Whitepaper

Use Case Orchestration: A Framework for Research & Innovation Development Planning

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TNO innovation for life

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1. Introduction

This whitepaper introduces a novel approach to planning and coordinating Research and Innovation Development (R&ID): the Use Case Orchestration Framework. It redefines how digital and technological innovation is planned, funded, and executed—across domains, departments, and projects—enabling organizations to reduce R&ID costs and effort by up to 30% without compromising ambition, creativity, or complexity.

Traditional planning methods—such as project-based management, Agile planning, and innovation portfolio roadmapping—often fall short in experimental and iterative R&ID environments. They isolate development, overlook reuse opportunities, and struggle to justify internal process improvements. The Use Case Orchestration Framework addresses these limitations by introducing a complementary synergy-driven planning layer that aligns use cases early, maps out overlaps, and sequences development to unlock strategic reuse and co-funding.

In real-world application across three distinct TNO settings, the framework has demonstrated tangible impact. Based on our experiences, it empowers organizations to pursue high-effort, high-impact goals that were previously considered out of reach, while accelerating time-to-market. The framework functions as a system for cross-cutting collaboration—encouraging alignment and co-development across domains and departments, and fostering a shared innovation culture. As such, TNO's broad and diverse domain landscape is an exemplary setting in which the full potential of the Use Case Orchestration Framework can be harnessed—enabling scalable cross-domain innovation, strategic reuse, and unlocking higher-order efficiency gains in complex R&ID environments.

1.1 Problem and Solution

Traditional planning frameworks—such as project-based management and Agile Planning—are typically optimized for product delivery within defined value chains and time-boxed execution cycles. While effective for incremental development, they are less suited to the exploratory, cross-cutting, and capability-building nature of R&ID. Experienced inefficiencies of existing frameworks in TNO R&ID are: repeated development of similar (components of) solutions across departments, the absence of proactive alignment between teams, and the difficulty of coordinating development across projects with separate budgets and timelines.

In response to these limitations, particularly in digital innovation and technical domains, we developed the Use Case Orchestration Framework and applied it as a complementary layer to existing frameworks. This was an iterative effort with refinement through internal workshops, planning sessions, and real-world applications in multi-domain, multi-departmental R&ID settings. The resulting framework successfully maximizes efficiency by prioritizing lower-effort use cases that contribute components to more complex ones, enabling partial development of high-impact solutions in earlier stages.

The framework is notably impactful in project-driven environments, where development is confined within distinct projects with separate budgets, making it difficult to support use cases that span multiple initiatives or represent internal-process improvements. In such settings, the framework enables co-development and co-funding from multiple projects, helps justify internal process improvements, and makes high-effort, high-impact innovations more feasible, while also maximizing reuse and accelerating delivery. Similarly, solution-oriented organizations serving diverse customer domains can benefit as well from the framework by strategically leveraging overlapping functional requirements across clients to orchestrate efficient development and align internal capabilities with external demand.

1.2 Target audience

This whitepaper is intended for Research

& Development strategists, innovation managers, portfolio planners, solution developers, digital transformation leads, Scrum Masters, Product Owners, and program- or project managers seeking scalable methods to improve planning, funding, and execution in challenging or chaotic innovation environments. It may also be of interest to department heads, business developers, and policy advisors involved in shaping innovation strategy across organizations. Additionally, it serves as a reference in any public or commercial interaction, as well as in publications, concerning TNO innovations and projects that apply the Use Case Orchestration Framework.

1.3 Reading guide:

This whitepaper provides a detailed methodology for applying the Use Case Orchestration Framework in any Research and Innovation Development (R&ID) environment. It includes results from real-world applications, explores the framework's implications for planning, funding, and innovation culture, and compares its impact and limitations with conventional approaches such as project management and agile planning. The structure of the whitepaper is as follows:

- Section 2 provides a background and literature review, positioning the Use Case Orchestration Framework in relation to existing planning approaches.
- Section 3 outlines the methodology of the Use Case Orchestration Framework.
- Section 4 presents results from its application in three organizational settings.
- Section 5 discusses the observed impacts, strategic implications, and limitations.
- Section 6 concludes with key findings and directions for future refinement.

2. Background

In this whitepaper, the term Research and Innovation Development (R&ID) is used rather than the more common Research and Development (R&D) to emphasize the exploratory, cross-domain, and capability-building nature of the activities addressed by the Use Case Orchestration Framework. While R&D often refers to product-oriented development—closely aligned with delivery-focused methodologies such as Agile Planning—R&ID captures the broader scope of innovation efforts, including early-stage ideation, experimentation, and internal process improvement. This distinction reflects the character of use cases within the orchestration framework, which are not always tied to defined products but often represent evolving technical opportunities across organizational boundaries.

Although the framework is broadly applicable to research and innovation, R&ID in this whitepaper refers primarily to digital- and technology innovation, in both domain-proprietary and domain-agnostic settings. At present, the planning and coordination of such R&ID efforts largely rely on frameworks originally designed for more linear or product-focused development. Commonly used approaches are: project-based planning, Agile methodologies, and innovation portfolio management. The following section outlines the limitations of these frameworks in supporting R&ID.

2.1 Project-Based Planning

Traditional project management frameworks (e.g., PRINCE2, PMBOK) define scope, allocate resources, and manage timelines within bounded project structures. These models are effective for delivering well-scoped outputs but assume a relatively linear development path. In practice, R&ID projects often evolve as new insights emerge, and their outcomes are uncertain or intangible. Project boundaries can inhibit collaboration and reuse, especially when similar technologies are developed in parallel across different teams.

Traditional project planning tends to isolate development within project boundaries. Each project operates with its own scope, budget, and timeline, making it difficult to coordinate shared development or cost-sharing across initiatives. This fragmentation limits the ability to recognize and leverage synergies, particularly when similar use cases arise independently in different departments. These practical limitations reinforced the need for a new planning approach—one that enables early-stage alignment, cross-domain collaboration, and shared development. The Use Case Orchestration Framework was developed in direct response to these challenges.

2.2 Product development frameworks

Product development frameworks such as Agile Planning and the Stage-Gate model offer structured approaches for delivering products. These methodologies are widely adopted in industry for their ability to manage complexity, reduce risk, and improve delivery cadence. However, as addressed hereafter, their underlying assumptions and operational constraints make them less suited for the exploratory, cross-domain, and capability-building nature of R&ID.

Agile methodologies

Agile methodologies like Scrum and Kanban, especially as structured in the Scaled Agile Framework (SAFe), organize development into fixed increments and align teams around shared goals within a value stream. SAFe Program Increment (PI) planning, held every 8–12 weeks, brings multiple Agile Teams together to set—and commit to—PI objectives, improving delivery cadence and responsiveness. However, this process is best for incremental product development and may not effectively support early-stage ideation, cross-project collaboration, or component reuse—key needs in R&ID settings where innovation often comes before productization.

Three dimensions of agile methodologies, SAFe in particular, have proven misaligned with the needs of R&ID:

1. Time-bound rigidity: agile planning organizes development across time in fixed cadences (e.g., two-week sprints), with dependencies mapped across components and teams. However, R&ID often involves experimentation and iteration, where outcomes are uncertain and timelines are fluid. Dependencies on research deliverables can introduce delays across the entire roadmap, as research frequently

encounters unexpected complexities. This makes agile planning too rigid for R&ID, which requires a framework that accommodates uncertainty and iteration.

2. Product-centric assumptions: agile development is optimized for effectively delivering products with clearly defined requirements, that have been established based on the functional wishes of the customer but which may change during the development time. In contrast, research often precedes product definition. Requirements may shift or dissolve entirely as new insights emerge. Planning research as if it were product development imposes artificial constraints and can lead to inefficiencies or misaligned priorities.
3. Value chain silos: Similar to Project Planning which isolates development within project boundaries, Agile Planning typically structures development per value chain or product line. This segmentation can obscure synergies across domains. As a result, similar technologies or components may be developed multiple times in parallel, with limited reuse. Retrofitting shared components after the fact is often less efficient than planning for them from the outset.

Stage-Gate Model (Cooper)

The Stage-Gate model, developed by Cooper (2019), is another widely used product development framework. It divides the innovation process into discrete stages—such as scoping, business case development, design, testing, and launch—separated by decision "gates" where progress is evaluated. This model is designed to reduce risk and improve decision-making by enforcing structured checkpoints and clear deliverables. While effective for managing product pipelines, the Stage-Gate model shares similar limitations with Agile Planning when applied to R&ID:

- It assumes a relatively linear progression from idea to product, which is often incompatible with the iterative and uncertain nature of research.
- It focuses on individual project success rather than coordinated development across initiatives.
- It lacks mechanisms for identifying reusable components or enabling co-funding across projects.

Both the Agile Planning and Stage-Gate frameworks are optimized for delivery, not exploration. They are well-suited to environments where product requirements are known and development paths are predictable. In contrast, R&ID often involves evolving objectives, overlapping technologies, and cross-domain collaboration—conditions that require a planning approach focused on synergy, reuse, and strategic orchestration.

2.3 Innovation Portfolio Management and Roadmapping

Innovation portfolio management and technology roadmapping offer more strategic planning perspectives. These frameworks aim to align R&ID investments with long-term goals, often using tools such as effort–impact matrices, stage-gate models, and innovation funnels. While useful for prioritization and filtering, these approaches typically focus on selecting the most promising ideas rather than coordinating their development. They rarely include mechanisms for identifying technical overlap between initiatives or orchestrating shared development across organizational boundaries.

