

Orchestrating collaborative projects: Inside ICT networks in Horizon 2020

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Abstract

This article investigates decisions taken at the project level in establishing and managing collaborative ICT projects under the European Framework Programme Horizon 2020. Based on interviews with project coordinators from European research organizations, we offer a detailed examination of how projects are built and managed, and how decisions influence the formation of collaborative networks. Projects are typically set up in three stages. In the first, a smaller group that has worked together before decides on the main idea. This leads in the second stage to a gradual invitation of partners to satisfy professional and formal demands, which also defines the structure of the project. If funded, more detailed decisions on ownership and interaction are taken in the third stage. Coordinators are under pressure from the regulatory control of the EU Commission, which can explain the strong preference for well-known partners, but the formal monitoring also provides tools for project managers.

Key words: information and communication technology; European Framework Programme; orchestration; research funding; collaboration

1. Introduction

How are multiparty research and development (R&D) projects put together in their initial stages? What are the organizational and policy implications of the way such projects are ‘orchestrated’, as we may call this process? These are essential questions of theoretical and practical interest in a world where collaborative research and innovation is ever more the norm. Collaboration is supported, for example, to remedy knowledge specialization and complexity (D’Ippolito and Rüling 2019), to improve efficiency and productivity (Katz and Martin 1997), and to focus efforts toward specific grand challenges or missions (e.g. Mazzucato 2018).

The multiannual European Framework Programmes (EU FPs) started in 1984 is a good example of large-scale research and innovation effort that is built upon complex forms of project collaboration (Breschi et al. 2009). Based on network theory and related perspectives, researchers have been interested in the dynamics in EU FP projects and the wider networks they constitute (e.g. Breschi and Cusmano 2004; Must 2010; Ortega and Aguillo 2010a,b; Paier and Scherngell 2011; Pandza et al. 2011; Piro et al. 2016; Protogerou et al. 2013). A central finding is that leadership of collaborative projects remains in the hands of a few central organizations (Pandza et al. 2011), resulting in ‘oligarchic networks’ that in practice control access to projects and related resources (Makkonen and Mitze

2016: 1211). Although there are databases about project proposals, partners, and outputs, less is known about the decisions made within the projects that can help us understand how and why the wider network patterns arise.

Sophisticated theoretical perspectives have been developed to understand funding agencies and their selection and delegation activities (e.g. Braun and Guston 2003; Gulbrandsen 2005; Klerkx and Leeuwis 2008; van der Meulen 2003) and the role of other intermediary or boundary organizations that coordinate efforts (e.g. Åm 2013; Guston 2001; Turnhout et al. 2013). Decisions made by the organizations that carry out the research and innovation activities are less emphasized in this tradition. There is, on the contrary, a huge project management literature, although only a small share of it is devoted to the types of partnerships of interest here (Brocke and Lippe 2015; König et al. 2013). Our aim with the article is to contribute also to a more theoretical understanding of decision-making in the set-up stages of large-scale research and innovation collaboration, primarily by bringing a specialized perspective on ‘network orchestration’ into the science and innovation literature. For our purpose, a multiparty research project is carried out by a consortium of participants, whose ties constitute a network. We are in particular interested in the considerations and decisions made in the early stages of the formation of a consortium, which we believe also can shed light on persistent network patterns in European research.

The article analyses collaborative projects in the program for information and communication technology (ICT) under the industrial pillar of the current EU FP, Horizon 2020 (H2020). Despite the rapid pace of developments in a broad array of technologies in this field, studies have found considerable clustering of collaborative networks that involve recurrent participation (Protogerou et al. 2010, 2013). To understand the processes involved in building up an EU FP project, the perspectives of project coordinators, who are affiliated with the central organizations in the ICT research and innovation networks, are required.

Since the project coordinator perspective is only to a limited extent covered in the literature on EU FP participation, our overall research question is: *how do project coordinators orchestrate research and innovation projects in H2020?* Orchestration is a composite term that includes decisions about aspects such as partner selection and removal, project structure and management of knowledge mobility and intellectual property rights (IPRs). Although the main empirical emphasis has been on private firms, we believe it is an interesting empirical question of how these orchestration activities play out in a setting where a ‘principal’ (cf. Braun and Guston 2003) has set important terms of collaboration in advance. In EU FP projects, this means that the EU Commission has determined important aspects such as topics, duration, and consortium characteristics like number and diversity of partners.

Using social network analysis (SNA), we identified the most central organizations in a dataset consisting of funded collaborative projects in the two consecutive ICT programs in the seventh EU FP (2007–13) and the current one, H2020 (2014–October 2017). We then conducted fifteen semistructured in-depth interviews with coordinators affiliated with the ten most central organizations identified through the first step. The main part of the article thus applies an in-depth, qualitative approach based on project coordinator interviews about ‘network orchestration’ (Dhanaraj and Parkhe 2006; Klerkx and Aarts 2013; Levén et al. 2014). This perspective has been used to provide detailed accounts about how collaborative networks are built, coordinated, and preserved (e.g. Dyer and Nobeoka 2000; Gausdal and Nilsen 2011; Leten et al. 2013; Levén et al. 2014; Sabatier et al. 2010). We use it to contribute to a better understanding of large-scale R&D projects by looking at the early-stage decisions made by coordinators.

We find that in selecting members for a project, a small core group of partners is consulted, who then codevelop the proposal as well as invite additional partners chosen on the basis of past collaborative relations and expertise. This is a fairly informal process where newcomers are normally not included unless absolutely necessary to satisfy formal demands. The coordinators have less freedom in EU FP projects than what much of the orchestration and project management literature assumes, but they also have the possibility to invoke the support of the funding agency to deal with difficulties in the consortia. The positive performance of coordinators enables them to select strong partners for new projects and to be invited for others’ initiatives.

The article is structured as follows: Section 2 presents the theory and context, while Section 3 presents data and the research design. In Section 4, we present and discuss the results before offering conclusions in Section 5.

2. Theoretical framework

2.1 Collaboration, principals, and agents

Multiparty collaborative research and innovation are often publicly (co)funded. This has been analyzed as a principal–agent

relationship, where the task of carrying out the relevant activities is delegated from a principal to an agent through a contract (Braun and Guston 2003). For our purpose, a funding agency like a research council or the EU directorate responsible for the FPs, is the principal, although the relationship is more complex when such agencies also get tasks delegated from ministries and other principals (van der Meulen 2003). The research units, firms, and other organizations that receive funding to do research and innovation, are the agents.

A principal–agent analysis highlights the main challenges of the relationship. There is most often a selection problem because the principal needs to figure out which agents (out of many options) that are the most likely to produce the desired results. In research and innovation, this selection is often partly based on information from the agents themselves, for example, the peer review built into the scientific publication system (Braun and Guston 2003). Furthermore, the actors may have different goals and interests, which can lead to moral hazard, that is, agent behavior not in line with the principal’s intentions, for example, if the goal of funding is innovation and the agent is mostly interested in research.

To handle these challenges, a system of formal requirements, monitoring, and reporting is most often established. This can become cumbersome and complicated, leading to tensions in the research and innovation community (Gulbrandsen 2005), which can become counterproductive to the very goals the principal wants to achieve in the long run (Shove 2003). Agents show how to meet the expectations and requirements in their proposals, as well as in the setup of their collaborative projects after receiving funding (Caswill 2003).

