Gaia-X
FEDERATION SERVICES
GXFS

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Strategies for Building Gaia-X Ecosystems using the Gaia-X Federation Services

In dialogue with the Gaia-X Projects

SHORT VERSION

September 2022

www.gxfs.eu

Foreword

Dear Reader,

In the summer of 2021, a total of eleven consortia were selected for funding for three years to implement the Gaia-X concept in various domains. Most of the projects started work at the beginning of 2022 and have now reached a concretisation stage which includes the establishment of Gaia-X federations.

With the publication of the study “Strategies for Building Gaia-X Ecosystems With the Help of the Gaia-X Federation Services – In dialogue with the Gaia-X funding projects”, we would now like to provide a first insight into how the conceptual work around the Gaia-X Federation Services (GXFS) is progressing. The study results show that a lot has already happened since the launch of the first projects in November 2021, but that there are still many challenges for the operational implementation of Gaia-X ecosystems based on the technical Gaia-X specifications.

The Gaia-X Federation Services (GXFS) are in the implementation phase parallel to the research projects and are now available in a first version. The GXFS project, funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK), delivered detailed technical requirements specifications as early as May 2021 and has since hosted a large number of accompanying information events, exchange forums and technical deep dives. One objective of this study was therefore also to obtain feedback on the currently available informational content and to identify any additional requirements that the projects have.

The study results are based on the analysis of an online survey and a series of extensive expert interviews conducted in the period from June to August 2022. The trend is clear: Gaia-X and GXFS are perceived as catalysts and a necessary foundation for future-proof and innovative digitalisation.

The mission for the Gaia-X funding projects is also clear. They are to develop business models that demonstrate a recognisable value creation potential or significantly improve existing procedures and processes for the economy and society. In part, the necessary extended requirements are also reflected in the functional design of the Gaia-X Federation Services. The GXFS toolbox as open source code needs to be continuously added to by the funded projects and we look forward to presenting the first results at our annual conference GXFS Connect 2022 and discussing their use with Gaia-X users.

We will start another evaluation round in spring 2023 and hope that you will enjoy reading about our findings to date in this paper.

Andreas Weiss
Head of Digital Business Models at eco – Association of the Internet Industry

Study Contents – Short Version

Quantitative Analysis

Method

In order to obtain an overview of the level of familiarity with GXFS as well as the implementation strategies for GXFS among the funding projects, a two-stage approach was applied. In July 2022, the consortium and/or technical leaders of the eleven funding projects were asked to respond to an online survey.

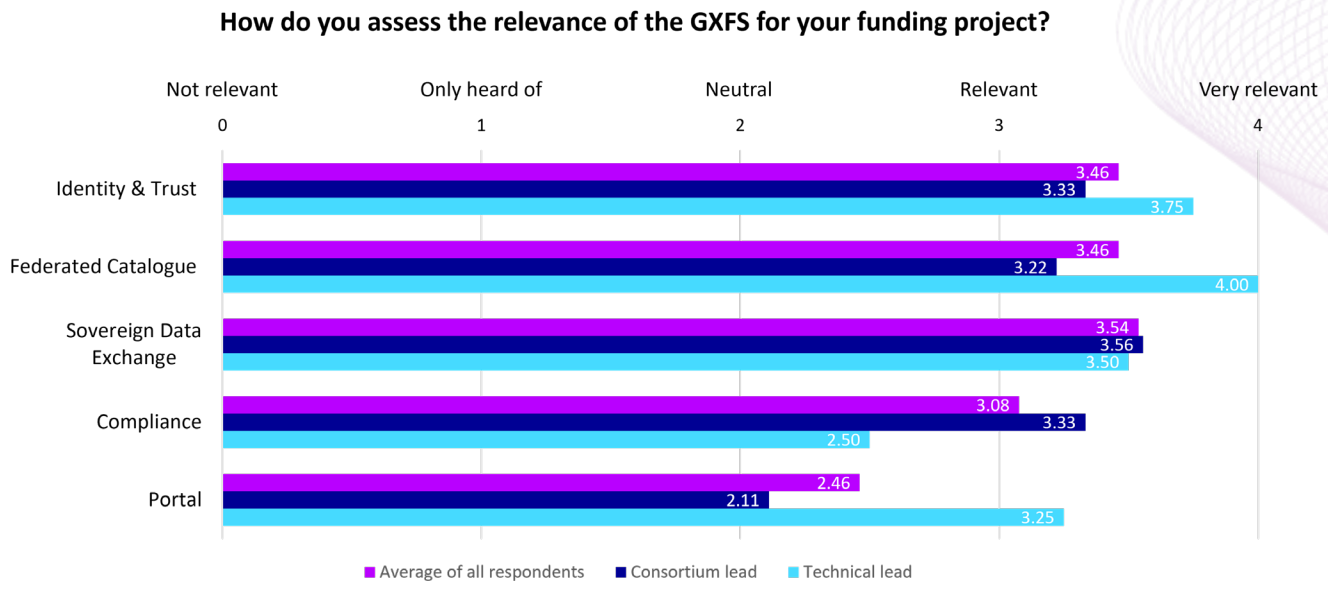
The responses of 14 participants were analysed and the following sections present an overview of the status in the funding projects after the first half of the year in terms of relevance, familiarity, planned use and preparation for use of the GXFS services.

