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The 'Institutional effect' over EU defence cooperation initiative

The case of preferential patterns of behaviour in the Permanent Structured Cooperation

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Abstract

Over the last decade, a confluence of strategic and security concerns has threatened the European Union's survival both within and beyond its political dimension. As a result, security and defence have risen to the top of the EU's political agenda, culminating in the approval of the EU Global Strategy (EUGS) in 2016. The EUGS represented a watershed moment in the EU's Common Security and Defence Policy: the EU agreed on ambitious levels of security and defence. The new policy is based on supporting capacity building among member states through instruments such as PESCO. Nonetheless, these instruments have caused variations in patterns of member state behaviour that have enhanced defense integration.

This research aims to understand what was the PESCO institutional effect on Member States' preferences and how it has affected the European security and defense goals. The research highlights the role of European agencies and how they contributed to solve collective action problem through a 'forum effect' on participants, using pro-actively the task of assessing co-operative projects proposals. As a result, PESCO's institutional effect led to cooperative outcomes between nations that allowed them to overcome coordination dilemmas, namely uncertainty about the willingness to contribute to a common project, which is typical of defense co-operation

Here, we used Rational Choice Institutionalism theory to investigate the PESCO project structure and its interaction with the European Defence policy. Cooperation between participating member states is presented within a cooperative game action, as part of a theoretical approach to game theory. It explains formally how PESCO entails elements to overcome collective action problem among participating member states, while emphasising the institutional design that promoted the European interests, and how this has led to more *Europeanised* security and defence. Findings are interpreted under the *Differentiated integration* concept.

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Contents

List of Acronyms **10**

1 Literature Review **16**

1.1 Theoretical contestation in European defence cooperation 17

1.1.1 From Constructivism to Rationalism 19

1.1.2 Rational Choice Institutionalism narrative in European cooperation 23

1.2 PESCO's institutional effect: a researchable problem 25

1.2.1 Differentiated integration in EU defence and security 27

1.2.2 Differentiated integration in PESCO 29

1.3 The Defence collective action dilemma and PESCO's rationale 31

1.3.1 PESCO as a coordination game 33

2 Research Design and Methodology **35**

2.1 Methodology, conceptualisation and operationalisation 36

2.1.1 Research's theoretical design 42

2.1.2 Research question 43

2.1.3 Access to data 46

3 Assessing the role of EU actors within defence initiatives **48**

3.1 Assessing agencies' influence in coordination game 50

3.1.1 The selected EU actors involved in defence initiatives 53

3.1.2 Caveats on measuring influence of PESCO Secretariat 58
3.1.3 Framing PESCO Secretariat's influence on pMS rational choice . . 60
3.1.4 Credibility and Reputation for PESCO Secretariat 63
3.2 Secretariat's resources 65
3.2.1 The agency of PESCO Secretariat: an empirical example 66
3.2.2 The agency of PESCO Secretariat on proposed project 70
3.2.3 Caveats in Agencies' reputation and credibility analysis 73
3.3 Conclusion 75

4 Analysing co-affiliation network in Permanent Structured Co-operation 77
4.1 Co-affiliation structure in European defence initiatives 79
4.1.1 PESCO a two-mode data network 82
4.1.2 Affiliation data of PESCO projects 85
4.1.3 Jaccard coefficient index of PESCO affiliation data 87
4.2 PESCO communities detection with modularity maximisation 93
4.2.1 The modularity measures 98
4.2.2 The projection method of a two-mode data matrix 99
4.2.3 The modularity maximisation 103
4.2.4 The communities within Europen defence initiatives 105
4.2.5 Communities variation in PESCO: from project proposals to project adoption 111
4.2.6 Project by project communities detection 114
4.2.7 Network centrality measurements 117
4.3 Assessing the variance in PESCO differentiated integration: from proposals to final projects 121
4.3.1 Conclusions 122

5 European defence initiatives: the Permanent Structured Cooperation and the European Defence Fund 126

5.1 Framing the PESCO initiative 129

5.1.1 The multi-layered PESCO governance 131

5.2 European agencies in defence cooperation 135

5.2.1 The EU's agencies assessment criteria for PESCO proposals 137

5.3 From the EDIDP to the EDF 144

5.3.1 The EDF 144

5.3.2 The EDF selection and award process 145

5.4 PESCO's interaction with the EDF 147

5.5 The PESCO projects: an empirical evaluation 151

5.5.1 The 2nd set of PESCO projects 157

5.5.2 The 3rd batch of PeSCo projects 159

5.5.3 The Work programme committee and the Secretariat: the 'gate-keepers' 163

6 The case of PESCO: a coordination game dilemma 164

6.0.1 Within-case analysis 164

6.1 PESCO as coordination game 2.0 166

6.1.1 Coordination game: the most likely successful scenario 168

6.2 Cheap talks 171

6.2.1 Cheap talks mechanisms 172

6.2.2 Incomplete information in defence cooperation 174

6.3 The model 177

6.3.1 Contribution game 178

6.3.2 pMS within cheap talk communication 180

6.3.3 pMS and influential communication in PESCO projects 182

6.4 Continuous problem in European defence endeavors 183
6.5 The European agencies' transformative effect on collective action problems 188
6.5.1 Numerical example 189
6.6 European Cooperation a continuous problem 191
6.6.1 Interpretation of the model 193
6.7 The EDF transformative effect on PESCO's continuous action dilemma . 195
6.8 Conclusion 200