This process gets progressively more complicated when the agent is better seen as a large and heterogeneous network rather than a single organization, where even the line between principal and agent can become blurred (Klerkx and Leeuwis 2008). In these situations, the principal–agent perspectives need to be complemented with ones that can deal with the institutional and/or micro-level complexity (Klerkx and Leeuwis 2008). The network governance perspective emphasizes how the wider context makes some forms of governance more suited than others (Provan and Kenis 2007). In EU FP collaborative projects, the ‘Lead organization’ form of governance is the most relevant. According to Provan and Kenis (2007: 9–12), this is associated with situations where goal consensus can be low, there is a moderate number of participants and a moderate need for consortium-level competences, and where participants have high trust in the lead organization (but not necessarily in one another).

A number of useful analytical points for a study of how project coordinators or lead organizations put together their projects can be inferred from the literature referred to so far, in particular the negotiation between the project itself (ideas, questions, potential partners, etc.) and the formal requirements set up to handle the complexities of the principal–agent relation. We may expect that this is a skill in itself that might be related to why some organizations are persistently more central than others in collaborative research and innovation. However, the literature referred to above looks mainly at collaboration from the funder’s (or principal’s) perspective. In the following, we will, therefore, introduce concepts more directly related to the activities of the project coordinator.

2.2 Network orchestration

There is an extensive literature on project management (e.g. Barnes et al. 2006; Calamel et al. 2012; Davenport et al. 1998; Grindley

et al. 1994; König et al. 2013), highlighting that managers of collaborative projects face a number of challenges such as uncertainty and risk, different cultures, reduced authority, and balancing flexibility and control. Despite the extensive knowledge on different project management strategies, collaborative projects are often very different from one another, which leads project managers to follow a ‘learning by doing’ principle for each project (König et al. 2013). The typical collaborative research project consists of actors from different sectors, disciplines, and cultures—thus, the specifics of interdisciplinarity make it difficult to generalize a rule for effective project management (Hollaender et al. 2008).

Based on a systematic literature review, Brocke and Lippe (2015: 1031, 1032) find three paradoxes of managing collaborative research projects and four strategies for how to solve these. The first paradoxical challenge is balancing flexibility and fixed structures. A certain level of freedom and flexibility is needed to produce innovative results, but firmer management may be needed to transform these results to applicable outcomes. Second, collaboration nurtures the integration of different ideas and perceptions, but the heterogeneity of partners and disciplines produces problems of managing partners from different cultures, sectors, and disciplines (see also König et al. 2013). Third, project managers are often left with limited authority because of their partners’ autonomy and because of governance structures decided by the principal, but certain tasks such as integration of results require full involvement of all parties. To solve these paradoxes, Brocke and Lippe (2015) suggest four strategies: ensure partner compatibility and a collaborative working style, develop, and communicate a clear and well-defined project vision (see also Grindley et al. 1994), define fundamental responsibilities but allow flexibility within them (see also Tatikonda and Rosenthal 2000: 418), and appoint a skilled project manager (cf. König et al. 2013; Procca 2008; Ruuska and Teigland 2009).

Many of these challenges and strategies are further developed within a single framework in the orchestration literature (Levén et al. 2014). Dhanaraj and Parkhe (2006) introduce the concept of

‘network orchestration’ to understand how some organizations are able to build, preserve, coordinate, and exploit organizations in their surroundings. The framework offers a detailed explanation of how collaborations are established and conducted. In this perspective, the coordinating organization is called the ‘hub’, which we will use synonymously with the lead organization.

Much like the conductor of a classical orchestra, the hub orchestrates the activities of its network as well as its members (Dhanaraj and Parkhe 2006). In large-scale publicly supported research projects, the network is a central source of participants in formal consortia. The hub exerts its power to build, coordinate, and pull together dispersed resources and capabilities from their wider network (Ritala et al. 2009) to produce some sort of results such as a successful project application or project outcome. As such the projects are central building blocks in the greater network, which in turn can be seen (partly) as the outcome of a number of projects.

The orchestrating hub deals with two different phases in building a network, including several underlying objectives (see Fig. 1). First, *design* refers to the configuration of the consortium. The second *orchestration* concerns the active management of the consortium (Batterink et al. 2010; Levén et al. 2014; Ritala et al. 2009).

As a starting point, we see the subobjectives in the two phases as important characteristics also for building and managing successful projects. This involves dealing with various tasks, for example, deciding the size of the consortium and ensuring that there are no appropriability issues among the partners.

2.2.1 Design of a multiparty project.

In the design phase, the hub must deal with ‘membership’, ‘structure’, and ‘(network) position’ (Dhanaraj and Parkhe 2006; Levén et al. 2014).

Securing membership involves defining the size of the venture: the number of partners necessary to perform the task, and their diversity (Levén et al. 2014). At this stage, the hub determines which and how many partners to recruit to the specific project. Second,

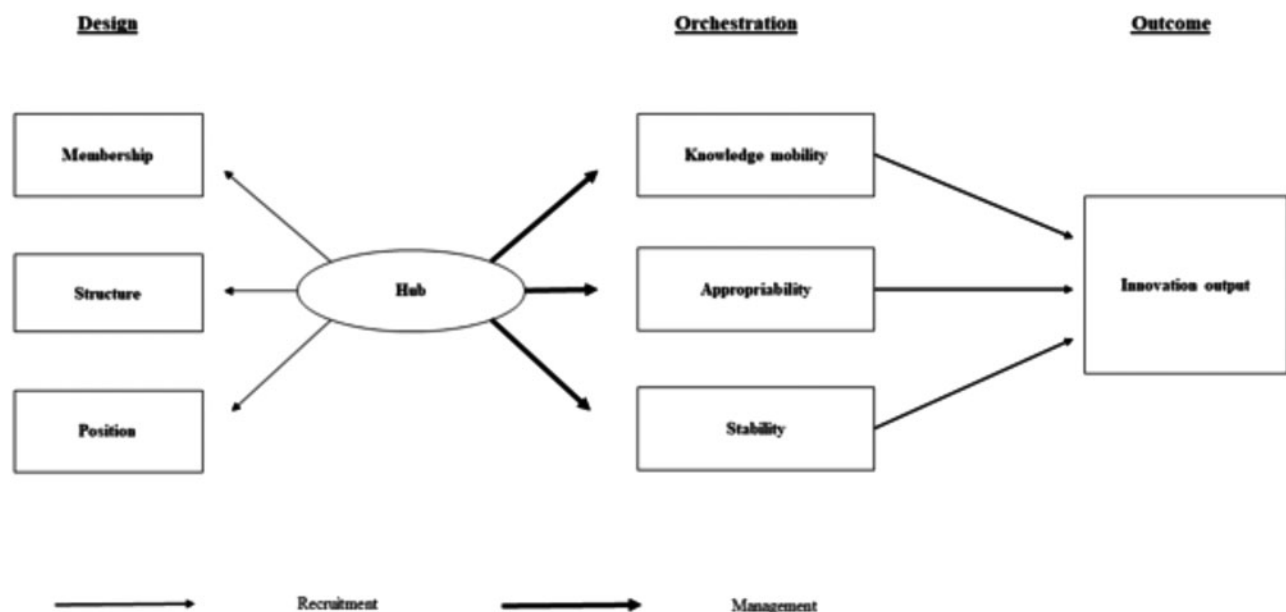


Figure 1. Orchestration framework.

