administrative sciences

MDPI

Article

Drivers for Clustering and Inter-Project Collaboration—A Case of Horizon Europe Projects

Takwa Benissa [1] and Anish Patil [2,*]

[1] Avesta Battery & Energy Engineering, 9400 Ninove, Belgium
[2] TechConcepts B.V., 2821 LE Stolwijk, The Netherlands
* Correspondence: anish.patil@techconcepts.eu

Abstract: This paper investigates the drivers and dynamics of clustering and inter-project collaboration within the framework of the Horizon Europe and Horizon 2020 projects. Leveraging a survey-based approach, we examine key themes surrounding the perception of clustering, the willingness to share information under legal confidentiality, and motivations for engaging with partners from different projects. The survey instrument, implemented via Microsoft Forms, was distributed among the consortia of eight EU projects participating in the SOLID4B cluster. Notably, the questionnaire was meticulously crafted based on an in-depth analysis of the SOLID4B case and comprehensive discussions with project coordinators and communication and dissemination managers from all participating projects. These discussions aimed to establish a clear roadmap for the cluster, ensuring the questionnaire's relevance and usefulness for all participants. Data analysis was conducted within the same platform, facilitating efficient data processing and visualization. Our findings reveal that a significant majority of respondents (48 out of 55) perceive clustering as a valuable asset, indicative of a positive shift in perspectives. Challenges related to confidentiality were addressed through nuanced insights, with respondents demonstrating a willingness to share routine best practices, significant breakthroughs, and deliverables within a legally protected framework. Furthermore, a robust majority (40 out of 55) expressed a keen interest in collaborative endeavors, underscoring a collective drive to extend activities beyond individual project boundaries. The study highlights the importance of clustering with other projects in maximizing the impact of the Horizon program, extending stakeholder networks, and sharing knowledge and achievements in research and innovation. These insights contribute to a deeper understanding of the motivations and challenges surrounding clustering and collaboration within the Horizon Europe and Horizon 2020 projects. Ultimately, the findings pave the way for informed strategies aimed at fostering a dynamic and interconnected research community.

Keywords: Horizon Europe; Horizon 2020; clustering activities; collaboration; synergies; impact

Citation: Benissa, Takwa, and Anish Patil. 2024. Drivers for Clustering and Inter-Project Collaboration—A Case of Horizon Europe Projects. *Administrative Sciences* 14: 104. https://doi.org/10.3390/admsci14050104

Received: 3 February 2024
Revised: 13 May 2024
Accepted: 14 May 2024
Published: 17 May 2024

1. Introduction

Horizon Europe is the EU's key funding programme for research and innovation, with a budget of EUR 95.5 billion for a programme that runs from 2021 to 2027. It is the 9th Framework Programme (FP) and its goals are to tackle climate change, help to achieve the UN's Sustainable Development Goals, and boost the EU's competitiveness and growth. The programme facilitates collaboration and strengthens the impact of research and innovation in developing, supporting, and implementing EU policies while addressing global challenges. It enables the development and dissemination of excellent knowledge and technologies (European Commission 2021).

As per the Directorate-General for Research and Innovation report with regard to the Systems-Based Methods for Research & Innovation Policy, European framework programs that boost research and innovation could be conceptualized and practiced under the Transformative Innovation Policy (TIP) approach. TIP refers to a set of strategic measures aimed

at promoting research and innovation activities that have the potential to fundamentally transform social, economic, and environmental systems (Directorate-General for Research and Innovation 2023).

An overview of the framework programs between 2002 (FP6) and 2023 (Horizon Europe–FP9) is illustrated in Figure 1. The framework program (FP) intends to define thematic priority areas that need support and implement horizontal actions to stimulate the efficacy of community research. The scope of the framework program, initially focused on pre-competitive research, has, over time, been widened to encompass all the activities of the innovation process. Innovation is a process encompassing many different activities conducted by various actors that exchange knowledge, funds, and skills. Innovation is the key driver of economic performance, and a critical factor in the 'competitiveness' of research and industries (Porter 1998; Ferras-Hernandez and Nylund 2018). Universities, institutes, and public research centers have a strategic role nationally by generating technological knowledge that is transferable to the industry, which can transform it into economic and social value for users and clients, the institution itself, and society. The objective of this collaboration is to develop and/or complete the innovation process for the production of goods and services competitively. Collaborative transnational research projects have been the main instrument for the implementation of the FP, with various types of beneficiary, including individual researchers and companies, public and private research organizations, public–private consortia, and also ministries, agencies and other users (EPRS 2017).

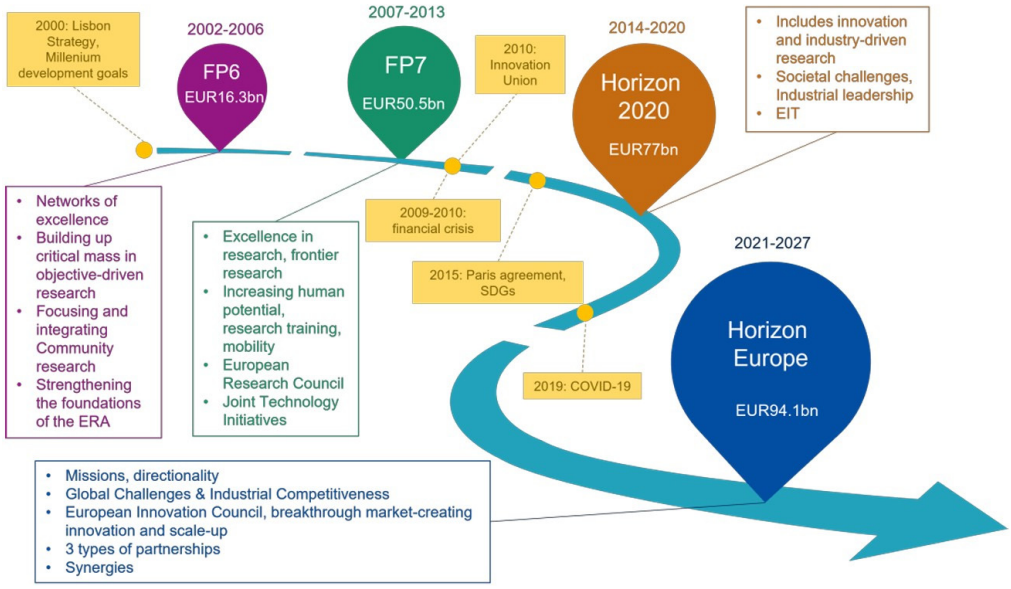

Figure 1. General evolution of the FP between 2002 and 2023. Figure source: (Cavicchi et al. 2023).

