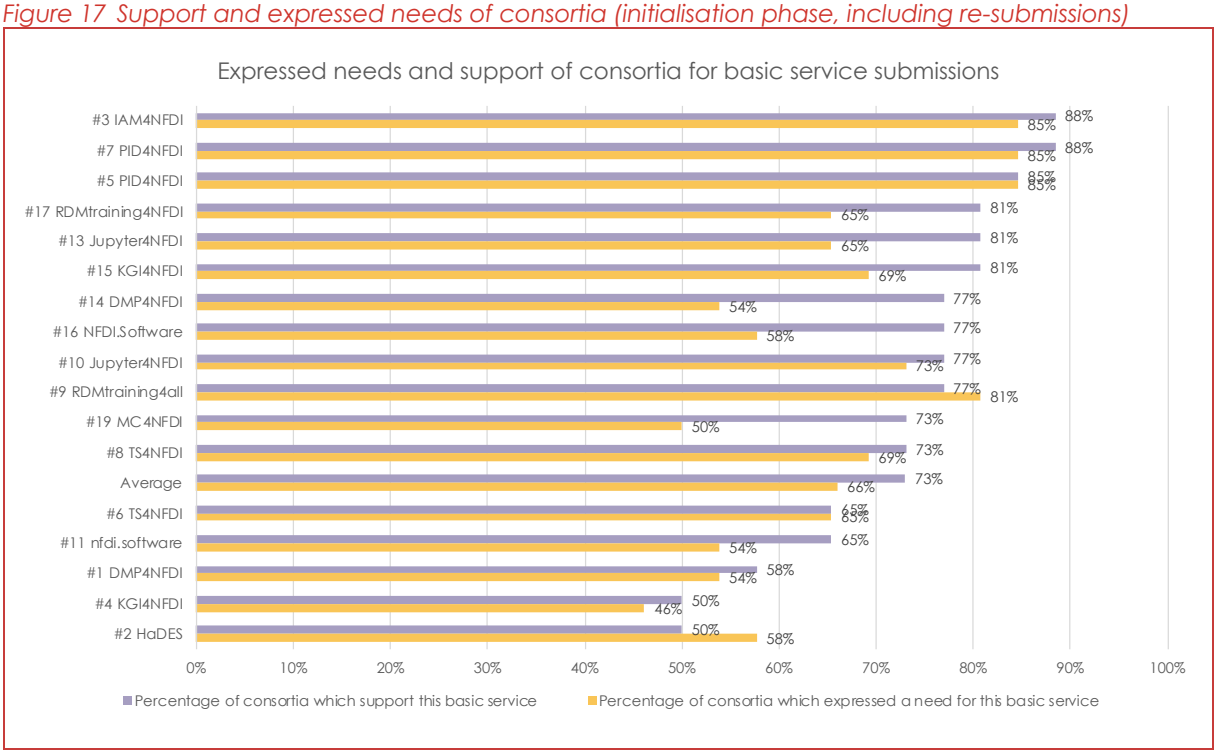
A concrete measure to address these concerns has already been implemented. For example, the TEC's recommendations are now published for the proposal teams, which enhances transparency. A further suggestion from a survey respondent is to introduce a 10-minute defence in front of the TEC (or some members of the TEC) which would improve the communication between the TEC and the developer teams that submit a proposal.

4.2.2 *Evaluation and decision-making processes in the consortia*

The evaluation and decision-making processes within the consortia play a critical role in the overall evaluation and decision-making process for basic service submissions since they are the primary target group for the developed basic services. However, the landscape of the 26 NFDI consortia is highly heterogeneous. They differ in terms of disciplinary focus, governance models, and organisational structures. Moreover, the consortia were established in three separate funding rounds (2020, 2021, and 2023), each with different timelines and developmental stages. All consortia are expected to develop and implement their own solutions within the current funding period, which runs until 2028.

After a submission round ends, Base4NFDI asks consortia for feedback on the submissions.[13] Consortia can state – among others – whether they support a basic service and if there is a need for the basic service in their consortia. For integration phase submissions, they can also state if they commit to using a basic service and to what degree.[14] During the first six submission rounds for the initialisation phase, an average of 66 % of consortia indicated a need for the proposed basic services. On average, 73 % of consortia supported individual submissions (see Figure 17). In general, most basic services receive support from a higher number of consortia than those that explicitly express a need for them. In the integration phase, support levels were even higher: an average of 94 % of consortia supported the respective submissions.

Figure 17 Support and expressed needs of consortia (initialisation phase, including re-submissions)



Technopolis Group. Based on surveys conducted by Base4NFDI with consortia spokespersons/coordinators for submission rounds 1-6 (initialisation phase).

[13] Not all consortia submitted a vote in time, but most did. On average, 24 consortia (out of 26) voted on a basic service submission in the initialisation phase. Abstentions are counted as voting against a basic service submission.

[14] This criterion was introduced during the ongoing process to better specify the nature of the consortia's commitment.

While these figures suggest a high level of support for the submissions, interviews reveal a more nuanced picture. Decision-making procedures vary significantly between consortia, and expressions of support or votes in favour are generally not regarded as binding commitments.

Findings from the consortia survey show that approximately half of respondents are aware of how decision-making processes are structured within their consortium, while a further 16% report having only partial knowledge of these procedures. Among those who are familiar with the process, the vast majority of respondents indicate that discussions mostly take place in a designated body (66 %). To a smaller extent, discussions take place in small information circles (13 %) or are held with nearly all consortium members (12 %). Decisions regarding whether to support a basic service submission are predominantly made either by the consortia's executive boards or by designated experts with subject-specific expertise. Conversely, it is rather an exception that decisions are taken together with almost all consortium members, nor does the spokesperson alone decide on a basic service submission.

Figure 18 Consortia survey: Awareness of decision-making procedures and discussion in the consortia

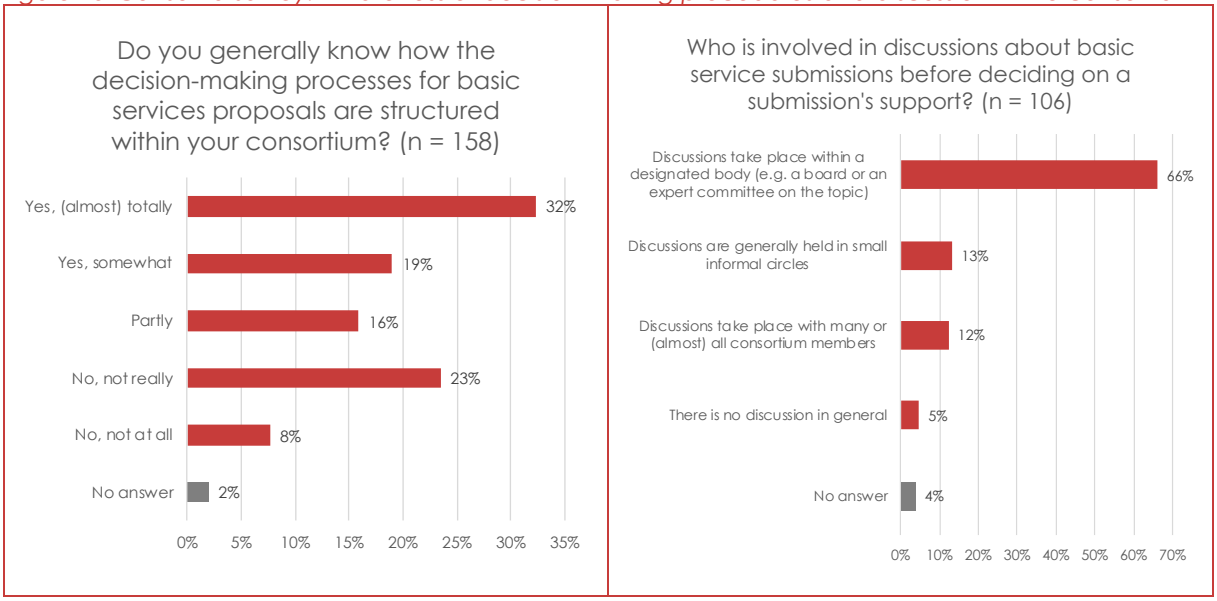


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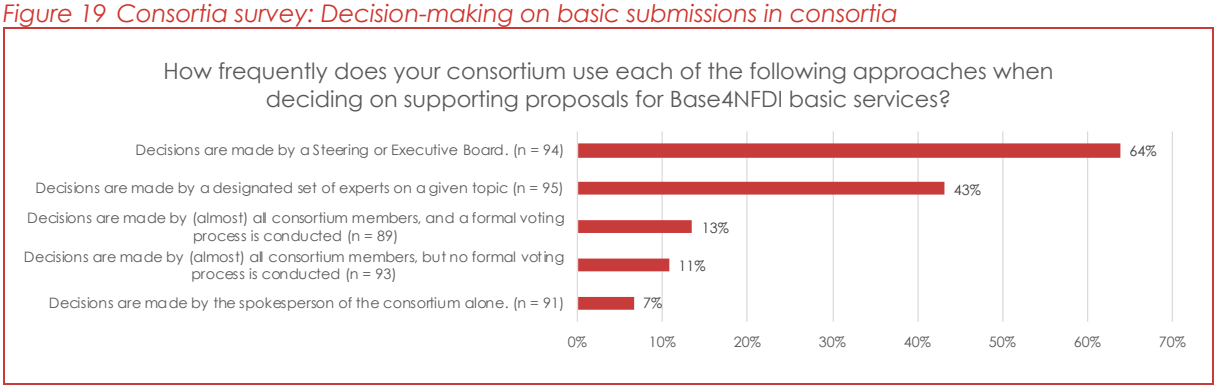
Figure 19 Consortia survey: Decision-making on basic submissions in consortia



Technopolis Group. Chart shows aggregated values for respondents that chose the answer options 'Always' or 'Frequently'. Other answer options were: 'Sometimes', 'Rarely', 'Never' and 'Don't know'.

Interview findings suggest that participants within the consortia are generally satisfied with these internal decision-making processes. This satisfaction is largely attributed to two factors:

the practical limitations on available time and the necessity of drawing on domain-specific knowledge when evaluating basic services.

However, several interviewees emphasised that a vote in favour of a basic service by a consortium does not constitute a binding commitment to use the service. Rather, many consortia vote in favour to avoid hindering the further development of a service, particularly given that funding for the development of basic services is not tied to the financial resources of the consortia themselves.

While consortia are asked to commit to use a basic service and to submit a formal vote, one interviewee highlights that binding usage agreements for basic services must be concluded directly between the service provider and individual institutions, as consortia themselves are not legally authorised to enter into such agreements. However, another interviewee notes that consortia can use their flex funds to commit to a basic service.

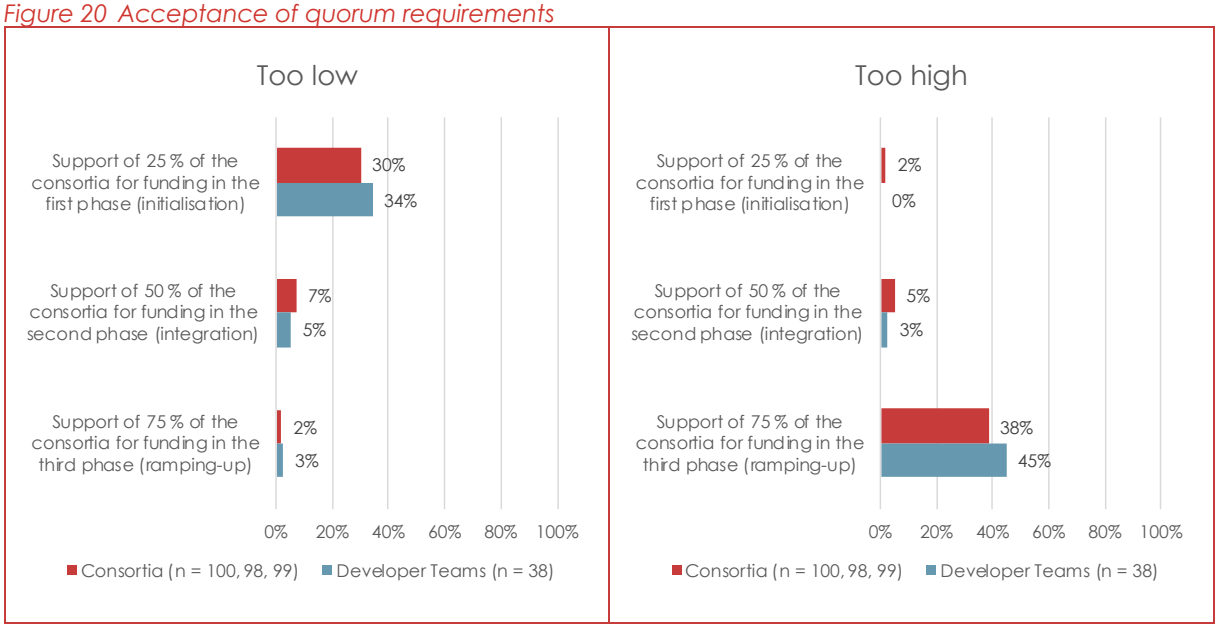
Additionally, it has been noted in an interview that only a subset of NFDI member institutions is represented within each consortium. As a result, consortia cannot guarantee the adoption of a given basic service by end-users, particularly when alternative options are available – this is especially relevant for end-user-oriented services.