A widely cited classification of roadmap types by Phaal et al. (2004) illustrates the diversity of planning approaches within technology roadmapping. Three types are particularly relevant to R&ID contexts:

- Strategic Planning Roadmaps: These support high-level strategic appraisal by comparing a future vision of the business—across markets, products, technologies, skills, and culture—with the current state. Gaps are identified and strategic options explored to bridge them. While valuable for vision-setting, this type does not provide operational guidance for coordinating development across use cases or projects.
- Long-Range Planning Roadmaps: Often used at the sector or national level, these extend the planning horizon and act as a radar for identifying potentially disruptive technologies and markets. They are useful for foresight and strategic awareness but lack granularity in terms of technical dependencies or reuse opportunities between initiatives.
- Integration Planning Roadmaps: These focus on how different technologies combine within products or systems, or evolve into new technologies. They are particularly relevant for managing

convergence and flow of technologies. However, they often omit the time dimension and do not explicitly support early-stage alignment or co-funding across organizational units.

While each of these roadmap types offers valuable strategic insights, they fall short in enabling the kind of synergy-driven planning required for efficient R&ID orchestration. None of them inherently support the identification of reusable components across use cases, nor do they facilitate joint development across projects with separate budgets. The Use Case Orchestration Framework addresses these gaps by introducing a structured method for capturing, linking, and sequencing use cases based on technical and functional overlap—enabling coordinated development and strategic reuse from the outset.

2.4 Gaps in Existing Frameworks

Despite their strengths, existing planning frameworks share a set of limitations when applied in R&ID environments, where the work is exploratory, cross-domain, and capability-driven. **Figure 1** below summarizes the characteristics of the Project-Based Planning, Agile Planning, and Innovation Portfolio Management frameworks from the perspective of R&ID application. While each offers value in delivery, cadence, or strategic filtering, none provides a structured method for orchestrating innovation across departments, domains, and projects.

These gaps manifest in several critical ways:

- Lack of early-stage alignment: Existing frameworks do not support the proactive coordination of innovation efforts before project boundaries are defined.
- Limited visibility of reuse opportunities: Technical and functional overlaps between initiatives are rarely identified or leveraged.
- Siloed development and funding: Projects operate independently, making it difficult to justify or execute shared development across units.
- Invisibility of internal process improvements: Innovations that improve internal effectiveness and workflows often fall outside the scope of project or product planning and remain unfunded.
- No mechanism for synergy-driven planning: There is no structured way to build roadmaps that reduce redundancy and accelerate capability development through reuse and co-funding.

These limitations underscore the need for a complementary planning approach—one that enables orchestration across fragmented innovation efforts.

Dimension	Project-Based Planning	Product Development Frameworks (Agile Planning, Stage-Gate)	Innovation Portfolio Management
Primary Focus	Delivery of scoped outputs within bounded projects	Incremental product delivery and risk-managed execution	Strategic alignment of innovation investments
Structure	Linear, scope-defined, budget-bound	Iterative (Agile), stage-gated (Stage-Gate), cadence-driven	Funnel-based, stage-gated, matrix-prioritized
Strengths	Clear scope, resource allocation, timeline control	Responsiveness (Agile), decision checkpoints (Stage-Gate), delivery cadence	Long-term prioritization, strategic filtering
Limitations in R&ID	Fragmented development, limited reuse, siloed execution	Too rigid for experimentation, product-centric assumptions, domain silos	Lacks mechanisms for shared development or reuse
Support for Cross-Domain Collaboration	Low	Moderate (within value streams or product lines)	Limited
Support for Internal effectiveness & workflow Improvements	Low	Low	Low
Reuse of Components	Rarely supported	Retrofitted post-development	Not explicitly addressed
Funding Model	Project-specific	Value stream-aligned or stage-gate budgeted	Strategic investment pools
Scalability	Limited to project scope	Scales within Agile teams or product portfolios	Scales across portfolios
Adaptability to Uncertainty	Low	Moderate	Moderate

Figure 1: This table contrasts Project-Based Planning, Product Development Frameworks, and Innovation Portfolio Management across key dimensions relevant to R&ID.

2.5 Positioning of the Use Case Orchestration Framework

The novel Use Case Orchestration Framework was developed to address the systemic gaps outlined above. It introduces a synergy-driven planning layer that complements existing frameworks by shifting the unit of planning from projects or products to use cases.

This shift enables:

- Early-stage alignment across departments and domains
- Strategic reuse of components and technical solutions
- Identification of synergies between initiatives
- Coordinated development and co-funding across projects
- Visibility and justification for internal process improvements

The Use Case Orchestration Framework is not intended for replacing existing planning methods. Project-based planning, Agile Planning, and innovation portfolio management remain present and unchanged within an organization. Instead, the orchestration framework serves as a complementary layer that enables R&ID efforts to be more efficiently organized and executed, while improving alignment with these existing frameworks.

Figure 2 visualizes, using the Stacey Complexity Matrix (Stacey, 2012) which is often referenced regarding Agile methodologies, how the different frameworks are effective in different levels of work complexity. The Stacy Complexity Matrix categorizes tasks along a spectrum from simple to chaotic, based on increasing uncertainty in both requirements (what is needed) and technology (how to meet the need). Traditional project management excels in the simple domain, where both requirements and technologies are well understood. Agile frameworks are effective in complicated and complex domains, where uncertainty is higher. R&ID typically operates in the chaotic domain, characterized by profound ambiguity and rapid change.

Within this context, Kanban—an Agile method focused on visualizing work and optimizing flow—has proven effective for planning the development of individual use cases. Nevertheless, Kanban lacks mechanisms to address the broader orchestration of multiple use cases across departments or domains. This highlights the need for a higher-level framework capable of integrating diverse innovation trajectories into a coherent strategic roadmap.

The following section presents the methodology of the Use Case Orchestration Framework in detail, illustrating how it operationalizes these principles through a structured, repeatable process. In the Impact and Limitations section, a comparative overview is provided of the existing frameworks and the Use Case Orchestration Framework (expanding on **Figure 1**).

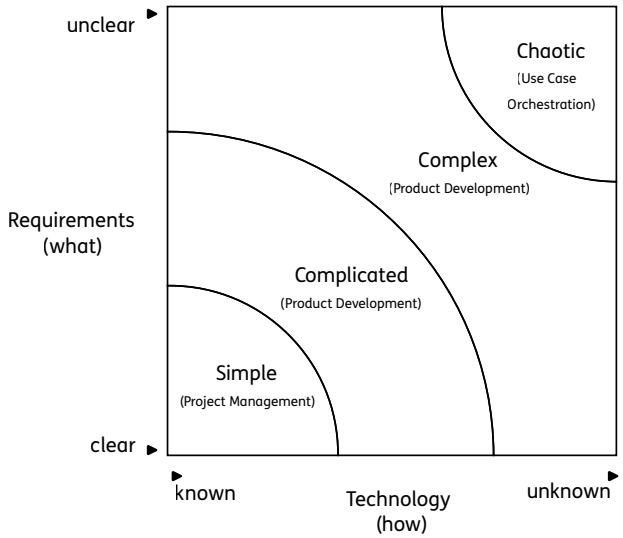


Figure 2: The Stacey Complexity Matrix (Stacey, 2012) illustrates how work types vary from simple to chaotic based on increasing uncertainty in requirements and technology, and where the frameworks discussed in this whitepaper are effective.

3. Methodology

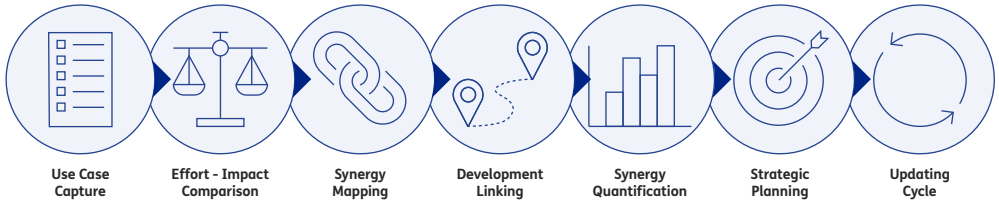
The orchestration framework consists of six sequential steps and an updating cycle:
1. Use case capture
2. Effort – impact comparison
3. Synergy mapping
4. Development linking
5. Synergy quantification
6. Strategic planning
7. Updating cycle

To illustrate each step of the framework, this section presents an anonymized real-world example ("**Example A**"). The setting for **Example A** is a multi-year, multi-unit, multi-domain TNO work program. However, it is equally representative of any context involving a single or multiple domain(s), or a single or multiple organizational part(s), where project-based working is predominant.

The R&ID context in this setting is AI and digital technology innovation. The purpose of the orchestration framework is to:
1. Identify the most efficient path for research and innovation development towards high impact.
2. Stimulate joint development efforts across different parts of the organization within the program.
3. Identify opportunities for reusing prior developments across the broader organization.
4. Identify opportunities for co-funding and co-development with other projects.

3.1 Use Case Capture

The orchestration framework is initiated with the capture of discrete use cases that represent specific functional or technical goals. These use cases may be newly ideated or derived by decomposing existing projects. The latter approach is often a starting point for an organization, department, or team applying the framework for the first time.