Almost all funding mechanisms within the FP require projects to collaborate with other partners. However, such a requirement is limited to intra-project collaborations; on the other hand, inter-project collaborations or collaborations with entities outside of the project are recommended. There are no clear mandates on how such collaborations should be developed. Over the last few years, evaluation studies have pointed out the increased need for collaboration outside of the projects to maximize the project impact, and increase synergies and innovation uptake (European Commission 2021; Secretary-General of the European Commission 2018; Science Europe 2016; ISE 2021).

Collaborative research programs have a significant impact on the structure of national innovation systems by creating and strengthening networks (dynamic and "fit for purpose"), which are essential for breeding innovation clusters (Shuman and Twombly 2010; Christensen et al. 2020; Ponomariov and Boardman 2010). These networks involve both technology and market stakeholders and are extended to include industry, research and technology producers (Liyanage 1995; Olmos-Peñuela et al. 2017). The network and col-

laboration among cluster members can play important roles in enhancing productivity and problem solving, which can contribute to enhancing the efficient use of resources (Barakat et al. 2023; Durugbo 2016). Social networks highlight the patterns of human interaction on one hand, while on the other hand, they have has important implications for the spread of information (Newman 2001). Scientific collaboration networks are an important subset of social networks as they document patterns of collaboration that drive technological progress and innovation in our society (Vasilyeva et al. 2021). Scientific collaboration with industrial and other interdisciplinary partners shows strong benefits in terms of innovation (Uyen and Carayol 2005; Keown et al. 2008).

This article makes a clear distinction between *networking* and *clustering*. Networking involves communication and information exchange for mutual benefit. A simple example of networking is the case in which a group of entities shares information about their experience with the use of a specific tool (Camarinha-Matos and Afsarmanesh 2006). On the other hand, clustering, as understood within the context of this research, in addition to exchanging information, involves aligning activities so that more efficient results are achieved (Ter Wal and Boschma 2011; Camarinha-Matos et al. 2019). Clusters are highlighted as a type of inter-organizational network that contributes to regional development and competitiveness (Franco and Esteves 2020). Clusters can be defined as interconnected entities (composed of different types of stakeholders) that cooperate among themselves, creating competitive advantages and developing environments that promote innovativeness (Zhao et al. 2023; Owen-Smith and Powell 2004; Whittington et al. 2009). In this context, inter-stakeholder knowledge exchanges arise as an alternative, filling the firm's knowledge gaps and helping to innovate and enter new markets (Porter 1990; Anicet Bittencourt et al. 2018).

In the context of EU projects, networking and clustering represent two distinct approaches to collaboration and knowledge exchange. Networking involves communication and information exchange among entities for mutual benefit, occurring on a broader scale and encompassing interactions between individuals, organizations, or institutions within a specific field or sector. Its goal is to facilitate the sharing of knowledge, experiences, resources, and best practices, often through activities such as workshops, seminars, conferences, webinars, online forums, and professional associations. Clustering, on the other hand, focuses on aligning activities among entities to achieve more efficient outcomes within specific thematic areas, research domains, or geographic regions. It aims to bring together stakeholders with complementary expertise, resources, and interests to address common challenges or pursue shared goals, typically through joint research initiatives, collaborative projects, knowledge-sharing platforms, innovation networks, and industry clusters. While networking emphasizes broad communication and information exchange, clustering fosters collaboration and synergy within targeted communities or domains, both playing essential roles in EU projects by facilitating collaboration, knowledge exchange, and innovation across different scales and objectives.

This paper presents a novel framework focusing on clustering activities within EU projects, offering insights into their impact and effectiveness in fostering collaboration, innovation, and knowledge exchange. It is critical to understand the factors driving collaborations among researchers, particularly between researchers from different disciplinary backgrounds and partners from other sectors (Woolley et al. 2015). Drawing from the lessons learned from clustering initiatives, it provides valuable guidance for optimizing future EU-funded projects to maximize their impact and address societal challenges more effectively. The objective of this paper is to investigate the impact and effectiveness of clustering activities within EU-funded projects, specifically focusing on collaboration, innovation, and knowledge exchange. Employing a cross-sectional methodology, this paper systematically analyzes and synthesizes data from a diverse range of EU-funded projects across different thematic areas and geographic regions. This approach enables the identification of common trends, challenges, and best practices across a broad spectrum of projects,

providing valuable insights for policymakers, project coordinators, and stakeholders seeking to enhance the effectiveness and impact of future EU-funded endeavors.

2. Problem Definition

The importance of interdisciplinary collaboration and stakeholder engagement in achieving the expected impact of the Horizon Europe program is well understood (Directorate-General for Research and Innovation 2023). However, it is yet unclear how interdisciplinary collaboration and stakeholder engagement should be carried out outside the project realm. Recognizing collaboration as a cornerstone of scientific progress, the European Commission fosters partnerships and knowledge exchange through its funding programs for research and innovation, like Horizon 2020 and Horizon Europe. Among the collaborative efforts promoted by the EU are so-called cluster events, typically joint workshops or conferences organized by one or several project consortia within a cluster.