4.2.3 Decision-making in the Consortia Assembly and evaluation and decision-making process as a whole

Final decisions on basic service submissions are taken by the Consortia Assembly, composed of the consortia spokespersons. The vote in the Assembly is intended to reflect the level of support and commitment among consortia for a given basic service candidate. Prior to each vote, Assembly members are informed whether the Technical Evaluation Committee (TEC) has reached the required two-thirds majority in favour of the submission. They also receive a summary of the key strengths and weaknesses identified by the TEC, along with information on how many consortia expressed support for the proposal. Additionally, the Consortia Assembly holds a discussion on each submission before the formal vote.

Each submission needs to pass a certain quorum threshold for each submission round. Survey responses provide further context regarding the quorum model and its acceptance. Around two-thirds of respondents support the quorum for the initialisation phase, 88-92 % support the quorum for the integration phase and 53 – 60 % support the quorums for the ramp-up phase. However, a notable minority of respondents (approximately 30–35 %) supports increasing the quorum threshold for the initialisation phase. Conversely, 38–45% advocate for lowering the threshold in the ramp-up phase. This suggests a tendency to harmonise the quorum thresholds across all three phases, moving towards a middle-ground value. These views are more prevalent among basic service developer teams than among representatives of the consortia.

Figure 20 Acceptance of quorum requirements



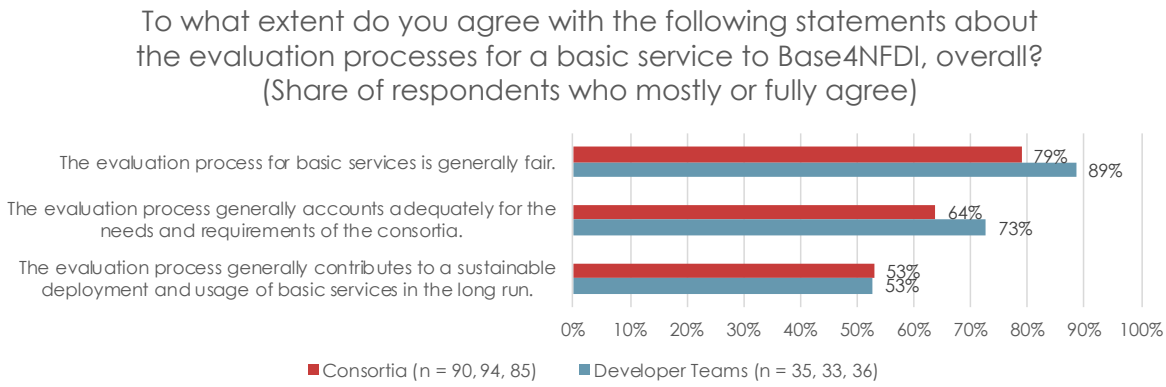
Technopolis Group. Survey question: "In your opinion, are the quorum requirements for approving funding for basic service development in the consortia assembly adequate?". Answer options were 'Too high', 'adequate', 'too low' and 'don't know'. Percentages are calculated excluding *'Don't know'* responses.

This tendency also emerged in several interviews. Some interviewees express concern that relatively few basic service proposals may ultimately align with the current phased model and its requirements. However, this concern is not supported by the voting behaviour of the consortia on basic service submissions. In the first six submission rounds, proposals submitted for the initialisation phase received, on average, approval from 73% of consortia, with no submission receiving less than 50% support. All proposals would therefore have met the defined quorum thresholds if the TEC had not issued a negative recommendation.

A case of tension between consortia support and the TEC's recommendations is the MC4NFDI submission (A Multicloud Infrastructure for the NFDI). Although the service received substantial backing from the consortia (73 % in favour), the TEC issued a negative recommendation – resulting in the proposal not being approved. This outcome led to discontent among some interviewees, who questioned the balance of decision-making authority between the TEC and the Consortia Assembly.

Overall, however, survey respondents are satisfied with the evaluation and decision-making as a whole. The vast majority considers the evaluation process overall to be fair (only 2 % of consortia respondents disagree and none of the developer teams respondents). The evaluation process is generally seen as responsive to the needs of the consortia: 64 % of consortia survey respondents agree with this statement, while only 10 % disagree. Perceptions are more mixed when it comes to the evaluation process's contribution to the sustainable development of basic services in the long term. Just over 50% of respondents in both the consortia and developer team surveys agree that it contributes to sustainability. A further 31–36% of both surveys partly agree, while 12–13% explicitly disagree. However, sustainability only becomes a formal evaluation criterion in the ramp-up phase – a stage that none of the services has reached to date.

Figure 21 Assessment of the evaluation process as a whole

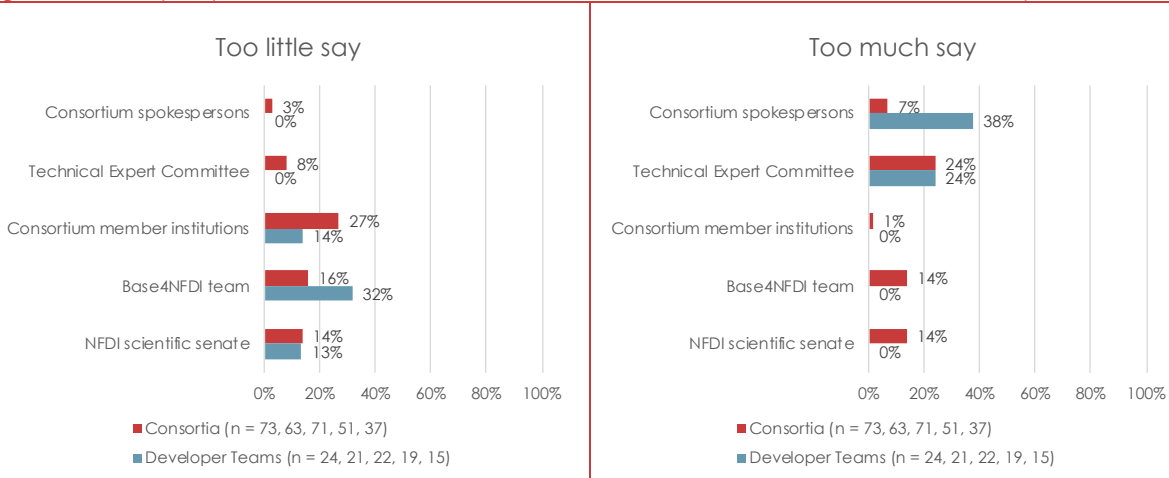


Technopolis Group. Values show share of respondents who answered with 'fully agree' or 'mostly agree'. Further answer options were: 'Partly agree / partly disagree', 'mostly disagree', fully disagree' and 'don't know'. Percentages are calculated excluding *'Don't know'* responses.

Figure 22 illustrates how survey respondents assess the relative influence of various actors involved in the evaluation process of Base4NFDI. A majority of respondents across both surveys (approximately 60–90% per actor) believe that all actors have an adequate level of influence. However, diverging views are also apparent: a notable minority of respondents from the consortia survey feel that member institutions have too little influence, while some participants from the developer team survey consider consortia spokespersons to have too much influence and Base4NFDI as having too little. However, it has to be noted that the number of respondents in the developer team survey is generally low for this question. Hence, the results have to be interpreted with caution. Additionally, perceptions of the TEC are mixed – around one-quarter of respondents believe that it holds too much say in the evaluation process.

Overall, the evaluation and decision-making processes are closely tied to – and intertwined with – the actual development process of basic services, which is discussed in more detail in the following chapter.

Figure 22 Survey respondents' views on actors' relative influence in Base4NFDI evaluation processes



Technopolis Group. Question: If you look at the processes for evaluating basic services at Base4NFDI overall, how do you personally consider the relative influence of the various actors involved? The evaluation process has been described to survey respondents "as the entire process involved in

evaluating basic service proposals at Base4NFDI. This includes the assessment and review of basic service submissions by the Technical Expert Committee (TEC), discussions and decisions about basic services within the consortia, as well as discussions, votes, and decisions made in the consortia assembly regarding basic services". Answer options were: 'too little say', 'adequate say', 'too much say', 'no say' and 'don't know'. Percentages are calculated excluding *'Don't know'* responses.

4.3 Service development and deployment

Overall, the development process for a basic service is considered an ambitious undertaking. Developer teams are composed of multiple institutions working collaboratively. Processes must also be adapted to accommodate evolving requirements – particularly since Base4NFDI itself had been in its formative phase and international integration with initiatives such as the EOSC was initially less of a focus than it is today. Furthermore, developer teams need to advocate for a viable long-term funding model and raise awareness of their basic service within consortia from diverse disciplinary backgrounds. Developers need to work closely with the consortia to understand their specific needs. This bottom-up approach is perceived as essential by the vast majority of interviewees and focus group participants for achieving broad acceptance. All of this is taking place in a context where the long-term financial sustainability of the NFDI still remains uncertain.

On the other hand, both interviewees and numerous survey respondents emphasise the large efficiency gains of this shared development approach. In particular, promoting collaboration between consortia and reducing duplicate efforts can significantly improve overall efficiency and support better interoperability.

While developer teams are overall content with the collaboration with Base4NFDI for promoting their basic services (see chapter 4.3.3), they identify opportunities for improvement, particularly concerning the communication of requirements for each development phase, the reduction of administrative formalities and the flexibility of the development process (see chapter 4.3.1 and 4.3.2).

4.3.1 Resource allocation for basic service development

While Base4NFDI is widely recognised for its commitment to fostering collaborative basic service development, the basic service teams state that they frequently encounter practical challenges – including extensive needs for internal team coordination, limited funding flexibility, and growing formal requirements – that can limit their capacity to fully focus on service development.

In particular, basic service teams composed of a larger number of institutional partners (from different consortia) frequently experience considerable inefficiencies and losses due to the demands of inter-organisational coordination. While multi-institutional developer teams are intended to reflect a broad base of expertise, ensure inclusive participation, and signal relevance of basic service proposals, the need to align institutional processes, reach consensus across diverse technical requirements and strategic perspectives, and repeatedly fulfil formal reporting and documentation requirements can place a burden on project leads, developer teams and administrative staff. As a result, developer teams perceive the bureaucratic overhead occurring during basic service development projects as disproportionate to the available budget, leaving relatively little room for the technical and developmental activities that lie at the heart of basic service provision.

Another challenge is the emergence of new requirements such as the integration of services with the EOSC federation – which were not explicitly foreseen in the original project planning. While such developments reflect important strategic shifts and advancements in the broader

research infrastructure landscape across Europe, teams state they lack the financial and temporal flexibility to adapt to them midstream. Developer teams describe that their budgets are fixed, and staff capacities are already stretched to their limits, and that accommodating these evolving demands means redistributing scarce resources or postponing other critical activities, both of which can jeopardise the quality, timely delivery, and sustainability of the services being developed. Several interviewees and survey respondents think that the current multi-stage funding model does not provide the necessary elasticity to absorb unforeseen changes or to scale activities according to emerging user needs or technological advances (e.g. EOSC requirements). This rigidity is seen to not only limit the adaptability of funded services but also impose additional strain on the personnel responsible for implementation. However, developer teams state that no budget is available for these tasks and no time has been set aside in the original work plan. Furthermore, they emphasise that newly added tasks are difficult to accomplish in the short first phase (initialisation), especially due to a lack of resources. As a result, they report that it feels like they are "shooting at a moving target" in terms of constantly changing, stress-inducing new requirements as the project progresses. As development requirements continue to increase – often unpredictably – without corresponding adjustments to funding, some developer teams have been forced to draw on financial resources from their home institutions in order to carry out the development of their basic service.

4.3.2 Basic service assessment and development process

A frequently voiced concern among developer teams supported through Base4NFDI revolves around the perceived **lack of clarity and transparency in the evaluation process.** Although the overarching three-phase model for evaluating basic service submissions is generally acknowledged as conceptually sound and logically structured, its implementation is subject to several practical ambiguities. Foremost among these is, from their perspective, the absence of a clear and comprehensible framework for how key evaluation criteria – such as the relevance and sustainability of a proposed service, or the application of Technology Readiness Levels (TRLs) – are weighted and interpreted by the TEC. Applicants consistently report a degree of disorientation regarding what the evaluators are assessing to what degree. Some developer teams are unsure whether the emphasis lies on the technical quality and feasibility of the implementation plan, the projected impact and alignment with broader strategic goals, or merely the administrative correctness of inputs and compliance with formalities. This ambiguity is perceived to not only create uncertainty but also to hamper teams' abilities to align their proposals with expectations, thereby increasing the risk of misdirected effort and resource inefficiencies. Consequently, while the evaluation process is seen as theoretically robust, shortcomings in communicative and procedural clarity – such as late-stage template updates, shifting KPI requirements, and repetitive bureaucratic demands like resubmitting letters of support for each development stage – hinder reliable planning and make it difficult for basic service developer teams to develop coherent, phase-aligned proposals for consecutive project stages over time.

In parallel to issues of evaluation transparency, developer teams state that **the procedural landscape of the submission and development process has grown increasingly complex and demanding over time**. The current framework requires applicants to navigate a growing array of formalities – ranging from extensive documentation and highly specific technical planning to formal signatures by institutional leadership – regardless of the size or maturity of the proposed service. This increase in procedural burden is particularly pronounced when compared to earlier submission rounds for service development, which were – in the view of the developer teams – evaluated under comparatively lighter requirements.