7 Conclusions **202**
7.1 Findings 205

Bibliography **210**

Appendix **229**

List of Figures

2.1 Research's analytical framework 45

4.1 Communities in PESCO projects 91

5.1 3rd wave PESCO timeline adoption 144

5.2 PESCO projects 152

5.3 Project: total/approved/rejected per category and batch, October 2018 - November 2019 155

5.4 Proportion of rejected projects based on categories 156

5.6 Density plot: project categories and n pMS 162

6.1 High and low externality game 168

6.2 Messaging strategy types with $N_1 = 7$ 181

6.3 The expected utility model: the decision facing actor i regarding actor j . 199

List of Tables

2.1 Research design framework 40

3.1 A cross-case analysis: Selection of EU agencies 56

4.1 Contingency Table 86

4.2 Jaccard coefficient index of Member States participating into PESCO . . 90

4.3 *HAC* Clustering Results 92

4.4 The PeSCo affiliation matrix: States-by-projects matrix 94

4.5 The PeSCo affiliation matrix: States-by-projects matrix 95

4.6 PeSCo: State-by-State co-affiliation matrix 102

4.7 Number of project per Member States 108

4.8 Summary Jaccard data analysis 122

5.1 Agencies' assessment criteria for PESCO proposals 137

5.2 Categorisations based on pMS level of interest 151

5.3 Illustrative example of operationalisation 151

5.4 Number of approved/rejected projects per category 153

5.5 3rd Batch PeSCo project 161

6.1 An example of Most- and Least-likely case for coordination game solution 166

6.2 Sequence of play 181

7.1 PESCO data frame with four variables. 232

7.2 Jaccard coefficient index based on PESCO project proposals 235

7.3 PESCO network centrality measures: empirical illustration 236

7.4 Project–by–project co-affiliation matrix 237

List of Acronyms

AoA	Avenue of Approach
CARD	Coordinated Annual Review on Defence
CAP	Capability, Armament and Planning Directorate
CapTech	Capability Technology
CSDP	Common Security and Defence Policy
DPD	Defence Planning Directorate
EDA	European Defence Agency
EDF	European Defence Fund
EDIDP	European Defence Industrial Development Programme
EDTIB	European Defence Technological and Industrial Base
EU	European Union
EU CDP	EU Capability Development Priorities
EU LoA	EU Level of Ambition
EUMC	European Union Military Committee
EUMS	European Union Military Staff
FAC	Foreign Affairs Council
FAC-Def	Foreign Affairs Council Defence configuration
LoA	Level of Ambition
MS	Member State
NAD	National Armament Director
NATO	North Atlantic Treaty Organisation
PESCO	Permanent Structured Co-operation
PMG	Project Management Group (EDA) or Political-Military Group (EU Council)
pMS	Participating Member States
PSC	Political Security Committee

SB-NAD Steering Board-National Armament Directorate

Introduction

In the last decade, a convergence of strategic and security issues challenged the European Union's future. Transnational threats and conflict in its borders have threatened its security, while strategic competition and multipolarity challenged its political stability. Cuts in defense spending due to the financial crisis highlighted the need of cooperation between the Member States to maintain effective military capabilities. Even though some preliminary efforts have been attempted, the lack of collaboration in the defense and security sector brought about an estimated cost of more than 25 billion euro each year (EPRS, European Parliament 2013). More than 80% of procurement and more than 90% of research defense innovation are still managed on a national scale. The European Defence Agency estimated that pooling procurement could save up to 30% of yearly defense costs, laying the foundation for further actions to promote cooperation. In June 2016, the Global Strategy for the European Union's Foreign and Security Policy (EUGS) was published and it marked a turning point in EU defence and security strategy, with both Member States and Institutions participating in this endeavour. The defensive tone of the document clearly underpinned what was the priority of the EU.

The EUGS immediately triggered to draw up an Implementation Plan on Security and Defence (IPSD)[1] that gave traction to so called 'winter package', adopted in November 2016, that included the European Defence Action Plan (EDAP). The final aim was to bring a new and more ambitious security and defence policy for the EU; it had been translated into a revised form of the Capacity Development Plan (CDP), thus establishing EU capability development priorities consistent with national defence plans (Blockmans, 2018). To ensure consistency between the EU and national level, it was also decided to implement the Coordinated Annual Review on Defence (CARD).

[1]Proposal from the High Representative of the Union for Foreign Affairs and Security Policy, Vice President of the European Commission, and Head of the European Defence Agency to the Council, "Implementation plan on security and defence", Council doc. 14392/16, 14 Nov. 2016

This instrument would have helped Member States to identify opportunities for joint ventures. Moreover, it provided a tool to analyse the execution of the CDP priorities. The CDP was intended to set common priorities while CARD provided an overview of prospects for cooperation; together, they paved the way for the Permanent Structured Cooperation (PESCO). The purposes of these instruments are to generate comprehensive information on security and defence capacities within the EU and to improve the European military capability.

In November 2017, to enhance the European defense capabilities, the European Union took an important decision: the Permanent Structured Cooperation (PESCO) has been adopted. An agreement that provides an institutional framework to facilitate the implementation of collaborative projects and initiatives in defense research, acquisition, and operations. A mechanism aimed to pool resources and expertise, create new capabilities, and develop innovative defense technologies while enabling greater interoperability between European member states.

Ministers of Member States notified to the High Representative and Vice President of the European Commission their political will to bind common commitments in defense investment, capability development and operational readiness. This was followed by the decision of the EU Council of the first list of participant nations that applied for cooperative grants. Subsequently, in March 2018, the European Council approved 17 cooperation projects which covered a wide range of military sectors. A second wave of seventeen projects was adopted at the end of November 2018, and a third wave of thirteen project were adopted in November 2019. By November 2019, 47 projects had been approved and financed, involving 25 EU member states and spanning a wide variety of military sectors. A fourth group of project was adopted in November 2021, updating the total number of project to sixty-one.

This commitment to strengthen Europeís military capacity is indicative of the political determination of the EU and its Member States to not leg behind the authoritarian

nations in a conflictual era of geopolitical tension. Some authors criticized the PESCO for the high number of Member States involved (De France et al., 2017), nevertheless, this inclusiveness reflects the importance of *cooperation* in defense and security issues, underscoring how central these issues have become to all European Member States.

This thesis explores the recent developments in European defence cooperation since the adoption of the first group of PESCO projects in 2017. By investigating and analysing the EU's role behind-the-scenes, it can help to understand how and why these transformations have occurred, what purpose they served, and what future developments are the most likely. In particular, this research will focus on how European agencies became active players and how confronted states' sovereignty, as well as how they succeeded in influencing Member States' preferences for cooperative policies. Finally, this study will provide an insight into the current state of European defence integration and its possible evolution.

In order to understand the role of EU agencies in the European defence and security cooperation, this research proposes a game theory approach and draws on Rational Choice Institutionalism and Europeanisation theories as its theoretical framework. By doing so, it aims to uncover the influence exerted by these agencies on Member States' decisions to participate in cooperative projects under the auspices of the EU. This endogenous explanation for developments in defence cooperation differs from exogenous accounts that are typical of intergovernmentalism and neorealism approaches. These approaches emphasise external factors such as Russia's assertive foreign policy and the migrant crisis as catalysts for EU cooperation. They fail, however, to recognise how EU institutions have been able to shape Member States' preferences towards greater collaboration through material incentives, such as the European Defence Fund, and socialisation mechanisms such as 'the forum effect' which helps overcome the collective action problem associated with military cooperations.