The overarching challenge lies in the ambiguity surrounding the implementation of interdisciplinary collaboration and stakeholder engagement beyond project boundaries within the Horizon Europe program. Despite the acknowledged importance of collaboration and engagement, particularly through cluster events, there remains a significant gap in understanding the most effective strategies for executing such activities beyond individual projects. This gap hinders the realization of Horizon Europe's objectives, as stakeholders grapple with the complexities of leveraging collaboration as a catalyst for scientific progress. Consequently, there is an urgent need for research aimed at delineating clear methodologies and frameworks to facilitate effective interdisciplinary collaboration and stakeholder engagement outside the project scopes within the Horizon Europe framework and associated funding programs.

With this objective in mind, there is a conscious effort to boost clustering amongst projects. The aim of forming a cluster is to facilitate synergies and knowledge exchange, ultimately accelerating scientific progress and innovation. When it comes to the way they are organized, not all clusters are alike: while some are formed ad hoc, for example, for a specific event (henceforth, referred to as bottom-up), others are already defined before a group of funded projects starts (henceforth, referred to as top-down).

When clusters are formed in an ad-hoc way - projects and their partners interact with partners from other projects, relevant stakeholders (including industries, NGOs or policy makers) and other entities such as regulatory bodies or standardization agencies as and when deemed necessary. On the other hand, top-down clusters have clear requirements from the start. For example, such methods of clustering include CSAs (Coordinated Support Actions), which encourage collaboration outside the project by having a single project that links different projects together to achieve a common goal. Herein, the objective is to enable mutual learning to enable projects to take advantage of insights and practices from other projects.

Projects that are members of clusters participate in joint activities and gain benefits from sharing complementary essential knowledge, including resources and skills (Guimarães et al. 2021). The clear benefit of clustering is the sharing of knowledge and the creation of synergies. Although the advantage of clustering, as an impact maximization strategy, is quite apparent, no literature review has given an insight into developing effective clusters and realizing their objectives. There is a need for an overview that can couple the level of clustering with the expected impact. Project coordinators and beneficiaries are already busy with developing new innovations, and clustering should not be an additional nuisance; instead, it should be of added value. Hence, this paper intends to develop a framework/overview that will summarize the various reasons why projects should cluster.

Keeping this problem in mind, this article will primarily address the following questions:

What are the perceived opportunities and challenges for the project and its beneficiaries when clustering and collaborating with other projects?
What are the key success factors for fostering sustainable collaboration and synergy within project clusters over the long term?

What are the barriers and challenges encountered by projects when attempting to join or participate in existing clusters, and how can these be mitigated?
What are the implications of project clustering for the dissemination and uptake of research results and innovations within relevant stakeholder communities?
What are the necessary conditions that could facilitate effective collaboration and knowledge sharing within project clusters?

3. SOLiD4B Cluster

The Solid4B collaboration stands as a catalyst for innovation, propelling the pace of advancement within the solid-state battery domain. The collaborative environment nurtures holistic problem solving, addressing challenges from diverse perspectives. Engaging a broad spectrum of stakeholders, including industry partners, policymakers, researchers, and the public, ensures the widespread recognition and appreciation of the benefits emerging from solid-state battery research. Through shared resources and knowledge, Solid4B optimizes the utilization of research and development, minimizing redundancies and maximizing the overall impact on the evolving landscape of sustainable energy solutions.

The Solid4B cluster is a hub for collaboration and innovation, strategically fostering research synergies among European-level projects on Li-metal-based solid-state batteries. In total, eight EU projects, funded under the topics HORIZONCL5-2021-D2-01-03, HORIZON-CL5-2021-D2-01-05, and LC-BAT1-2019, have established a solid knowledge base around Gen 4a and Gen 4b SSBs and share Gen 4b material-related achievements. The SOLID4B cluster represents a collaborative initiative comprising 99 partners across 19 countries, collectively spanning the entire value chain of Li-metal-based solid-state battery (SSB) production. With a diverse composition of stakeholders, including research institutions, manufacturers, and suppliers, this cluster aims to address critical challenges and advance the technology of solid-state batteries. The international distribution of partners underscores the global nature of this effort, fostering a rich exchange of expertise and resources. The comprehensive coverage of the value chain ensures the involvement of key players in material development, cell manufacturing, testing, and commercialization. This holistic approach positions SOLID4B at the forefront of research and development, with collaborative efforts focused on joint projects, knowledge sharing, and technology transfer. The noteworthy technological advancements achieved by the cluster are anticipated to have far-reaching implications for the field, promising improvements in battery performance, safety, and sustainability.

Operating as a dynamic network, the SOLID4B cluster's fundamental purpose is to convert research data into valuable insights for various stakeholders. In doing so, the cluster nurtures a collaborative environment that transcends the confines of individual projects, promoting shared knowledge and driving collective progress in the field. The cluster focuses on advancing R&D in the electric vehicle field, contributing to sustainable transportation. The cluster maximizes the dissemination of research achievements, ensuring a broader impact and awareness. Additionally, by sharing knowledge and experience, Solid4B supports individual project performance, facilitating effective problem solving and success. An overview of the SOLID4B cluster projects is presented below:

- SPINMATE: Create a scalable, sustainable pilot line (TRL6) for the large-scale manufacturing of Generation 4b (Gen 4b) Solid-State Battery (SSB) cells and modules.
- ADVAGEN: Creating high-energy-density EU-made SSBs, crucial for sectors like the automotive industry.
- AM4BAT: Revolutionizing lithium-ion battery manufacturing by utilizing additive manufacturing technologies for 3D lithium-ion batteries.
- HIDDEN: Developing self-healing processes that could extend the lifespan of lithium-metal batteries by 50%
- PULSELION): Enhancing energy density and safety in lithium-metal solid-state batteries, focusing on large-scale, in-house production.