One of the most frequently highlighted structural challenges is in the tight and fragmented **phasing of the funding cycle.** The one-year-long initialisation phase, which is meant to serve as a foundation for forming a cross-institutional developer team as well as for planning and piloting service development, is widely perceived as too short to effectively establish internal coordination and strategic partnerships required for efficient project delivery and long-term success. This compressed timeline undermines efforts to conduct meaningful onboarding or training of development team staff members and to gain broader support from relevant communities within the NFDI. Moreover, the overall phasing model is considered to lack continuity. According to developer teams, the transition from the initialisation to the integration phase is too abrupt, creating unnecessary disruptions in momentum. In addition, proposals for the integration phase need to be prepared in the midst of the initialisation phase (six months after project start), leading to significant overload and risking the overall quality and thoughtfulness of submissions. This challenging planning environment for teams and institutions is strained by the uncertainty regarding phase continuation. Since funding is awarded for relatively short increments but with a time-to-grant of several months, each phase carries the risk of termination, complicating long-term strategic thinking and making it difficult to recruit and retain qualified personnel.

In parallel, interviewed PIs from developer teams state that the administrative structure of Base4NFDI imposes a **considerable burden on project teams, particularly on the project coordinators who must navigate multiple cycles of proposal submission, review, and revision**. This workload is intensified by long, disjointed timelines: a typical cycle includes preparation through the early summer, proposal submission in July, funding decisions announced in autumn, and the actual disbursement of funds only occurring in February of the following year. Some PIs state that these delays can affect project planning, onboarding of staff, and continuity of operations. In addition, proposal deadlines are often considered too tight to allow for substantive engagement with stakeholders or iterative quality improvement. In addition, documentation requirements remain high throughout all phases, and even unchanged proposals must be resubmitted with new institutional letters of support and fresh leadership signatures, increasing procedural fatigue. Rather than reducing administrative demands over time, the staggered funding model tends to replicate bureaucracy with each phase, treating them as independent projects instead of stages of a single, coherent service development lifecycle. In the focus group with developer teams, it has been mentioned that this approach undermines the principle of adaptive, iterative development and stretches already limited resources thin.

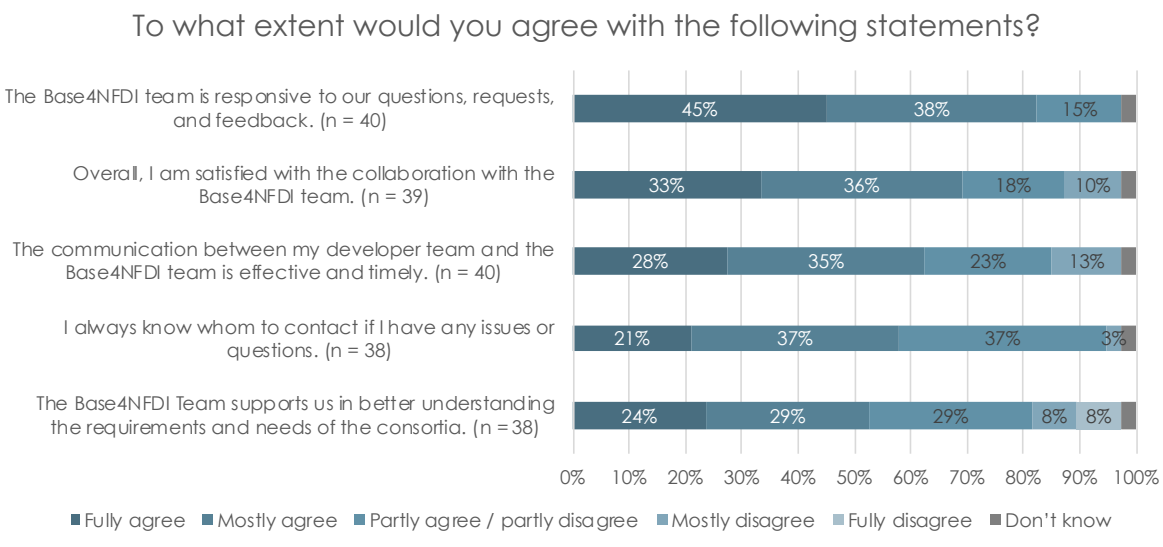
Another highlighted major procedural obstacle is the **expectation that applicants plan and articulate the entire multi-phase lifecycle of their service from the very beginning**. Developer teams think that they are expected to present a comprehensive vision that includes long-term outcomes, milestones, and performance indicators for submissions to the initialisation phase – even though the initialisation phase was originally conceptualised to be exploratory by nature – to ideally allow for iteration and realignment. This high level of foresight planning is often perceived as impractical by developer teams, particularly in a rapidly evolving technical and institutional landscape. The close interdependence between the first and second phases (initialisation and integration) further complicates this planning requirement. The boundaries between initialisation and integration phase are seen as porous, and many key decisions cannot be finalised until early implementation has revealed practical constraints and opportunities. Nevertheless, the formal proposal architecture does not permit this kind of flexibility. As a result, some teams think they are compelled to artificially separate planning into discrete stages, thereby distorting natural workflows and limiting the responsiveness of their approaches.

Finally, some developer teams mention that it is challenging to find the right balance between forming a functional and efficient developer team and being inclusive and open to many institutions from different NFDI consortia or section member institutions. On the one hand, smaller developer teams (with fewer institutions involved) tend to be more agile, better able to coordinate internally, and more effective in deploying limited resources toward development goals. On the other hand, Base4NFDI's evaluation criteria place a strong emphasis on broad community representation and alignment with NFDI section structures, which incentivises the formation of large, inclusive teams. Proposals involving three or four institutions – though potentially more manageable and coherent – may be perceived as lacking community backing or strategic breadth. At the same time, proposals involving 20 or more institutions become unwieldy, both administratively and operationally. In such cases, coordination becomes a challenge, communication suffers, and per partner funding diminishes to levels that risk ineffectiveness. While the intention behind larger and more inclusive developer teams is to aggregate diverse domain knowledge and technical expertise, focus group participants point out that this rarely translates into reduced individual workload. In fact, the increased coordination required often results in an overall increase in administrative complexity.

4.3.3 *Collaboration and support structures between basic services, Base4NFDI and NFDI consortia*

The survey results (Figure 23) suggest that the developer teams are relatively content with the support that the Base4NFDI team offers. 83 % of the survey participants state that the Base4NFDI team is responsive to questions, requests and feedback. 69 % state that they are overall satisfied with the cooperation with the Base4NFDI team. 63 % state that the communication between the developer team of their basic service and the Base4NFDI team is effective and timely. 58 % of participants know who to contact in case they have any questions. While almost no one disagrees with this statement, a considerable minority (37 %) only partly agrees with that statement. And finally, 53 % are of the opinion that the Base4NFDI team helps the basic services to better understand the needs of the consortia, pointing out room for improvement regarding the communication between developer teams and the consortia.

Figure 23 Developer teams: Satisfaction with collaboration with Base4NFDI



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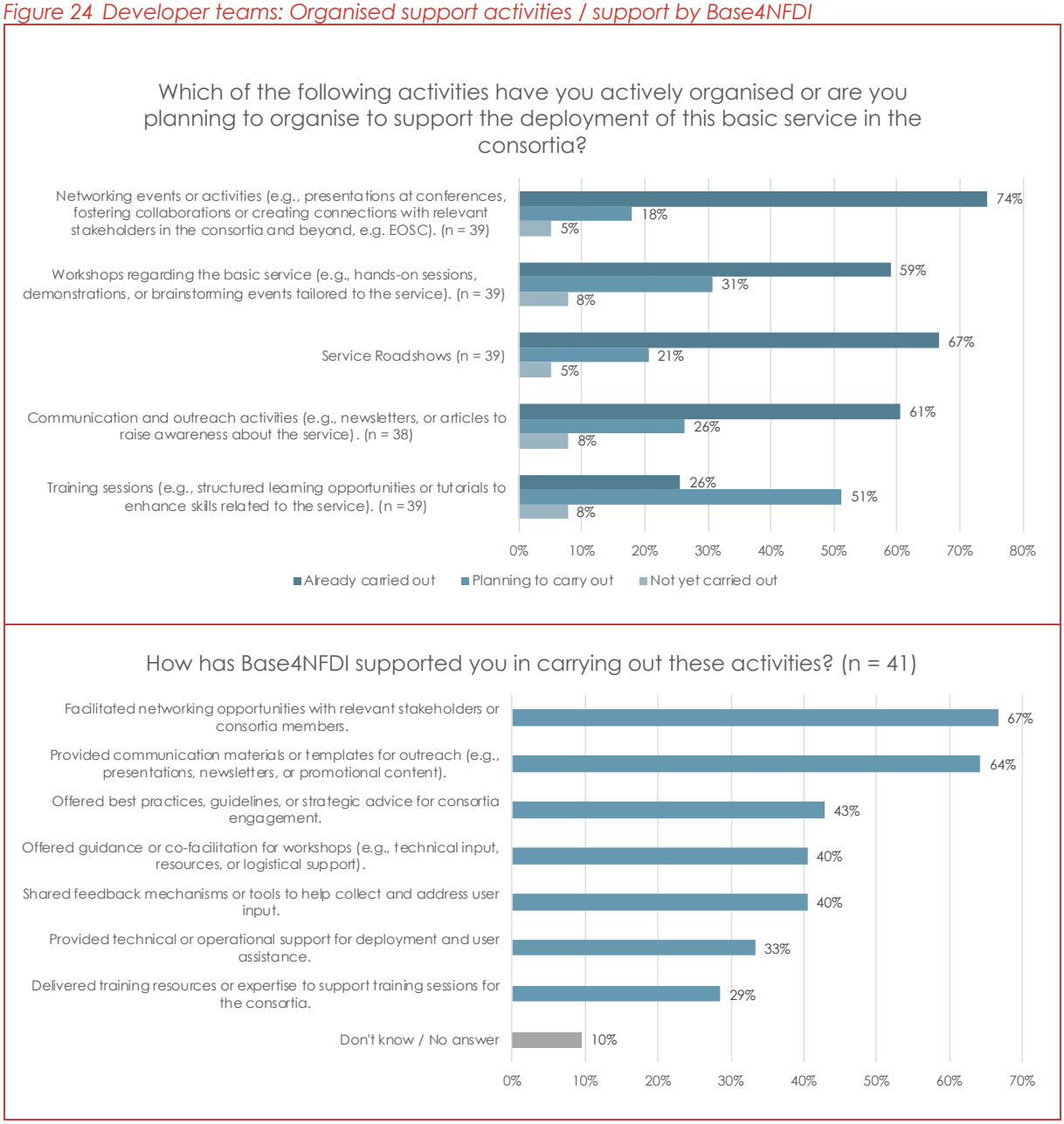
The survey reveals that the most commonly organised activity to support the deployment of the basic service has been networking events (74 %), followed by service roadshows (67 %) and communication activities (61 %). While training sessions have so far been the least implemented (26 %), they have the highest planned uptake (51 %), indicating a strong future focus on skill-building. Overall, consortia appear actively engaged in a mix of outreach, collaboration, and capacity-building efforts. Furthermore, the survey shows that Base4NFDI has been most helpful in facilitating networking (67 %) and providing communication materials (64 %) to support consortia activities. Fewer respondents reported receiving support in the form of training resources (29 %) or technical and operational assistance (33 %), suggesting these are areas with potential for increased involvement. Overall, support has been strongest in outreach and engagement, with more limited input in hands-on or technical domains.

Figure 24 Developer teams: Organised support activities / support by Base4NFDI



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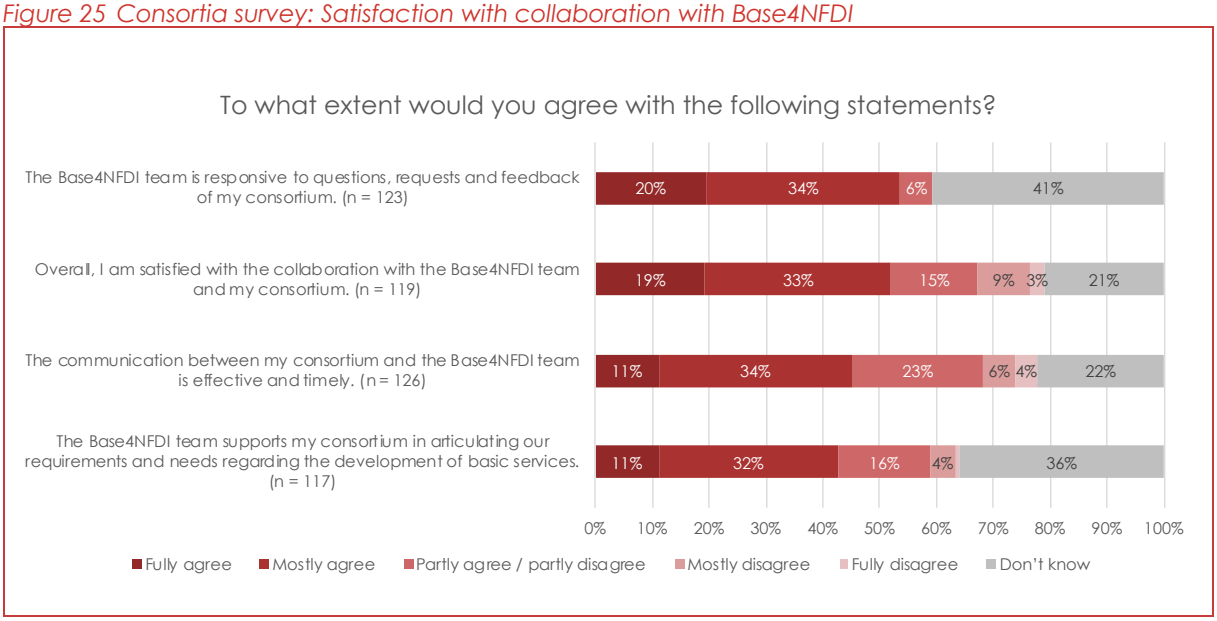
In the interviews on cooperation with Base4NFDI, some developer teams emphasise that more direct support from Base4NFDI is needed in some respects, especially when initiating projects. While Service Stewards (SER) are widely appreciated as competent and accessible contacts, many developer teams lack a designated counterpart in several consortia for overarching coordination. Although helpful support offerings exist, they are not always accessible during the intense early phases. Some add unintended overhead – especially legal requirements and templates requiring additional institutional processing. Nonetheless, the onboarding process was deemed helpful overall, with the in-person meeting in Garching in early 2025 fostering collaboration, trust and clarity. However, the early phase was also marked by information overload, and teams called for clearer guidance, checklists, and visual timelines to ease orientation.