Source: Dhanaraj and Parkhe (2006: 661).

and related to selection of membership, the hub must consider how to ensure optimal density in the project, as well as the autonomy allowed to each partner. Density concerns the degree of formal and informal relations that keep the partners together, and it can be advantageous to recruit organizations where such relations already exist (Levén et al. 2014). Autonomy concerns whether members can act independently. The ideal composition of density and autonomy will depend on the goal of the project. For solving a set of highly predefined tasks, a project organization without extensive individual freedom may be necessary. In our case, this can to a great degree depend upon the goals and collaboration demands set up by the principal, that is, the funding organization.

Finally, rather than to secure membership and structure actively, the hub must use its position more indirectly to attract partners and to exert influence in the ensuing process. ‘Position’ refers to the centrality ascribed to the hub organization, primarily by project members because of the hub’s previous performance as a lead organization (Batterink et al. 2010; Levén et al. 2014). Reputation may be important for attracting partners as well as for expanding the network of contacts.

2.2.2 Project orchestration

Once the project is designed, the hub must deal with several objectives: knowledge mobility, innovation appropriability, and stability, referred to as a phase of orchestration (Dhanaraj and Parkhe 2006).

Knowledge mobility concerns the ease of which knowledge is shared, acquired, and disseminated within the project; this can be boosted by increasing each member’s ability to identify, absorb, and assimilate knowledge from others (Dhanaraj and Parkhe 2006; Hurmelinna-Laukkanen et al. 2012). Further, the hub may support the fruitful exchange of knowledge by reinforcing a sense of common identity among the members, so that they are motivated to share openly. Finally, the hub can ‘socialize’ the network through exchange forums and by formal or informal communication channels, thereby enhancing the network’s social and relational capital (Levén et al. 2014). Again, these aspects are probably influenced strongly by the funding organization, and the interesting empirical aspect may be how the lead organization can negotiate between pre-set terms and what the aspiring partners would have decided on their own.

Closely related is the need to handle worries about free-riding and opportunism among the members—not doing so might lead to decreased commitment and confidence in the project, in turn, affecting knowledge mobility (Dhanaraj and Parkhe 2006). Managing innovation appropriability including IPR is a central concern in economics of innovation (e.g. Teece 1986). Balancing sharing of information, contractual pre-arrangements, and joint ownership will in some cases probably be complicated tasks (Dhanaraj and Parkhe 2006; Levén et al. 2014).

Finally, the hub must secure stability for continued collaboration (Dhanaraj and Parkhe 2006). At the project level, it may imply orchestrating the project in such a way that its members will be interested in joining forces in later projects. Avoiding members feeling exploited (appropriability concerns) or poor communication (knowledge mobility) are relevant activities.

2.3 Challenges in an EU FP project

In the 1980s, concerns were voiced about the deteriorating market share and innovation capacity among European firms, especially in the IT industry and compared to the USA and Japan. This resulted

in European Strategic Programme on Research in Information Technology in 1982 (Protogerou et al. 2010). In 1984, the first EU FP was launched, covering a much broader field of research. ICT has since then remained a part of later FPs.

Within H2020, the ICT program is part of the pillar ‘industrial leadership’, although ICT projects can be found also in the two other pillars of H2020: ‘excellent science’ and ‘societal challenges’. Research and innovation activities within the ICT program are based on assumptions that the capabilities of modern ICT systems are growing exponentially, fuelled by progress in a number of areas—and that, if properly supported, these developments can provide opportunities for European research and innovation organizations (The Council of the European Union 2013). ICT projects are often broad, encompassing a mix of research and innovation.

The ICT projects analyzed in this article are collaborative ones, where a consortium of partners have responded to an announced call by submitting a project proposal for evaluation and have subsequently received funding. Every collaborative project is led by a principal investigator, a coordinator, who assumes the lead role in drafting the project proposal, negotiates with the EU Commission, and administers project deliverables (Henriques et al. 2009; Protogerou et al. 2010).

Orchestration provides a potentially useful framework for looking at how decisions are made in the formation and early stages of such collaborative projects. Although it is oriented at understanding wider networks of firms and potentially other organizations, its distinction between a design phase and an orchestration phase can be relevant for distinguishing between a phase dominated by the demands of the funding agency—the principal—and a phase where the project itself may take somewhat more self-governing decisions.

Similar to Levén et al. (2014), we argue that the coordinators in EU FP projects may see the subobjectives of orchestration processes (cf. Fig. 1) as challenges. The main aspect is, as mentioned, the negotiation between the internal needs of the project and its partners and the requirements from the EU Commission, for example having at least three partners from different EU member states. Coordinators must also accept that EU FP projects have predefined topics, with limited time and budgets, all of which will influence the structure of the project. In Table 1, we have summarized our expectations from this short literature review, and we will explore these issues further in the empirical analysis.

3. Data and research design

To identify and select lead actors in the ICT program for interviews, we applied SNA, operationalizing the lead as project coordinators

Table 1. Possible challenges in orchestrating an EU FP project.

Objective	Challenge
Membership	Complementarity among partners
Structure	Organizing members and activities to ensure communication and strengthen relations
Position	The role of reputation of the hub in building the project
Knowledge mobility	Plans for knowledge flows
Appropriability	Dealing with ownership and the possibility of free riding and other forms of moral hazard
Stability	Ensuring a stable project

affiliated with organizations holding a central position in networks at the highest levels of centrality in both the seventh framework programme (FP7) and H2020. [Dhanaraj and Parkhe \(2006: 659\)](#) defined a ‘hub’ or lead organization as an entity that holds a central position in a network structure, and uses its power and prominence to influence how the network develops. These entities, termed ‘focal firms’ by [Busquets \(2010: 482\)](#) are seen as integral to centrality in much of the network literature ([Ahuja 2000](#)). [Busquets \(2010\)](#) argues that the more central the actor, the greater influence will it have on overall network behavior.

3.1 Registry data

The analysis of project coordinators from the top ten orchestrators is based on a dataset consisting of 3,642 collaborative projects in FP7 (2007–13) and H2020 (2014–October 2017) (2,328 in FP7 and 1,314 in H2020), under the two consecutive ICT programs, with 9,741 organizations participating: 5,773 in FP7 and 3,968 in H2020.¹ The data extract encompasses the EU twenty-eight as well as the European Free Trade Association member states Iceland, Liechtenstein, Norway, and Switzerland. The data were collected from the EU Commission’s external data warehouse, ECORDA. They are similar to what is publicly available from the Community Research and Development Service CORDIS, but data on H2020 projects in ECORDA had been updated more recently, making it possible to include a longer time-period from H2020 in the analysis.²

3.2 Network analysis

To identify the lead organizations in the ICT networks we utilized SNA. This is a tool that describes the interaction in and composition of a network, identifying to what degree the different organizations is connected to each other and their importance relative to each other ([Scott 2012](#)). The network is defined by organizations (or ‘nodes’) linked by a relational tie if they have partnered in a project, which is represented by a link (or ‘edge’).

A common approach in SNA is to evaluate the interaction among the nodes in a network, and identify which node holds a more strategic role in relation to the rest, for example, acting as a gatekeeper by having many ties in several projects. These strategic positions are best assessed by ‘centrality’, which quantifies the importance of each node relative to others ([Scott 2012](#)). We computed three measures of centrality: betweenness ([Freeman 1978](#)), closeness ([Abbasi et al. 2012](#); [Freeman 1978](#)), and eigenvector centrality ([Newman 2008](#); [Ruhnau 2000](#)), all of which capture the importance of each node relative to others. We extracted the various measures separately for the network in FP7 and H2020, which we matched to each organization in the dataset. All the organizations were ranked with the normalized centrality measures, from those holding the highest values (close to 1) to those with lowest measures of centrality (close to 0). This yielded a combined ‘top 10’ list of the organizations holding the highest levels of centrality in FP7 and H2020 (see [Table 2](#)).