- SEATBELT: Battery cell with a low cost, sustainable and safe design, meeting a high energy density (>380 Wh/kg) and long cyclability (>500 cycles).
- SOLiD: Developing a sustainable and cost-efficient pilot-scale manufacturing process for advanced solid-state Li-metal batteries.
- PSIONIC: Developing all-solid-state battery technology by using amorphous cross-linked polyethylene oxide laminated on a thin lithium foil.

In conclusion, the Solid4B cluster fuels innovation in solid-state batteries, fostering collaboration for electric vehicle advancement. Focused on lithium-metal-based batteries, the cluster boosts research dissemination and project performance.

4. Research Methodology

In order to address the research questions raised in this study, a cross-sectional approach by means of a questionnaire was used to gather valuable insights from the partners of the SOLID4B cluster. Notably, the formulation of the questionnaire stemmed from a comprehensive analysis of audience feedback on participation in SOLID4B cluster activities, supplemented by extensive dialogue with cluster partners (Benissa 2023). These interactions facilitated the development of a clear roadmap for the cluster, ensuring that the questionnaire effectively captured the multifaceted motivations, approaches, and challenges encountered by project stakeholders. This iterative process underscored the importance of stakeholder engagement and participatory decision making in shaping the research methodology, thereby enhancing the relevance and applicability of the study findings. The questionnaire is a tool widely used for data collection compared to interview and observation in empirical research; this study used Closed (multiple choice) and Open (descriptive) questions (Trupti and Ronald 2022; Wong et al. 2012). The most prevalent method of data collection is the employment of online questionnaires because of their efficiency and cost-effectiveness in the collection of vast amounts of information, which makes the process of data collection and analysis harmonized (Rowley 2014; Taherdoost 2022; Mildred 2014; Dewaele 2018).

As shown in Table 1, the questionnaire consisted of four main sections: motivation, approach, implementation, and general open questions and the corresponding questions and types.

The questionnaire included a variety of variables related to motivation, approach, the frequency of collaboration, awareness of cluster-level events, and general experiences with cross-project collaboration. A total of 55 responses were collected. Out of the 55 respondents, 22 were representatives from the industry, 3 were from academia, 22 were from R&D centers, 8 were from innovation consultancies and 3 were from public agencies. The questionnaire utilized a combination of closed-ended multiple-choice questions, offering participants the flexibility to express their opinions and preferences succinctly. Subsequently, the quantitative data obtained from the closed-ended questions underwent rigorous statistical analysis to unveil underlying patterns and trends among the core partners within the SOLID4B cluster. Furthermore, the qualitative insights derived from the open-ended questions were meticulously analyzed thematically, allowing for the extraction of nuanced and context-rich information from the participants' responses. The utilization of the Microsoft form platform not only facilitated the survey administration process but also enabled seamless data management and analysis, ensuring a comprehensive evaluation of the survey results.

Table 1. Questionnaire structure and questions.

#	Section	Corresponding Questions	Type
1	Motivation–Why do projects cluster	i. What are the primary drivers for collaborating and clustering with other projects? ii. Do you collaborate because there are inherent benefits or because it is required by the EU? iii. Over the course of your project, what benefits does your organization expect to receive from collaborating with other projects? iv. Are there any specific challenges or barriers to effective collaboration and knowledge exchange with partners from other projects? v. Please reflect on question #4. Do you have any recommendations for the SOLID4B cluster to overcome the above-mentioned challenges?	Closed, multiple choice. Except question v., which is open, descriptive
2	Approach–How should projects cluster	vi. What is the optimum frequency, according to you, for a common cluster activity? vii. If there is a confidentiality agreement between all the cluster projects in place? What are you willing to share with other projects? viii. Do you think that a common repository of related projects with the following information would help collaboration and increase synergies?	Closed, multiple choice
3	Implementation–When should networking happen	ix. Do you actively seek opportunities to engage with partners from different projects in external events, conferences, or research networks to expand the cluster's reach and influence? x. The cluster leader has strived to organize events at the cluster level every 6 months. Are you aware of these events? Have you received regular updates about the progress? Would you like to participate actively in such events?	Closed, multiple choice
4	General–open questions	xi. From your experience, do you have any example of a successful collaboration/clustering across different projects? According to you, what are the factors contributing to its success? xii. When it comes to the SOLID4B cluster, are the expectations and opportunities arising from cross-project collaboration clear to you?	Open, descriptive

5. Analysis and Results

This section analyzes the questionnaire responses, and the analysis is grouped into two sections: opportunities and challenges. These two sections reflect on the research question of this article and highlight why projects cluster and the challenges that need to be addressed before such clustering can deliver positive results and help in maximizing project/cluster impact.

5.1. Opportunities

In analyzing the survey results, a compelling narrative emerges, indicating that the vast majority of our partners, precisely 48 out of 55 respondents, perceive clustering not as an obligation but as a significant and advantageous asset for their organizations. This

finding suggests a fundamental shift in how our partners conceptualize clustering, transcending the notion of a mandatory collaboration and moving towards one that brings tangible benefits. Key insights from the responses highlight the proactive nature of our partners, who actively seek and embrace opportunities to engage with counterparts from various projects. This proactiveness is particularly evident in their enthusiastic participation in events and workshops facilitated by the clustering initiative. The deliberate effort to form connections across projects indicates a recognition of the value derived from interdisciplinary interactions and the cross-pollination of ideas. The qualitative aspect of the responses indicates that partners perceive clustering as a dynamic platform fostering collaboration, knowledge sharing, and synergies that extend beyond the confines of individual projects. The sentiment expressed reflects an understanding that these collaborative endeavors contribute to the enrichment of both personal and organizational perspectives. Moreover, the survey results underscore the importance of events and workshops as critical spaces for these interactions to unfold. The partners actively seeking such opportunities suggests a collective desire for continuous learning, networking, and the establishment of a collaborative ecosystem. The connections forged across projects not only contribute to the partners' professional development, but also enhance the overall effectiveness and innovation potential of the entire clustering initiative. In conclusion, the survey results offer compelling evidence that the partners within the clustering framework not only embrace but actively value the collaborative environment it provides. This shift in perception from obligation to benefit emphasizes the significance of fostering a culture of active engagement and collaboration within our scientific community, ultimately contributing to the collective advancement of knowledge and innovation.