Similarly to the developer teams, the respondents of the consortia survey are overall satisfied with the collaboration with Base4NFDI. The responses indicate generally positive perceptions of the collaboration with Base4NFDI, with around half of participants either fully or mostly agreeing that the team is responsive (54%), communicative (45%), and collaborative (52%). However, a significant proportion of respondents – especially regarding support for articulating needs (36%) and responsiveness (41%) – selected 'Don't know', suggesting limited direct interaction. Overall, while satisfaction is notable, there may be scope for improving visibility and engagement with some consortia.

Figure 25 Consortia survey: Satisfaction with collaboration with Base4NFDI



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Base4NFDI was in a formative phase when consortia and sections had already begun their work, and some interview partners wished to further develop certain communication structures. For developer teams, it is challenging to establish communication structures with all consortia (e.g. establishing a direct contact person in all consortia) although such bilateral communication channels are considered to be an important addition to other essential communication channels (e.g. sections/SLOs). Moreover, communication channels for direct inter-consortia communication are considered helpful by some interviewees.

Service Stewards are viewed as central support figures, helping with coordination and connecting teams across services. In the focus group with the developer teams, it was

mentioned that it should be clarified to what extent information disclosed in internal discussions among a developer team is treated as confidential by Service Stewards, in order to foster a safe space for open exchange. In contrast, developer teams do not always know how the role of SLOs is defined. While their primary role is related to activities in the sections, some developer teams are not sure whether SLOs are also meant to establish to connect developer teams with consortia.

A recurring challenge for the development process is the coordination between basic services and the NFDI consortia. Most NFDI consortia report close collaboration with a small number of basic services – typically between one and four (Figure 26) – while the majority of basic services state that they coordinate with six to fifteen different NFDI consortia (Figure 27). This asymmetry underscores the complexity of cross-cutting collaboration and highlights the need for more scalable and structured interaction models. SERs state that – while they initially focused more on establishing ties with the developer teams – they are currently working on establishing closer ties between the developer teams and the consortia. Given the large number and variety of NFDI consortia, this process will take some time, however.

While some NFDI consortia report effective integration – particularly where there is a natural overlap between development teams and NFDI consortias needs – collaboration becomes significantly more difficult as the number of services increases, especially when services lack thematic proximity or existing personal ties. In such cases, interaction is often minimal or non-existent, with consortia expecting greater initiative from basic services to establish meaningful contact.

Figure 26 Consortia survey: Collaboration between consortia and each basic service

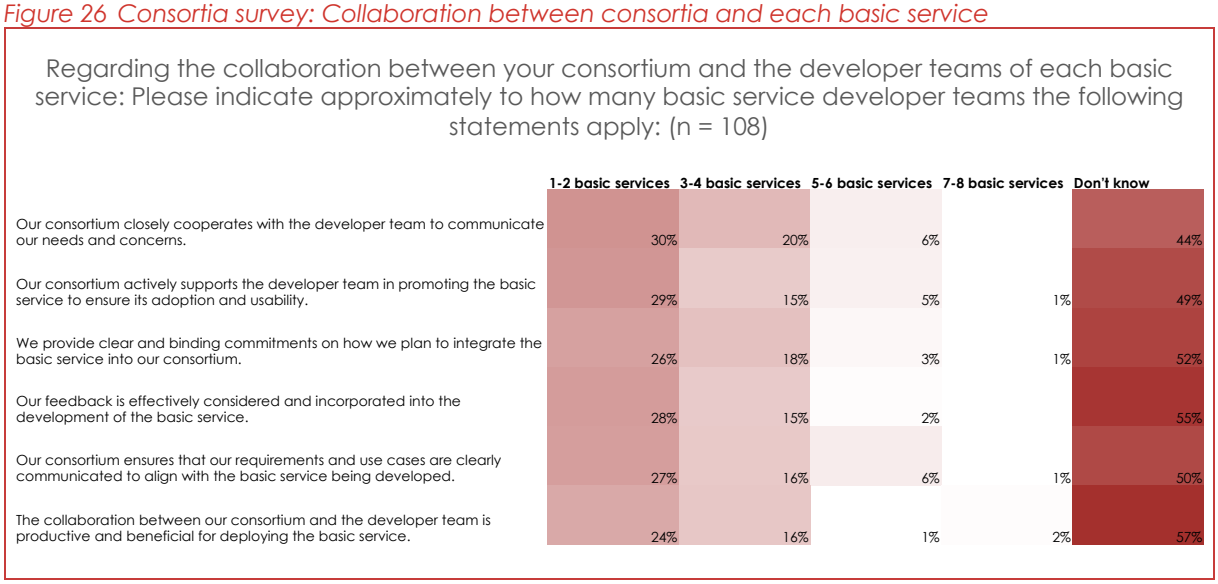

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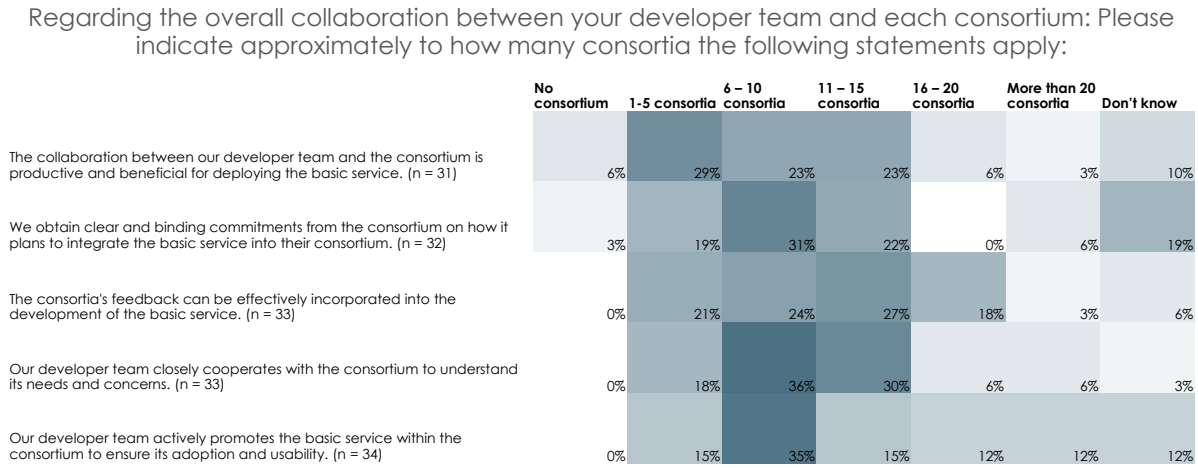
Figure 27 Developer teams survey: Collaboration between developer teams and each consortium



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Although a multi-stage collaboration process is formally in place – ranging from requirement analysis to joint implementation – the involvement of different stakeholder groups at various levels complicates communication. What happens at the developer or technical working level is not always visible or easily understood at the management level of the NFDI consortia, leading to gaps in coordination and strategic alignment. Improved transparency and more structured communication across all levels of involvement are needed to ensure that needs, requirements and responsibilities are mutually understood. Base4NFDI requires that each service conducts a requirement analysis by reaching out to the NFDI consortia within the first three months of the initialisation phase.[15] This is mandated through a structured survey, which must be sent to at least one contact per consortium. While this approach ensures a minimum level of engagement, it is also described by many as overly ambitious and resource-intensive, particularly during a phase already burdened with team onboarding and internal ramp-up tasks. Service Stewards play an important facilitative role in this context by presenting services and helping to establish contacts. Nevertheless, the effectiveness of this mediation effort by the service stewards varies depending on prior familiarity and organisational alignment between basic services and thematic consortia. Where natural links exist – for instance, when a member of a developer team is part of a NFDI consortium – communication tends to happen organically. In other cases, however, support for initiating and sustaining collaboration tends to be lacking. While Service Stewards are regarded as approachable and competent, many teams still lack a clearly assigned point of contact for cross-cutting coordination, leaving them uncertain about where to turn for strategic alignment beyond technical questions.

Structural mismatches further complicate coordination. NFDI consortia operate on a long-term 5+5-year funding structure, while basic services follow a five-year development phase that is divided into three shorter, sequential funding phases – resulting in a different planning and review rhythm. This misalignment creates friction in planning and undermines the potential for synchronised development and uptake of basic services. Moreover, the early stages of service development require time to gain traction, but the current project architecture does not

[15] It is also possible to start the requirement analysis before the initialisation phase as some developer teams have done.

adequately accommodate this initial period. Feedback mechanisms, although present in the form of surveys and regular reviews, are not always translated into actionable adjustments or sustained dialogue.

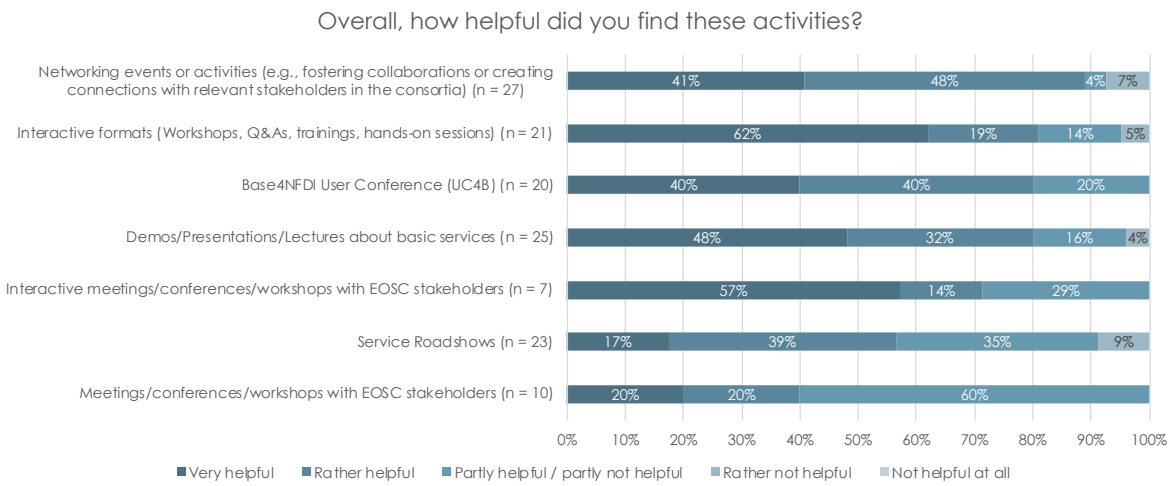
4.3.4 Promotional and outreach activities by Base4NFDI

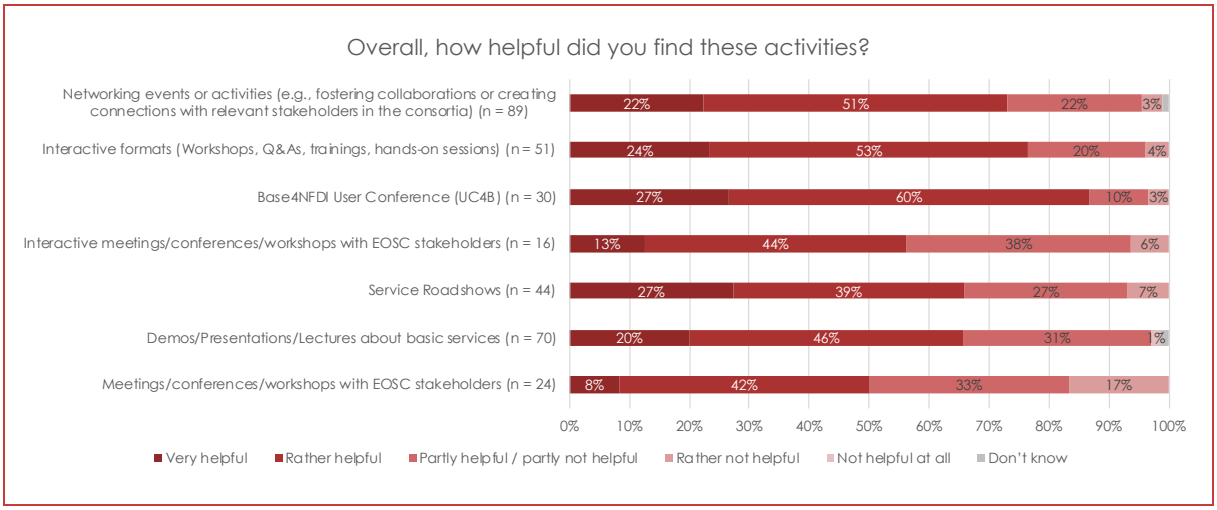
Both developer teams and consortia generally appreciate the range of support activities and events organised by Base4NFDI, recognising their value for community building and information exchange. When asked which events they had already attended the participants of the developer teams survey answer as follows: Networking Events (64 %), Demos and Lectures about Basic Services (62 %), Service Roadshow (55 %), Base4NFDI User Conference (48 %), Meetings with EOSC Stakeholders (26 %). Consortia survey respondents (n = 143) primarily attended Networking events (64 %) and Presentations on basic services (50 %), followed by Interactive formats (36 %), Service Roadshows (31 %), Base4NFDI User Conference (21 %), and around 15 % participated in EOSC-related meetings.