3.3 Selection of cases and interviewees

Case selection was conducted by what [Yin \(2014\)](#) terms ‘a two-phase approach’: first choosing from a larger set of quantitative data, and then narrowing down the sample by selection criteria. This was done to ensure reliability, that the study can be easily reproduced, and external validity—at least among organizations in the EU ICT landscape. From the SNA, we identified the ten most

Table 2. Key orchestrating organizations.

Rank	Organization	Sector	Number of interviewees
1	Fraunhofer-Gesellschaft	RTO	1
2	Technical Research Centre of Finland (VTT)	RTO	1
3	The French Alternative Energies and Atomic Energy Commission (CEA)	RTO	3
4	Technical University of Eindhoven	HEI	1
5	IMEC	RTO	2
6	Netherlands Organization for Applied Scientific Research (TNO)	RTO	2
7	Politecnico Milano	HEI	1
8	SINTEF	RTO	2
9	ATOS	PRC	1
10	Eurescom	PRC	1

RTO, research and technology organization; HEI, institute of higher education institution; PRC, private company.

central organizations in the EU ICT program. Next, we identified all funded projects (completed and ongoing) in H2020 ICT with *coordinators* affiliated to the specific organization in the sample. All the projects had communicated results and progress via online websites; we used these to obtain names and contact information of the individual coordinators, as well as confirming organizational affiliation. Additionally, we collected information about each project through the online service at CORDIS (cordis.eu).

3.4. Interview analysis

During four months in early 2018, we conducted fifteen in-depth interviews using a semistructured interview guide (see Appendix). Ideally, interviews should be conducted face-to-face, but due to a broad geographical spread of the interviewees, we had to settle for telephone interviews. We still managed to arrange two interviews in person. Each interview lasted from forty-five to sixty minutes and was recorded. Lack of nonverbal communication may pose a threat to reliability and interpretation. We tried to remedy this by organizing the interview guide into few and more open-ended questions, leaving time for probing and going deeper into the issues raised by the interviewees.

The fifteen interviews cover all ten organizations; however, for some institutions, we were able to speak with only one interviewee (see [Table 2](#)). One respondent is not sufficient to give a clear picture of a large organization such as Fraunhofer—but our interest is not in the organizations themselves but in the decisions made by coordinators employed there to set up/design and implement/orchestrate multiparty projects.

The projects tied to the fifteen coordinators were funded between 2014 and 2017. In the ICT program the projects are classified based on the main ambition of the call. *Research and innovation actions* (RIA) are projects tackling clearly defined challenges, which can lead to new knowledge or technology. *Innovation actions* (IA), on the contrary, are closer to the market and typically involve demonstration and prototyping. While RIA and IA deal with funding of research and innovation, a third instrument, *coordination and support actions* (CSA) covers coordination and networking of research and innovation projects. Of the fifteen projects, two were CSA, four IA, and nine RIA. To protect the anonymity of our interviewees, we

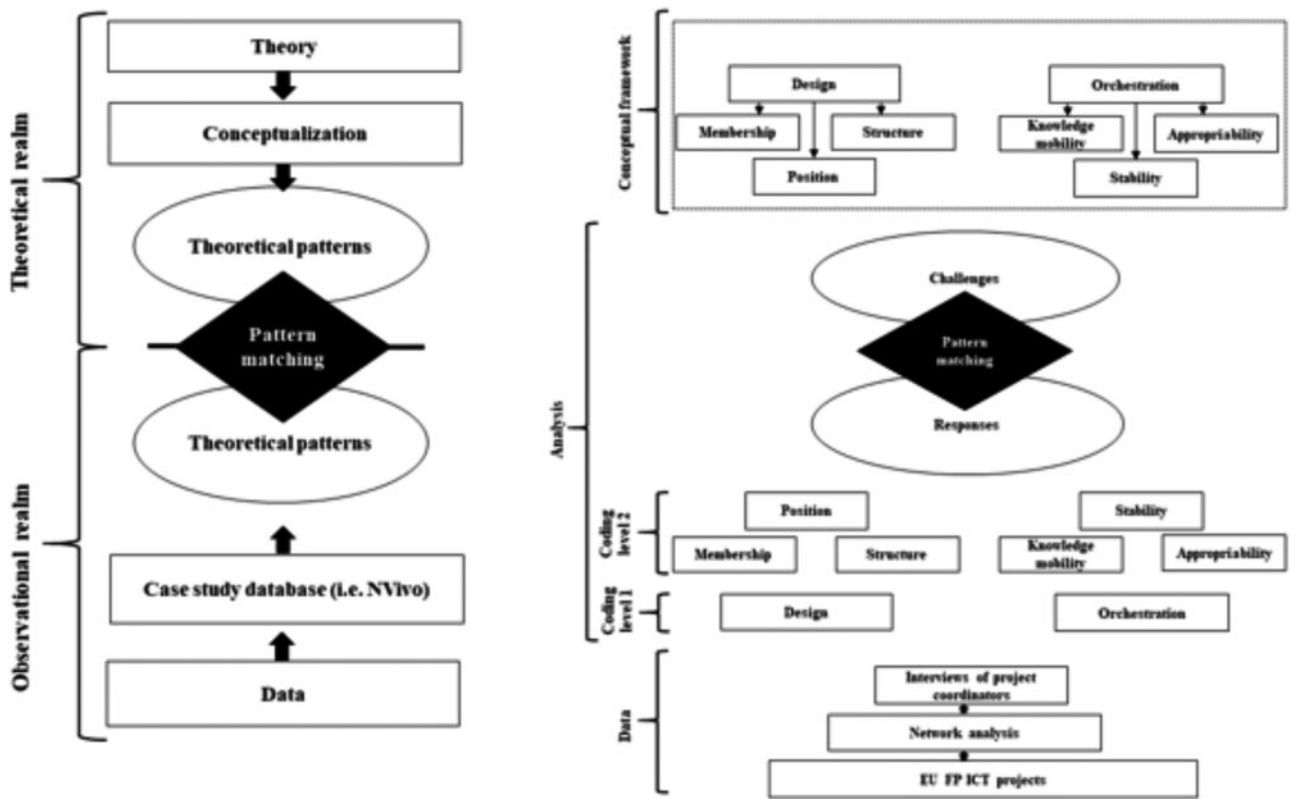


Figure 2. Pattern matching model.

Note: The model on the left is the basic structure, adapted from Sinkovics (2018) and Trochim (1989).

do not provide more details about them or the projects they coordinate.

Interviews were coded using NVivo. We started from the theoretical propositions defined by the literature on orchestration, with pattern matching as the analytical technique (Yin 2014: 136, 143–147): comparing an empirically based pattern—how coordinators respond to orchestration (the observational realm)—and how they are assumed to respond to its challenges (theoretical realm; Trochim 1989). See also Fig. 2, outlining the basic analytical structure, and the operationalization of the different objectives as challenges in Table 1.