Subsequently, the results of in-depth interviews with the project managers, which were conducted after the online survey, are presented.

Result: Relevance

The persons responsible for the funding projects consider all GXFS services, as presented at the beginning along with the work packages, to be relevant. However, the assessments vary here between consortium leaders, who are usually more responsible for the user aspects of the use cases to be created and the corresponding business models, and the technical leaders, who focus on technical requirements and performance.

The level of knowledge about the work packages influences the assessment of their relevance, as we show in the next section. There is also a connection with development progress and corresponding information for the portal, which is generally assessed as being somewhat less relevant.

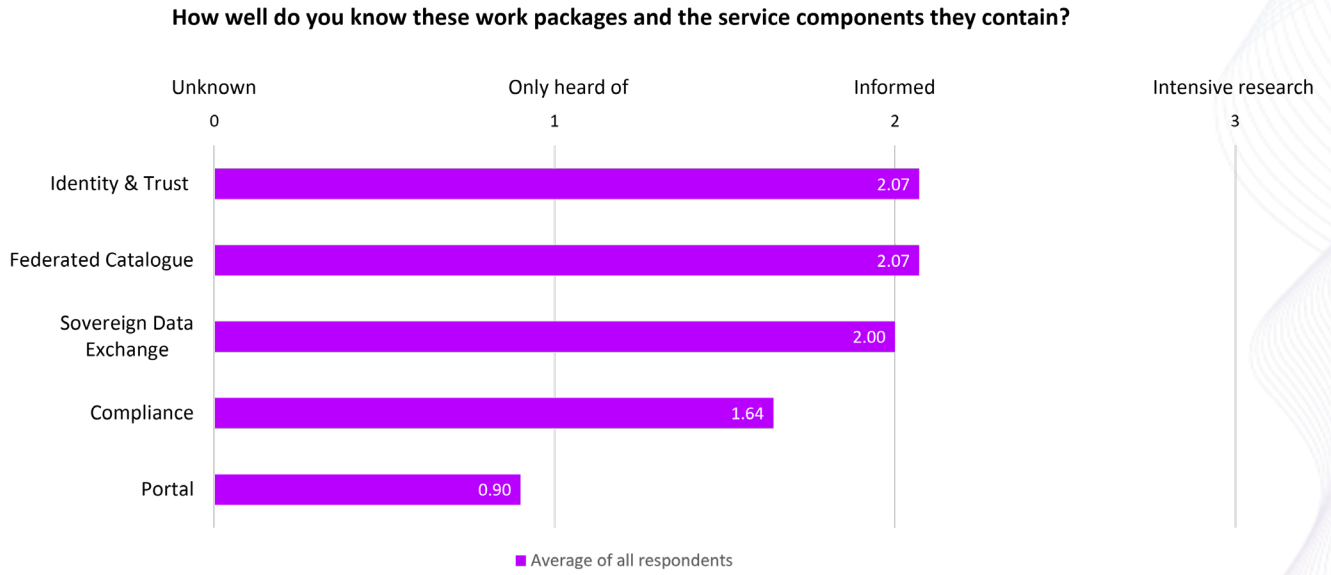


Source: Online survey of consortium and technical leaders of funded projects; Boecker-Ziemen, July 2022; n=14.

Graph 5: Relevance of the GXFS work packages

Result: Level of Information

The funding projects are, in general, familiar with the GXFS work packages. A focus of information gathering in the first months of the project terms was on the identity and trust services as well as the federated catalogue services – which was also related to the availability of more detailed information, among other things. The technical project leaders are generally better informed than the consortium leaders.