Before discussing the details of the process, it is necessary to define the term "use case" within the context of the orchestration framework. A use case describes the R&ID effort focused on a collection of interdependent technical components, which may be applicable across multiple projects or products. From the perspective of the Stacy Complexity Matrix (**Figure 2**), a use case is likely chaotic in nature but may contain individual components that are complex or complicated. Examples of use cases are:
- Object detection of buildings on satellite imagery
- Categorizing documents on document types
- Generative AI assistance for literature review
- Aerial photography ingestion
- Intelligence platform service for a particular domain

Like these examples show, a use case can define a single operation or a whole platform. The number of technological components within a use case can thus vary depending on the complexity of the innovation. Some components may be reused further along the roadmap, where naturally higher-effort and higher-impact use cases contain more technical components and require more R&ID. For example, in generative AI application development, a summarization use case may involve only a few components: ingesting documents, processing them with specific parameters, and outputting a summary to the user. A subsequent use case—such as a retrieval-augmented generation system capable of reasoning across domains based on a corpus of internal knowledge—would involve many more technical components, some of which could be reused from earlier use cases like the summarizer.

In the **Use Case Capture** step of the orchestration framework, each use case is described using a standardized template that includes fields such as: Name, description, Solution Category, effort, impact, department, and more. To capture

this information uniformly and efficiently for each use case, an intake form can be used. **Figure 3** provides an example of attributes that make up such a form. This decomposition allows for a granular view of what is being developed and enables comparison across otherwise unrelated projects. This form can be used as a template but we advise to further tailored it to fit the domain of application, providing more relevant context for both users and orchestrators.

Upon completion of this step in the orchestration framework, an overview of all captured use cases—organized by project—can be created, as illustrated in **Figure 4** for **Example A**. Each block in the figure represents a use case, including full details as captured using the intake form. Use cases that are project-agnostic, or that represent general internal workflows or process improvements, can be grouped in a separate collection, as they are not (yet) directly linked to a specific project.

At this stage, it may also become apparent that some use cases across different projects could be merged. In **Figure 4**, the use cases marked with yellow numbering are merged use cases, where highly similar needs were identified across different projects. This indicates an opportunity for co-development and/or co-funding of the same R&ID effort.

To ensure consistency, traceability, and discoverability, use case documentation must be maintained in a centralized repository—preferably an organization-wide wiki or structured database. This enables keyword-based search across all use cases, providing a user-friendly way to scope prior ideas and identify opportunities for reuse or synergetic development, supporting R&ID ideation and proposal processes. Additionally, this allows for referencing the same use cases in a multiple roadmaps, which may occur as roadmaps can be constructed from different organizational or technical perspectives. To avoid confusion and duplication, each use case should exist as a single, consistent entry—referenced across roadmaps rather than duplicated.

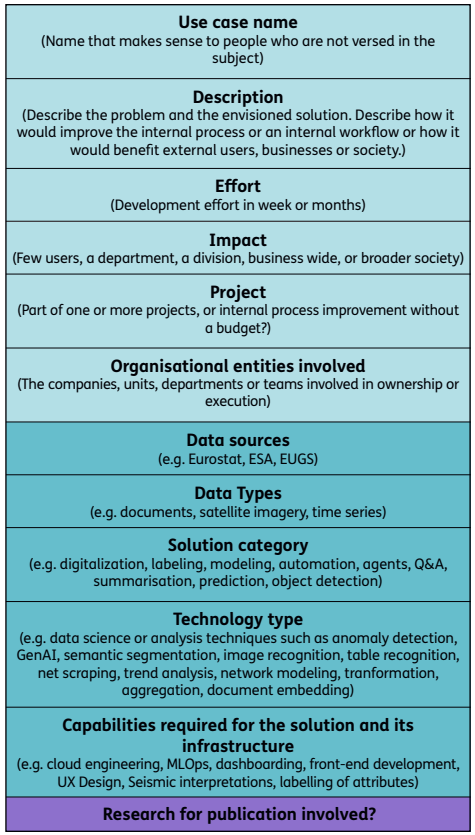


Figure 3: Example list of descriptive attributes for a use case capture form.

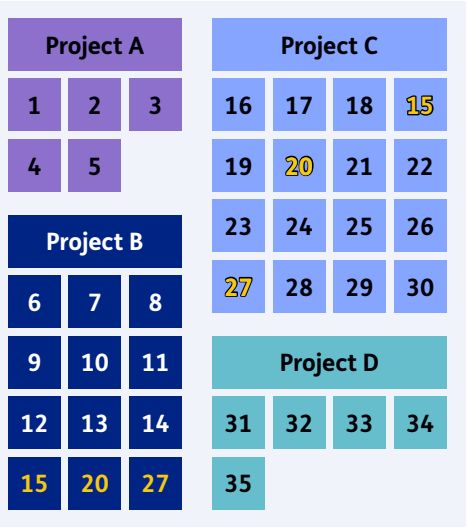


Figure 4: Anonymized Use Case Capture view of a real-world TNO work program consisting of 4 projects, decomposed into a multitude of R&ID use cases that have been identified through collective ideation sessions and one-on-one business analysis efforts with subject matter experts. Use cases are colored per project to later be able to visualize synergies across projects.

3.2 Effort-Impact Comparison

In this step of the orchestration framework, each use case is evaluated using a relative impact–effort matrix (**Figure 5**). This matrix helps to prioritize use cases by comparing their expected impact—on business operations, customer value, scientific advancement, or societal benefit—against the estimated development effort.

Use cases will plot into four quadrants, each suggesting a different strategic approach:

- Quick wins: Low-effort, high-impact use cases that should be prioritized for immediate development.
- Strategic investments: High-effort, high-impact use cases that require significant resources but promise substantial returns.
- Exploratory or foundational efforts: Low-effort, low-impact use cases that may serve as early-stage pilots or stepping stones.
- Candidates for consolidation or deprioritization: High-effort, low-impact use cases that may not justify the required investment unless synergies or reuse opportunities are identified.

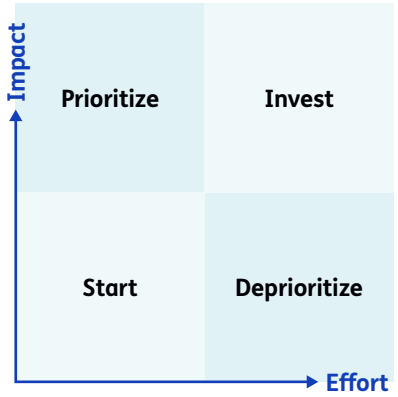


Figure 5: A relative matrix used to compare use cases based on estimated development effort (horizontal axis) and expected impact (vertical axis). The four quadrants help identify quick wins, strategic investments, exploratory pilots, and candidates for deprioritization.

To populate the matrix, each use case must be assessed relative to each other use case. This comparative evaluation enables orchestrators to identify “low-hanging fruit” (top-left quadrant) and flag use cases that may be too resource-intensive for the value they deliver (bottom-right quadrant).

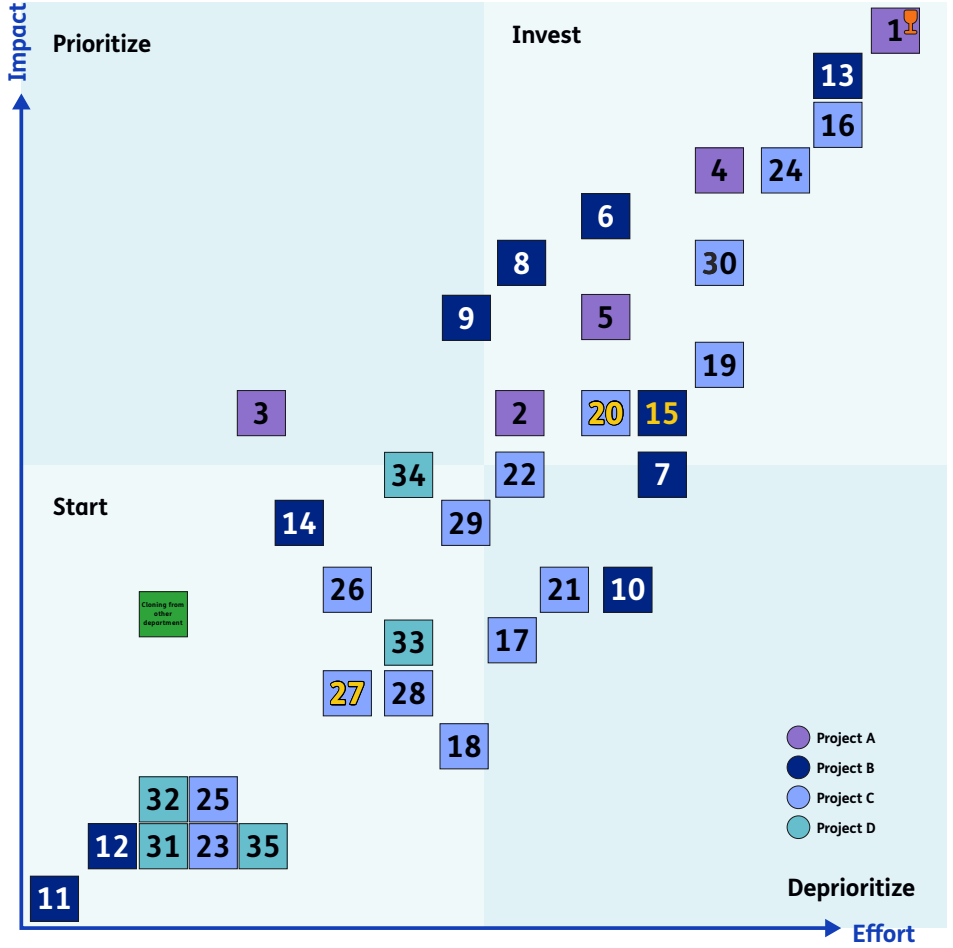


Figure 6: Use cases are plotted on a relative scale based on development effort and expected impact. The matrix enables comparative evaluation and supports roadmap decisions through visual clustering of use case feasibility and value.