The structure of this research is as follows: The first chapter provides a framework for analysis. It discuss the European cooperation on defence from various perspectives including the rational choice institutionalism, commenting the role of the European agencies in the realm of security and defence policy. It explains the rationale behind creating such Agencies, and how they evolved to facilitate cooperation among EU member states. It discusses under which condition their role have been pivotal in reaching out to this cooperation. Chapter 2 addresses the research design and methodology used for the research, while chapter 3 offers empirical network analysis of the PESCO projects, mapping out a costellation of preferential patterns of cooperation among its participants. Chapter 4 discusses the role played out by the EU agencies, and how their projects' assessment have influenced the cooperative outcomes. The last chapter introduces the model used to frame the interaction among pMS with a PESCO project, why defence cooperation are a particularly difficult example of collective action problem but at the same time how it could be overturn through the role of European agencies and interaction with other EU initiatives.

Every part of the research is introduced by a preface to better navigate across the research's elements. The preface to Chapter I defines the words *agencification* and *europeanisation*, as defined by the current scientific literature, commenting on the research's theoretical positioning and contribution to the literature dealing with European defence cooperation. The preface to second Chapter introduces the methodology and the case study selection, highlighting some key aspects that emerge from their analysis. Preface to the third chapter helps us to acquaint with the PESCO mechanism and the last chapter preface introduces the features of the model.

Chapter 1

Literature Review

In recent years, the theoretical debate over the development of European cooperation in defence and security has become increasingly prominent. Classic theories of European integration generally focused on why integration occurs rather than how the EU and its various policy domains operate, while alternative theoretical schools presented new distinct analytical tools to explain EU cooperation. Constructivism, governance, Europeanisation, liberal intergovernmentalism, two-level games theory, institutionalism and Neorealism are among the approaches that have been used to explore the dynamics of the European integration in this field. Since the adoption of the European Defence Action Plan (EDAP) in 2016, a new comprehensive defence package for the EU emerged in order to enhance EU cooperation on defence and security. These included the Coordinated Annual Review on Defence (CARD), the Permanent Structured Cooperation (PESCO), the European Defence Industrial Development Programme (EDIDP) and the European Defence Fund (EDF) for acquisitions or research projects related to defence capabilities. This raises questions about how these instruments affect the functioning of

the defense policy within Europeís broader framework of rational choice institutionalism. The proposed research seeks to answer these questions by examining EU cooperation on defence and security since EDAP adoption in 2016 and exploring how recent instruments have shaped its evolution under rational choice institutionalism.

The past decade has seen a marked shift in the theoretical debate within both international relations and EU studies. The "great debate" between neorealism and liberal intergovernmentalism, which had been the major theoretical issue of the late 1990s, gave way to a new confront between rational choice and constructivism. This chapter will focus on four prominent schools of thought that have addressed the EU's cooperation on security and defence, as well as its Common Security and Defence Policy. By analyzing how these different approaches assess the EU's current efforts, we can better understand the main sides of this controversial issue.

1.1 Theoretical contestation in European defence cooperation

Realists have long viewed European cooperation on defence and security as the by-product of states' pursuit of national interests. Structural realists (Walt, 2006; Posen, 2004a; Mearsheimer, 1990) and classical realists (Hyde-Price, 2012; Dyson & Konstadinides, 2013b) argue that power, a central variable in the security policy of states, lies within the realm of national sovereignty, while the EU is uncertain of its own role as a powerful actor (Biscop, 2018b).

Moreover, realism draws upon the Cold War structure to explain why earlier attempts at integrated European defence have failed (Jervis, 1978). The settlement following World War II, they argue, prioritized US security interests over those of Europe,

thus preventing successful cooperation in key areas such as foreign policy, security and defence policy (Quinlan, 2001). Consequently, the US 'Offshore Balancing Strategy' adopted in Europe in the last decade has been a crucial catalyst for the new initiatives in European military sector. In this regard, the two percent GDP benchmark in military expenditure, as proposed by the Obama administration, can be seen as a mere ëred herringí, as the US's security concerns were not focused in Europe (Fabian, 2018).

Indeed, the post-Cold War era has seen the United States to become the unique hegemonic power. While most countries are primarily interested in what is occurring within their immediate neighbourhood, for the US much of the world is its neighbourhood (Jones, 2007). The US security concerns were led off the European continent. The disparity between American and European threat perceptions has been exemplified in recent years due to Russia's increased assertiveness towards EU member states (Durkalec & Kroenig, 2016; Galeotti, 2016). This geopolitical climate led the European states to cooperate with each another for mutual defence and security purposes. in an effort to offset US power. So, scholars are reconsidering the defence cooperation as something more than simply an armament procurement issue (Jervis, 2003; Jones, 2007). Structural realists argue that the new European initiatives in the military sector are not an autonomous process of Europe's own accord, but rather a consequence of the US ëOffshore Balancing Strategy' implemented on Europe (Mearsheimer & Walt, 2016) . Hence, the EU member states began to be more concerned about a world in which their values and interests concur only for Washingtons purposes (Jervis, 2003).

A major debate about the relaunch of European security and defence cooperation occurred between neo-realist and liberal intergovernmentalist scholars. Neo-realists posited that European states were driven by structural changes in the international system, primarily revolving around US hegemony, which led to a reformed process of ëbandwagoningí on US power Cladi & Locatelli (2012). It is an adaptive process as a result of

structural changes in the international system, particularly in the transatlantic relations between the US and post-Cold War EU[1] (Art, 2005; Jones, 2007). Alternatively, intergovernmentalists (Dyson & Konstadinides, 2013b) emphasized the role of governments as catalysts of domestic policy preferences and view EU integration as a means through which self-interests and advantages for domestic interest groups are pursued (Moravcsik, 1998). As such, the historical process of European cooperation in defence and security, from the European Community Defence (ECD) in 1954 to the adoption of the Treaty of Maastricht in 1993 and its accompanying Common Foreign and Security Policy (CFSP), is seen as a consequence of government decisions based upon national interests. This approach considers these decisions as a consequence of governments' choices based on national interests, with constraints and opportunities arising from powerful domestic constituents, states' relative power within the international system, and institutions bolstering credibility between states (Moravcsik, 1998, p. 18).