The survey results (Figure 28) show that 89 % of developer team respondents view networking events and activities as very helpful or rather helpful. Interactive formats like workshops are also regarded positively by 81 % of the respondents. 80 % of the participants of the survey also feel that the BASE4NFDI User Conference adds value.

The Service Roadshow, on the other hand, was only seen positively by 56 % of the respondents and the perceived least helpful activity were the Meetings with EOSC stakeholders, which only 40% of the respondents viewed positively. Although the number of respondents is particularly low for this answer item (n = 10). Very few respondents find that any of the attended activities were not particularly helpful at all, and none found any activity not helpful at all. Compared to developer teams, consortia generally rate the helpfulness of activities slightly lower across most categories. For example, 73 % of consortia find networking activities helpful, compared to 89 % of developer teams. However, dissatisfaction with any activity is also low. One area where consortia reported higher helpfulness was the Base4NFDI User Conference (87 % vs. 80 %). Overall, developer teams appear to perceive the activities as more helpful, possibly due to their closer alignment with technical goals.

Figure 28 Developer teams' and consortia's views on Base4NFDI activities





Technopolis Group; Note: Throughout the report, results from the survey of the developer teams are presented in **blue**, while survey results from the consortia survey are depicted in **red**.

Interviewees generally echo the sentiment of the survey. The annual User Conference, for example, is seen as a vital platform for showcasing the portfolio of basic services to the broader community. However, feedback suggests that its timing – immediately following the CoRDI (Conference on Research Data Infrastructure) meeting – may limit participation and engagement. Spacing these major events further apart could improve accessibility and allow teams to better prepare and capitalise on the opportunities presented. Similarly, the Roadshow events are considered beneficial in raising awareness and fostering connections. Yet, concerns have been raised regarding the condensed scheduling of these activities, which leaves insufficient time for teams to absorb insights, follow up on contacts, or integrate lessons learned into their workflows. Allowing greater intervals between events would enhance their impact and reduce participant fatigue. The annual retreat held in May, which brings together all basic services, receives positive feedback as a key opportunity for networking and cross-service collaboration. Participants value the dedicated time and space to exchange experiences, share challenges, and explore potential synergies. Ensuring that sufficient time is consistently allocated to these interactions is critical for sustaining collaborative momentum. Despite these strengths, **several developer teams note a gap in the support portfolio concerning the transitional phases of service development – particularly during and after the integration phase**. Existing support structures tend to focus on technical and procedural onboarding but fall short in addressing strategic issues such as business model development, sustainability planning, and user engagement strategies. While there is general agreement on the importance of these topics, the absence of targeted guidance or resources leaves teams without clear pathways to ensure long-term adoption and impact of their services.

4.3.5 Incubator projects

4.3.5.1 Design and development of the incubator process

The interviewed PIs of the basic services (IAM4NFDI, TS4NFDI) see the design and development of the incubator process as a practical, agile mechanism to accelerate the adoption and integration of their services across the NFDI landscape. Drawing inspiration from earlier initiatives, including projects led by the pan-European GÉANT research and communication network, they designed the process to be lightweight and flexible, avoiding unnecessary bureaucracy while still ensuring structured collaboration. Incubators run in six-month cycles, supporting both technical implementations (like widget integration or service extensions) and

strategic alignment (such as with policy frameworks or EOSC use cases). They perceive the process as having a formalised structure with open calls, clear application procedures, and a transparent selection process that favours disciplinary diversity and project readiness. The incubators include a kick-off, regularly scheduled check-ins according to the individual design, and continuous communication. The incubators try to not reject „unsuitable" applications, deferring them to a later call and aiming to support a wide range of needs and different consortia over time. The incubator is not intended to develop new services from scratch but to help researchers and institutions implement existing tools effectively within their domains. Overall, the incubator is valued by its coordinators as a low-threshold, high-impact tool that enables real progress through practice, helps surface unforeseen needs, and strengthens community ties – ultimately serving both the basic service and the NFDI ecosystem as a whole.

The incubator projects perspective on the design and execution of the incubator process is more nuanced and somewhat divided. One participating project views the incubator as a valuable instrument to advance and refine existing services. In particular the benefits of integrating terminology services and improving metadata standards in alignment with FAIR principles are highlighted. For technically mature services, the incubator provides a structured yet flexible opportunity to expand functionalities and promote interoperability across consortia. The collaborative setup – with access to expert teams, shared documentation spaces, and recurring coordination meetings – is seen as enabling efficient, goal-oriented progress and even laying the groundwork for future independent developments beyond the incubator framework. On the other hand, a different project expresses notable dissatisfaction. The interviewed participant voiced criticism regarding both organisational and technical aspects of the process. The administrative overhead – such as the requirement to submit formal applications and interim reports – is perceived as disproportionate, especially given that most proposals were accepted regardless. Furthermore, the developer highlights recurring technical errors at the interface with the technical implementation by the core basic services team, which stalled progress and could not be resolved independently. The interviewee believes that such core technical components should already be stable by the third incubator cycle. The lack of technical support during key coordination meetings further exacerbated the problem: only one of three checkpoints included a technical representative, while others were attended solely by administrative staff / project coordinators unable to assist with technical implementation issues. This led to a growing sense of frustration for the interviewee, who raised concerns about the overall readiness and responsiveness of the basic service – prompting questions about whether the project is sufficiently developed to integrate with incubator projects or still requires foundational improvements. This perception may be explained by the fact that IAM4NFDI is basic service comprised of software components from five different providers, where even one less mature component can affect the overall impression of the system's readiness.

4.3.5.2 Implementation: Successes, challenges and lessons learnt

The **Principal Investigators of the basic services** view the implementation process of the incubator projects positively. In their eyes, the incubators have successfully supported technical integration, with examples such as API gateway enhancements and the extension of widgets, which now benefit a broader user base. It is seen as particularly effective in surfacing user requirements that inform the iterative refinement of services, aligning them more closely with community needs. In this way, the incubator contributes not only to service uptake but also to the long-term adaptability and relevance of the services themselves. Support from the Base4NFDI development team was not central to implementation, partly because the incubator concept predates Base4NFDI in some cases. Nonetheless, coordination through Service Stewards and visibility efforts such as roadshows and LinkedIn promotion are

appreciated. Direct programming support, however, remains outside Base4NFDI's scope. Some challenges are acknowledged, especially in cases where incubators could not be completed within a single cycle due to personnel turnover in the incubator project teams or limited resources within the consortia of the incubator projects. Still, such cases are not seen as failures but as part of a learning process that may lead to follow-up projects or additional funding applications. In general, the PIs view the incubator as a meaningful and productive instrument that facilitates cross-consortial collaboration, enhances service integration, and supports sustainable adoption across the NFDI framework.

The perspectives of those implementing the incubator project diverge significantly. One participant broadly confirms the Principal Investigators' positive evaluation of the incubator process. In particular, collaboration with the basic service team is described as highly effective. The integration of technical components – such as HTML widgets and APIs – was smooth and aligned well with project goals. Documentation was clear and accessible, and the basic service team responded quickly and constructively to questions or issues. A combination of regular coordination meetings, flexible ad hoc support, and shared documentation platforms created a productive and collaborative working environment. This structure not only facilitated the current implementation but also enabled sustainable reuse and independent extensions beyond the incubator phase. In contrast, another incubator participant painted a more critical picture.

4.3.5.3 Transferability of the incubator process to other basic services

The **principal investigators of the basic services** largely agree that the incubator process demonstrates strong potential for transferability to other basic services. They emphasise that while specific content and technical scope vary between services, the underlying process design – including structured planning tools (e.g. goal-setting tables), clear deliverables, and modular project scoping – is broadly applicable. This applies not only to technically focused services but also to basic services that focus on training or policy development. Furthermore, cross-service exchange has already begun regular monthly online meetings facilitated by Base4NFDI and in-person events such as a "Speed-Dating" format, which was a part of Base4NFDI meeting in Garching, creating space for sharing practices and initiating collaborations. One of the interviewed basic services plans to participate in another basic service's incubator as a project partner, enabling a reciprocal perspective and further testing of process scalability. Key transferable success factors identified in the incubator process include the flexibility of the model, its generic template-like structure, and the emphasis on community engagement and peer exchange. Regarding future incubator processes of other basic services, the PIs **advise keeping incubation scopes compact to remain feasible within resource limits**, **possibly dividing more complex projects into multiple cycles**. They also recommend proactive outreach to consortia – frequent presentations and transparent communication help raise awareness and promote broader adoption. A central directory of services and contact points would further improve discoverability and coordination. Summing up, the incubation model is seen as adaptable and effective, offering a low-threshold, community-driven mechanism that could be tailored to various domains and service maturities across the NFDI ecosystem.

In contrast to the principal investigators' view, **incubator participants** assess the transferability of their approaches more pragmatically. While they do not actively engage with other incubators, this is not perceived as a limitation. Given the diversity of services and needs, they emphasise the importance of **individualised support over standardisation** or centralised coordination. Although a shared dashboard exists to track incubator projects, joint meetings or structured exchange formats are currently not established – but not necessarily missed due

to different thematic and technical specifics that require more individual support. Nonetheless, incubator participants confirm that their own projects are transferable, particularly across multiple consortia. For example, the solution of one participating service of the incubator is already being implemented in two consortia and is planned for use in another. Expertise is also actively shared – for instance, through upcoming repository workshops with consortia. While no specific structural elements were highlighted as essential for replication, a strong lesson learned is the need for broad adoption of shared services. Participants stress that consistent use of basic services, e.g. terminology services, is critical for semantic alignment and ensuring metadata quality across domains.

4.4 Overall assessment of development processes

This section presents the conclusions on the effectiveness, efficiency and coherence of the BaseNFDI basic service development. (see Chapter 2.2). The results are presented along the evaluation questions (highlighted in red). Where evaluation questions address similar themes, they are grouped and answered collectively to ensure coherence and avoid redundancy.

Are the criteria for evaluating incoming proposals clearly communicated? (Coherence)

The criteria used for evaluating basic services are, in general, appropriate – particularly given the wide variety of service types under development. However, it could be clarified more clearly how the criteria are weighted. On the other hand, providing more explicit guidance is challenging due to the inherent diversity of the services being proposed. For non-technical teams, the relevance and application of Technology Readiness Levels (TRLs) are not always clear. In response, Base4NFDI is currently working to establish the term "Maturity" as a more inclusive and accessible concept to describe the developmental status of services. The role of sustainability in the evaluation process also remains somewhat unclear. While sustainability may be of limited importance in the early development phases, the TEC already considers this aspect from the outset. A major challenge in assessing sustainability is the current lack of clear commitments from the consortia, which limits the ability to make reliable projections regarding long-term viability. The quorum thresholds set by the Consortia Assembly are generally appropriate. However, it could also be reasonable to increase the threshold for the initialisation phase and lower the one for the final phase. To date, no basic service proposal has failed to meet the quorum requirements in either the first or second development phase.

Does the technical expertise within the TEC complement each other in evaluating proposals? (Coherence)

The technical expertise within the Technical Expert Committee (TEC) is, in general, complementary and well-aligned for the evaluation of basic service proposals. Despite some criticism on specific decisions, the majority of stakeholders are satisfied with the performance and contributions of the TEC. In cases where specific expertise is lacking, external reviewers are consulted. Where conflicts of interest arise, affected TEC members recuse themselves from the evaluation process. Nonetheless, certain decisions made by the TEC have been met with criticism from segments of the NFDI community. In such a case, it could be helpful to communicate how external reviewers are involved in its decisions and to establish a more systematic approach to include such reviewers to improve the acceptance of the TEC. Moreover, a "pitch"-format where applicants can pitch and defend their submission in front of the TEC could help to overcome potential misunderstandings and criticism. The criticism of some decisions points to the challenging nature of the TEC's role in the evaluation process. Commitments by consortia to basic services are often formulated in vague terms, and the quorum requirements for the first two development phases do not constitute significant barriers to proposal submission. Consequently, the TEC's recommendations serve as a central instrument in the evaluation of basic services. Given this central role, transparent communication is essential – particularly concerning the involvement of external reviewers, the transparent communication of conflicts of interest and the communication of decisions and their overall role in the evaluation and decision-making process.

Are the decision-making processes and the subsequent allocation of funds transparent and understandable for stakeholders? (Efficiency)

Are the reasons for adjustments, such as costs or new/unanticipated tasks, comprehensible? (Effectiveness)

The decision-making process and the overarching three-phase funding model are logically structured and widely accepted by the stakeholders. Despite that, there is development that poses some uncertainty for both developer teams and consortia – potentially limiting the development process and the commitments of the consortia. The reasons for necessary adjustments – particularly in response to evolving requirements such as integration with EOSC – are broadly understood and acknowledged as strategically relevant by developer teams. However, the current funding framework lacks the flexibility to accommodate such mid-course corrections. Teams report that the fixed budget allocations and rigid timelines hinder their ability to adapt to new demands without redistributing scarce resources or postponing core activities. This limitation is particularly acute for institutions without dedicated project support, leading to some tensions between ambitious service objectives and practical feasibility. In consequence, while the emergence of new priorities is comprehensible, the structure of the funding model constrains teams' capacity to respond effectively, thereby potentially affecting both the quality and sustainability of outcomes.