As can be seen from Figure 2, the primary drivers behind collaboration include technical synergies (82% of respondents) and networking (80%), followed by visibility (55%). Only a third of respondents identified impact, as well as the exchange of market knowledge and intelligence, as drivers for clustering. Given the high score for technical synergies as a driver, it can be inferred that the strong technical focus and identity of the SOLID4B cluster have a positive impact on fostering technical collaborations, which is in line with the SOLID4B goals. In total, 44 out of the 55 participants also identified networking as a primary driver, indicating that clustering is a useful tool in harnessing interdisciplinary collaboration. An increased visibility score of 55% seems to be a nice side benefit of being involved in clustering, but it does not seem to be a key driver. Only every third participant identified impact and market intelligence exchange as a clustering incentive.

Figure 2. Primary drivers for collaborating and clustering with other projects.

As presented in Figure 3, an overwhelming majority, specifically 52 out of the 55 survey participants, identified scientific exploitation (e.g., follow-up project) as a significant benefit of clustering. In line with the recognition of technical synergies and networking as the primary motivations for clustering, it can be reiterated that scientific exploitation is the primary anticipated benefit within these collaborative activities. Commercial and social exploitation achieved comparatively lower scores, with 42% and 29%, respectively. The stakeholders expressing interest in commercial exploitation predominantly consist of industrial and R&D participants, pointing to the significant potential for bilateral collaborations resulting from clustering activities. It can also be noted that only 10 out of the 55 participants expect policy changes as an outcome of clustering, indicating little awareness of how clustering can impact change on a regulatory level.

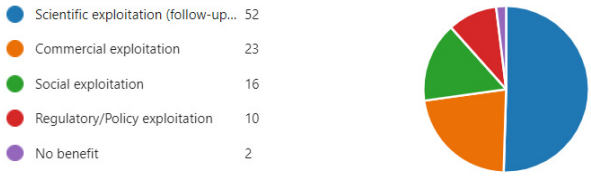

Figure 3. Expected benefits of collaborating with other projects.

5.2. Challenges

As illustrated in Figure 4, the main hurdle confronting the cluster is confidentiality, with approximately 50% of the respondents identifying it as a critical obstacle that requires resolution to enhance the impact of collaborative clustering efforts. Addressing the critical challenges of insufficient commitment and limited inter-project communication is imperative, as around 50% of the responses pointed out these two main obstacles. These issues are closely tied to the underlying motivations behind clustering activities among EU projects and within individual consortia.

Figure 4. Specific challenges or barriers to effective collaboration with other projects.

These insightful findings led us to delve deeper into the cluster partners' overarching vision for effective collaboration. In a scenario where legal solutions effectively mitigate confidentiality concerns, partners express a willingness to predominantly share best practices (%), significant technical breakthroughs (%), deliverables (%), and requirements and market information (%), as elucidated in Figure 5. This strategic approach to collaboration underscores a collective commitment to fostering an environment where knowledge exchange and shared insights can flourish, ultimately propelling the cluster towards its collaborative goals.

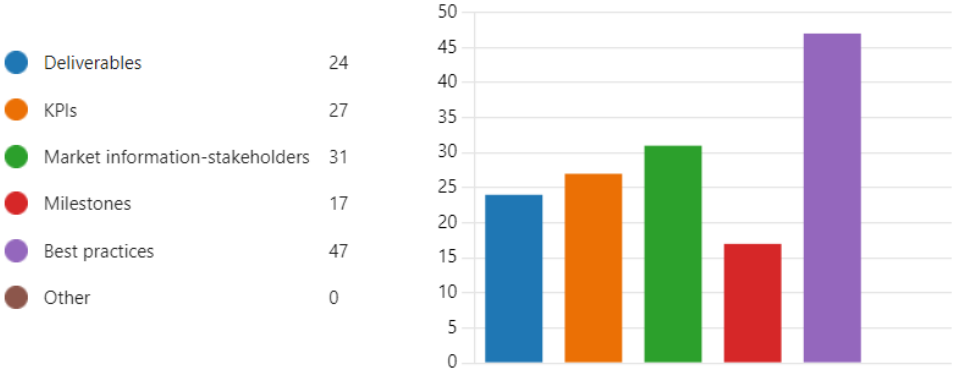

Figure 5. Perceived benefits of a common repository for cluster projects.

As seen in Figure 6, the survey results revealed a nuanced hierarchy of willingness to share among partners. The highest score was attributed to the inclination to share "best practices routine." This finding suggests a strong desire among partners to contribute and exchange established methods and procedures within their projects. The emphasis on routine practices implies a collective interest in enhancing operational efficiency and standardizing approaches across various initiatives, ultimately benefiting the entire clustering ecosystem. Two additional areas, "sharing significant breakthroughs" and "sharing deliverables and market requirements," received comparable scores. This indicates a shared

willingness among partners to contribute not only to the broader community's knowledge base, but also to divulge critical information related to major advancements and project outcomes. The emphasis on sharing deliverables and market requirements underscores the collaborative spirit aimed at aligning projects with market needs, potentially fostering synergies and accelerating the translation of research outcomes into practical applications. The nuanced understanding of the partners' willingness to share, as reflected in the survey results, provides a valuable framework for establishing protocols that respect confidentiality while facilitating meaningful collaboration. This highlights a collective recognition that, within a legally protected environment, certain types of information can be shared for the greater benefit of the clustering community. This nuanced understanding sets the stage for developing policies and agreements that can strike a balance between encouraging openness and safeguarding sensitive information. In conclusion, the survey responses shed light on the complexities surrounding confidentiality within clustering activities, offering insights that can inform the development of strategies and frameworks to address these challenges. The willingness to share best practices, significant breakthroughs, and deliverables underscores a shared commitment to advancing knowledge and innovation within a framework that respects each participating partner's legal and confidentiality considerations.