1.1.1 From Constructivism to Rationalism

Central to constructivists thought is the idea the EU is leading a gradual convergence of national strategic cultures among its Member States, which enabled cooperation on security and defence in the post-Cold War era. This convergence is evidently seen through initiatives such as the Common Security and Defence Policy (CSDP) and Permanent Structured Cooperation (PESCO). Through these projects, a 'pooling and sharing' approach has been adopted by a large number of Member States, resulting in an attempt to attain an homogenous EU military development. Many scholars considered them as

[1]For instance, the Kosovo crisis is considered as a milestone in the EU integration history because it acted as a decisive catalyst in the development of the EU's international security role. In the 1990s the EU was still facing the ashes of its failing conflict management during the Yugoslavian crisis, and continuously re-considering the consequences of Europe's declining priority in US foreign policy. At the same time, by the end of the 1990s, an emerging consensus in favour of a European defence autonomy paved the way for the declaration of the European Security and Defence Policy (ESDP), known as the St. Malo agreement in June 1998.

indicative of an ongoing 'EU military strategic culture', thereby demonstrating how national defence and security policies are being 'Europeanised' across the continent (Meyer, 2005; Rieker, 2006; Howorth, 2012).

However, despite this apparent progress in terms of European defence cooperation over the past decade, the empiric evidence suggests that EU Member States are increasingly diverging in their defence policy outlooks (Andersson, 2015; Hyde-Price, 2018). Studies about differentiated integration highlighted the tendency of individual states to pursue bilateral cooperation patterns outside the EU directives (Leuffen et al., 2012; Howorth, 2019). Consequently, it appears that Europe is experiencing a multilayered convergence on defence cooperation rather than pursuing a unified framework, consistent with the constructivist theory.

Furthermore, constructivist literature on European CSDP stresses the idea of the EU as a normative, civilian power. Duchene (1972) argued that decreasing reliance on traditional military power could afford the EU leverage in international fora, leading to a CSDP with soft-power policy instruments (Howorth, 2007). Manners (2008) furthered this concept by suggesting that convergence of national strategic cultures, allowing for defence and security cooperation, is due to states recognizing the reduced efficacy of military force. These constructivist theories view the EU as a post-national normative actor in foreign policy.

Taking an opposite view, in an effort to strengthen security and defense in Europe, the EU created incentives for Member States to cooperate in security and defence, such as the European Defence Fund (EDF) and the PESCO. After reviewing the first submitted PESCO projects, it can be observed the great interest in traditional military sectors and operations, such as the development of armaments, and joint operations between for small- and medium-size states. This policy exemplifies medium-sized countries' ability to take part in large weaponry supply chains, as well as revealing the economies of scale

resulting from joint participation. As a result, more sophisticated and expensive projects became attractive as their high potential benefits were liable.

In contrast to constructivist thought of EU as normative power, the economic analysis (Weiss & Biermann, 2018; Andersson, 2015; Van Scherpenberg, 1997) highlighted the economic interests of private firms that have driven cooperation in sectors such as arms development, motivated by the potential for profit. This school of thought suggested that rapid technological changes and intensifying competition in capital-intensive fields like R&D have spurred the European collaboration (Weiss & Biermann, 2018).

Aside form the potential economic benefits, the new European cooperation initiatives on defence and security have shown the EU's interest in traditional military power. Is it possible to convey this transition within a constructivist approach? Or should the new cooperation policy of the EU be explained by institutionalist rational approach?

Nevertheless, constructivist theorists posit that the alignment of national interests and strategic cultures is contingent upon the consideration of various factors, including shared experiences from joint missions, similar threat assessments, and elite socialisation within mutual institutions (Meyer & Strickmann, 2011). Various PESCO projects are designed to address these ideational elements in order to bolster convergence between national strategic cultures.

The concept of elite socialisation has been identified by neo-functionalist too as the key factor in both European integration and common strategic culture (Smith, 2004). The theory of the elite socialisation suggests that, through regular contact in EU institutions such as the Political and Security Committee (PSC), the European Union Military Staff (EUMS) or the European Defence Agency (EDA), national policy elites converge towards greater consensus, agreemnets and common views. In this way, an epistemic supranational community develops to weaken the efforts of individual states (Haas, 1992; Cross, 2013).

The re-launch of the CSDP, initiated in 2016, indicates a sudden shift of defence cooperation. Since Èlite socialisation is a gradual process, the shift cannot be attributed solely to this factor. According to Jenkins-Smith & Sabatier (1994), changes in core aspects of policies require non-cognitive factors exogenous to the subsystem. Neorealists posited that structural political changes, such as Russia's recent assertive foreign policy, can serve as impetus for changes in policy core aspects. Therefore, while Èlite socialisation may have played a role in the re-launch of CSDP, it is not the only change factor.

In addition to the previous critique, constructivist thought failed to appreciate the role played by EU agencies in gathering, reshaping or influencing national preferences to optimize the resource distribution. This research seeks to explore the conditions under which the agency of EU actors is beneficial to the system and to ascertain their role in the process of fostering increased defence cooperation. It will do so by investigating whether the agencies fostered convergence between different national interests and lead to cooperative outcomes.

EU agencies have often been neglected in the traditional intergovernmentalist and neorealist literatures, but constructivists have sought to address their role. For instance, the 'Theory of Structuration' (Giddens, 1984) suggested that political actors and the structure of the CSDP are 'mutually constitutive'. However, the theory fails to properly consider how EU agencies contribute to the European security and defence cooperation policy subsystem, for example suggesting preferential patterns of cooperation.

Within the EU cooperation on defence and security, EU agencies have exerted considerable influence over governments, resulting in a shift of the 'peripheral' and 'operational' preferences of national actors. In the PESCO, through they agency of evaluation and assessment of defence projects submitted by national actors or private firms, EU institutions and agencies worked influence preferential patterns of cooperation, enhancing integration and defence policy convergence. As a result, agencies reshaped national actors' perceptions of their interests and reconfigured their strategic cognitive paradigms

to align States with EU objectives. This dynamic is best understood through the lens of rational choice institutionalism, which enables us to understand the salient aspects of the socialisation processes within a collective-action model (Dyson & Konstadinides, 2013b; Meyer & Strickmann, 2011; Sabatier & Weible, 2007), and the resulting 'institutional effect' (Botcheva & Martin, 2001).