Once all use cases are plotted, their relative impact and effort scores can be inferred from their position on the matrix. These scores can be recorded in the intake form or in the centralized repository where all use case descriptions are stored, ensuring reproducibility and traceability throughout the orchestration process.

Figure 6 presents the effort–impact matrix populated with the use cases from **Example A**. Use Case 3 stands out as a clear quick win, combining low development effort with high expected impact, and should therefore be prioritized. In contrast, Use Case 10 appears to require relatively high effort for a modest return, and—if considered in isolation—would be a candidate for deprioritization. However, when viewed in the context of other use cases that share overlapping technical components, the development effort for Use Case 10 could be significantly reduced. This interdependency may render it feasible through coordinated development. Use Case 1 is characterized by high complexity and high impact. It represents a strategic ambition—potentially the "holy grail" of the program—that would, due to the high effort, be unattainable if pursued independently. Its feasibility depends on the prior development of several foundational components across other use cases, which together contribute to the realization of the larger solution envisioned in Use Case 1.

3.3 Synergy mapping

Synergy mapping is essential for identifying potential overlaps in development and recognizing opportunities for reuse. These synergies are used in Step 4 to relate use cases to one another within a sequential roadmap.

Depending on the R&ID perspective—whether from a specific domain or a particular part of the organization—use case synergies may be relevant at different levels, such as:

- Technological development
- Innovation or research workflows components
- Functional objectives

For example, in a domain research context, the goal might be to identify similarities in research workflows where repeated efforts across the organization could be unified or standardized. In this case, the use cases could be mapped on workflow-component synergies. In the context of AI application, the aim could be to uncover opportunities for reuse of prior (components of) innovations, or to identify co-development and co-funding possibilities across organizational units. In this case the use cases could be mapped on technology-type synergies.

Some examples of attributes on which synergies may be identified include:

- Data innovation or processing techniques (e.g., modeling, summarization, prediction)
- Infrastructure needs (e.g., cloud engineering, dashboarding)
- Application domains (e.g., document analysis, geospatial processing)

In **Example A**, synergies were identified on the Data Innovation Category attribute, which could be grouped into innovation groups (**Figure 7**). This list does not represent an exhaustive set of categories, but is merely what for this particular set of identified use cases exists.

For **Example A**, the innovation categories defined per use case are used to generate a network diagram (**Figure 8**). This provides a comprehensive view of all synergies across use cases, projects, domains, and departments.

When applying the orchestration method at scale, manually connecting use cases based on synergies becomes impractical. In such cases, network analysis tools should be used on a database of captured use cases. Orchestrators can then filter the full set of defined use cases by attributes such as domain, department, date of capture, and others to generate synergy mapping views for roadmaps tailored to different organizational- or domain-specific perspectives.

Data Innovation

Group	Category
Generative AI	GenAI pre-processing (labelling, metadata generation)
	GenAI Assistants (summarisation, QA)
	GenAI Copilots (domain tailored RAG and/or fine tuning, for writing and co-creation)
	GenAI Agents (more autonomous AI specialists, collaborating with humans in a process)
Analysis group	Network modelling
	Financial/business operations modelling
	Trend analysis
	Statistics/Data analysis
	Dashboarding
	Geospatial analysis
Data Science, AI, predictive group	Scenario simulation
	Entity recognition
	Semantic segmentation
	Time series prediction
	Anomaly detection
	Object detection
Data Engineering	Data harmonisation
	Data augmentation
	Data collection
Platform Development	

Figure 7: non-exhaustive example of innovation categories used in anonymized Example A to identify synergies between use cases across projects.

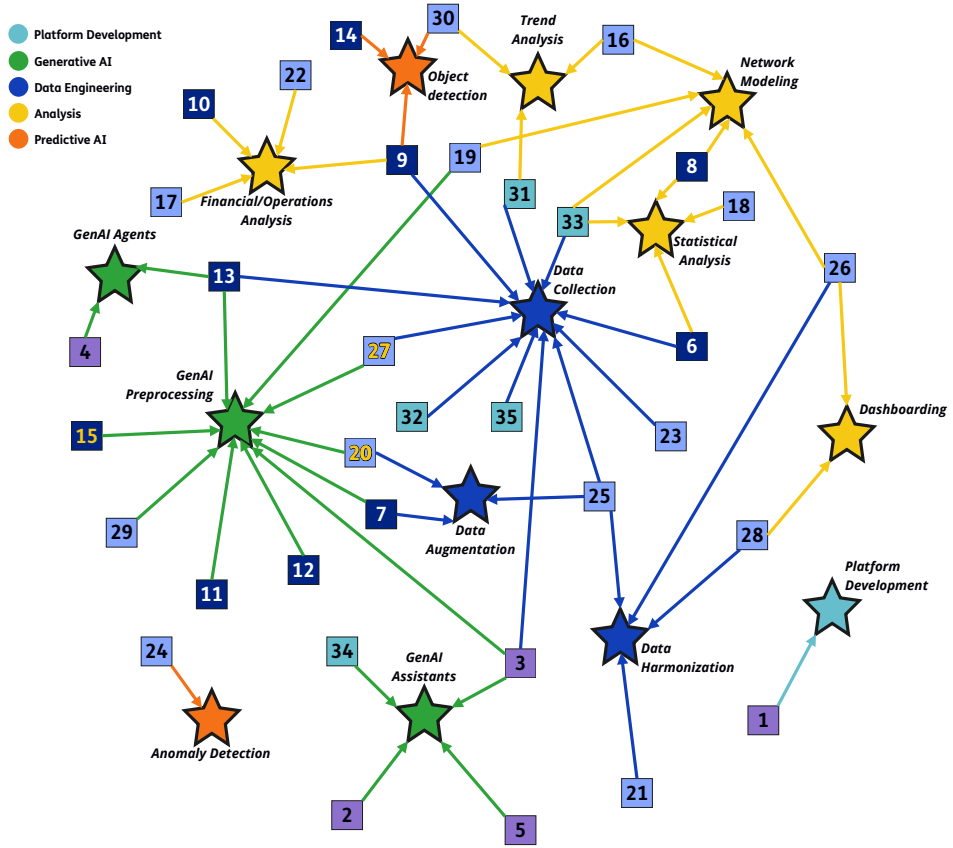


Figure 8: Use cases are plotted in a network diagram, from the “use case number” attribute (blocks) to the “data innovation category” attribute (stars). The applied coloring is based on a grouping of use case categories, as illustrated in Figure 7. One use case can have a multitude of data innovation categories, which is reflected in this network diagram by arrows pointing to multiple stars.

3.4 Development Linking

In this step of the orchestration framework, use cases are connected based on the technical or functional overlaps identified during the synergy mapping exercise (Step 3, **Figure 8**). This transforms the previously static matrix into a directional roadmap. **Figure 9** illustrates this for **Example A**.

The categories identified during synergy mapping represent directional potential rather than confirmed bidirectional synergies. A category assigned to a use case indicates that on this category the use case can contribute its effort to the next use case. The receiving use case does not need to have the category of the incoming synergy. For example, Use Case 1 may be the sole use case categorized under "Platform Development" (**Figure 8**), yet multiple other use cases may contribute components to it. This reflects a one-way linkage: the category serves as a thematic anchor for outgoing synergies. Furthermore, the presence of a category does not imply that a link for it with another use case must exist. Unlinked categories may represent latent synergy potential. For example, Use Case 33, has three categories (Network Modeling, Statistical Analysis, and Data Collection; **Figure 8**) but does not have a link to another use case on those categories.

At this stage, it may become evident that certain clusters of use cases are internally connected but isolated from others. In such cases, it can be useful to separate these clusters into distinct roadmaps to focus on synergies within specific themes. However, maintaining a holistic view across all themes may also be beneficial, especially for identifying new synergies as development progresses.

In **Example A**, the generative AI use cases form a tightly connected cluster. While it would be justifiable to create a separate roadmap for these, they also share links with use cases from other categories. For this reason it is opted to retain the integrated roadmap. Use Case 33, although unconnected to others, remains relevant to the work program and is also retained on the roadmap.

Some use cases that initially appeared infeasible—such as those in the lower-right quadrant of the effort–impact matrix—have found synergetic development paths through shared components (Use Cases 10, 77, 18, and 21). This reduces their overall effort and justifies their inclusion in the roadmap. If this would not have been the case, then it can be decided to deprioritize these use cases and take them out of the roadmap view.

Use Case 3, previously identified as a quick win, benefits further from synergies. Its required components are already being developed in Use Cases 11 and 12. Additionally, a use case from a different project in another part of the organization with a high amount of reusability has been identified and can be cloned as a starting point. These synergies reduce the development effort even further, reinforcing its status as a high-priority quick win.

Use Case 1, previously identified as the program's "holy grail," increasingly emerges as the central objective toward which all development efforts converge. This illustrates how a directional roadmap often culminates in a few high-impact, aspirational goals—sometimes referred to as "north star" use cases. Such clarity not only supports orchestrators in planning and coordination but also helps subject matter experts and project managers understand how individual developments contribute to the overarching strategic vision.