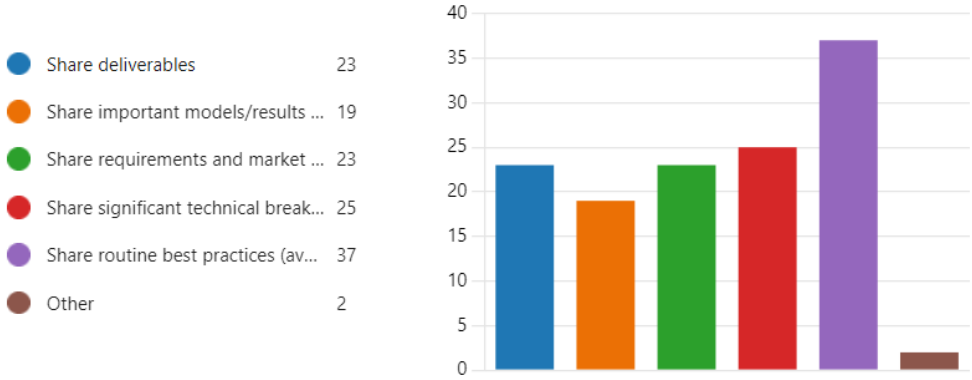

Figure 6. Type of information that participants are willing to share.

As shown in Figure 7 below, the questionnaire results regarding partners' motivation to engage with counterparts from other projects and attend conference events or workshops reveal a robust and positive trend. A significant majority, namely 40 out of the 55 respondents, expressed a keen interest in such collaborative endeavors. This heightened enthusiasm underscores a collective drive among partners to actively seek and participate in activities beyond the confines of their projects. The motivation to engage with partners from diverse projects indicates a recognition of the value inherent in cross-disciplinary interactions. The diversity of perspectives, expertise, and approaches that stem from collaboration across projects can foster a rich and dynamic environment, potentially leading to innovative solutions and advancements within the broader clustering initiative.

Figure 7. Interest in collaborative engagement.

The survey results demonstrate a strong inclination among partners to actively engage in cross-project collaboration, highlighting the recognition of its value in fostering diverse perspectives and driving innovative advancements within the clustering initiative.

6. Discussion

Within the ecosystem of collaborative clustering, confidentiality issues emerge as a multifaceted challenge that demands nuanced consideration. The SOLID4B Cluster, despite its proactive approach to fostering collaboration, finds itself at the intersection of information exchange and proprietary interests. As projects within the cluster span diverse research domains and often share common goals, the need to protect sensitive information while promoting knowledge sharing becomes increasingly complex. This complexity is further compounded by the competitive landscape inherent in research and innovation endeavors, where safeguarding intellectual property and maintaining a competitive edge are paramount.

At the heart of the confidentiality challenge lies the tension between the desire for open collaboration and the imperative to protect proprietary information. While participants express a willingness to engage with counterparts from other projects during cluster events, concerns regarding the inadvertent disclosure of sensitive data persist. The fear of intellectual property theft or misappropriation looms large, particularly in sectors characterized by rapid technological advancements and fierce market competition.

Moreover, the SOLID4B Cluster's collaborative efforts extend beyond technical collaboration to encompass broader objectives such as market intelligence exchange and impact assessment. In this context, confidentiality concerns assume heightened significance, as the dissemination of commercially sensitive information could have far-reaching implications for market positioning and strategic decision making.

To navigate these complexities, the cluster must adopt a multifaceted approach that balances the imperatives of collaboration with the need for confidentiality. This entails developing robust protocols for information sharing that delineate clear boundaries and safeguards against unauthorized disclosure. Additionally, fostering a culture of trust and transparency among cluster partners is essential, as it encourages open dialogue while instilling confidence in the integrity of the collaborative process. From a practical standpoint, the SOLID4B Cluster can leverage technological solutions such as secure data-sharing platforms and encrypted communication channels to mitigate confidentiality risks. These tools not only enhance data security but also streamline collaboration by providing a centralized repository for information exchange. Furthermore, the cluster must engage in ongoing dialogue with stakeholders and policymakers to solicit feedback and address evolving concerns regarding confidentiality. By soliciting input from participants and adapting its approach in response to emerging challenges, the cluster can foster a collaborative environment that prioritizes both innovation and integrity. In conclusion, confidentiality concerns represent an important barrier to effective collaboration within the SOLID4B Cluster and similar collaborative clustering initiatives. By adopting a proactive and multifaceted approach to addressing these challenges, the cluster can promote a culture of trust, transparency, and innovation that underpins its success in the dynamic landscape of research and innovation.

Finally, the intersection of confidentiality concerns and collaborative clustering within the SOLID4B Cluster presents multifaceted challenges that demand nuanced consideration. As projects within the cluster span diverse research domains and often share common calls, the need to protect sensitive information while promoting knowledge sharing becomes increasingly complex. The tension between the desire for open collaboration and the imperative to protect proprietary information lies at the heart of this challenge. This tension is exacerbated by the competitive landscape inherent in research and innovation endeavors, particularly in sectors characterized by rapid technological advancements and fierce market competition. Practical implications include the necessity to develop operational protocols for information sharing, leverage technological solutions such as secure data-sharing platforms, and foster a cultural shift towards trust and transparency among cluster partners. Theoretical implications encompass the refinement of frameworks for managing boundary-spanning research collaborations and the exploration of the ethical considerations surrounding confidentiality in collaborative research settings. Addressing

these implications is crucial for promoting a culture of trust, transparency, and innovation within collaborative clustering initiatives, ensuring their success in the dynamic landscape of research and innovation.