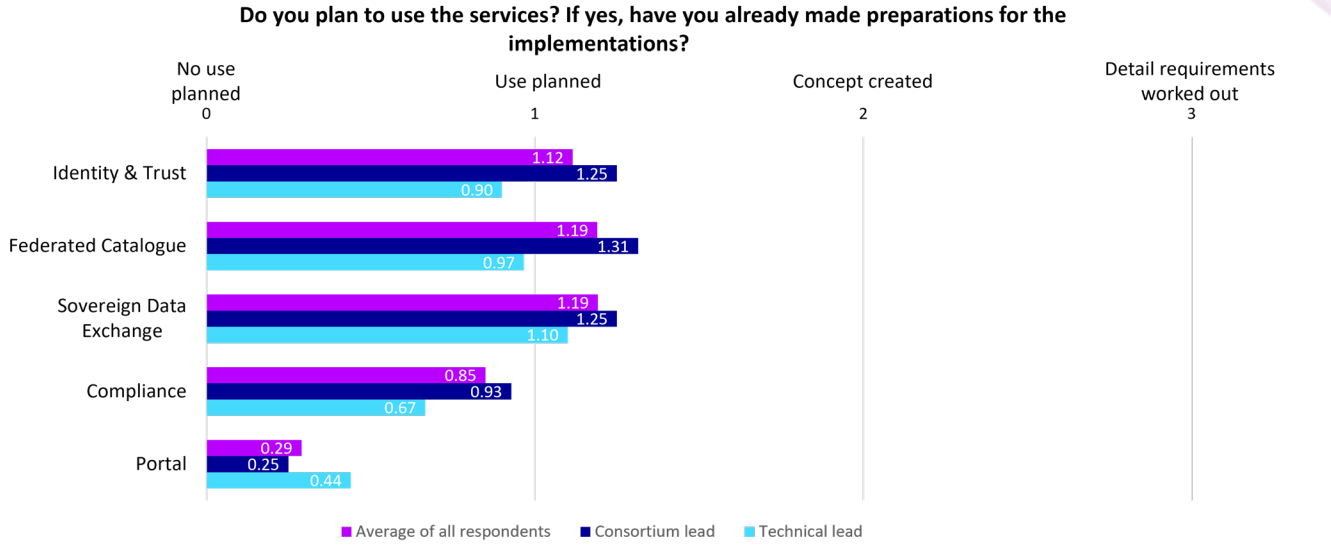


Source: Online survey of consortium and technical leaders of funded projects; Boecker-Ziemen, July 2022; n=14.

Graph 6: Perceived level of knowledge about the GXFS work packages

Result: Planned Readiness for Use and Preparation

Even though those responsible for the funding projects have already dealt with the principles of the Gaia-X Federation Services – in great detail, in some cases – they are not yet particularly advanced in their preparations for actually using the GXFS components. In the following interviews, it was questioned to what extent this is related to the availability of information and specifications and their simplicity and comprehensibility.



Source: Online survey of consortium and technical leaders of funded projects; Boecker-Ziemen, July 2022; n=14.

Graph 7: Planned Readiness for Use and Preparation

The survey revealed that the less the individual services are known, the less their implementation has been prepared for. This is also due to the fact that more implementable information is already available for some packages than for others.

The results of the online survey were presented anonymously. However, the project leaders were asked to indicate the name of their project as well as their function (consortium leader, technical leader) before answering. This was used for the preparation of the subsequent personal interviews.

In combination with “profiles” describing the projects, the answers were used as a basis for the following questions in the interviews. This was done individually by project. Thus, it was possible to gain a deep understanding from both methods of information collection. The core results from the interviews are presented on the following pages.

Expert Interviews

Method

Following the evaluation of the results of the online survey, in-depth expert interviews were conducted with those responsible for seven funded projects. Participants included both consortium leaders and technical leaders, which, as expected, influenced the content of the discussions– and also made it possible to get a comprehensive picture.

Detailed interview guidelines were used that addressed the topics of familiarity, relevance and use or preparation for implementation from the online survey. In addition, interviewees were asked about the importance of Gaia-X as the basis of the project and the GXFS. The interviews concluded with an outlook; a vision for the projects and Gaia-X in the coming years.

Objectives of the interviews:

- To get a better understanding of the project objectives, the use cases, and possible business models as well as the stakeholders on the technical and user sides.
- To verify the interpretations of the online survey: To detail the assessments of the quantity and quality of information and specifications.
- To get a better understanding of the situations regarding the (technical) preparation of the implementation.
- To gather outlooks, perspectives and feedback with a focus on the GXFS.

In the following, the results from the interviews with representatives of very different projects are presented: different sectors, different target groups, technology vs. user focus, approach to and progress in the implementation of the GXFS.