Our initial procedure was to code each interview according to the two stages of the framework: to organize statements about establishing/designing versus managing/orchestrating a project. In a second step, we coded these two subsets of data according to underlying objectives like membership and managing knowledge mobility. This resulted in new subsets that were analyzed for recurring themes (dis)agreement among interviewees and nuances. Although our main coding strategy was confirmatory, that is matching interviewee statements with the challenges, the ‘theoretical realm’ (cf. Trochim 1989), we also encountered and coded new concepts that did not fit the orchestration framework, and we looked for terms used by the interviewees when they talked about project design and management. The results are summarized and discussed in Section 4.

4. Results and discussion

The following subsections analyses how the project coordinators described the various challenges involved in designing and

orchestrating an EU FP ICT project. The results are summarized in Table 3.

4.1 Design phase

4.1.1 Selecting partners

All interviewees underlined that their own and partners’ project ideas and the pre-set goals and themes provide essential guidelines for inviting partners. In almost all cases, the basic idea for the proposal was conceived by the coordinators themselves or someone closely connected to them. Interpreting why there had been a call related to a specific topic was an important part of this process. The idea, and in turn the submitted proposal, were incrementally codeveloped as new partners were added. Complementarity or non-overlap was important, as was ensuring that each added partner could be justified by the proposed idea, the topic of the call and other criteria built into the call such as a minimum organizational or geographical diversity.

Four of the coordinators explained that partner selection was a two-step process. First, they made use of what they termed a ‘core group’: a small network of two to five persons who had shared scientific interests and experience from previous projects. The core group worked out the feasibility of the project, redesigned it to suit the announced call, and mapped out the competencies and partners needed for a full consortium. Only after the project-specific targets became defined was the second step of expansion of partners set into motion.

Diversity requirements were seen as complex. For example, the coordinators stated that when inviting firms, it was seen as essential to avoid involving direct competitors, as they had experienced how

Table 3. Summary of theoretical challenges and responses.

Objective	Challenges	Responses
Design phase		
Membership	How to ensure complementary partners?	<p>By developing the proposal either alone or with a core group before recruiting the rest, the coordinator can ensure that the right people are invited. The scope of the project determines the number of partners (size) and the competencies needed to achieve the objectives (diversity).</p> <p>Partners are recruited on the basis of expertise, capabilities, and whether they have pre-existing relations. By recruiting partners who are already connected by previous collaboration, whether directly or indirectly, the coordinator can secure commitment and a certain level of confidence among the members.</p> <p>The chances of finding a qualified partner increase proportionally with the growing size of the network. However, having too many partners is avoided, as that may hamper communication. Newcomers (to EU FP projects or to the coordinator) might be invited: they may be new to the hub, but not necessarily new to other partners.</p>
Structure	How to organize members and activities to ensure communication and strengthen relations? What is the role of trust?	Establishing working packages (WP) tasked with producing various types of deliverables to other WPs or the project itself helps to secure the structure. This is further supported by selecting strong WP leaders who can ensure collaboration inside and across WPs. ICT projects are largely pre-defined and do not allow much room for autonomy; however, most coordinators attempt to find a middle way between 'laissez-faire' and a stringent organization.
Position	Role of reputation of the hub in building the project?	This can be done by attracting the best possible partners with the help of past success and skills in leading EU FP projects, access to a broader network where the coordinator holds influence, and organizational capabilities (e.g. infrastructure, technology, and expertise). Network position appears to support network establishment more indirectly, depending on the coordinator's reputation.
Other aspects		
Self-selection		The decision to coordinate a project instead of being a regular project partner depends on a number of factors, which varied among the interviewees. Taking the coordinator role involves both risk and cost, but is potentially rewarding. For some it is a part of their organizational strategy to lead and steer the focus of the projects, enabling them to stay at the forefront of their field. For others, it was more a question of economy, placing themselves in the coordinator role because of their high hourly rates.
Orchestration phase		
Knowledge mobility	Planning for knowledge flows	This can be achieved by securing a shared operational language, one that will ensure knowledge absorption, and by establishing a project based on existing relationships. Pre-existing relationships are important for network identity, which may also be strengthened through more informal socialization. Through more formal linkages (communication portals and workshops), the coordinator can further strengthen the social and relational capital in the project.
Appropriability	Deal with ownership and the possibility of free riding and other forms of moral hazard	<p>By drafting an exploitation plan and an IPR agreement in advance, the coordinator communicates the specifics of the type of outcomes in the project, and how to deal with ownership upfront and during the project. Violation of IP agreements can entail legal consequences, and any breach of confidence will be met by sanction that affects new collaborative opportunities in that network.</p> <p>Where applicable, projects may be open source, which can counteract problems concerning secrecy. Some projects deliberately include commercializing entities, to ensure a designated recipient of the outcome. Appropriability is in tension with knowledge mobility—the balance between just enough information, and too much.</p>
Stability	Ensuring a stable project	<p>By leveraging reputation, the project coordinator's track record can strengthen links within the project. Coordinators can signal trustworthiness to partners, supporting confidence. They may also 'lengthen the shadow of the future' by creating anticipations of what could be expected from working together, e.g. broader access to laboratories and technology, but also future collaboration in other, related projects.</p> <p>Results indicate that stability is enforced by the grant agreement between each partner and the EU Commission.</p> <p>Innovation appropriability is closely linked to network stability. One case demonstrated the consequences of reduced confidence in the project on network stability: the collapse of network stability affected the reputation of the coordinator when he tried to establish a new project later.</p>
Other aspects		
Principal's role		The coordinators (i.e. agents) are under pressure from the regulatory control of the EU Commission (i.e. the principal), which appears to explain the strong preference for well-known partners. To some, the regulatory control represents a tool for them as coordinators to deal with delayed or unwilling partners.

that could spur conflict during the project. They also applied different criteria for different types of partners, such as ‘technical skills’ for research organizations and ‘products and manufacturing approach’ for firms. Overall, the aim was to ensure complementarity and piecing together organizations representing different parts of the technology defined in the project idea and/or the call. One coordinator explained ‘The technology behind printed electronics is done by many different organizations. So, you need CEA, VTT, and TNO to make this. Separately we cannot offer such technology’.

We found that the partner selection process, both the core and the later invitees, was described in informal and nontechnical terms. One said, ‘From project A I knew this guy at technical university B, we had worked together before and I just liked how that went’, while another stated that partners were chosen simply ‘because in project C we got along so well’. Apart from this emphasis on earlier relational experience, the interviewees talked at length about ‘quality’ and ‘excellence’, and a few also mentioned other aspects like a willingness to experiment or to use their own resources in the project. These traits were seen as given, not something that could be changed, meaning that ‘when we make the plan, we basically draft in the partners ... because we cannot change their strategy’. The stepwise process implies that coordinators gradually invite partners, from their own networks, and each new addition adds new potential partners to the pool. With each new partner, there is a ‘snowball’ effect, enabling identification of the expertise and capabilities via the networks of the partners. One coordinator explained, ‘they could be newcomers to me but not newcomers for one of my partners – there has to be a link’. Thus, the consortia are embedded in a wider pre-existing network. Occasionally, newcomers may have to be included, but only as a last resort. The interviewees regarded this as a risk, due to uncertainty regarding performance. Only for scientific-technological reasons was this seen as necessary, because ‘ticking all the right boxes of gender, geography and so on’ should ideally not be a separate issue in a good project.