7. Reflection

This article identified the perceived opportunities and challenges faced by Horizon Europe projects when clustering and collaborating with other projects. A clear majority of the interviewees perceive clustering not as an obligation but as a significant and advantageous asset for their organizations. Hence, it is paramount to identify and collect all the best practices in one place in order to create a recipe book to be followed by Horizon Europe projects to maximize their project impact. Mutual learning to enable projects to take advantage of insights and practices from other projects, including relevant similar projects funded by other EU funding instruments, will help projects to optimize their resource usage and increase the visibility of their projects. Clustering with other projects is very important to maximize the impact of the Horizon program, extend the stakeholders' network and share knowledge and achievement in research and innovation.

In examining the limitations of this study and its subsequent analysis, it is crucial to acknowledge several key constraints that may influence the interpretation and generalizability of the findings. Firstly, the sample size utilized in this research may not fully represent the diversity of the population under investigation, potentially leading to skewed results or limited external validity. Additionally, the methodology employed, while pragmatically designed for the Horizon Europe project, may not be easily replicated to other general projects. Furthermore, the time frame within which the study was conducted may not capture long-term trends or changes in the variables studied, thereby limiting the study's ability to provide a comprehensive understanding of the phenomenon. In this case, it is recommended that a follow-up study is conducted on the long-term impacts of clustering and collaboration on business. By acknowledging these limitations, future research endeavors can strive to address these shortcomings and contribute to a more nuanced understanding of the subject matter.

Author Contributions: T.B. and A.P. worked together and everything was done in close collaboration. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Climate, Infra-structure and Environment Executive Agency (CINEA) and the European Union under the Horizon Europe projects SPINMATE (Grant agreement: 101069712) and ADVAGEN (Grant Agreement: 101069743). Views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the European Union or CINEA.

Institutional Review Board Statement: Ethics Committee or Institutional Review Board approval should not be required as this research does not carry out any research on animals, as well as there is no activity with interventions on the human participants. A simple online questionnaire (Microsoft form) was used to gather data from the participants. The participants are beneficiaries of projects that are a part of the SOLID4B cluster. This questionnaire was optional, and only interested participants were asked to submit their inputs to let their perspectives known. The analysis of the collected data was anonymized and is gender/nationality/industry agnostic. The results presented in the paper show a general overarching trend and not the opinion of a specific person, thus avoiding any further privacy issues.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data were collected as an excel file via a Microsoft teams form.

Acknowledgments: We would like to thank the beneficiaries of the Horizon projects that are a part of the SOLID4B cluster for completing the questionnaire. These projects are presented in Section 4 of this article. A special thanks goes to Kunsulu Nurekeyeva for sharing her insights while structuring the approach and research methodology for this article.

Conflicts of Interest: Author Takwa Benissa was employed by the company Avesta Battery & Energy Engineering. Author Anish Patil was employed by the company TechConcepts B.V.

References

Anicet Bittencourt, Bruno, Mariana Bianchini Galuk, Vanessa Daniel, and Aurora Zen. 2018. Cluster Innovation Capability: A Systematic Review. *International Journal of Innovation* 7: 26–44. [CrossRef]

Barakat, Mahmoud Ramadan, Nicoleta Tipi, and Jialin Snow Wu. 2023. Sustainable Supply Chain Clusters: An Integrated Framework. *Management Decision* 61: 786–814. [CrossRef]

Benissa, Takwa. 2023. SPINMATE: D3.2 Report on the Conclusions of the Dedicated Workshops. Spinmate Project. Available online: https://zenodo.org/records/10818414 (accessed on 10 April 2024).

Camarinha-Matos, Luis M., and Hamideh Afsarmanesh. 2006. Collaborative Networks: Value Creation in a Knowledge Society. In *International Federation for Information Processing Digital Library; Knowledge Enterprise: Intelligent Strategies in Product Design, Manufacturing, and Management*. Boston: Springer. [CrossRef] [PubMed]

Camarinha-Matos, Luis M., Rosanna Fornasiero, Javaneh Ramezani, and Filipa Ferrada. 2019. Collaborative Networks: A Pillar of Digital Transformation. *Applied Sciences* 9: 5431. [CrossRef]

Cavicchi, Bianca, Oceane Peiffer Smadja, and Julien Ravet. 2023. The Transformative Nature of the European Framework Programme for Research and Innovation. In *Analysis of Its Evolution between 2002 and 2023*. Luxembourg: Publications Office of the European Union.

Christensen, Malene Vinther, Mika Nieminen, Marlene Altenhofer, Elise Tancoigne, Niels Mejlgaard, Erich Griessler, and Adolf Filacek. 2020. What's in a Name? Perceptions and Promotion of Responsible Research and Innovation Practices across Europe. *Science and Public Policy* 47: 360–70. [CrossRef]

Dewaele, Jean-Marc. 2018. Online Questionnaires. In *The Palgrave Handbook of Applied Linguistics Research Methodology*. Edited by Aek Phakiti, Peter De Costa, Luke Plonsky and Sue Starfield. London: Palgrave Macmillan, pp. 269–86. [CrossRef]

Directorate-General for Research and Innovation. 2023. *Systems-Based Methods for Research & Innovation Policy*. Brussel: Directorate-General for Research and Innovation.

Durugbo, Christopher. 2016. Collaborative Networks: A Systematic Review and Multi-Level Framework. *International Journal of Production Research* 54: 3749–76. [CrossRef]

EPRS. 2017. *EU Framework Programmes for Research and Innovation. Evolution and Key Data from FP1 to Horizon 2020 in View of FP9*. Brussels: European Parliamentary Research Service.