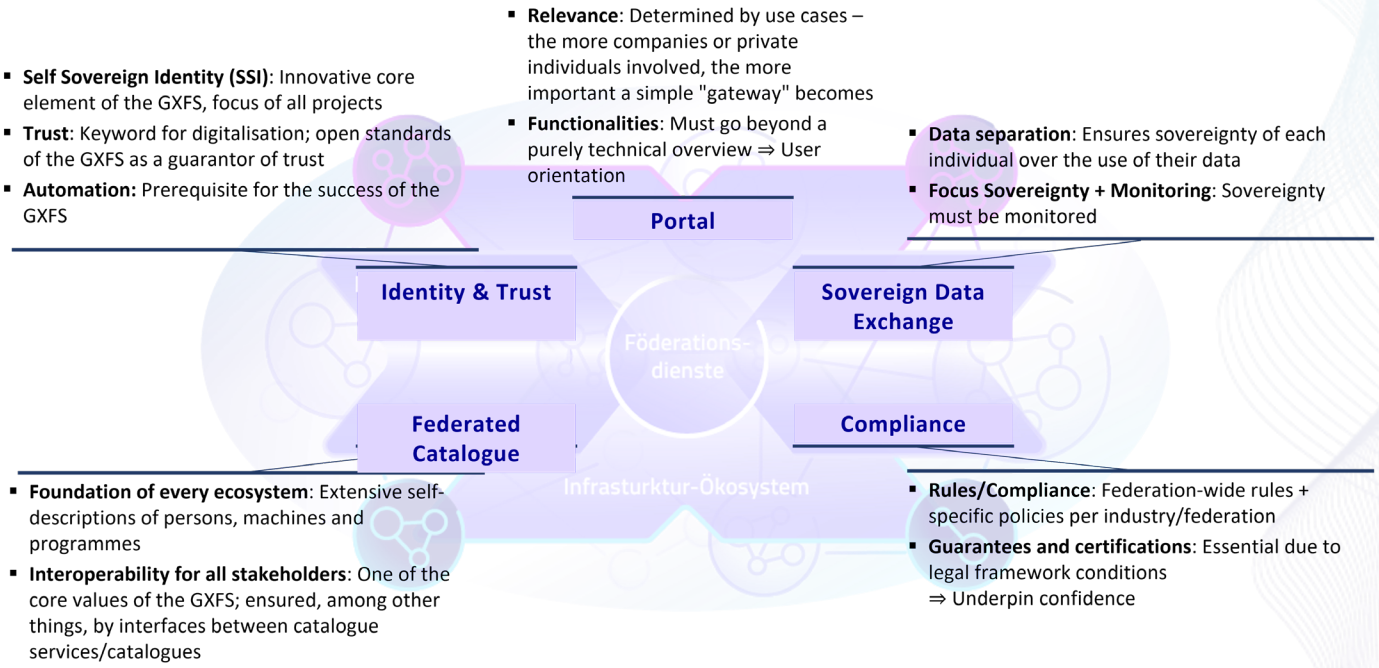
Results

The substantive feedback from the discussions with those responsible for the funded projects ranged from general assessments of the importance of Gaia-X as a European standard to more detailed reflections on the GXFS work packages and the expectations of individual services.

For this reason, the results are presented in two sections below. To begin with, we will deal with the GXFS work packages and their services, as these are the focus of this study. The chart below serves as an overview. In order to present the contents from the direct perspective of the interviewees, quotes from the interviews were added (here translated into English from the original German).

In the second step, aspects on topics related to Gaia-X and the GXFS are summarised. This subchapter has been divided into the topics GXFS in the context of Gaia-X, implementation (including processes and problems) as well as an outlook on a “big picture” that reinforces the importance of the GXFS. Initial recommendations are also made in this part.

Findings on the GXFS work packages



Graph 9: Central results by GXFS work package

GXFS Work Package I: Identity & Trust

Self Sovereign Identity (SSI): Innovative core element of the GXFS, on whose implementation all projects focus

As expected, all projects have a strong focus on highly sensitive data – be it personal data (e.g. health) or business-critical data (e.g. finance).

To protect this data, a strong anchor identity is a fundamental requirement. The “Self Sovereign Identity” (SSI) enables a new approach here that replaces and unifies existing solutions.

A challenge at this point also lies in self-determination: More than one identity per person may need to be enabled. This is to enable a person to ensure that their health data, for example, which is made available to a psychologist, is not inadvertently additionally disclosed to the company sports club.

The project leaders are well informed about the services in the work package “Identity and Trust Services” and already have quite concrete ideas about the implementation.

Trust: The keyword for digitalisation that is always brought to the fore; open standards of the GXFS as a guarantor of trust

Trust is key because data is valuable. In particular, use cases in which customers still do not dare to store their data in the cloud or even make it available for further purposes are the focus of the GXFS funding projects. For the latter, it must be mandatory to specify data releases individually.

The openness of the GXFS standards and codes is a crucial prerequisite for also digitalising smaller companies and private individuals who have no confidence in today’s (economically driven) cloud systems. In the case of the GXFS, control and security functions are also mentioned in the same breath as trust.

"Innovation comes from interconnection – with the GXFS we can identify all participants without a doubt. The trust services go hand in hand with the self-descriptions and catalogue services here."
– Dr Jan Hendrik Schoenke, Car Repair 4.0

Automation: An automated process, especially of the identity and trust services, is a prerequisite for the success of the GXFS

An automated solution is imperative for the authorisation of participants, without which the ecosystems cannot function. These are offered by the GXFS.

Only through automation is the necessary scalability given and can regulatory issues be addressed. An automated, unambiguous identification of all participants and assets is equally crucial for AI applications.

GXFS Work Package II: Federated Catalogue

Foundation of every ecosystem: Extensive self-descriptions of persons, machines and programmes

Only the self-descriptions provide an overview of which data is stored where. This makes them a cornerstone of the ecosystem.

The architectures around the self-descriptions are the focus of the implementation preparations. Many projects are already well advanced with these services. This is justified by the current project participants, who are identified via the self-descriptions.

It is also essential to ensure compliance within the framework of self-descriptions. This must also be determined and checked on a topic-specific basis via the federations.

A complementary benefit of self-descriptions lies in the possibility of integrating into the ecosystems not only people or companies, but also machines that can "identify themselves" (M2M, AI) or programmes.

Interoperability for all stakeholders: One of the core values of the GXFS; ensured, among other things, by interfaces between catalogue services/catalogues

Uniform catalogue services that everyone can access create a uniform basis (terms, dimensions, materials, etc.). It is to be expected that in the building industry, for example, catalogues will be DIN-certified. This is revolutionary for the industry by setting a true industry standard.

Trust also plays a major role in interfaces and catalogue services in general. All information must be validated taking into account various criteria. In addition, linking several catalogues must make it possible to find additional services. This in turn must work in conjunction with ID authentication.

The catalogues of different federations must also be able to communicate with each other – in future, perhaps even across different projects and domains/branches.

GXFS Work Package III: Sovereign Data Exchange

Data separation: Ensures sovereignty of each individual over the use of their data

The ability to separate one's own data enables a much more efficient use of large amounts of data for different purposes (for example, AI, federated learning, diagnostics, research). In the funded projects, there is a particular focus on ensuring that only data relevant to the defined use cases is selected and described and then shared and evaluated. With the help of the GXFS, a clear classification is possible for the first time.