This process also implies that the number of partners in the consortium was kept to a minimum, as the partner selection process moved into saturation. The interviewees mentioned many challenges in over-large projects related to coordination, performance, and communication. The number of project members also seemed to be a matter of balancing between the funding available and the expertise needed to succeed. This does not mean that the projects mentioned in the interviews were similar in size, they varied between four to five partners and twelve or more.

4.1.2 Establishing a project structure.

Closely related to the selection of partners is the challenge of how to organize the members and activities so to ensure sufficient communication and strengthen relations. Interview responses indicate that an active distribution strategy is taken in all ICT projects during the proposal drafting phase: the partners are allocated to specific work packages (WPs). As such the project templates resemble a ‘hub and spoke’ model (Thune and Gulbrandsen 2014), where tasks are separated into subtasks that mostly link to the coordinator rather than to each other. WP leaders are selected among the partners and are all closely linked to the hub that connects them all. The WPs also make visible and communicate the different targets and organization of the project as a whole. In smaller projects, partners may be engaged in multiple WPs. Although the WP hub-and-spoke model was embraced in general, there were also critical voices against it. One interviewee stated, ‘When you build a project, you really have

to avoid separate WPs. You always want to create links between the WPs to make the project more dynamic’. This seemed sensitive to consortium size, where one coordinator reflected, ‘In FP7 you had these integrated projects that sometimes were twenty up to forty partners. Then you just end up with very isolated WPs, no interaction – only multiple isolated projects’.

Related to the question of structure, project coordinators seem to experience a dilemma: whether to allow greater individual freedom, perhaps leading to achievements above and beyond the set objectives of the project—or to limit autonomy to a bare minimum in order to meet the strict deadlines and budgets set by the Commission. FP ICT projects are announced as calls on a specific topic, decided by the EU Commission and defined in detail by the applicants, they are limited in terms of time and budget, which reduces the degree of autonomy. Deadlines have to be met and specific outcomes produced, leaving scant room for altering the predefined chain of work-tasks that is decided in the design phase.

However, the uncertain nature of innovation, and to some extent of research, requires an element of freedom—as long as the main target of a project can be achieved. This was tackled in very different ways. One project coordinator preferred to keep autonomy to a minimum: ‘We usually have quite clear view of what needs to be done in the project. The partner can either be convinced to support that or else he will not be a partner in that project’. Others talked about the importance of freedom, also to be able to attract the best scientific partners. One said that s/he agreed with the overall priority of ICT calls to create jobs in Europe, but that in order to attain this goal, more original research was often needed than what was possible to promote in the project. The structure was, therefore, setup to be able to do research ‘under the radar’ in the WPs. Most coordinators seemed to follow a pragmatic approach, avoiding too strict rules because it increased the risk of drop-out, but also making sure that deliverables and targets were met (‘they are sacred’). Creating such a balance is difficult, which might explain why they prefer partners with whom they have worked well in earlier projects. There were also other central aspects for deciding the balance, such as the historical rejection rate of proposals and the technological readiness level, the latter was mentioned by almost half the interviewees. If the readiness level is high and industry partners are involved, the project structure might move toward less autonomy and flexibility.

4.1.3 Reputation as a facilitator for network design

Besides actively recruiting partners and designing the project structure, the project coordinator’s reputation and experience seemed to work both to attract partners and to legitimize the coordinator role including the decisions in designing the project. In this way, coordinators meet the challenge of strengthening the network.

Although the interviewees did discuss reputation, especially in the form of bad reputation when potential partners who had ‘not delivered’ in earlier work were excluded, their main term was ‘experience’ rather than reputation. All interviewees had years of experience from partnering and leading EU FP projects, some for decades. This experience may give rise to a form of signaled reputation, but more statements were made about gaining the skill of drafting proposals and managing projects. In the sharp competition for EU FP funding, the reputation of this skill preceded them, attracting partners who wanted an experienced coordinator. As one interviewee stated, ‘...it is best to have people who know how to run a project, so that the other partners can focus on making scientific contributions’.

To some extent, it is a bit difficult to distinguish between the acquired skill in leading projects and the fairly substantial network of potential partners that follows it. Reputation can be seen as a network characteristic. In line with network theory and preferential attachment (Abbasi et al. 2012), new entrants may prefer to attach themselves to already well-connected peers. This can lead to great differences over time in organizations' opportunities. Several coordinators mentioned that they were regularly approached by others wanting them to become involved as a partner or to lead a project. One coordinator had been approached by several small- and medium-sized businesses (SME) that wanted him to participate in their project, because that would give them access to IBM, a large multinational company that otherwise seemed unapproachable. A coordinator mentioned in this aspect:

It gives a lot of visibility [...] with the EC, with other research groups, and that is a kind of investment. Because the effort for managing the project is not [...] the money. But payback is in the fact that it gives you reputation, and that means that you are invited to join other proposals, which gives you access to new knowledge.

In a similar vein, interviewees mentioned that some of the coordinator's organizations have technological infrastructures that are regarded as very attractive to others: 'We [...] attract the interest of the best partners. Because they know if they collaborate with us, we open our labs quite easily', one coordinator explained.

4.2 Orchestration phase

If the project proposal is selected for funding, the coordinator must manage the project and its partners toward the intermediate and final milestones and deliverables. The orchestration perspective (Dhanaraj and Parkhe 2006) highlights three major processes: communication, appropriability, and sufficient stability.

4.2.1 Managing communication

The main challenge for communication was the diversity of partners both in terms of sectors and disciplines. As explained by one coordinator:

'[W]e have people coming from the microelectronic industry, which is a very sterile, clean, industry. On the other side, you have people from metallurgy. They are very skilled, but do not have the same feeling regarding "clean surfaces". In metallurgy, that means chippings – but for us that means microscopic particles of dust. In OLED technology we deal with nanometres, so different meanings can have great impact'.

Even where there were pre-existing relations among the partners, the interviewees explained that building a common language and understanding required special attention. 'Communication must be continuously monitored and pushed whenever necessary', one coordinator said, referring to the need for ad hoc meetings and problem-solving. Some interviewees also noted the positive effect of having strong WP leaders who took responsibility for promoting and monitoring the communication in each WP, while the coordinator maintained an overview across the whole project.

Exchange of knowledge could be ensured through various means, and the interviewees talked about formal and informal as well as physical and digital meetings and the establishment of an infrastructure for sharing. It is not surprising that different types of communication are needed in multiparty projects, even when all or almost all partners already know one another. However, it is

interesting to note that many interviewees put a lot of emphasis on the need for physical meetings where all partners were present at least two to three times per year. This seems related to a socialization process whereby new individual team members become acquainted with the larger network. Informal socialization through dinners and events was seen as important for building trust, and for many, the overall aim of early-stage communication was less oriented toward project goals and deliverables and more toward building a shared identity. One coordinator stated, 'In any project it is important to try to establish a bit of a kind of community spirit among the members. [...] That is actually quite important because you will inevitably encounter problems'. Communication was here seen as a tool to develop problem-solving capacity in the project team.

4.2.2 Managing appropriability

Interviewees talked about different aspects of appropriability, including ownership of knowledge, confidence among the partners, and free-rider behavior. There can be a tension between revealing knowledge that may be of crucial importance for the project and exposing oneself to opportunistic behavior from other partners.