European Commission. 2021. Horizon Europe—THE EU RESEARCH & INNOVATION PROGRAMME 2021–27. Available online: https://research-and-innovation.ec.europa.eu/system/files/2022-06/ec_rtd_he-investing-to-shape-our-future_0.pdf (accessed on 6 February 2024).

Ferras-Hernandez, Xavier, and Petra Nylund. 2018. Clusters as Innovation Engines: The Accelerating Strengths of Proximity. *European Management Review* 16: 12330. [CrossRef]

Franco, Mário, and Lurdes Esteves. 2020. Inter-Clustering as a Network of Knowledge and Learning: Multiple Case Studies. *Journal of Innovation & Knowledge* 5: 39–49. [CrossRef]

Guimarães, Luciana G., Pierre Blanchet, and Yan Cimon. 2021. Collaboration among Small and Medium-Sized Enterprises as Part of Internationalization: A Systematic Review. *Administrative Sciences* 11: 153. [CrossRef]

ISE. 2021. *Position on Horizon Europe—ISE Task Force on Horizon Europe*. Strasbourg: The Initiative for Science in Europe (ISE).

Keown, Kiera, Dwayne Van Eerd, and Emma Irvin. 2008. Stakeholder Engagement Opportunities in Systematic Reviews: Knowledge Transfer for Policy and Practice. *The Journal of Continuing Education in the Health Professions* 28: 67–72. [CrossRef] [PubMed]

Liyanage, Shantha. 1995. Breeding Innovation Clusters through Collaborative Research Networks. *Technovation* 15: 553–67. [CrossRef]

Mildred, Patten. 2014. *Questionnaire Research. A Practical Guide*. London: Routledge.

Newman, Mark E. J. 2001. The Structure of Scientific Collaboration Networks. *Proceedings of the National Academy of Sciences* 98: 404–9. [CrossRef] [PubMed]

Olmos-Peñuela, Julia, Ana García-Granero, Elena Castro-Martínez, and Pablo D'Este. 2017. Strengthening SMEs' Innovation Culture through Collaborations with Public Research Organizations. Do All Firms Benefit Equally? *European Planning Studies* 25: 2001–20. [CrossRef]

Owen-Smith, Jason, and Walter W. Powell. 2004. Knowledge Networks as Channels and Conduits: The Effects of Spillovers in the Boston Biotechnology Community. *Organization Science* 15: 5–21. [CrossRef]

Ponomariov, Branco L., and P. Craig Boardman. 2010. Influencing Scientists' Collaboration and Productivity Patterns through New Institutions: University Research Centers and Scientific and Technical Human Capital. *Special Section on Government as Entrepreneur* 39: 613–24. [CrossRef]

Porter, Michael E. 1990. *The Competitive Advantage of Nations*. London: Macmillan Press Ltd.

Porter, Michael E. 1998. Clusters and the New Economics of Competition. *Harvard Business Review* 76: 77–90. [PubMed]

Rowley, Jenny. 2014. Designing and Using Research Questionnaires. *Management Research Review* 37: 308–30. [CrossRef]

Science Europe. 2016. *The Framework Programme That Europe Needs*. Brussels: Science Europe.

Secretary-General of the European Commission. 2018. *Proposal for a REGULATION of the EUROPEAN PARLIAMENT and of the COUNCIL Establishing Horizon Europe—The Framework Programme for Research and Innovation, Laying down Its Rules for Participation and Dissemination*. Brussels: European Commission.

Shuman, Jeffrey, and Janice Twombly. 2010. Collaborative Networks Are The Organization: An Innovation in Organization Design and Management. *Vikalpa* 35: 1–14. [CrossRef]

Taherdoost, Hamed. 2022. Designing a Questionnaire for a Research Paper: A Comprehensive Guide to Design and Develop an Effective Questionnaire. *Asian Journal of Managerial Science* 11: 8–16. [CrossRef]

Ter Wal, Anne L. J., and Ron Boschma. 2011. Co-Evolution of Firms, Industries and Networks in Space. *Regional Studies* 45: 919–33. [CrossRef]

Trupti, Rathi, and Bindu Ronald. 2022. Questionnaire as a Tool of Data Collection in Empirical Research. *Journal of Positive School Psychology* 6: 7697–99.

Uyen, Nguyen-Thi, and Nicolas Carayol. 2005. Why Do Academic Scientists Engage in Interdisciplinary Research. *Research Evaluation* 14: 70–79.

Vasilyeva, E., A. Kozlov, K. Alfaro-Bittner, D. Musatov, A. M. Raigorodskii, M. Perc, and S. Boccaletti. 2021. Multilayer Representation of Collaboration Networks with Higher-Order Interactions. *Scientific Reports* 11: 5666. [CrossRef]

Whittington, Kiersten Bunker, Jason Owen-Smith, and Walter W. Powell. 2009. Networks, Propinquity, and Innovation in Knowledge-Intensive Industries. *Administrative Science Quarterly* 54: 90–122. [CrossRef]

Wong, Kee-Luen, Seng Fook Ong, and Thiam-Yong Kuek. 2012. Constructing a Survey Questionnaire to Collect Data on Service Quality of Business Academics. *European Journal of Social Sciences* 29: 209–21.

Woolley, Richard, Mabel Sánchez-Barrioluengo, Tim Turpin, and Jane Marceau. 2015. Research Collaboration in the Social Sciences: What Factors Are Associated with Disciplinary and Interdisciplinary Collaboration? *Science and Public Policy* 42: 567–82. [CrossRef]

Zhao, Liangjie, Yan Liang, and Haojie Tu. 2023. How Do Clusters Drive Firm Performance in the Regional Innovation System? A Causal Complexity Analysis in Chinese Strategic Emerging Industries. *Systems* 11: 229. [CrossRef]