While constructing directional roadmaps, it is important to be cautious with "loops", where two or more development trajectories share starting- and ending use cases. Loops may indicate redundant development paths that artificially inflate synergy levels. Each looping path should be critically assessed to determine whether it reflects genuine reuse or unnecessary duplication. In some cases, it may be appropriate to unify looping paths to streamline development.

For instance, in **Example A**, loops are present as shown in **Figure 10**. Two loops originate from Use Case 11, leading respectively to Use Case 13 and Use Case 1. These loops do not represent duplicate efforts, as they pertain to distinct applications in different domains. From the same starting point, different technologies are developed along separate trajectories, ultimately contributing components to the same downstream use case. For both these loops consolidation is not feasible as the use cases and the innovation categories differ significantly.

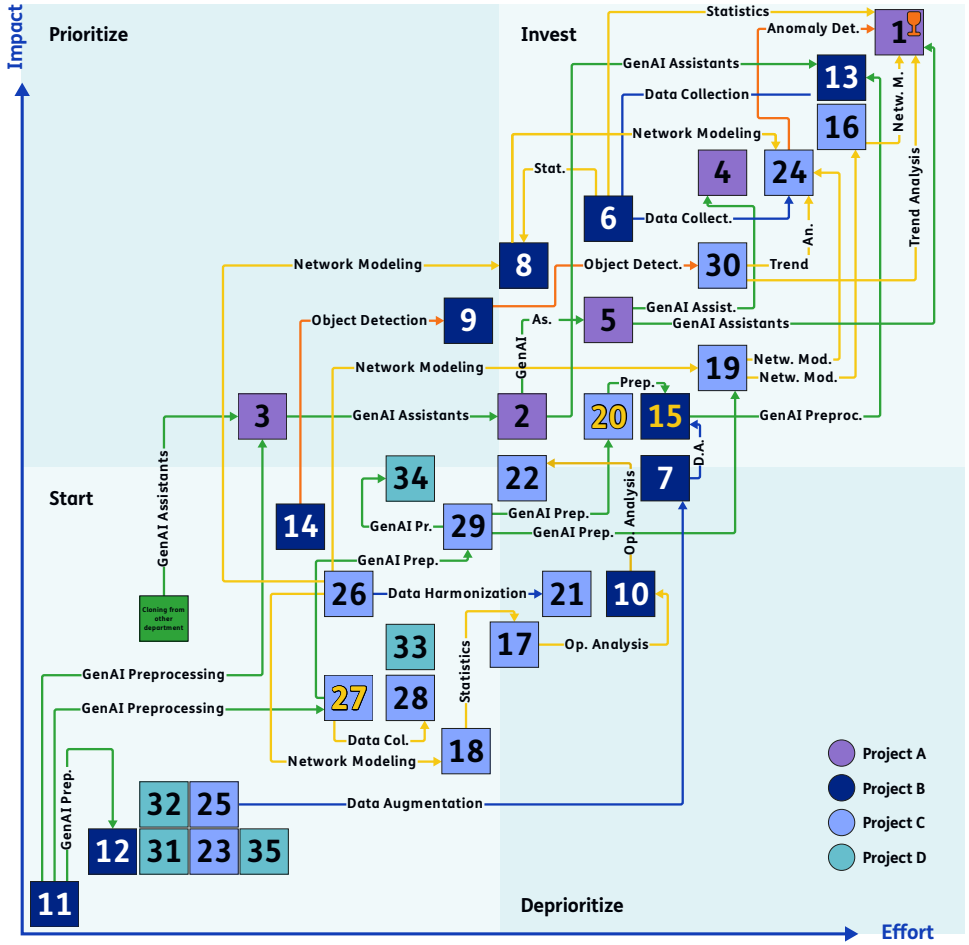


Figure 9: This figure extends the effort–impact matrix by adding directional links between use cases based on shared technical or functional components identified during synergy mapping. The resulting roadmap highlights development dependencies and opportunities for reuse, enabling orchestrators to plan coordinated, efficient R&ID trajectories across projects and domains.

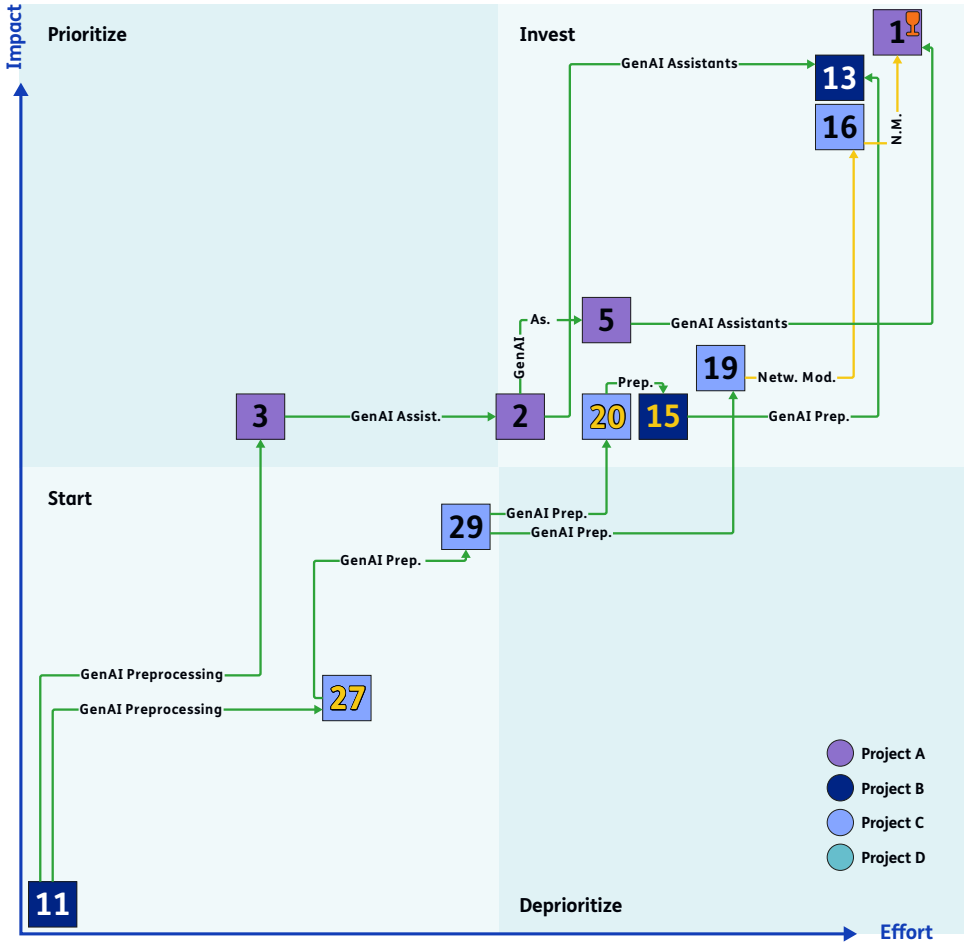


Figure 10: This figure shows a subset of use cases that represent a loop, where there are multiple development trajectories with a same starting point and end point.

3.5 Synergy Quantification

In this step, the directional roadmap is enriched by quantifying the degree of overlap between use cases. Technical and functional synergies—identified earlier in the mapping phase—are now expressed as percentages, indicating the proportion of shared components or development effort. **Figure 11** illustrates this by showing, for each use case, the percentage of its development effort that can be reused from preceding use cases. In other words, it visualizes how much effort is saved in a given use case due to synergetic development.

For example, Use Case 11 contains a technical solution that is entirely reused in Use Cases 12 and 27, albeit applied to a different domain and at a larger scale. In such cases, the development effort for the downstream use case is significantly reduced—they are effectively half-completed at the outset. Similarly, Use Case 3 has several components, of which some do not have to be newly developed because two other use cases are doing that already. Together, these two use cases represent half of the total effort that Use Case 3 would have had if it were to be developed in isolation.

These quantified links help orchestrators assess where joint development can reduce duplication, accelerate delivery, and improve resource efficiency. Additionally, it helps them to build a business case for coordinated development. For example, if two use cases share a significant portion of their components, sequencing their development strategically—rather than treating them as standalone efforts—can substantially reduce total effort and cost.

Synergy quantification supports cross-project funding models by revealing where shared investment yields mutual benefit. It also enables internal process improvement use cases—often more difficult to fund directly through one project—to be included in the roadmap by leveraging the efficiency margin gained through synergetic development.