The main approach for dealing with these issues appeared to be the before mentioned recruitment of partners with previous, positive collaboration experiences. However, if this pattern should be breached, the project members could exercise some type of social justice, and several talked specifically about exclusion from later collaboration. One coordinator said: '[W]e know that if it [breach of confidence] happens, we will never ask them to join a consortium again'; another noted: 'This is a community, so of course you lose your reputation'. The threat of such social sanctions seemed to be the preferred strategy rather than actually removing a partner from the project, which would involve the funder and would cost time and resources.

In addition, in any EU FP project, the consortium must complete a detailed grant agreement with the EU Commission that explains how intellectual property (IP) from the project is to be divided and valorized. Unlawful breach of the contract will have legal consequences, to be administered by the EU Commission (e.g. loss of funding). Coordinators also stated that they often drafted a consortium agreement upfront where each partner specifies his or her own exploitation plan in the project. The main rule seems to be that ownership follows attribution:

The main rule is that ownership of projects results is regulated in these consortium agreements. This is regulated by contracts, [...] ownership of a result accrues to those who have developed it. If it is a collaborative effort between several persons, then they share.

However, having contracts among the partners was not necessarily sufficient to avoid concerns of appropriability. Coordinators actively engaged in dealing with ownership of project outcomes to 'make sure that no one feels taken advantage of'. Consortia with academic and industry partners may have particular challenges that need to be negotiated:

[S]ometimes you have small conflicts because the academic partners want to publish as much as they can, and they want to be the first to publish. To an industry partner, filing a patent takes time, at least a few months and sometimes even a year. Generally, we have to engage in discussion of what can be said or

written in these scientific publications, to reach some sort of agreement among the partners.

Some coordinators attempted to deal with ownership concerns by inviting partners specifically intended to commercialize the outcome: 'That means that you must give them the priority to valorize or industrialize the product as a partner'. Such arrangements define in advance who is to have ownership of the outcome.

Another approach, if appropriate, could involve developing open source technology, which bypasses secrecy: 'In the past there was conflict in terms of the license or there was conflict as to who could use the different components. In this project, we produce open source Then, none of the partners really care [about ownership]'. However, several interviewees underlined that protecting IPR is an integral element in these ICT projects, and that they must balance what can be disclosed in and from the project. If an industry partner risks losing a competitive advantage by being open about the results, they may choose not to, as long as they provide the project with a certain minimum of information.

4.2.3 Managing stability

Judging from the interviews, the challenge of ensuring project stability appeared to less of a concern compared to the active management involved in knowledge mobility and appropriability. Part of the explanation may be the grant agreement signed with the EU Commission, which enforces stability through detailed time plans and deliverables. The emphasis on stability in the orchestration framework may be more relevant for bottom-up collaboration among equal partners. In our cases, we see that stability was not primarily related to the project. Partners were allowed and often encouraged to form additional joint projects with other members, as long as it did not interfere with the current project. What appeared to strengthen network stability was the future anticipation of being invited to join another project led by the same coordinator or another influential organization in the network. Moreover, and similar to managing innovation appropriability, failure to fulfill project tasks could be 'punished' by discontinuing the possibilities for new collaboration ventures with the network. In other terms, the risk of sanctions supports network stability.

4.3 Other aspects: self-selection and principal's role

In the interviewees' experiences with coordinating multiparty projects, two important themes emerged that are not directly dealt with in the orchestration framework. The first we may call self-selection, which refers to the decision to actually coordinate a project instead of being a regular project partner. We see this as a first step in the design phase when a consortium is formed based on an external call. To coordinate or not to coordinate can be a hard decision to make, largely because the coordinator role is seen as more costly (more administrative work) and risky (if the project fails, the coordinator may get an unreasonably large proportion of the blame). Most of the interviewees said that they had bought professional help with project administration from a dedicated unit in their organization or an external consultancy or, in a few cases, delegated this aspect to one of the project partners.

Answers to why they decided to be the lead organization in a project ranged from the simple 'It is natural for us to be the leading institution' to more complicated pathways starting with an external request to lead a project. For many of the interviewees, the decision to be coordinator required top management support to make sure that the theme of the project was in line with the organization's

overall strategies and priorities. This means that there is an internal decision-making process that may require individuals to promote the project idea in their own organization before committing themselves to the coordinator role. As such orchestration also has an organization-internal component. An underlying issue seemed to be that many interviewees and their organizations perceived coordination as something that often was not fully covered by the EU FP grant. For a few interviewees, there were other financial aspects in the sense that their decision was based on their high hourly researcher rates, which were easier to put into the budget as coordinator than as a regular project partner.

The second important aspect not directly dealt with in the orchestration framework is the relationship to the project funder, the EU Commission. The theme in the call, the total budget and the criteria for selection and for running the project put a lot of limits on how freely coordinators could manage the projects. This is probably why selecting partners who 'understand the system' was mentioned as crucial by so many of the interviewees. In the interviews, this issue appeared in particular in the orchestration phase.

In this phase, the funder assigned a project officer and one or more special reviewers to assess the progress of the work with respect to milestones and deliverables. For some of the interviewees, this represented an opportunity also for them as coordinators to deal with partners that were delayed or unwilling to put in the needed effort: 'I tell him [the delayed partner], please ... give me a justification so that I can ask the project officer permission to delay a terrible report or something. Doing this you give the feeling to the partner that he is responsible, not to me but the Commission. So it is another way of putting pressure on them'. Others were quite negative to the interim review system and said it generated more administrative work that detracted from the results of the project. In one project, a critical progress review from the EU Commission led partners to lose confidence in other partners and the coordinator:

They [the EU Commission] thought the project management was not going well, things were behind [...] [S]ome people, this group in Barcelona thought that they had been singled out for a lot of problems. So instead of being energized and putting in all their effort, everyone was suddenly in risk-avoidance mode.

This coordinator was unsuccessful in dealing with the tensions arising after the critical review, which the interviewee in turn tied to reputation and position. He added: '[in setting up a new project] I asked those who might be interested whether they would like to put together a proposal, but only one responded. The others didn't say no, they simply didn't reply'.

5. Conclusions

This study has sought to better understand the decisions underlying the formation and management of collaborative networks in EU FP projects. These are examples of principal-agent relations (e.g. [Braun and Guston 2003](#)) which are delegations through contracts where a principal (the EU Commission and its directorates) sets the overall topic and a number of project characteristics, and then selects an appropriate agent—a consortium led by a coordinator—to carry out the actual work. We have been interested in the decisions made by these coordinators in the early stages of consortium formation and management. Such coordinators have been termed 'orchestrators' ([Klerkx and Aarts 2013](#)), and a project management literature has emerged that analyses these organizations' 'orchestration' attempts ([Dhanaraj and Parkhe 2006](#)). We have used this literature as a

starting point to understand how project coordinators orchestrate research and innovation projects in H2020.

We find that the process can be seen as consisting of three stylized phases. In the first one, a small group of organizations comes together to develop the initial project idea that responds to the call. The selection of coordinator either emerges from the discussions in this phase or is clear in advance if the eventual coordinator is the one that invites the core group together. This organization's reputation as a successful orchestrator in the past is important for attracting the best possible partners. In the second phase, the consortium-in-planning adds new members that are needed to realize the project idea. This also implies deciding on the overall project structure of WPs and other deliverables, and making choices about appropriability. The latter issue can have very different answers such as defining principles of ownership in advance, defining actual ownership in advance, or deciding that the project should be 'open source', that is, no ownership. When (or if) the project is funded, the third stage implies setting up an administrative and communication infrastructure to ensure milestones and deliverables. This often implies third party assistance and interactions with the principal through project officers and reviewers. To some extent, it can also mean that a formal structure is put into place that makes sure that the external demands are met, while ensuring a certain level of research work or flexibility in the project.