An accidental merging of previously separated data that counteracts the anonymisation process must be prevented at all costs. Error-free “neutralisation” or anonymisation of data also creates trust – data misuse is avoided (e.g. China). Critical data exists at many levels. It is not only about personal data, but much more about business-relevant commercial key figures, sensitive technical data and much more.

Focus Sovereignty + Monitoring: Control mechanisms are needed to ensure sovereignty

Sovereignty (of data ownership and its controlled exchange) and trust go hand in hand. In this context, the GXFS control mechanisms expected or, where they exist, appreciated by the interviewees are also repeatedly emphasised.

Visible sovereignty is also created by the fact that, in some applications, the data is processed where it is created (“Compute-2-Data principle”). This refers, for example, to healthcare (at the patient’s side) or marine research (at the bottom of the ocean).

Sovereignty applies to all users and at all levels, down to all individual citizens. Each individual can decide for themselves at what point in time and through which methodology and to what extent data is used. In addition, everyone can monetise their data afterwards.

GXFS Work Package IV: Compliance

Rules/Compliance: Federation-wide rules + specific policies per industry/federation

Many projects talk about a general “Gaia-X compliance”. This is reflected in the fact that compliance is expected for all individual GXFS services.

The thematic diversity of the funding projects opens up the opportunity to apply an overarching set of rules that includes basic framework agreements on digitalisation and cloud systems – that is a first.

In addition, each industry/federation must develop its own compliance requirements to suit individual use cases. This creates opportunities for sector-wide “white papers”. Based on this, certifications on data use and exchange can be made at a later stage.

In every (research) project, all rules are redefined. Underlying regulation can nevertheless be automated and standardised. These rules must in turn be anchored via the self-descriptions.

In all projects, compliance is rated as an overarching requirement and therefore very important, but with a lower urgency than the first three work packages. This can be justified by the fact that specific rules can only be defined in the course of the preparations and the first implementation activities.
The general assessment is that compliance is technically proportionate and easily achievable. The presenta-

tion for end users is seen as more complicated.

Guarantees and certifications: Essential for underpinning trust due to legal frameworks

In the majority of the discussions, in addition to the monitoring already mentioned several times, it was also about guarantees and certifications – in line with existing standards or new requirements to be adopted. In particular, it must be possible to certify identities and services.

Those accessing data must be just as identifiable as the data owners (right to informational self-determination). Furthermore, the obligations of data processors to provide evidence are significant and can be resolved through this work package.

Automation once again plays a decisive role here – only through this can guarantees be reliably met. Guarantees are important because infrastructure and use cases that are critical must be able to rely on certain parameters.

GXFS Work Package V: Portal

Relevance of a portal: Determined by use cases – the more companies or private individuals involved, the more important a simple "gateway" to the ecosystem becomes.

In some cases, the portal is considered important for B2B relationships, in other cases, for end-customer relationships (B2B or B2P (Business to Patient)). No uniform pattern can be discerned here, as the use cases of the funding projects cover a broad spectrum of end users.

When there is a standardised portal that everyone can access and read and manage data in, it will be a real step forward. This is particularly true for use cases that are aimed at many companies, especially smaller ones, or at private individuals.

Functionalities of a portal: Must go beyond a purely technical overview and aim at user orientation.

The expected benefit of a GXFS portal also varies depending on the design and functionalities: If it (only) provides an overview of the technical details of the GXFS, it is classified as less relevant ("nice to have").

Individual projects are already developing their own portal services. Therefore, the GXFS portal is considered less urgent and relevant. What is still missing, however, is a solution for the presentation of data, i.e. it should not be organised exclusively for pure access. Here, the portal still needs to be developed.

In general, the portal establishes the connection between the ecosystems and the users. In a project with this in mind, great emphasis is placed on accompanying research involving user requirements and with the help of benchmarks in other countries.

GXFS in the Context of Gaia-X, Implementation, Outlook

In the context of Gaia-X:	Implementation	Outlook
▪ **Special position of Gaia-X:** Sector-independent neutrality from public sources ▪ **Values and USP of Gaia-X:** Trust, interoperability and data sovereignty as USPs and part of the 10 Core Values ▪ **Fulfilment of the USP of Gaia-X:** Requires compatible, interoperable and automated processes ▪ **GXFS – added value through completeness:** Interplay between interacting services ▪ **GXFS – Innovation in data handling:** Data becomes manageable through trust services, data separation, self-descriptions and sovereign data exchange	▪ **Implementation problems**: Vary from a (perceived) fundamental lack of technical detail to content-driven challenges in the project setting. ▪ **Information availability and use**: "Best Practices" – reading lists and hackathons ▪ **Progress in preparation and implementation**: Vary depending on the project setting and approach. ▪ **Procedure for implementation**: The approach of already developing solutions now in order to integrate them later for the GXFS is promising	▪ **Vision, "Big Picture"**: All projects define themselves through a societal contribution to open digitalisation ▪ **Role of the GFXS**: Enabler and necessary foundation for the open digitalisation of the economy and society ▪ **Technology & Use Cases**: Not all projects so far seem to have closely linked technology and user perspectives ▪ **Feedback/Wishes**: "Codes, codes, codes – even if they are 'only' beta versions!" ▪ **Marketing**: Good marketing is also the key to success here

Graph 10: GXFS in the context of Gaia-X, implementation, outlook

GXFS in the context of Gaia-X:

Special position of Gaia-X: Sector-independent neutrality with public funding

Gaia-X defines the rules of the game, with the support of public funds. This is done with the help of a construction kit (GXFS). The idea of the GXFS is to convert the existing laws for data exchange, for information and exchange rights etc. into digital rules of the game.