It is important to note that these percentages may evolve as development progresses. For use cases positioned further along the roadmap, precise quantification may not yet be feasible, as many of the preceding developments are

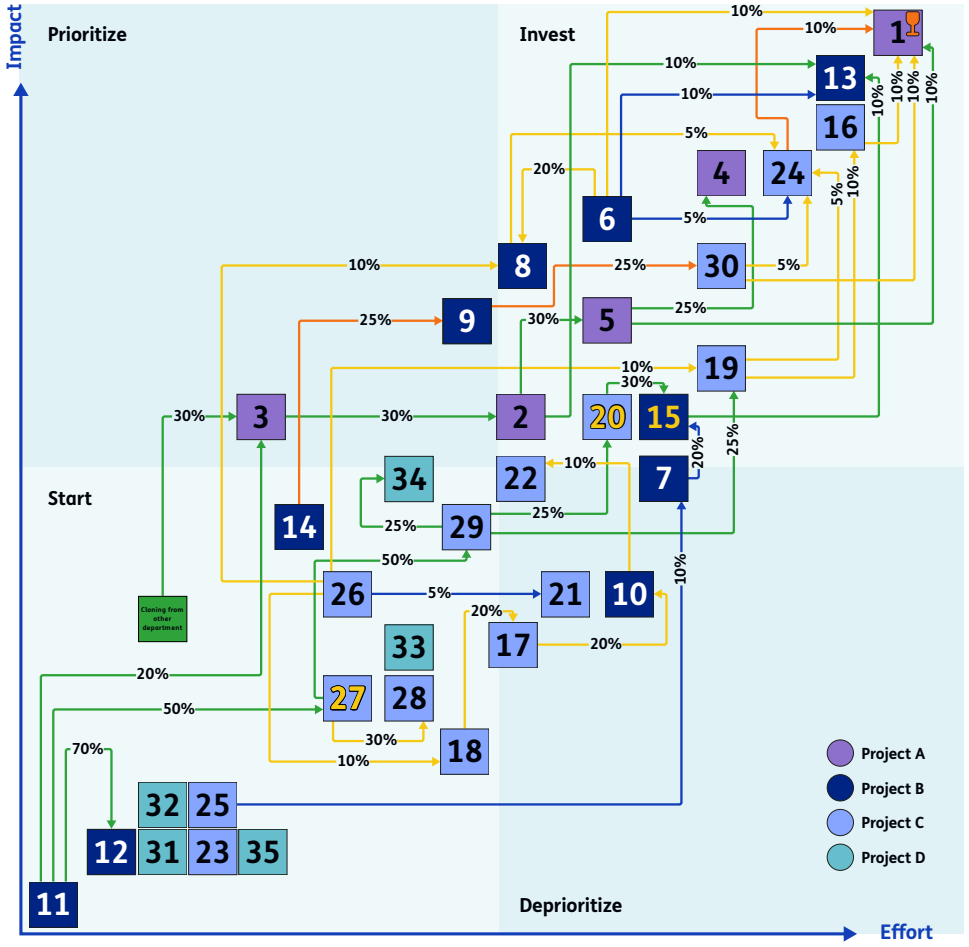


Figure 11: This figure shows the directional roadmap with quantified synergies between use cases, expressed as percentages of shared development effort. Each link indicates the proportion of a use case that can be reused from preceding developments, supporting strategic sequencing and efficient resource planning.

still in early stages or have not yet begun. This uncertainty is acceptable, as the development sequence has already been established in the previous step. However, quantification at this stage does provide a valuable input for orchestrating funding across projects and aligning development efforts with strategic goals.

Ultimately, this step transforms the roadmap from a directional overview into a strategic planning tool—guiding decisions on resource allocation, timing, and collaboration across domains and departments.

3.6 Strategic Planning

In this step, stakeholders such as project-, department-, and program managers are consulted to align with the roadmap and its proposed sequence of developments. Their input may elevate the priority of specific use cases based on organizational relevance, strategic goals, or stakeholder importance. This is particularly valuable when multiple starting points exist within the roadmap, allowing decision-makers to focus development efforts on the most impactful trajectory or to distribute resources across parallel paths.

With this input, the development roadmap is finalized. Strategic starting points are identified within the sequence(s) of use cases, taking into account estimated effort, expected impact, quantified synergies, and managerial prioritization. This ensures that the roadmap reflects not only technical logic but also organizational strategy. **Figure 12** illustrates strategic planning for **Example A**, where Use Cases 3, 11, 14 and 26 are selected as priority starting points.

- Use Case 11 is identified as a starting point for R&ID due to the low effort and high amount of reuse in subsequent use cases. This interdependency makes the case for joint development and shared funding across initiatives (of projects involved in Use Cases 11, 12, 27, and 3).
- Use Case 3 is prioritized due to its favorable position in the effort–impact matrix and its role as a precursor to a sequence of dependent use cases. However, it requires components from a prior use case (11) and even from a project outside the current program. The prioritization indicates an urgency to accelerate the completion of use case 11.

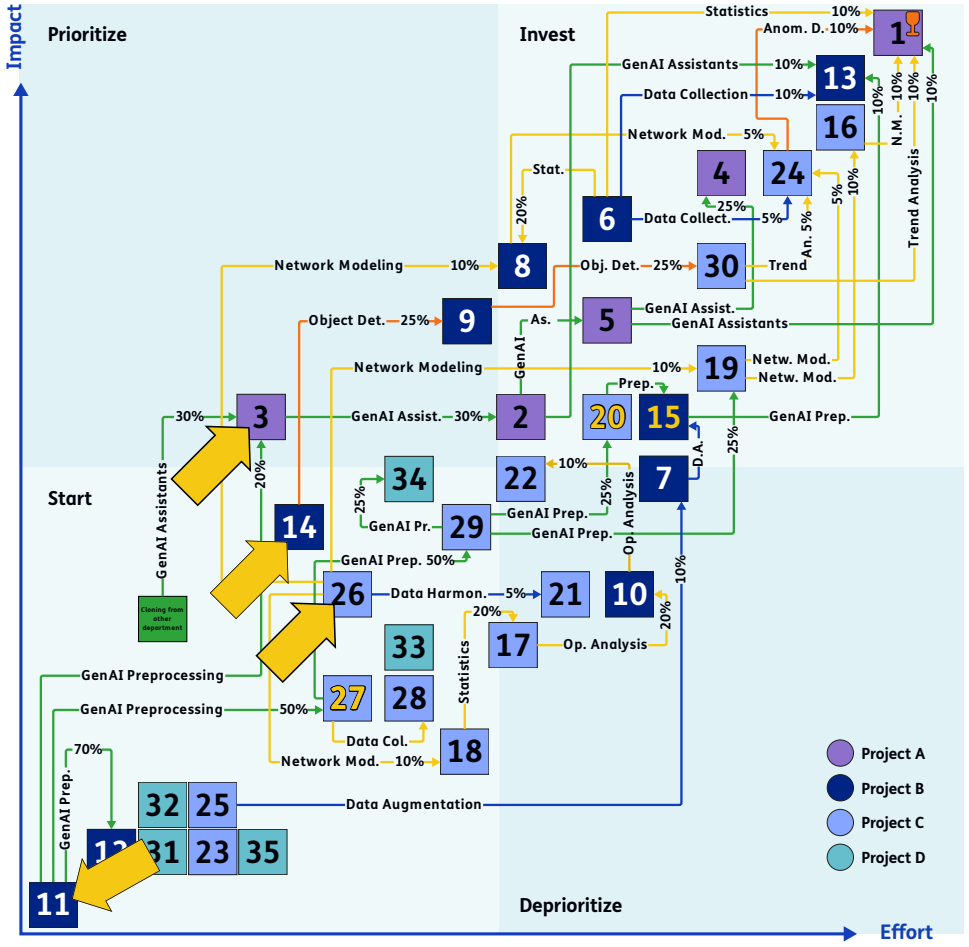


Figure 12: This figure shows the roadmap with both the synergy name and percentage for completeness, and with stars indicating the prioritized starting points for R&ID. Use Cases 3, 11, 14, and 26 are highlighted based on their strategic position, synergy potential, and organizational importance.

- Use Cases 14 and 26, while lacking preceding use cases to draw synergies from (a common trait for initiating use cases), show strong synergy with subsequent developments and plot with relatively high impact for the required effort—making them a strategic anchor for future work.

To further accelerate roadmap execution, it must be assessed whether specific use cases should be developed internally or sourced externally. Especially in cases where it is required to start R&ID further along the roadmap because of a strategic position or other urgency (potentially driven by organizational mandates), external solutions must be considered as substitutes for internal R&ID efforts.

The strategic sequencing and prioritization supports alignment across departments and informs downstream planning activities such as SAFe PI planning, product roadmapping, and resource allocation. It ensures that development efforts are not only technically sound but also organizationally coordinated. The roadmap now serves as a strategic tool that connects technical development with organizational goals, funding opportunities, and delivery timelines.

3.7 Updating Cycle

As R&ID progresses, new insights emerge and initial assessments of effort, impact, and synergy may shift. Use cases may evolve, new applications may be identified, and the most efficient development paths may change. New use cases may also arise at any point in time. To ensure the roadmap remains accurate and actionable, periodic re-evaluation and refinement is essential—ideally every quarter or at least twice a year. During each cycle, the descriptions, estimated effort, expected impact, quantified synergies, and strategic priorities of both existing and newly identified use cases must be reviewed and updated. This ensures that the roadmap reflects the current state of innovation and remains aligned with organizational goals.

This re-evaluation can be organized as a plenary planning event, similar to SAFe PI planning, where relevant stakeholders (e.g., project managers, product owners, researchers) convene to align on development priorities for the upcoming period. These sessions serve not only to update the roadmap but also to showcase progress, inspire new applications, and ideate new use cases. All input from these events feeds into the updated roadmap. Additionally, this event offers a touch point with product owners, meaning that it a meeting point between the Agile Planning cycle for product development and the Use Case Orchestration cycle for R&ID. It is at this point that the use cases that have matured into products can start transitioning to the Agile Planning cycle for productization and for maintenance support, representing the implementation or operationalization of new innovations.