This is a complicated management task, which can explain why coordinators primarily include partners with whom they have previous work experience. Newcomers are seldom included in these projects, at least not those who have no relational ties to any partner or previous EU FP experience. Those who are included have expertise, infrastructure, or access to a market deemed valuable to the project—but also an in-depth and tacit understanding of how the funding system works and what the principal expects.

Our analysis adds to the orchestration literature by analyzing research and innovation projects that have many more pre-defined constraints than what [Dhanaraj and Parkhe \(2006\)](#) suggest for networks of innovating firms. We find, for example, that stability is less of an issue, and that stability tends to last beyond single projects. The literature distinguishes between a design phase, where key decisions about the consortium are made, and an orchestration phase, where the consortium is implemented in practice, each with three subgoals. Our interviewees indicate one extra subgoal in each phase. In the design phase, the self-selection to coordinate is a very important decision, which may require significant internal work to decide upon the project's fit with priorities and resource availability in the organization. In the orchestration phase, the implementation of a structure that remedies the lack of formal power of the coordinator—as partners are bound by a grant agreement with the Commission, not the consortium—is often essential. For some coordinators, the structure imposed by the funder becomes not just an external requirement but also a possible tool for dealing with unexpected behavior by the partners in the consortium.

We also add to the general literature on principal-agent relations in research and innovation funding by showing how such relations are embedded in various networks and from one multiparty project to another, and how the projects are set up to handle goal differences and diverging perceptions of moral hazard. The latter is especially important if (according to the coordinators) principals have unrealistic assumptions about direct partner collaboration and sharing or about the required research work. To some extent, the distinction between principal and agent can become blurred especially when the monitoring, review, and sanctioning system of the

principal in some cases is turned into a project management tool for the coordinators. If this project management does not work, coordinators risk losing reputation and be excluded from later networks and projects, which we can see examples in our data.

Exclusion seems to be rare, however, and the most common patterns seem to be that projects lead to strengthened partner relationships that carry over to later opportunities. Management of complex and to some extent predefined multiparty projects is a strong experience-based skill, which is very unevenly distributed. We believe our small and exploratory study shows the importance of a strict focus on the agents in principal-agent relationships. Later investigations can usefully look at how funding and project management criteria become places of negotiation and interpretation (we find indications of this) and on possibly unique project management features of multiparty and multinational research and innovation projects. The orchestration framework can provide a useful starting point, also on a more metaphorical level, but has some limitations when applied to the complex EU FP context. Later in-depth research should focus also on the members in these collaborative projects and not solely on the orchestrators, as well as coordinators that do not represent the most successful recipients of EU funding.

It is not easy to infer clear policy implications from a small and exploratory study. We would like to point to two aspects of reflection and discussion. First, the complexity of and details in the criteria for funding and monitoring may hinder a broader inclusion of organizations in the FP projects. Knowing how the system works is such an important aspect of being a 'good partner', which means that the design of the system may put limits, for example, on the propensity to include newcomers. Second, our interviews indicate that the project officers and external reviewers can in some cases be useful tools for project development and management, rather than just a means for accountability enforced by the principal. More policy discussion and perhaps more investigations are needed to see in which situations the monitoring part of the system can be a helpful tool for research and innovation projects rather than just a control mechanism.

Notes

1. Although the aim was to explain how research organizations orchestrate ICT projects in *Horizon 2020*, participation data from FP7 were included, to ensure that the entities in question repeatedly hold a central role over time, and that the measures of only H2020 are not affected by the limited operational time.
2. For other studies using ECORDA, see [Barajas and Huelgo \(2010\)](#); [Breschi et al. \(2009\)](#); [Must \(2010\)](#).

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Appendix

A1. Interview guide

A1.1 Interview introduction

- Briefly present the study and the outline for the talk you are about to have
- Approximate length (sixty minutes)
- Anonymity
- Tape recording and informed consent

A1.2 Interviewee

- What experience do you have with leading/coordination research projects?
 - In EU FP especially

A1.3 Conceptual framework

- **DESIGN (building the network/project)**
I would like to talk about your role and actions taken when establishing this project, which ended up being funded in a very competitive program.
- **Network membership—selecting partners:**
 - How were partners recruited and selected?
 - **Ques:**
 - Core consortia? Previous partners?
 - Long-term collaborations?
 - Cherry picking from a broad network of contacts?
 - Strategic selection of partners for the long run, and not necessarily for the specific project?
 - What qualities are looked for in a partner?
 - **Ques:**
 - Reputation, how does this matter?
 - What are the main differences between the partners in your project?
 - **Ques:**
 - Newcomer?
 - End users, industry?
 - Experience
 - Competitors?
 - Challenges with establishing the project?
 - What was necessary to build the project?
- **Network position—of the hub organization:**
 - Why do you take the leading role?
 - **Ques:**
 - Budget? Scientific? Long-term investment? IPR? Standards? Infrastructure?
 - Why do you think your partners prefer that you lead the project?
 - What decides who coordinates and invites partners?
 - How is the position preserved over time?
 - Do you experience that potential partners contact you with proposals rather than you contacting them?
- **Network structure:**
 - What is important when you put together a project? What works, and what can be better?
 - **Ques:**
 - Formal or informal composition?
 - The type of organizations, and why?
 - To what extent is the participant's **autonomy** in the project seen as important?
 - **Que:**
 - Hence, are the partners encouraged to act independently or are they needed to follow a predefined path to solve delivery on the project's main objectives.
- **PROCESS (management of the project/network)**
Now, I would like to know how you manage the project. What are the more concrete actions taken by you as the coordinator in the project, to sustain the free flow of information, trust, and that you deliver on the proposal target?
 - Have you experienced any challenges with managing EU FP project(s)? If so, could you please elaborate?
- **Knowledge mobility—the ease with which knowledge is shared, acquired and deployed**
 - How do you ensure that information flows freely among the partners?
 - Experience with internal conflicts?
 - **Ques:**

- Any specific measure taken?
 - For example: socializing the network through common workshops or conferences?
 - Forums or other arenas where they can share information? Online or in person?
- **Network stability:**
 - Have you experience with any dropouts from your projects?
 - **Ques:**
 - What happened?
 - Is there a risk for it?
 - What do you do to sustain stability in the projects?
 - Do you experience any goodwill from your partners because of your reputation as a scientist and from previous projects?
 - How do you divide the workload between the members?
 - How is the project composition of private companies, higher education institutions, and research institutes affecting the activities?
 - **Que:**
 - Is this diversity (multiplicity) a challenge or a benefit?
- **Innovation appropriability—ownership:**
 - How do you ensure that everyone shares information openly within the project?
 - **Ques:**
 - Can you recollect any challenges with this?
 - Avoid freeloaders
 - Have you agreed on any formal or informal contracts?
 - Are there any conflicts between those producing the knowledge (the research organization) and those using it (i.e. users, profit-seeking firms)?
 - **Que:**
 - Specifics with EU FP projects?
 - How do you deal with outcome/innovations from the project that can be valorized?
- **End of interview**
 - Would it be possible to contact you later for a brief follow up interview to hear your thoughts on the results/conclusions?
 - Would you like to add something that you feel we have not talked about?