The sector-independent neutrality of Gaia-X is a significant factor. Therefore, the GXFS must necessarily be developed in the community – no services are prescribed, only the framework conditions are provided.

Nevertheless, there is some doubts as to whether Gaia-X and the GXFS will prevail. For success, a critical mass of participants is needed who trust the ecosystem. If a private provider manages this better and faster, it will possibly prevail over Gaia-X.

Values and USP of Gaia-X: Trust, interoperability and data sovereignty as USPs and part of the 10 Core Values

The values of GXFS are relevant to the projects – but they are brought to the fore with varying degrees of emphasis. Here, the topics of trust, sovereignty and interoperability are specifically emphasised, which thus emerge as the USPs of the GXFS.

One of the projects brought a special perspective to the issue of trust. The term “trust framework” is irritating, especially from the perspective of the user. What Gaia-X is trying to do is unique. Gaia-X's Unique Selling Proposition (USP) is theoretically the 10 Core Values; they enable inclusive, open, democratic, data-sovereign ecosystems. This makes Gaia-X something very valuable. Then, though, the claim is: “We have a trust framework”. That is the wrong term. Trust can only be built over time. Time plays a very important role. What you can say is: “We have a framework for building secure systems.” Trust, however, can only be built through lateral exchange.

However, this also means in the context of the preparation and implementation of the GXFS that all projects must engage in exchange with the end users. This in turn leads to those end users being able to

see the added value of such an ecosystem – so that, in turn, trust can be built.

Compatible, interoperable processes are needed to fulfil the Gaia-X USP

In all projects, several use cases are set up that concern different domains. These use cases can already be used to test the topic of interoperability within the project (important role in Gaia-X).

Thus, there will usually be several ecosystems per project – and above them a superordinate "meta-ecosystem". In a further step, it must also be possible to connect to other ecosystems that meet the Gaia-X/ GXFS compliance requirements. In order to ensure this interoperability, common standards are needed in the regulations.

In order for Gaia-X to meet expectations, compatible, interoperable processes must be defined and implemented across all funding projects – based on the GXFS.

GXFS – added value through completeness: Interplay between interacting services

Federation services are only a small part of the data spaces to be created. Nevertheless, they are a crucial approach: No new standards are developed and imposed. Instead, actual interfaces are created that are readable and usable.

"We understand sovereign data exchange all the way to the citizens.
Data sovereignty at all levels. This can thus only be ensured in combination of all GXFS work packages."
– Harald Wagener, Health-X

GXFS – Innovation in data handling: Data becomes controllable

In all interviews, the aspects of trust, data separation, self-descriptions with the help of data, sovereign data exchange were emphasised as added value and unique selling proposition of the GXFS.

All companies, institutions, people and machines generate huge amounts of data that could not be used until now. This is partly because many people fear data misuse and therefore store their data "in the basement" or "on islands". They do not want to make data available for research purposes, for example, because they do not trust anonymisation – the GXFS can provide a remedy here with their data protection-compliant approach.

Data can be controlled through unique identification and the possibility of consent to data processing. By breaking up data packets, data can be separated for specific uses. This guarantees optimal transparency.

"The GXFS create a secure foundation when dealing with data;
a foundation on which trust can grow."
– Dr. Shalini Sahoo, Possible

Implementation

Implementation problems vary from a basic lack of technical detail to content-driven conflicts of interest/ challenges

The challenges in establishing the federations lie in the different interests of the consortium partners involved – from the user side (use cases) to the technical partners.

However, the bigger problems result from a technical point of view. There are no codes yet, no prototypes and nothing "to try out". Alpha versions of the codes are also welcome to make the GXFS more tangible.

Information availability and use: "Best Practices" – reading lists and hackathons

The availability of information is assessed differently. While one project still refers to too long and very technical 200-page documents, another project – with a lot of time and effort – has worked through all sources of information and created and updated internal reading lists for the different project participants in order to make the information more compactly available. Reading this is a "focused homework activity", as one respondent put it. The technical requirements dossiers also all have to be gone through, which can be seen as a problem for non-English speakers due to the English language of the documents.

In some conversations, the hackathons and deep dives were highlighted as good sources of information and preparation, as well as the recordings of the deep dives for later in-depth study. In the hackathons, codes are developed in advance (by the project participants) that are "quick & dirty" but represent something "tangible". This is considered to be very informative.

"Anyone who says there is not enough information has not yet gone through everything that is available. The challenge is to sift through everything, prioritise, and – finally – read."
– Gino Barnard, Possible

Progress in preparation and implementation: varies depending on the project setting and approach.

Progress in preparing for implementation also varies quite a lot. This correlates with perceived information availability and use.