1.1.2 Rational Choice Institutionalism narrative in European cooperation

Rational choice theories have become increasingly popular amongst researchers studying international cooperation. Indeed, states' proclivities to institutionalise their relationship brought scholars to investigate whether institutions matter at all or not, and their eventual casual effect on behaviour of their participant member states. Despite some criticism to their empirical validity (Mearsheimer, 2017), scholars began to explore the underlying logic that Institutions hold over their participants through examples of outcomes that are difficult to explain without taking into account the role of institutions (Botcheva & Martin, 2001). In particular, the Rational Choice Institutionalism (RCI) approach has been employed to assess the influence of EU institutions on member states decision-making process (Pollack, 2007), to explore the preferences formation, seen as an endogenous process, and then to explain the political outcomes of the agreements (Greif & Laitin, 2004; Büthe, 2006).

The RCI's ability to formalise both independent and dependent variables, as well as collect systematic quantitative data for hypothesis-testing make it a strength among theory-based studies of EU politics. Examples of areas where RCI has found empirical support include MEPs' responses to institutional incentives when voting on legislation, and the Commission's influence over Member States through principal-agent analysis

(Pollack, 2007). Hence, institutionalist work try to empirically assess whether European institutions foster cooperation and influence state's attitude to cooperate in situations in which they would otherwise find cooperation difficult. To this extent, literature records account for instances in which institutions have led states to behave in a more cooperative manner and also have enhanced patterns of cooperation (see Mitchell, 1994; Martin, 1994), including military cooperation (Duffield, 1992). But not always international institutions' primarily goal was to enhance member states cooperation, it mostly depend on the institutional's desired goal and scope. Indeed, institutions feature a specific-issue design: they have been created to address some specific fallacies and they often clearly aim a specific state behaviour: as in the PESCO for instance, where the primarily scope is to increase cooperation and defence capability, it occurs throughout the twenty more binding commitments, and its institutional design aims to address a collective action dilemma, that hampers defence cooperation, through enhancing cooperative behaviour among its members. But other international institutions, such as the NATO instiutionalised military alliances may set different goals, consider for instance the NATO Politics of 2% in military spending agreed by its member states in 2014 that has more to do with coordination than cooperation in a strict term.

Nonetheless, since most of these studies on international cooperation maintained a focus on cooperation as their dependent variable, the institutional effect under their scrutiny have been been treated through a single dichotomous variables: cooperation or not (see Botcheva & Martin, 2001). But the dichotomisaion of this dependet variable does not sim to fit with a plethora of institutional designs which aim to solve a variety of problems that eludes the simple resolution of collective action dilemma and that cannot be properly explain simply trying to ascertain if its participant cooperate or not. Indeed, these studies suffered from methodological biases and challenges of their validity since they could not offer explanations for alternative institutional effects on state behaviour.

Scholars like Botcheva & Martin (2001) advocated for a more discriminating de-

pended variable that fits better in describing institutional effect that were not previously caught by the simple dichotomised 'cooperate/not cooperate' variable. Indeed, they argued that EU institutions can lead to policy convergence or divergence among EU members depending on the design and objectives of the institution, and that the latter does not mean an institutional failure. Moreover, externalities are pivotal in their argumentation: on the one hand when externalities are high for member states, they are more likely to experience policy convergence. On the other hand, when they are low divergence is more probable. Some states have increased gradually their cooperation while others do not, so some scholars advocate for a nuanced approach on the institutional effect, summarised in the question: "what effects institutions should have and under what conditions they should have these effects" (Botcheva & Martin, 2001, pag 1).

1.2 PESCO's institutional effect: a researchable problem

In the previous sections we explored how different academic approaches have been adopted to explain new developments in the EU cooperation on security and defence since the re-launch of the CSDP in 2016. Since the majority of them rely on an exogenous explanation (as structural realists did) and the focuses solely on the agency of member states, these theories are neglecting the role played by the EU institutions, most peculiarly, how they shape the preferences of the member states. Indeed, these new institutions, such as PESCO and CARD, were born with the precise goal to encouraged defence cooperation in which states would otherwise find co-operation difficult.

Investigating the role that these institutions have to enhance European cooperation requires to mention an important caveat in our theoretical framework. It refers to the so-called *epiphenomenality* (Botcheva & Martin, 2001). Being an institution created

by states for the states, PESCO responds to the changes of the geopolitical conditions and to changes of strategic interests, for example the changes brought about by the war in Ukraine. Thus, any variation of cooperation could result not only from institutional effects, but from changes in structural variables too. This is what scholars such as Botcheva & Martin (2001) meant, when referring to institutional endogeneity problem. Nevertheless, since our study focuses on the variation in patterns behaviour within a relatively short time frame that occurs from projects proposals to their adoption, it is unlikely that these variations are rooted into some structural changes. Rather, an examination of PESCO institutional design and the agency of EU actors is required to understand how they shape member states' cooperation. Furthermore, as explained in the previous section, one way to address the endogeneity problem is by avoiding dichotomous variable of whether member states decide to cooperate or not in a given project to confirm or rebut the PESCO's institutional effect. Indeed, as we will see in the our empirical chapters 3 and 4, the agency of EU agencies involved in the PESCO as its institutional design's effect on EU member states' defence integration is more complex than what a simple dichotomous variable—member states cooperate or not in a PESCO project—could explain.

Assessing whether member states comply with the 20 binding commitments, and if PESCO has been successful to overcome the collective-action dilemma, prevent us to explore alternative institutional effect that must be considered but do not belong to the dichotomised category of 'cooperate—do not cooperate' (Botcheva & Martin, 2001, pag. 4). This argument serves to prevent criticism originated in the unintended consequences and undesired effect of institutions which cast shadows on the modern institutionalist theory (Gallarotti, 1991). Indeed, one of the consequences of PESCO, as proposed by our research's findings, do not fall in the standard definition of cooperation. Conversely, preferential patterns of cooperation, differentiate integration and divergence can be explained as the result of an institutional effect. It is important to emphasize that they

are not meant as alternative measures of cooperation; instead, they are additional concepts of possible effects on state behaviour. Differentiated integration, and preferential patterns of cooperation, do not necessarily mean a PESCO failure.

1.2.1 Differentiated integration in EU defence and security

The European Union's differentiated integration approach allows member and non-member states to selectively participate in EU policies (Schimmelfennig, 2019), which has been lauded as a way to recognize that "one size does not fit all". While the Union can be beneficial to allow cooperation between member states, it can also generate unfairness (Leruth et al., 2019) due to different spillovers of policies to countries. Coded into EU treaties and legislation, it has resulted in labels such as "multi-speed Europe", or "Europe à la carte" - a contrast to uniform integration, where all members partake in the same policies (Schimmelfennig et al., 2023).