Does the process ensure that the "common needs" outlined in the proposal are identified and addressed through basic services? (Effectiveness)

Are NFDI structures sufficiently involved? (Effectiveness)

Common needs are primarily identified within the working groups of the sections, which also play a key role in accompanying the development process of basic services and aligning their relevance with the requirements of NFDI institutions. These section working groups offer a distinct advantage in terms of agility compared to the larger and more heterogeneous NFDI consortia. Their flexibility enables a dynamic approach to proposing basic services and the bottom-up nature of this process is widely viewed as a positive factor contributing to the broader acceptance of basic services. However, there is a recognised need to strengthen the connection between the consortia and the sections. Since consortia do not have independent legal status, their members officially represent their home institutions within the sections. This structural characteristic can hinder direct institutional coordination. As a result, strategic alignment and coordinated planning between sections and consortia can be fragmented, potentially weakening the overall coherence of service development efforts.

Furthermore, the activities and outcomes of section working groups are not always transparent to all stakeholders. Improved oversight, better communication, and greater inclusion across sections and consortia are necessary to ensure coherence, traceability, and shared strategic direction in the development of basic services. NFDI structures – such as sections and consortia – are involved in Base4NFDI, but the degree of involvement varies from service to service. While developer teams report productive exchanges, particularly where pre-existing institutional ties exist, broader engagement across the NFDI landscape is perceived as fragmented. Consortia are typically more strongly involved in three to four services, while the others appear to be of lesser relevance – reflecting the high diversity within the NFDI. Within Base4NFDI, section involvement is mainly focused on the three sections from which basic service proposals have emerged so far. A persistent challenge is the asynchrony between consortia and sections. If consortia had better insight into section activities, it could increase the relevance of the services developed. The NFDI Senate is mainly involved in the ramp-up phase and has therefore played a limited role so far.

Is the development process regularly analysed and improved? (Efficiency)

Structural improvements – such as onboarding events and regular user exchanges – have been positively received and signal a willingness to adapt. However, procedural rigidity remains a significant concern. Timelines can sometimes be overly tight because deliverables must be met within short funding phases. Momentum and planning continuity can be disrupted, especially

during transitions between funding phases. Repetitive documentation requirements and prolonged time-to-grant cycles further strain resources, particularly when proposals must be resubmitted with minimal changes. In this context, teams report a growing burden from formal requirements, which is perceived to have increased over time. This trend suggests a lack of systematic dialogue between the coordination structures and the service teams – particularly the absence of a joint review mechanism in which procedural demands could be assessed and streamlined collaboratively. These issues are compounded by the expectation that teams articulate long-term, multi-phase development plans from the outset – despite early-stage uncertainties and the need for iterative adaptation. As a result, the development process tends to favour static over adaptive planning, limiting responsiveness and undermining agile service evolution. This front-loading of strategic planning creates a paradox: it asks teams to forecast uncertainties while simultaneously denying them the structural flexibility to course-correct once those uncertainties materialise.

How do various external stakeholders assess cooperation with Base4NFDI, particularly with the Service Stewards and Section Liaison Officers? (Relevance)

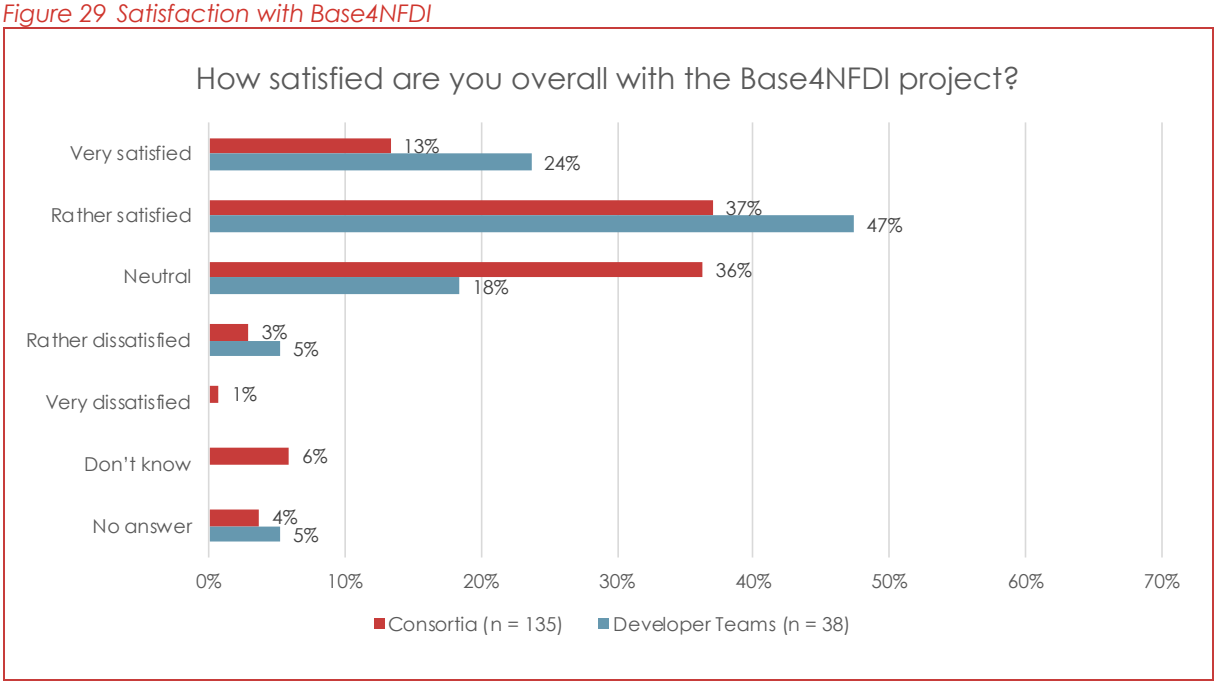
External collaboration with Base4NFDI is generally viewed positively by the stakeholders. The Service Stewards offer valuable support to the developer teams. Initially, they focused more on defining how they collaborate with the developers and are now working on linking the developer teams with the consortia – a task made challenging by the large number and diversity of stakeholders. Base4NFDI's training and networking activities are perceived as helpful to both the consortia and the developer teams. Although the SLOs were highly engaged and those covering vacancies took on additional responsibilities beyond the original scope (e.g. monitoring sections not originally attributed to them), staffing shortages initially prevented them from monitoring all sections equally. Their connection to the sections is crucial for ensuring the legitimacy of input of Base4NFDI, making their role increasingly important in the future. While the consortia express a desire for closer ties to the sections, this is more of an NFDI-wide issue and lies beyond the direct scope of Base4NFDI.

5 Relevance of Base4NFDI and strategic alignment

5.1 Overall satisfaction with Base4NFDI

The overall satisfaction with Base4NFDI is seen differently between consortia and developer teams. While 50 % of respondents from consortia are very satisfied or rather satisfied. Meanwhile 71 % of developer teams were either very satisfied or rather satisfied with NFDI. Out of the NFDI consortia, 36 % of the respondents have a neutral perception of Base4NFDI, twice as high as the 18 % of respondents from developer teams which hold this view. A small share of consortia respondents is rather dissatisfied (3 %) or very dissatisfied (1 %) with Base4NFDI. Only 5 % of developer team respondents are rather not satisfied. None of the developer teams are very dissatisfied. A further share of respondents (10 %) from consortia did not have an opinion or did not answer the question. For developer teams, this share is at 5%.

Figure 29 Satisfaction with Base4NFDI



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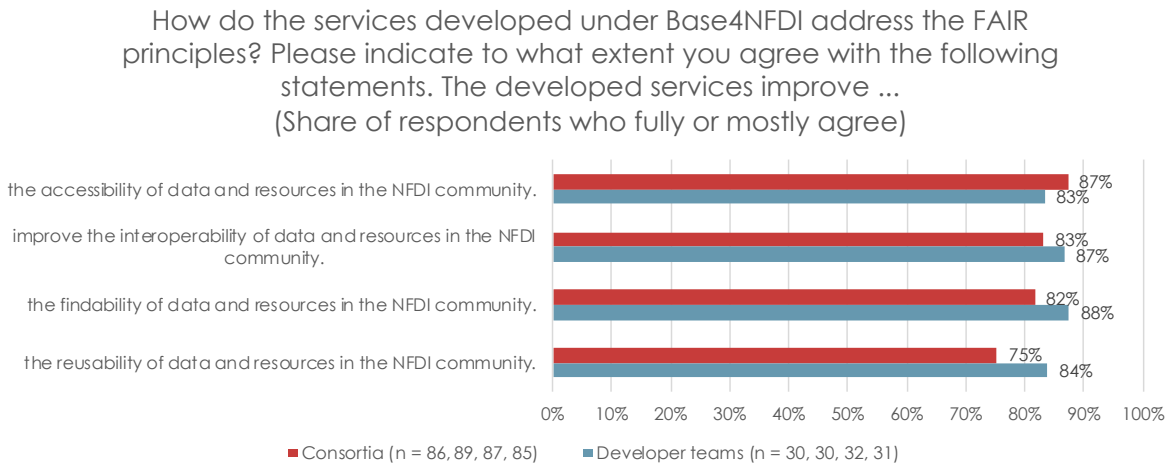
Both consortia and developer teams perceive NFDI as contributing strongly to all four FAIR principles, with only minor differences. Accessibility is rated slightly higher by consortia (87% vs. 83%), while developer teams give slightly higher ratings for findability (88% vs. 82%) and reusability (84% vs. 75%). Interoperability is rated similarly by both groups (83% consortia, 87% developers). Overall, perceptions are consistently high across stakeholders.

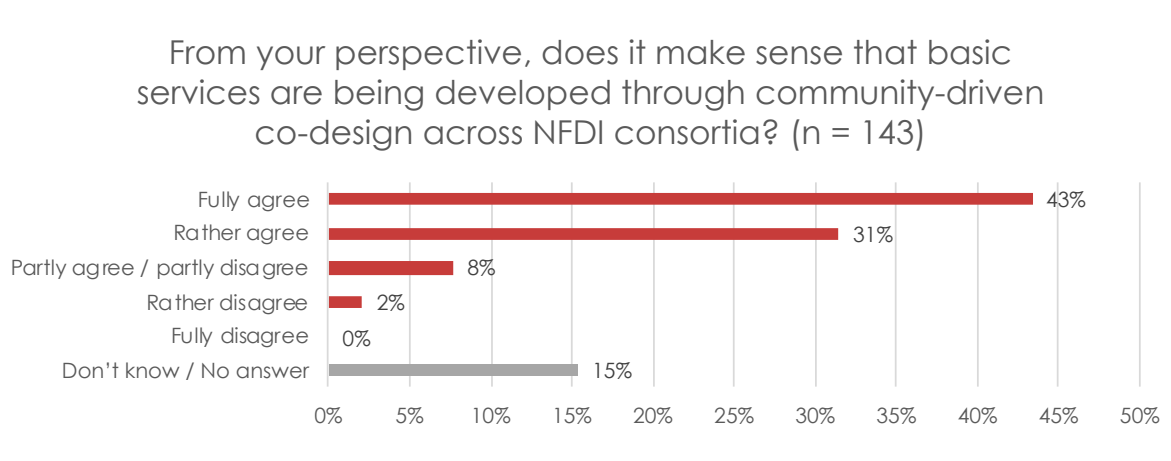
Figure 30 Survey respondents' views on addressing FAIR principles in Base4NFDI basic services



Technopolis Group. Values show share of respondents who answered with 'fully agree' or 'mostly agree'. Further answer options were: 'Partly agree / partly disagree', 'mostly disagree', fully disagree' and 'don't know'. Percentages are calculated excluding *'Don't know'* responses.

A key feature and strategic choice of Base4NFDI within the NFDI ecosystem was to launch bottom-up calls for the development of basic services. A large majority of respondents judges this approach as positive (43%) and 'fully agrees' that the community driven approach makes sense. A further 31 % of respondents "rather agrees". Only 8 % of respondents only partly agree/partly disagree and 2 % rather disagree. A share of 15 % answered 'don't know' or provided no answers. Thus, despite some perceived flaws of the practical implementation of the bottom-up approach outlined in earlier chapters, the overall strategic choice is perceived positively by Base4NFDI stakeholders.

Figure 31 Consortia survey respondents' view on community-driven co-design approach of Base4NFDI



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Overall satisfaction has been generally described as high during the interviews. The bottom-up structure of Base4NFDI was generally perceived positively, particularly in contrast to the more top-down structure of the EOSC. Given the central importance of acceptance and community buy-in within the NFDI, a bottom-up approach is regarded as essential. Without broad acceptance, the services provided are unlikely to be widely adopted or effectively utilised.

Several interviewees and survey respondents also highlight that Base4NFDI plays a crucial role in enabling cross-consortial collaboration. It is widely recognised as a significant achievement that Base4NFDI **creates the conditions necessary to prevent each consortium from developing isolated, non-integrated solutions**. It seeks to identify synergies and provides targeted funding to incentivise consortia to collaborate on the development of basic services. This approach reduces the need for individual consortia to independently develop redundant solutions. Moreover, it actively encourages exchange and cooperation between consortia, thereby contributing to a more coherent and integrated research data infrastructure

However, several respondents and interviewees expressed the view that a more strategic approach is needed to better support the overarching NFDI structure and align with EOSC requirements. Some perceive a risk that strategically important services – particularly those operating in the background or across domains – may be overlooked under the current process.

5.2 Relevance of basic services to its target groups

To gauge the relevance of basic services developed in Base4NFDI, we asked respondents from both surveys about the general utility of the basic services under development to different types of actors and ends. Multiple answers were possible.