In all of them, however, basic concepts have been created. The focus here is on determining services and use cases for the projects, but also basic technical models for interfaces, etc.
Completion of the technical architectures and infrastructures is generally scheduled for Q4 2022. In this context, too, however, codes are always requested first; they do not have to function flawlessly and completely, but they do give an indication.

The planned milestones have been met so far and this is expected to remain the case until the end of 2022. After that, however, the basic preparatory activities will have been completed and the actual implementation codes will not yet be available.

In some projects, the definition and detailing of the use cases is already well advanced.

Implementation process: The approach of already developing solutions now in order to integrate them later for the GXFS is promising

<u>Use Cases</u>

One project in particular stands out in terms of user orientation. The use cases are carefully detailed and requirements for services and interfaces are defined through accompanying research and user studies. This will be discussed in more detail in the next chapter. The use cases have always been matched to the architecture level.

In another project, about 200 services/use cases were selected very comprehensively, which were then broken down to six remaining ones in a multi-stage process with the help of a requirements catalogue. Currently, the services are being transferred to the process modelling. In addition, lawyers are working on the regulatory framework for the sector.

Technical Architecture/Infrastructure

The basic tenor of all projects is that they would rather have something imperfect ("alpha versions" of codes) that is improved in short iterations instead of having to wait too long for the "finished" code. This approach is common in the IT development environment.

Since the majority of the projects already existed before the BMWK competition was announced, in some cases there are already comparable technologies in use or under development. These are to be made "Gaia-X compliant" later or compared with GXFS solutions and migrated to the new environment. This saves effort later on. Thus, a kind of "bypass" is already being built today, with which one can go into the implementation phase.

A slightly different or complementary approach is to use the source codes from the hackathons. From the IT side, the handling of unfinished code is considered acceptable and each project is encouraged and empowered to write functionalities themselves that are not included in the standard GXFS offering. Being Open Source is unanimously rated as a strength of the GXFS.

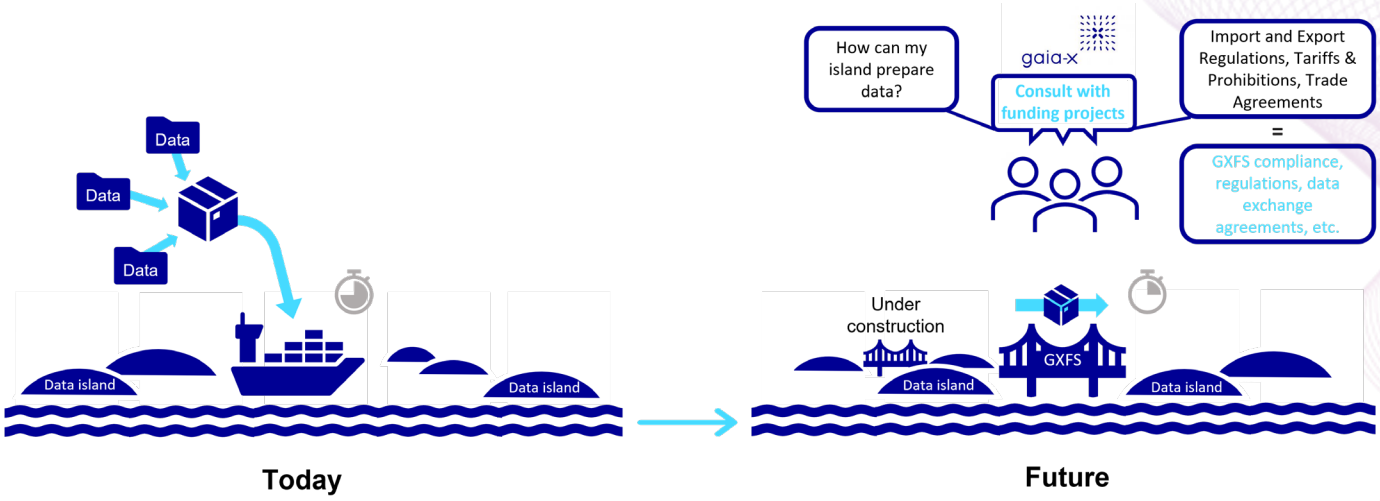
"Participation in the hackathons is key to the progress of the project. The hackathons not only generate source codes, but also the reassurance of knowing that other projects have similar issues and problems."
– Gino Barnard, Possible

Outlook

Vision, the "Big Picture": All projects define themselves through a societal contribution to open digitalisation

All participants in the funding projects are aware of the opportunities and also the responsibility to solve a societally relevant problem: Digitalisation at a level that was previously impossible without Gaia-X and the GXFS. In many sectors, "cross-island" services will create enormous economic and business value.

One of the interviewees illustrated the relevance of the GXFS with the following picture:



Graph 11: From data islands to connecting through "bridges of trust"

All projects, including those whose preparations are not very far advanced, are highly motivated to make the project a success. The diversity of sectors in the funding projects is also seen as an opportunity to achieve the societal goals. It is also appreciated that Gaia-X is a purely European project and that the GXFS thus follow European guidelines, which are superior to those of the US, for example.

As mentioned above, the focus should be on building a system that has sufficient security and control

mechanisms. This leads to trust being built up over time – always with a view to the 10 Core Values of Gaia-X.