These plenary planning events are not limited to a single roadmap but encompass all roadmaps relevant to the organization and relevant to PI planning. They provide a structured forum for roadmap orchestrators to present their planning, share progress, and align priorities across teams, departments, and domains. By bringing together stakeholders from across the organization—including product owners, PI planners, and business developers—these sessions facilitate early visibility into the maturity and trajectory of innovations. This enables smoother transitions from research to operationalization and ensures that upcoming developments are anticipated in downstream planning cycles. Moreover, these events foster cross-pollination of ideas, allowing new collaborations and use cases to emerge. When sufficient synergies are identified, they may even lead to the creation of new roadmaps at different organizational or technical levels, combining efforts across previously disconnected units.

4. Application results

The Use Case Orchestration Framework has, at the time of writing, been applied in three distinct organizational settings:

- The Generative AI program for the TNO EMT unit
- The AI program of the Netherlands Materials Observatory
- The AI program of the Geological Survey of the Netherlands

While these programs are centered on AI innovation, the framework was used to orchestrate a diverse set of use cases—including those focused on data ingestion, engineering, governance, and domain-specific analysis. This demonstrates that the framework is not limited to AI, but is broadly applicable to any research and innovation development effort. Across these implementations, the orchestration of use cases in synergetic roadmaps has demonstrably contributed to several key outcomes:

- Reduction in development effort, by enabling reuse of components across use cases
- Lower overall costs, through coordinated planning and avoidance of redundant work
- Facilitation of co-funding, with individual use cases supported by up to three different projects
- Cross-pollination of ideas across departments and application domains
- Improved strategic visibility, enhancing alignment and progress tracking among managers and coordinators

These impacts were identified through internal evaluations and repeated observations. While formal quantification is still in progress, early modeling and synergy assumptions provide indicative results.

4.1 Strategic Funding and Feasibility Outcomes

The use case roadmap provides a structured and transparent representation of development trajectories, which has proven effective in facilitating co-funding arrangements. Because individual use cases often span multiple projects and departments, their visibility within a shared roadmap enables budget holders to identify overlapping interests and coordinate funding contributions. This clarity supports distributed investment strategies and reduces the likelihood of duplicated development efforts. Furthermore, the roadmap enhances the feasibility of high-effort, high-impact use cases—often referred to as “north star” or “holy grail” use cases. These aspirational goals are frequently discussed but seldom pursued due to uncertainty regarding the required development path. By explicitly mapping the intermediate use cases and their dependencies, the orchestration framework reveals a stepwise route toward these complex solutions. This visibility has, in practice, led to increased stakeholder engagement, a shift in innovation momentum, and a greater willingness to support ambitious R&ID initiatives. In all three applied TNO settings, this has contributed to a cultural shift within departments and work programs, particularly in digital innovation efforts, where the roadmap has enabled stakeholders to envision and commit to transformative outcomes.

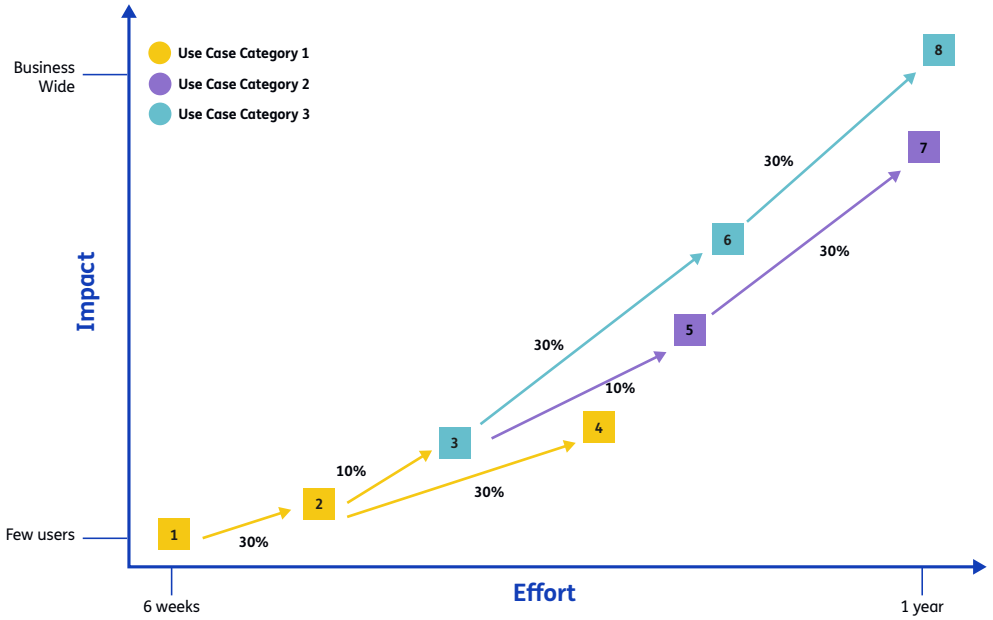


Figure 13: Illustration of a hypothetical roadmap of eight use cases plotted on an absolute scale, showing how synergetic development sequencing reduces lead time and cost compared to isolated development.

4.2 Roadmap Modeling

Figure 13 illustrates these outcomes in a hypothetical roadmap on an absolute scale, illustrating development cost reductions when synergies are leveraged across use cases. In this scenario:

- Use Case 1 requires 6 weeks of development by one person and impacts several internal users
- Use Case 8 requires a year of development by one person and impacts the entire organization

If development begins with Use Case 8, lead time and costs are high, risking stakeholder disengagement and obsolescence. By orchestrating development based on synergies, co-development and co-funding reduce total effort cost and accelerate delivery.

In this example, intra-category (e.g., technology type, functional area) synergies yield a 30% efficiency gain, while inter-category synergies yield 10%. These assumptions align with synergies identified in **Example A**.

Figure 14 breaks down absolute costs of efforts by multiplying development time by an average hourly cost of €200 and factoring in synergy percentages. The result is a ~25% reduction in total effort and cost. Such a breakdown can be instrumental in building a business case for a project.

4.3 Quantified Outcomes

Based on hypothetical modeling and synergy assumptions, the following results are derived:

- 10–30% reduction in R&ID costs is achievable when use cases are developed with orchestration rather than in isolation
- 10–30% reduction in development effort is achievable, accelerating time-to-market for solutions
- Greater domain diversity is positively correlated with higher synergy potential

Use case	Standalone development cost	Fraction synergy	Synergetic development savings	Synergetic development cost
8	€ 200.000	0,3	€ 60.000	€ 140.000
7	€ 150.000	0,3	€ 45.000	€ 105.000
6	€ 120.000	0,3	€ 36.000	€ 84.000
5	€ 100.000	0,1	€ 10.000	€ 90.000
4	€ 70.000	0,3	€ 21.000	€ 49.000
3	€ 50.000	0,1	€ 5.000	€ 45.000
2	€ 40.000	0,3	€ 12.000	€ 28.000
1	€ 30.000	0	€ 0	€ 30.000
Total cost	€ 760.000	0,25	€ 189.000	€ 571.000

Figure 14: Break-down of development costs for the hypothetical roadmap, in both the scenario of developing each use case in isolation and in synergy.

5. Impact and limitations

This section discusses the observed impacts and practical limitations of the Use Case Orchestration Framework, based on internal evaluations and repeated observations across multiple departments and domains. The insights presented here are drawn from its application in three distinct TNO settings and reflect both the strategic benefits and operational challenges encountered during real-world implementation. These findings serve as a basis for interpreting the framework's effectiveness, identifying areas for refinement, and guiding future applications.

Figure 15 revisits the comparison of planning frameworks, now including the Use Case Orchestration Framework. Unlike the other entries, which are based on literature, the fourth column reflects observed outcomes from the framework's application across multiple organizational settings. This positioning highlights how the orchestration method complements and extends existing approaches.

Dimension	Project-Based Planning	Product Development Frameworks (AgilePlanning, Stage-Gate)	Innovation Portfolio Management	Use Case Orchestration Framework
Primary Focus	Delivery of scoped outputs within bounded projects	Incremental product delivery and risk-managed execution	Strategic alignment of innovation investments	Synergetic planning across use cases and domains
Structure	Linear, scope-defined, budget-bound	Iterative (Agile), stage-gated (Stage-Gate), cadence-driven	Funnel-based, stage-gated, matrix-prioritized	Sequential roadmap based on use case dependencies and synergies
Strengths	Clear scope, resource allocation, timeline control	Responsiveness (Agile), decision checkpoints (Stage-Gate), delivery cadence	Long-term prioritization, strategic filtering	Early-stage alignment, reuse, cross-domain coordination
Limitations in R&ID	Fragmented development, limited reuse, siloed execution	Too rigid for experimentation, product-centric assumptions, domain silos	Lacks mechanisms for shared development or reuse	Requires centralized documentation and stakeholder buy-in
Support for Cross-Domain Collaboration	Low	Moderate (within value streams or product lines)	Limited	High
Support for Internal effectiveness & workflow Improvements	Low	Low	Low	High (makes internal use cases visible and fundable)
Reuse of Components	Rarely supported	Retrofitted post-development	Not explicitly addressed	Central to planning logic
Funding Model	Project-specific	Value stream-aligned or stage-gate budgeted	Strategic investment pools	Enables co-funding across projects
Scalability	Limited to project scope	Scales within Agile teams or product portfolios	Scales across portfolios	Scales across domains, departments, and units
Adaptability to Uncertainty	Low	Moderate	Moderate	High (supports evolving use cases and iterative refinement)

Figure 15: Comparative overview of planning frameworks, including the Use Case Orchestration Framework, based on observed outcomes and positioning within Research and Innovation Development contexts.