As the EU grew, its policies had to accommodate a variety of national preferences, so that differentiated integration emerged as a way to safeguard both the supranational institutional progress and the national peculiar interests. The Schengen Area Treaty is perhaps the most prominent example of the principle(Verhelst, 2013). Indeed, four non-EU countries signed the resolution, while two EU countries rejected it. This kind of selective implementation of treaties has been advocated to advance the integration, but also recognizing individual differences between member states. Nonetheless, as Brexit looms over the future of the European Union, the question of ìdifferentiated integration" has become increasingly central and questionable (see Markakis, 2020). On the one hand, proponents of this approach view it as essential for the EU's long-term survival and successful integration, while on the other hand other scholars opposed this principle, even though they recognize its potential benefits (Bellamy & Kröger, 2022). Moving forward, any revisions to EU treaties could be used to bolster differentiated integration, a concept

already included in existing documents. The implications of such a move remain mixed.

Differentiated integration allows greater fairness in cooperation among member states and at the same time enable some states to pursue the deepest integration without the constraint of the whole participation of member states. According to Bellamy et al. (2022), it provides the opportunity for specific member states to opt out of certain policies or be excluded from their applications until they met predetermined conditions. Differentiated integration is thus a powerful tool that could potentially facilitate more equitable collaboration between EU countries.

The flexibility of the approach is considered as the perfect formula for accommodating divergent strategic preferences between EU member states and for eluding the opposition to defense initiatives within EU framework (see Martill & Gebhard, 2022; Hoeffler, 2019). Thus far, differentiated integration has been successfully applied outside of the EU's core policy areas, indicating its potential as an effective tool for addressing complex regional security issues. For instance, the Nordic countries have employed a policy framework of differentiated integration to address their own particular defense and security needs as the coronavirus pandemic affected global security. But it is likely that similar strategies will remain essential in allowing Nordic countries to maintain a cooperative stance towards their own defense and security measures (Bengtsson, 2020).

Another clear example of how differentiated integration permeated the security domain is the European Union's Common Security and Defence Policy (CSDP). The CSDP has been traditionally characterized by an integrated approach, relying on the union of member states' capabilities to address common threats. However, the recent rise of differentiated integration processes has allowed for a more nuanced policy-making. For instance, in armament related issues, the CSDP seeks to interweave single market regulation with operational-military requirements around the issue of capabilities, thus granting the EU an unprecedented level of capability (Hoeffler, 2019). This approach emphasizes the EU's need to balance differentiation and integration in order to

ensure effective policy-making in security and defence domain. By exploring new ways to bridge the gap between regulatory processes and military capabilities, CSDP attempts to provide a model for how different approaches can be synthesized in order to develop comprehensive solutions (Hoeffler, 2019). This approach has enabled European countries to strengthen their multilateral defense cooperation, while also allowing for France to take a leading role in defense matters (the E21 initiative), and the Commission in humanitarian aid, civil crisis response, and various forms of rules and regulations (Rieker, 2021).

1.2.2 Differentiated integration in PESCO

Permanent Structured Cooperation (PESCO) is the latest and most dynamic example of Differentiated Integration (DI). Through selective membership, external participation, and project-based clustering, PESCO introduces a novel form of differentiation in EU security cooperation (see Houdé & Wessel, 2023; Martill & Gebhard, 2022). Scholars Houdé & Wessel (2023) questioned whether DI in PESCO is constrained by principles of consistency and sincere collaboration. More fundamentally, they query whether there can be a balance between commonness and differentiation in EU security policy. Thus, DI within the PESCO raises questions about its compatibility with the EU's core principles and whether it still contributes towards a shared policy. So, PESCO offers the most malleable form of differentiated integration among those provided for in the Treaties, it has still produced a notably inclusive expression of enhanced cooperation - albeit at a cost (Blockmans, 2021).

Since the participation to PESCO does not require to participate in all projects , but at least in one, as required by binding commitments, it provides an avenue for differentiated integration. Such a principle offers member states significant leeway, thereby creating a path for the deepening divergence of EU defence integration. PESCO initia-

tive has been widely touted as a way to increase efficiency in national defense spending, reduce competition between national industrial interests, and create a less fragmented defense industry. However, the potential drawbacks of PESCO must be taken into account. The framework could lead to an excessive reliance on national realities instead of expertise, impeding the development of functional military products (National representative, PESCO, interview). Furthermore, many of the projects launched or planned under PESCO have already existed prior to its implementation and have simply been placed under the framework in order to expedite their progress (Blockmans & Crosson, 2019). Given that differentiated integration can produce complex configurations with distinct forms of differentiation, PESCO stands out for its complexity in this regard. It combines elements of both internal and external differentiation along with differentiating integration and cooperation structures (Martill & Gebhard, 2022). Despite these challenges, PESCO initiative is a remarkable attempt to create a unified military infrastructure across the continent. According to interviewed national representatives, the benefits of PESCO are manifold: it could lead to an improved transparency between member states, greater efficiency in the EU's industry and internal market as it might trigger economies of scale, making it pivotal for improving the efficacy of defence spending and potentially harmonize military equipment across the EU. Nevertheless, it faces a number of obstacles that could impede its success. Prioritization of projects is one such barrier. PESCO initiatives are generally aligned with Common Defence Priorities (CDP) across 11 domains but do not address capability shortfalls that loom at a lower level of ambition (LoA), as the first wave of PESCO has shown. There is also serious challenges on project timelines, as well as an ongoing struggle to separate member states from political and industrial motives that impede cross-border cooperation. While all these motivations account for the overall success or failure of PESCO it is pivotal for our analytical framework to understand what we mean for success or failure and that depends on what kind of problem PESCO is aiming to address from a conceptual standpoint.

1.3 The Defence collective action dilemma and PESCO's rationale

Since PESCO overall goal is to foster cooperation among its members, then its institution would have been designed to overcome specific collective action problems. But this argumentation is misleading as not every institutionalised relation between EU member states are designed to address every problem of collective action. Different institutions are meant to solve different problems (Botcheva & Martin, 2001) and, as PESCO addresses a variety of defence issues, it is trivial to put them all in a single category called "cooperation", see 1.2. What is important for our research is to understand whether PESCO necessarily represent a case of resolution of collective action dilemma or not.