Several trends are visible in both charts

- **Highest relevance for NFDI community**: relevance for the overall NFDI community is consistently rated the highest. This holds true for 7 out of 8 basic services in the consortia survey (exception: Jupyter4NFDI) and for all services in the developer teams survey. Average utility ratings: 48 % (consortia) and 61 % (developer teams).
- **Services of Base4NFDI proposal are rated highest for relevance to NFDI community as a whole and complementing EOSC services**: IAM4NFDI, PID4NFDI, and TS4NFDI – services already prioritised in the Base4NFDI proposal – are rated highest in both relevance and alignment with EOSC services. These services have also been under development the longest.
- **Consortia survey respondents attribute greater relevance to their own consortia than their own individual institutions**: consortia survey respondents rate services as more relevant for their consortia (avg. 39 %) than for their individual institutions (avg. 31%). Developer teams show a more balanced view: 25 % (own consortium) vs. 27 % (own institution).
- **EOSC alignment ranked lowest**: complementarity with EOSC services receives the lowest relevance scores in both surveys.
- **No basic service reaches the 75% quorum threshold in the consortia survey**: only IAM4NFDI achieves this threshold in the developer teams survey (note: survey responses are not fully representative of the entire NFDI community or all consortia).
- Overall **alignment between consortia and developer perspectives**: both groups show similar ranking patterns. Developers assign higher relevance for the NFDI community overall, but lower for their own consortia/institutions compared to the consortia respondents.
- **User utility shows more variation**: certain services – Jupyter4NFDI, nfdi.software, DMP4NFDI, and RDMTraining4NFDI – are perceived as particularly useful for individual users.

Figure 32 Consortia survey respondents' view on relevance of basic services for different target groups

Which of the following basic services are, from your point of view, in general useful for the following user groups? (n = 135)

	IAM4NFDI	PID4NFDI	TS4NFDI	Jupyter4NFDI	DMP4NFDI	KGI4NFDI	nfdi.software	RDMTraining4 NFDI	Average
For individual users	35%	23%	23%	49%	35%	17%	29%	37%	31%
For my institution	40%	35%	31%	31%	33%	19%	24%	31%	31%
For my consortium	56%	46%	47%	36%	35%	29%	25%	39%	39%
For the NFDI community as a whole	73%	61%	52%	39%	44%	36%	33%	50%	48%
For complementing EOSC services	19%	14%	13%	9%	7%	10%	5%	4%	10%
I don't know this service	12%	10%	19%	11%	17%	25%	26%	17%	17%

Technopolis Group. Multiple selections were possible for each basic service.

Figure 33 Developer teams survey respondents' view on relevance of basic services for different target groups

Which of the basic services are, from your point of view, in general useful for the following user groups? (n = 38)

	IAM4NFDI	PID4NFDI	TS4NFDI	Jupyter4NFDI	DMP4NFDI	KGI4NFDI	nfdi.software	RDMTraining4 NFDI	Average
For my institution	32%	29%	34%	24%	32%	24%	13%	29%	27%
For individual users	32%	26%	32%	39%	34%	34%	29%	42%	34%
For my consortium	29%	18%	34%	29%	32%	24%	13%	21%	25%
For the NFDI community as a whole	84%	71%	71%	45%	55%	53%	47%	61%	61%
For complementing EOSC services	37%	29%	34%	11%	21%	29%	16%	13%	24%
I don't know this service	8%	3%	13%	16%	18%	18%	24%	21%	15%

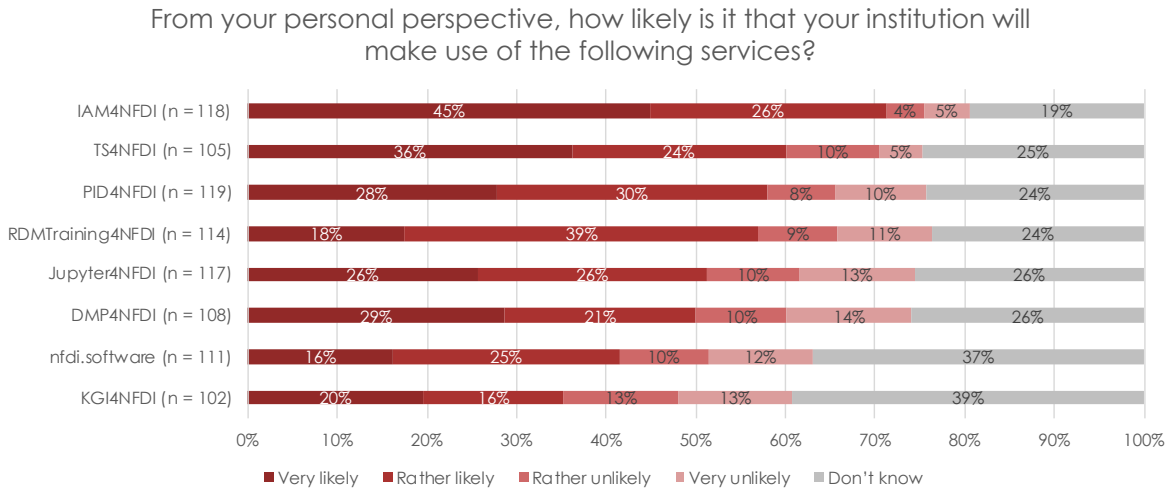
Technopolis Group. Multiple selections were possible for each basic service.

Some of these trends have also been echoed in interviews and open text responses in the online surveys. Several respondents note that it is not always clear to them where a community service ends and basic service begins. Although a formal definition exists, it is regarded as too broad and lacking sufficient operational clarity to some respondents. Another point of confusion concerns the actual target audience for basic services. Depending on the service in question, the intended users may be consortia, infrastructure institutions, or individual researchers. This variability contributes to differing expectations about the scope and function of Base4NFDI. Divergent opinions also emerged regarding the overarching purpose of Base4NFDI. Some interviewees argued that its focus should be limited to a small number of essential services that are relevant to nearly all consortia – thus forming a kind of backbone for the NFDI, with an implicit expectation of widespread or even mandatory adoption. In contrast,

others viewed the initiative as a platform for developing a broader pool of services, from which consortia and researchers can selectively draw according to their specific needs.

Asking respondents about the likelihood of adoption of basic services at their own institutions, positive responses (very likely and rather likely) rank between 70+ % and 35 %. The highest ranked service was IAM4NFDI with 71 %, followed by TS4NFDI, PID4NFDI and RDMTraining4NFDI with each between 55 % and 60 %. Jupyter4NFDI and DMP4NFDI are ranked at 50 %, nfdi.software is ranked at 40 % and KGI4NFDI is last with 35 %. For both of these two basic services, the low number is largely caused by the high number of 'don't know' responses, which is notably high with 37 % and 39 % respectively. Both services were unknown to slightly higher shares of respondents.

Figure 34 Consortia survey: likelihood of adopting basic services at home institution



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Looking at the reasons why a service is unlikely to be adopted by respondents' institutions, several answers stand out. The most frequent answer points to the lack of a demand at responding institutions (avg. 24 %), followed by the existence of comparable services (avg. 20 %), and failure to meet the specific needs of the institution (12 %). Notably, other constraints such as costs, interoperability, or lack of support were rarely deemed as problematic. Uncertainty about the long-term sustainability was mentioned, but only half as often as the existence of comparable services or lack of general need for it.

Figure 35 Consortia survey: Main reasons for not adopting a basic service

What are, in your opinion, the main reasons your institution is (rather) unlikely to adopt this service?

	IAM4NFDI (n = 16)	PID4NFDI (n = 27)	TS4NFDI (n = 19)	Jupyter 4NFDI (n = 33)	DMP4NFDI (n = 29)	KGI4NFDI (n = 39)	nfdi. software (n = 25)	RDMTraining 4NFDI (n = 28)	Average
Our institution does not need this service.	19%	33%	21%	30%	21%	21%	24%	25%	24%
We already have a comparable service in operation.	31%	19%	16%	24%	28%	3%	12%	29%	20%
The service is too general and does not meet the specific needs of our institution.	13%	11%	0%	12%	21%	21%	8%	14%	12%
The long-term sustainability of the service is unclear.	6%	7%	11%	6%	10%	15%	8%	7%	9%
The service proposal is not convincing.	6%	7%	0%	6%	7%	5%	20%	18%	9%
We lack the resources or expertise to implement the service.	0%	7%	11%	9%	0%	13%	8%	0%	6%
Implementing the service is too costly.	6%	0%	11%	0%	0%	5%	4%	0%	3%
There is insufficient support or guidance available for implementing the service.	6%	4%	0%	0%	0%	3%	0%	4%	2%
The service is not interoperable with other services we use.	6%	0%	5%	0%	0%	3%	0%	0%	2%
Other reasons	6%	11%	26%	12%	14%	13%	16%	4%	13%

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5.3 Sustainability of basic services

Sustainability of basic services (sustainable operation) has emerged as a recurring concern in interviews. Several interviewees characterise the issue as a "chicken-and-egg" problem: development teams require firm commitments from consortia to proceed with service development, while consortia, in turn, are reluctant to commit without clarity on the long-term sustainability of these services. This results in mutual uncertainty for both actors regarding the operating model of services. Additionally, Base4NFDI is only permitted to fund projects, with no long-term funding available for operating models.

In the focus group discussions, one participant observed that the challenge of sustaining basic services is not primarily about achieving the right quorum of votes but about securing adequate funding. Therefore, at the level of the entire NFDI, it would be important to assign clear financial values to the services provided.

A number of structural challenges were identified – some of them extend beyond the scope of Base4NFDI and concern the NFDI as a whole:

- The uncertainty surrounding the long-term funding of the NFDI overall poses a significant barrier to long-term commitments from stakeholders.
- Developer teams are expected to become increasingly specific and detailed in their proposals with each funding round. This is seen by some as an unrealistic demand and, arguably, a responsibility that should be addressed collectively by the NFDI as an overarching organisation. Clear decision-making structures and well-defined long-term funding models are necessary within the NFDI.
- In the focus group on sustainability, it was noted that the overarching architecture of the NFDI is not yet fully developed. Processes to establish a common infrastructure concept are taking a long time: a clear idea is needed of how a federation could interact in a technical and organisational sense. Only once such a concept exists can it be incorporated into sustainability considerations. In the section Common Infrastructures, there is a working group

on the overall architecture addressing this issue, and work on it is already underway within the consortia as well. However, coordinating and aligning activities between sections and consortia requires significant time and effort, and financial resources to support this coordination are often lacking.

- As a result, a broad variety of basic services is being developed which adds further complexity to the development of a sustainable funding model. A sustainable long-term funding model highly depends on the type of service being developed. For example, IAM4NFDI primarily targets consortia, while Jupyter4NFDI rather targets individual end-users.

In both interviews and focus group discussions, two primary funding models were most frequently discussed: 1) **Infrastructure institutions** could provide basic services through their access to **institutional funding**. 2) Alternatively, the **Flex Funds of the consortia** could be used if they commit to basic services.

Institutional Funding for Infrastructure Providers

The focus group noted that while a decentralised model works well during the development phase, it may be less effective for long-term operation. For the sustainable operation of basic services, it was argued that involving infrastructure institutions – and equipping them with institutional funding – could be transformative. As one participant phrased it, the ability of infrastructure providers to access substantial institutional funding could be a "*game-changer*" for ensuring the sustainability of basic services. However, one interviewee points out that meaningful participation from infrastructure institutions can only be expected if the operation of such services aligns with their strategic objectives. Infrastructure institutions primarily act within the scope of their formal mandates. Any engagement beyond this scope would require bilateral agreements, which may limit scalability. To incentivise broader participation, one suggestion was to integrate the operation of basic services into the formal remit of these public institutions – again described as potentially transformative, but only if it aligns with their institutional objectives. For some infrastructure institutions, it is also legally challenging to offer basic services through means other than institutional funding, as they are not permitted to provide services in exchange for payment.

An alternative model involves the use of **Flex Funds** by consortia, contingent on their commitment to specific basic services. One interviewee emphasised that the responsibility for supporting such services lies with the consortia. The interviewee advocated for establishing best-practice models on how clear and binding votes of consortia can be obtained. This would also require shifting greater responsibility to the consortia. The process of obtaining votes from consortia has been described as "soft" by an interviewee, especially when a consortium is not directly involved in the service. However, the need for voting creates additional overhead in the consortia. A possible compromise has been mentioned in an interview: For ramp-up phase voting, consortia could receive more time and better information to make informed decisions. However, voting – combined with a clear statement of commitments – should then be mandatory for consortia. In this context, a focus group participant emphasises the importance of establishing communication structures between consortia, sections, and the NFDI Association. There is a need to improve communication across these levels. Currently, sections meet irregularly, proposals are often developed in silos, and coordination between consortia remains limited. Strengthening these communication channels may prove an effective solution to receive clearer commitments from relevant stakeholders.

The future of services that do not progress to the final phase remains highly uncertain. One participant noted that the structure and purpose of the proposed "tool pool" is unclear to them. Within the focus group, maintaining such services in a state of reserve was generally viewed as neither a good nor a sustainable solution.

Given the diversity of services under discussion, some have advocated for a mixed funding model. In this model, institutional funding would support strategically important services, while other services might require alternative mechanisms – such as targeted incentives or flexible consortium-based funding. While services such as IAM4NFDI and PID4NFDI benefit from well-defined responsibilities and institutional frameworks, others – such as DMP4NFDI – necessitate greater involvement from the consortia themselves. In cases where consortia operate under constrained budgets, providing additional resources as an incentive for operating basic services was proposed. Overall, it was suggested that tailored, service-specific solutions may be required to ensure sustainability, rather than a one-size-fits-all funding model.