Compared to project-based planning and product development frameworks such as Agile Planning and Stage-Gate, Use Case Orchestration offers a distinct advantage in contexts where innovation is exploratory, cross-domain, and capability-driven. While traditional frameworks excel at managing delivery within bounded scopes and timelines, they often struggle to accommodate uncertainty, reuse, and internal process improvement. Innovation portfolio management, though more strategic, typically focuses on filtering and prioritization rather than coordinating development across initiatives.

Use Case Orchestration fills these gaps by introducing a synergy-driven planning layer that enables early-stage alignment, visibility of internal use cases, and co-funding across projects. Its roadmap-based structure supports reuse of components and sequencing of development based on technical overlap—capabilities that are not inherently supported by the other frameworks. This makes it particularly well-suited to R&ID environments where overlapping technologies, evolving objectives, and distributed funding are the norm.

The remainder of this section discusses the framework's observed impact in practice, including cost and effort reductions, strategic visibility, and cultural alignment, as well as limitations encountered during implementation.

5.1 Synergy Potential and Domain Diversity

Experience shows that the highest synergy potential in R&ID arises when an organization or project spans multiple domains. This diversity provides a richer feeding ground for innovation and reuse of technical developments. For example, a GenAI labeling use case exists within the geology domain, and the Geological Survey of the Netherlands (part of TNO) will put in the effort to perform R&ID on it. However, the same use case is present in several domains within the TNO unit of Energy Materials and Transition (EMT), and this synergy provides an opportunity to share the R&ID effort across the EMT unit—yielding results sooner and with broader impact. The Use Case Orchestration Framework systematically maps such synergies and provides orchestrators with a structured method to plan R&ID efforts efficiently and strategically across the EMT unit.

The amount of cost savings and development acceleration that can be expected depends on the degree of synergy within a work program or across an organization. Among the three TNO settings where the framework has been applied, the Generative AI roadmap exhibits the highest potential for cost savings and effort reductions. This is partly due to the domain-agnostic nature of the technology, but more significantly due to the EMT unit's high variety of application domains. This diversity creates a broader user base for overlapping developments, fostering favorable conditions for co-development and co-funding.

As stated in section 4.3, the 10–30% reduction in R&ID cost and effort is based on modeled synergy assumptions and early-stage applications of the framework. It is not a guaranteed outcome, but rather a realistic upper bound observed in synergy-rich environments—particularly those with high domain diversity, fragmented development, and latent reuse potential. While higher percentages may be theoretically possible and can certainly be fabricated by decomposing projects into more use cases with greater overlap, the framework is designed to reveal existing synergies, not to inflate them. Practitioners benefit most from honest mapping, where reuse opportunities are surfaced and validated through structured planning—not assumed. Overestimating synergy can lead to misaligned expectations and ineffective coordination. Moreover, inflating both synergy percentages and the number of use cases in a roadmap would ultimately result in the same total effort and cost. If anything, it would reduce clarity and make strategic planning and decision-making more difficult.

5.2 Effort–Impact Scaling: Relative vs. Absolute

The framework's Effort–Impact matrix is intentionally relative to allow flexibility for experimentation, iteration, and pragmatism. While an absolute scale could be used, it would require more maintenance as development progresses. However, there is a compelling reason to adopt an absolute scale: it enables quantification of impact and effort, which supports the formulation of business cases for entire roadmaps. The framework could

be refined to include a step that assesses the roadmap on an absolute scale, similar to the hypothetical modeling exercise performed in the previous section of this whitepaper. This step would enable organizations to quantify effort cost savings and development acceleration.

5.3 Strategic Anchors, North Stars, and internal processes

The framework supports the identification of strategic anchors—use cases that serve as starting points for roadmap development due to their high impact and synergy potential. It also enables the emergence of "north star" use cases: aspirational goals toward which development efforts converge. These use cases provide clarity and motivation across teams and help align technical development with organizational strategy. High-impact, high-effort use cases (such as north star use cases), which might otherwise be considered out of reach due to their resource demands, can become feasible through a synergetic path of use cases distributed across multiple projects.

The framework also brings internal process or workflow improvements to the forefront—initiatives that are often difficult to fund because they fall outside the scope of specific projects. Through use case orchestration, these efforts can be embedded within broader development trajectories involving existing projects or made visible to management as candidates for new project creation and budget allocation.

5.4 Organizational Alignment

The updating cycle, ideally conducted quarterly or biannually, ensures that roadmaps remain accurate and actionable. These sessions resemble PI planning events and foster cross-pollination of ideas, enabling new collaborations and use cases to emerge. Involving product owners, managers, and other stakeholders in these sessions ensures alignment across the organization on the R&ID paths and prioritizations. They also help to generate awareness in the PI planning process regarding use cases that are becoming mature and transition from research and innovation development into a product implementation and maintenance.

A lack of collaboration and transparency are common challenges across organizations. These issues are often addressed through ad hoc communication and spontaneous collaboration, which may offer short-term relief but rarely result in scalable or repeatable solutions. Contrastingly, the framework embeds transparency and coordination directly into the planning process to systemically address these challenges. By capturing use cases in a structured format, mapping their overlaps, and sequencing their development, it establishes a repeatable and scalable method for orchestrating innovation. This structure introduces a form of soft governance that stimulates transparency and collaboration: once use cases are documented and synergies are visible, teams become accountable for not leveraging them or for preventing reuse. The framework transforms coordination from a cultural aspiration into a planning discipline, enabling organizations to move from reactive collaboration to proactive orchestration.

5.5 Risks and Limitations

While the Use Case Orchestration Framework offers clear strategic and operational benefits, several challenges should be acknowledged.

Quantifying synergies early in development can be difficult, especially when technical dependencies or reuse potential are not yet fully understood. There is also a risk of overestimating reuse, which may lead to unrealistic expectations about cost savings or development acceleration. Especially for use cases positioned further along the roadmap, precise quantification may not yet be feasible, as many of the preceding developments are still in early stages or have not yet begun.

Establishing a metric to evaluate the successful orchestration of use cases could support methodological integrity and enable the setting of organizational targets. However, defining targets based on synergy percentages or effort reductions risks incentivizing artificial inflation within the roadmap. The objective is to identify the most efficient R&ID trajectory—not to maximize synergy or cost reduction relative to an exaggerated standalone baseline. At present, no elegant metric exists that simultaneously encourages synergy and efficiency while discouraging excessive decomposition of work into use cases. These competing dynamics require careful balancing

by use case orchestrators. Continued implementation and broader adoption may yield insights for a follow-up study aimed at defining a reliable metric for assessing roadmap quality.

Successful orchestration depends on centralized documentation and stakeholder buy-in. Without consistent intake, tracking, and cross-team engagement, the roadmap may lose relevance or fail to capture emerging opportunities. Additionally, adoption across an organization requires a shift in mindset—from project-centric development to coordinated, reusable innovation. This transition can be slowed by siloed workflows, lack of awareness, or resistance to change.

Finally, while orchestration can positively influence innovation culture, capability development, and strategic alignment, these outcomes are not automatic. They require deliberate effort to embed orchestration practices into planning cycles, capability management, and leadership communication. Without this, the framework may remain a tactical tool rather than a strategic enabler.

6. Conclusion

In this whitepaper, we present a detailed methodology for the Use Case Orchestration Framework, contextualize its application through anonymized real-world examples, evaluate its observed benefits across multiple organizational settings, and compare it to existing planning frameworks. The framework has demonstrated tangible impact in three distinct TNO environments, with strong potential for broader adoption across the organization. It has proven effective in complementing traditional planning approaches and addressing their key limitations for Research and Innovation Development (R&ID) by introducing a synergy-driven planning layer that enables early-stage alignment, cross-domain collaboration, and strategic reuse of components. Key findings are:

- Use case orchestration effectively bridges domains in R&ID, enabling coordinated and efficient development across projects, departments, and technical domains.
- Based on observations from three applications within TNO, the following estimated outcomes were derived:
  - A 10–30% reduction in overall R&ID costs is achievable by considering the totality of use cases and their synergies, rather than treating them in isolation.
  - A 10–30% reduction in overall R&ID effort is achievable, accelerating time-to-market for solutions.
- Organizations with greater domain diversity offer more opportunities for synergy, placing them at the higher end of the potential savings range.
- The framework facilitates joint development and co-funding across projects and units, providing clarity and alignment for stakeholders.
- The framework introduces a form of soft governance that stimulates transparency and collaboration by making teams accountable for not leveraging synergies or preventing reuse.
- The framework enhances strategic visibility, supporting better progress tracking and decision-making among managers and coordinators.
- The framework enables visibility and justification for internal process improvement use cases, which are often overlooked in traditional planning frameworks.
- The framework provides a system to solve the long-standing organizational challenges of siloed development and duplicated effort, by embedding coordination and reuse directly into innovation planning.
- The framework may be further refined to include a step for absolute scaling of the Effort–Impact matrix, enabling more precise quantification of savings and acceleration.
- While the framework's impact is evident, formal quantification will require continued application and evaluation through existing and future roadmaps.

In addition to its operational benefits, the framework has proven effective in fostering organizational alignment and supporting a cultural shift toward coordinated development and reuse. Its iterative design and real-world validation across diverse settings underscore its relevance and adaptability for R&ID planning.

7. Acknowledgments

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