Collective action dilemmas posits that, when member states share a common aim, there is a risk of suboptimal outcomes arising from those who do not contribute their fair share[2]. As happens in all Public Good games, (Binmore, 2007), this phenomenon is the result of two factors, some state does not contribute because it expects that others will do their work at their place and moreover, the state fears of being taken advantage by the free-riders that do not contribute. The implications are far-reaching: if member states fail to recognize and solve this dilemma, they may be unable to achieve their shared goal. To this regard, PESCO has emerged as a potential solution to the collective action problem implied in the public good game. By facilitating cooperation between EU member states, PESCO seeks to strengthen their military capability and interoperability between its members. However, the issue PESCO is facing does not seem to fit perfectly with the typical collective action dilemma for a couple of reasons. First, in a collective action dilemma, individuals have incentives to free-ride, resulting in an

[2]Collective rationality advocates for a Pareto-efficient equilibrium in those cases where one exists. However, the Stag Hunt Game declined used by experts in inter- national relations draw attention to the limitations of rational diplomacy (Binmore, 2007)

unsatisfactory outcome for all parties involved. This can be seen in instances of public goods provision, where individuals may benefit from the good without contributing to its production. Such scenarios demonstrate how collective action can be undermined by incentives to shirk obligations and reap rewards at the expense of others. But this is not the case of PESCO; the Ireland non participation in almost every project does not mean that the country is free-riding at the expense of others, because the benefits of one project are shared only between the participants. This is exactly the rationale behind the differentiated cooperation approach adopted by PESCO, in which different levels of integration are manifest among member states. All EU countries have the option to join a given PESCO project, yet not all have decided to take this step. Moreover, each state is free to involve itself in different projects, or with varying intensity, according to their country-specific priorities and capabilities. Moreover, member states may participate in different projects or at different levels of intensity, depending on their national priorities and capabilities. This approach was meant to provide a more effective and efficient engagement in projects, as only those member states able to contribute in areas where they have a comparative advantage would have join a specific project.

The resolution of a pure collective action dilemma would have entailed a monitoring mechanism to ensure member states compliance and some punishment provision whenever a state fails to comply with the rules. Those mechanisms are not present in the PESCO institutional design or are too weak and unlikely to be adopted. For these reasons it would be inaccurate to assess the failure or the success of PESCO solely based on the lenses of cooperation since it is not a pure case of collective action dilemma resolution. Instead, PESCO fits better in another kind of game such as coordination game.

1.3.1 PESCO as a coordination game

PESCO's institutional design reflects the coordination problem that is often discussed in studies of international institutions (see Botcheva & Martin, 2001; Snidal, 1985; Stein, 1982). This type of games takes the form of a battle of the sexes or a prisoner's dilemma. In the former, two individuals must decide which event to attend, despite having different preferences. The latter involves two people determining whether to cooperate or defect for mutual gain. Both scenarios illustrate how actors may need to coordinate their actions to achieve an optimal outcome. PESCO can be seen as a coordination game, as it involves member states aligning their military capabilities and efforts to achieve a common goal of a stronger European defence. Both in the prisoner's dilemma and in the battle of the sexes, players must communicate implicitly (as in the repeated prisoner's dilemma) or explicitly (as in the battle of the sexes) to coordinate their actions. For example, in the context of PESCO, member states need to align their military strategies and capabilities to work together effectively and to avoid conflicting efforts. However, it does not necessarily represent a collective action dilemma since member states do not have an incentive to free ride on the contributions of others, leading to a suboptimal outcome for everyone. While there may be challenges to achieving an effective coordination among member states, as explained in the previous section, PESCO is designed to promote cooperation and coordination and its success will depend on the ability to coordinate member state's actions to work together effectively towards common goals. This being said, from a methodological standpoint, to assess the success or not of PESCO a more accurate measurement of institutional effects is needed, since the simple definition of cooperation as a resolution of collective action dilemma does not fit in here. As we will better explain in the next chapter, addressing PESCO as coordination game implies variation in state behaviour as our dependen variable. This offers a more reliable indicator

of PESCO's institutional effects[3]. These variations are measured through the formation and variation in the preferential patterns of cooperation measured by the Jaccard index.

[3]For a better explanation on how variation in state behaviour measures institutional effect (Botcheva & Martin, 2001, see)

Chapter 2

Research Design and Methodology

Introduction

This chapter outlines the research design and methodology used to analyze the empirical data of this research, which aims to frame the interaction within PESCO through a utility function. It elucidates how different terms comprising this function will be further evaluated based on which data will be collected and for what purpose. It further expounds upon the methods utilized to collect data and test hypotheses. Conclusively, this chapter delineates the research question and subsequent hypothesis, in addition to outlining the methodological approach taken to answer them. From a methodological standpoint, it further highlights the importance to measure and test the changes of preferential co-operation patterns through Network Analysis as a mean to validate our

hypothesis.

2.1 Methodology, conceptualisation and operationalisation

We propose that the study of PESCO initiative should concentrate directly on patterns of member state behaviour. In order to ascertain the institutional effect of PESCO, this research will measure any variation of preferential cooperation patterns, as well as the level of cooperation, between EU member states. I will compare states' behaviour before and after the so-called 'clearing house workshop', that is, the event in which the EU agencies present their assessment reports about the submitted cooperation projects, and I will determine the variations occurred after the projects evaluation. Due to the short period of time between the initial application and the final approval, variations are unlikely attributed to structural changes, as they normally take much longer time to make effect. Conceptually, this would avoide the epiphenomenal problem. From a methodological point of view, I will measure and test the changes of preferential cooperation patterns through Network Analysis. The overall patterns of state behaviour are measured using the *modularity*, a statistical index of social proximity and preferential relationships, and an innovative aspect of our research is the use of maximum modularity algorithms to test the statistical significativity of their variations with time. Furthermore, I will use an additional similarity algorithm and test the mean and standard deviation between proposals and adopted project.

Our analytical framework lies on the institutional effect, therefore it is necessary to identify appropriate outcome variables to assess the effect that steams from the Institution. Authors of Botcheva & Martin (2001) contended that these variables should be based on the on the specific problem and the institutional design the model tries to address, namely, in our case, the EU initiatives designed to foster cooperation and

integration. With this in mind, our choices in exploring the above mentioned outcome variables (variation in preferential patterns, and metrics on social proximities) are grounded in their ability to explore PESCO institutional effects. We wished to elude the standard category 'cooperation—no cooperation' as dependent variable, see our motivation in 1.2. By doing so, we can gain a wider understanding of the variations of PESCO pattern behaviours. In our theoretical framework, it means also to ask whether PESCO might contribute to foster member states defence integration or promote a differentiated integration, interpreted as a consequence of its institutional effect. My study also relies in descriptive statistics to provide insights about fulfilled commitments. In sum, by carefully examining these various indicators, the study aims to better understand the PESCO institutional effect on its members.