5.4 Overall assessment of the relevance of Base4NFDI

Is Base4NFDI achieving the objectives set at the time of evaluation, in line with the work programme and stakeholder expectations? (Relevance)

Has the work programme been adapted to meet any emerging needs? (Effectiveness)

Does the process ensure that the basic services are state-of-the-art and best suited to requirements, while also guaranteeing integration into international initiatives? (Effectiveness, Coherence)

Base4NFDI has successfully enabled collaboration across consortia, and all basic services currently under development are considered relevant by their respective target groups. While some of these services are viewed by stakeholders as broadly beneficial to the NFDI community or to the consortia as a whole, others are seen as primarily serving the needs of more specific user groups. This reflects a central challenge: Base4NFDI must address a wide range of diverse requirements and expectations.

There is a potential risk of misjudging the overall utility of Base4NFDI services if diverse perspectives are not fully considered. Findings related to individual users raise important questions about the intended user groups – whether services are aimed at individual researchers, consortia, or both – which suggests that the development and roll-out process should be sensitive to these differences. Additionally, the low perceived utility in complementing EOSC services prompts a strategic reflection on whether Base4NFDI services are meant to be integrated directly into the EOSC federation, or rather to strengthen NFDI's internal capabilities to participate in EOSC. These contrasting views highlight the ongoing need for a clearer, more unified understanding of what constitutes a basic service and what strategic role Base4NFDI should play within the larger NFDI ecosystem. When respondents of the consortia survey were asked about the likelihood of adoption at their own institutions, the high ranking of basic services enabling NFDI core capabilities (AAI, PID, interoperability) is noteworthy.

To ensure long-term operational viability, basic services must align with the strategic frameworks of existing institutional infrastructures. However, a significant portion of survey respondents expressed concern that the perspective of individual researchers remains underrepresented in this process. While this highlights that certain basic services (esp. those which operate rather in the background) are of greater relevance to providers rather than individual users, consideration should be given to how the perspectives of researchers might be more effectively integrated into the submission process.

Sustainability presents a classic "chicken-and-egg" problem: consortia require confidence that services will reach completion before committing long-term support, while development teams need binding commitments from consortia to justify continued investment. In most cases, reliable assessments of sustainability can only be made once a service is fully developed or integrated into the so-called "tool pool." It is important to emphasise that Base4NFDI remains an ambitious initiative. Efficiency gains and strategic value can still be demonstrated even if a basic service is adopted by a smaller community – provided that it serves a clear purpose – even if used by fewer than 75 % of the consortia.

The integration of EOSC requirements into Base4NFDI processes illustrates the initiative's strategic responsiveness to emerging needs. Looking ahead, engagement at the international level is expected to become increasingly important for shaping and aligning service development with broader scientific infrastructure trends. Emerging needs from the community can be incorporated through the bottom-up structure of the submission process, although transparency of the work in the sections is an issue – esp. for third-round consortia. Moreover, a

significant number of survey respondents think that researchers do not have enough say in the submission process – which might affect their sustainability in the long run.

6 Conclusion and recommendations for action

Several aspects of Base4NFDI have been highlighted and positively evaluated by stakeholders. These include its bottom-up organisational structure, the facilitation of cross-consortia collaboration, and the support provided by Base4NFDI throughout the development and coordination process. Furthermore, the ambitious nature of Base4NFDI is widely recognised. The project was established after the sections and most consortia had already commenced their work, and the long-term funding framework for NFDI as a whole remains uncertain. Additionally, the consortia and participating institutions represent a wide diversity of disciplines, structures, and priorities. In this context, identifying basic services that are universally relevant presents a considerable challenge.

The following recommendations, derived from the evaluation, are intended to further strengthen the project and support its continued development. The recommendations for action are also assigned to the respective level of action: 'Operational project level', 'Strategic project level', and 'Project context' (NFDI-wide aspects).

1. Strategic project level: In order to secure the long-term sustainability of developed basic services, we recommend **establishing clear and differentiated funding pathways.** Furthermore, funding paths should be aligned with the future development of the NFDI, especially in light of the outcomes and follow-up of the recently completed structural evaluation**.** Given the diversity of services currently under development, a one-size-fits-all model is unlikely to be effective. Instead, three complementary funding tracks could be articulated in greater detail:
   i) First, a pathway should be created in which NFDI (infrastructure) providers are provided with institutional funding to operate basic services. A dedicated budget for NFDI "core" services – i.e. those serving the overarching NFDI architecture and, possibly, EOSC node capabilities – would help safeguard their continued operation and integration, ensuring their sustainability beyond the development phase.
   ii) Second, consortia should be encouraged and, where appropriate, required to articulate their long-term commitment to specific services. This could include a clear indication of how they intend to allocate their Flex Funds to support the sustainability of those services. To strengthen accountability and decision-making, it should be considered whether voting by consortia during the ramp-up phase ought to be made mandatory. However, consortia must be given sufficient time, information, and preparation to make informed decisions. Formal declarations of support in the ramp-up phase would allow for greater transparency and alignment, helping to ensure that only services with sufficient backing proceed to implementation. One possible approach to improving planning and commitment would be the development of an adoption roadmap – a structured plan in which consortia and institutions specify when and under what conditions they intend to adopt a given basic service. Such a roadmap could enhance transparency, support sustainability planning, and provide development teams with clearer indications of future uptake across the NFDI landscape.
   iii) In addition, the role and purpose of the tool pool for services that do not reach the ramp-up phase must be clarified. This includes exploring alternative funding mechanisms or maintenance strategies for services that, while not selected for full implementation, may still offer value to specific user groups.
2. Strategic project level: The current three-stage development process for basic services has been identified as a source of considerable administrative burden and planning insecurity for both developer teams and consortia. In particular, the relatively short duration of the

initialisation phase, combined with uncertainty surrounding progression to the integration and ramping-up phases, poses significant challenges for sustainable planning and implementation. From the perspective of the evaluation, it is recommended that the structure of the development process be re-evaluated and better aligned with the overarching goals of Base4NFDI. This could involve an internal consultation – such as a workshop including all four TAs and the SERs to reflect on the results of the evaluation and to discuss and identify actionable improvements. Several structural alternatives could be considered here:

i) If the goal is to ensure that most selected basic services reach an operational stage, a two-stage process could be more adequate: This could consist of an initial feasibility or prototyping phase (e.g. one year), followed by a longer development and implementation phase spanning several years. Alternatively, the initialisation phase and the integration phase could be merged into a cohesive multi-year programme, allowing for a more streamlined and continuous development process. Given the current state of the project – with many services on the verge of ramp-up and several already entering the integration phase – it may also be worth considering whether merging the integration and ramp-up phases could serve as a viable structural alternative (e.g. if this leads to increased commitments from the consortia or creates opportunities for better coordination and synergy between the two phases).

ii) Alternatively, if the initialisation phase is seen as a design phase, primarily intended to conduct requirements analyses, initial service design and setting up efficient developer teams, then the three-staged model may still be appropriate. In this case, however, adjustments could be made to mitigate its drawbacks. For instance, extending the duration of the first phase or shifting certain administrative and evaluative requirements to later stages could ease the burden on developer teams and provide additional time to demonstrate the viability of their services (see also recommendation 6 i).

3. Strategic project level: **Criteria for evaluating basic services**: Continue establishing an evaluation criterion about "**service maturity" instead of Technology Readiness Level** to account better for non-technical services (see also recommendation 7). Furthermore, **clearly communicating how criteria are weighted** in the evaluation process could be beneficial for the acceptance of the evaluation process. Explicitly stating that "service maturity" is now used would acknowledge the diversity of service types and community needs. In this context, it may also be helpful to clarify how the TEC criterion "scalability" is defined, as scalability may take different forms in technical versus non-technical services.
4. Strategic project level: Base4NFDI enables collaboration across consortia and sections, providing a shared space for coordination and the development of basic services that address cross-institutional needs emerging from the sections. The evaluation process for basic services is inclusive of all consortia, creating a foundation for community-driven service development. The breadth of expertise within the community is considerable, and the knowledge base provides an important resource for shaping relevant and sustainable services. This positions Base4NFDI to take a leading role in identifying and integrating emerging needs within the NFDI. At the same time, a more strategic approach could help to ensure that service development also supports the overarching NFDI architecture and aligns with broader frameworks such as EOSC. It is recommended to find an appropriate balance between maintaining the central role of the bottom-up approach and integrating strategic elements to help shape the overall NFDI architecture. The strategic approach should be designed to align with and fit into the results of the recently concluded structural evaluation.

5. Project context: In a bottom-up model such as that of the NFDI, ensuring input legitimacy is essential. For this to be achieved, a more coordinated approach within the NFDI is needed which would likely be beneficial for all stages of services development (from submission to ramp-up). In particular, the role of the sections – as key bodies in the identification and development of basic services – must be made more open and navigable for all relevant stakeholders. Several adjustments could potentially help improve the current process:
    i) Establish a strategic coordination mechanism between consortia, the sections, and potentially other bodies such as the NFDI Senate. Such a mechanism would enable structured dialogue on overarching architectural needs and priorities of the NFDI, thereby improving alignment at a strategic level. Strategic coordination should be aligned with the emerging EOSC federation,[16] as this would ensure interoperability, avoid duplication of efforts, and position NFDI services effectively within the broader European research infrastructure landscape.
    ii) Facilitate operational coordination between sections and consortia. One practical measure could be the designation of contact persons within each consortium who are responsible for liaising with the sections and keeping their communities informed about relevant activities.
    iii) Enhance the accessibility and transparency of section work. This could include providing clear, up-to-date overviews of section activities, current work statuses, objectives, and timelines. Increasing the visibility of these processes would make it easier for consortia and individual actors to engage meaningfully with section initiatives.
    iv) Promote the definition of basic services and consider narrowing the scope of what defines a basic service.
6. Operational project level: To improve the development process and reduce unnecessary barriers for applicants, several procedural adjustments should be made. These aim to ease the administrative burden on developer teams, clarify evaluation criteria, and ensure sufficient preparation time for changes to application materials.
    i) **Reduce formal and administrative burdens**: It should be considered removing the requirement for rector or institute head signatures for integration and ramp-up application phases; PI-level authorisations should be accepted where appropriate. Eliminating redundant signature requirements unless substantial changes have been made would streamline follow-up applications phases. A critical assessment of all documents is recommended to strike a balance between what is necessary and what is too much technical overhead for the developer teams.
    ii) **Communicate template changes in advance**: Any modifications to application templates or formal requirements should be announced at least three months prior to the submission deadline to allow for adequate preparation.
    iii) **Define standards for community support**: Develop clear guidelines for what constitutes sufficient community backing for developer teams, such as minimum partner numbers or specific endorsement criteria.

[16] This could build on work done by Base4NFDI identifying complementarities and linkages with EOSC, including possible core services and node resources among Base4NFDI. See Bernard, L., et al. (2025). Base4NFDI *White Paper: "Advancing Essential Services to Complement EOSC"*. Zenodo. https://doi.org/10.5281/zenodo.14732131 and Bernard, L., et al. (2024). *Base4NFDI Policy Paper: "Base4NFDI Services and EOSC: Guidance for Interoperability"*, Version 1 (Version 1). Zenodo. https://doi.org/10.5281/zenodo.13946300.

7. Strategic/operational project level: **Evaluation and decision-making**: To enhance the evaluation process and foster greater transparency and acceptance of decisions, several improvements are recommended regarding communication, review participation, and the clarity of the TEC's role.
   i) Introduce a short defence or pitch format: Implementing brief presentations before the TEC could improve communication and increase acceptance of its decisions. To balance this, the scope of proposals and application templates could be reduced, focusing on a concise project outline rather than a full application to minimise administrative burden.
   ii) Include external (international) reviewers more systematically: Incorporating international reviewers into the TEC could enhance the credibility and acceptance of decisions within the broader community.
   iii) Clarify the TEC's role and authority: Clearly define whether the TEC's decisions are advisory or binding, and ensure that the governance and decision-making framework is communicated transparently.
8. Operational project level: To improve internal coordination, communication, and decision-making structures within Base4NFDI, a number of practical adjustments are proposed. These aim to streamline processes, clarify responsibilities, and strengthen collaboration across roles and Task Areas (TAs).
   i) **Strengthen coordination at working level and clear up responsibilities by establishing task leads**: Introduce coordination mechanisms closer to the operational level, such as appointing task leads within the Base4NFDI Task Areas. This would enable teams within Task Areas to make decisions on routine matters without constant recourse to co-spokespersons. Furthermore, it would help further clarity responsibilities within TAs.
   ii) **Streamline communication between Base4NFDI and developer teams**: Consider establishing and clearly communicating single points of contact for consortia and sections, but also within developer teams.
   iii) **Introduce feedback and appraisal mechanisms**: Establish structured feedback processes between team members and co-spokespersons, covering both project progress and opportunities for training and personal development.
   iv) **Strengthen the role of Section Liaison Officers (SLOs)**: Fill last vacant SLO positions and clarify their function in connecting sections and consortia.
   v) **Empower Service Stewards (SERs)**: Given their function at the intersection of service development and project coordination, it is recommended to more clearly define how SERs navigate their dual role – particularly regarding their involvement in strategic discussions within developer teams and the handling of internally shared information – to support open communication.
   vi) **Clarify Task Area structure and naming**: Consider referring to Task Areas by their functional name rather than by number in external communication. In the long term, merging TA1 (Service Initialisation) and TA2 (Service Integration and Ramping up for Operation), as well as TA3 (Service Coherence Processes and Monitoring) and TA4 (Project Governance), could help reduce overlap and improve coherence.

Appendix A Interview guides & survey questionnaires

In a separate document.

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