Role of GFXS: Enabler and necessary foundation for the open digitalisation of the economy and society

The GXFS are very important, but not sufficient on their own. This needs to be built upon. In the health sector, the previous focus on B2B problems and B2B communication is not sufficient, as B2P (patient) becomes relevant here. In this respect, GXFS is seen as an enabler, but open problems require more far-reaching solutions. Again with a focus on user requirements, the projects need to answer the question of how digitalisation can be built on an ethical foundation. This is a significant societal issue. Gaia-X creates a basis for designing legally and ethically sound digitalisation. The GXFS are the "tools" for this.

From an economic perspective, resistance is most likely to come from small and medium-sized enterprises; the main motivation to participate in the ecosystems is based on the possibility of rule-compliant data exchange. These aspects of specific user groups must also be taken into account.

Interplay between technology and use cases: Not all projects so far seem to have closely linked technology and user perspectives

The project participants are aware that they are starting with a large technical scope and have to develop applicable and understandable solutions from there. All projects have named use cases. This was also part of the application for the funding competition. Some projects are relatively far along and are being implemented. On the other hand, there is a huge gap between technology and the user's perspective that needs to be bridged in the projects. Reality shows that many companies and people are still very far away from digitalisation, even if the technologies already exist.

Feedback from the projects: "Codes, codes, codes – even if they are 'only' beta versions!"

In line with the openness embedded in Gaia-X's core values, it is encouraged to also release unfinished codes to enable development and implementation of the ecosystems according to plan. The advantage of this is that all those involved can already get a picture of the situation and contribute their competences to the development process.

In this way, a feedback process of a collaborative development of the technologies with inherent input from the funded projects regarding the requirements is created – after the first prototypes could be tested. This could speed up the implementation of the GXFS at all levels.

Marketing: Good marketing is also the key to success here

Finally, it was pointed out on several occasions that the success of the GXFS also requires good marketing to help build trust and create sufficient momentum in the projects and among users. This marketing can also be done on the basis of technical components. All levels must be covered, from the user's point of view to technology.

After the representatives of the funding projects have given a comprehensive picture of ongoing activities, project input and support requirements, implementation preparation and the current status of GXFS implementation, it is both possible and desired to derive recommendations for action for all parties active in the GXFS environment from this information. In this way, the project leaders can support each other in the implementation of the GXFS. These recommendations for action are presented on the next page. Finally, the results of the study are briefly summarised and an outlook for the coming months is given.

Recommendations for Action

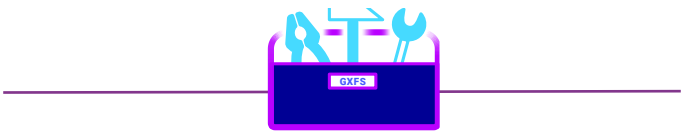
1. **Information:** There is sufficient information available. The documentation must be sorted – a structured reading list is recommended. It also takes a lot of time to read all the information. In addition, it is recommended to participate in project-internal networking events, but also GXFS conferences, hackathons and deep dives.

2. **Software architecture:** The basic technical preparations can be prepared with existing components. If GXFS codes and components are available, they can be compared by functionality and, if necessary, integrated or replaced by GXFS. This approach is recommended to ensure a speedy implementation as soon as the codes are available.

3. **Use cases/user perspective:** It is advisable to include user requirements for the GXFS in the concept developments at an early stage. Possibilities for this are accompanying research (also comparative studies in other countries), user studies by market research institutes and an early direct involvement of the users (e.g. in focus groups; here especially SMEs and private individuals).

4. **Project organisation and cooperation:** Regular team meetings and jour fixes, joint committees (e.g. use case steering committee + technology steering committee with “cross-over membership”), joint information platforms and team events have proven to be promising in project work. The interaction of the different companies in the federations is an important building block in the implementation of the GXFS.

5. **GXFS Community:** Cooperation across projects also makes sense in order to promote know-how transfer and exchange. Participation in hackathons, deep dives and workshops that are successively carried through the community is also recommended for this networking.



Conclusion & Outlook

The aim of this study was to provide insight into the implementation of Gaia-X Federation Services (GXFS) in BMWK-funded projects. Based on the survey of those responsible for the funded projects, it becomes clear that although GXFS is known in principle to all project participants, implementation strategies are still in their infancy.

The issue of “trust” when dealing with data plays a crucial role. The use of data becomes controllable for each data owner. This is a strong innovation and is seen as a success factor for the GXFS.

The project leaders are unanimous in asking for earlier disclosure of the necessary codes so that prototypes can be built to simulate the interaction of all services. It is clearly understood that the finished GXFS are a “minimum requirement”. All functionalities that are required for specific sectors and projects should and can be additionally programmed by the respective projects.

All projects define themselves through a societal contribution to open digitalisation This makes the role of the GXFS as an enabler and necessary foundation for the digitalisation of the economy and society very relevant.

In the next few months, most of the funded projects will finalise their concepts for the software architectures and implement them on the basis of the GFXS codes. In parallel, it is very important to concretise user requirements in the projects by involving potential users in studies and research projects on the specific use cases. In addition, a delta study is planned for 2023.

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