Before delving into the patterns of preferential cooperation as a product of the institutional effect (chapter 3), we first clarify the logic of member state interaction within PESCO under the lenses of a cooperative game. In section 1.3 we already explained from a game theory perspective what collective action dilemma PESCO tries to figure it out, now we are going to dig deeper and formally frame the cooperative game. In this model, each country is presented with a decision-making process in which they must rationally weigh their costs and benefits of proposing, supporting, or joining projects. Additionally, preferential patterns of cooperation can influence how countries ultimately decide to join or not projects, while rules embedded in PESCO design add further complexities to the game. For example, the unanimity ruling procedure for project adoption creates an incentive for countries to cooperate and communicate with one another, while simultaneously making it more difficult for any one to dictate an outcome. EU agency assessments are not binding, they are a form of moral persuasion forcing them to consider external evaluators' feedback.

From a conceptual standpoint, the following utility function characterizes the pref-

erences of state i involved in the PESCO project:

$$u_i(X) = B_i + \sum_{j \in X} C_{i,j} V \tag{2.1}$$

where X is the set of countries that join a project, $C_{i,j}$ is the level of cooperation between countries, with higher values indicating greater levels of cooperation, V is the marginal value of cooperation, while B_i is the value of the project for nation i, independent from other nations' behavior. Considering the role of EU agencies required by the PESCO institutional design, the utility function changes as follows:

$$u_i(X) = wA_i + (1 - w)B_i + \sum_{j \in X} C_{i,j} V, \tag{2.2}$$

where w represents how much weight is given by a country i to EU agenciesí assessment of a project. I assume that this value is between 0 and 1 and reflects the level of confidence in the assessment, and A_i denotes the value of Agencies' assessment. The comparison between the two functions denotes the role of EU agencies and how it cause variation patterns of preferential cooperation since w affects B_i and therefore the decision to participate or not in project j.

The methods used to determine the various terms composing the function is as follows: X will be determined by counting the amount of member states that have joined the project. B_i, the interests, is expressed by the variables 'project leader', 'project partners' and 'project observer', to determine when the interest is 'high', 'medium' or 'low' respectively. This information has been gathered through interviews, official documents and reports. $C_{i,j}$ is calculated using a similarity algorithm known as Jaccard coefficient which is used here to express social similarity. V as cooperation value, whether or not a project has been submitted by a member of country's preferential group, is assessed through a clustering technique, known as hierarchical clustering, that is then

tested and validate by the modularity maximisation method. A_i, the assessment of EU agencies, is based on the report the Agencies give for each proposed project. Table 2.1. Summarizes our research framework and methodology used to determine each terms of the function.

From the comparison of function 2.1. and 2.2. it is clear how the role of EU agencies affect the utility function of a member states and therefore its rational decision to join or not a given project. In particular, when wA_i is higher than $c_{i,j}V$ it can foster integration between countries that are usually not so close. On the other hand, it can reinforce differentiated integration when they both have high values. Nonetheless, while A is operationalised by looking at report's assessment for every submitted projects, the w value (weight that is given by a country i to EU agencies's assessment on project j) has to do with Agencies' credibility and reputation.

Linked to the EU agencies's assessment, we assume the distinct knowledge and competence held by EU agents, enabling them to exercise considerable sway over the policy-making process. It is assumed that other participants in this process, such as national actors, lack this level of knowledge which makes it impossible for them to wield similar influence; moreover, we assumed that security and military policy-making relies on technical competence and rational judgement (Majone, 1997). In a field marked by mistrust, knowledge and data are essential components for a system of coordination and cooperation that only third parties involved can offer.

The above utility functions can characterize a coordination game model, consistent with our rational choice theoretical framework. This is particularly evident in the defence cooperation initiatives within the EU framework, in which the stakes of individual decisions are high, so calculation of utility is possible and the rules of engagement are delineated (such as within PESCO procedures and CARD mechanisms).

Rational choice theory dictates that individuals make decisions based on their ex-

Table 2.1: Research design framework

Expected utility when projects are submitted		
Terms		**Indicators**
1.1) X	$\Rightarrow$	• the set of countries that join a project;
1.2) B_i	$\Rightarrow$	• the value of the project for nation i, independent from other nations' behavior;
1.3) $C_{i,j}$	$\Rightarrow$	• is the level of cooperation between countries, with higher values indicating greater levels of cooperation;
1.4) V_i	$\Rightarrow$	• is the marginal value of cooperation;
Changed expected utility when projects are assessed by Agencies		
Terms		**Indicators**
1.5) w	$\Rightarrow$	• represents how much weight is given by a country i to EU agencies' assessment of a project;
1.6) A_i	$\Rightarrow$	• denotes the value of Agencies' assessment;
1.7) $1 - w$	$\Rightarrow$	• the value of the project for nation i taking into consideration the Agencies' assessment
Data collection		
Terms		**Methods used to collect data**
2.1) X	$\Rightarrow$	• by counting the amount of member states that have joined the project;
2.2) B_i	$\Rightarrow$	• by the variables 'project leader', 'project partners' and 'project observer', to determine when the interest is 'high', 'medium' or 'low' respectively;
2.3) $C_{i,j}$	$\Rightarrow$	• by a similarity algorithm known as Jaccard coefficient;
2.4) V_i	$\Rightarrow$	• by a clustering technique, known as hierarchical clustering;
2.6) A_i	$\Rightarrow$	• by the report the Agencies give for each proposed project.

pected utility they will gain, and it appears that member states consistently respond to material incentives.[1]In this regard, participating Member States have found great appeal in the European Defence Fund as a way to get involved in EU defence and security cooperation.[2]

In Chapter 3, I will try to unveil the patterns of preferential cooperation and their variations, that are the terms in the second part of the utility function. The Chapter is focused on network analysis, that is proved to be an extremely useful tool to explore patterns of cooperation in many other applications, see (De Nooy, 2003). Thus, the research uses it to map out patterns of preferential cooperation before and after the agency of EU institution in the form the community they make around patterns of cooperations. Furthermore, through the analysis of *nodes centrality*, I will evaluate which actors are the most relevant. Research suggests that network analysis can offer a comprehensive view of governance structures and state power (Mérand et al., 2011). This approach does not necessarily serve as a theoretical concept, nevertheless it does provide an effective formal representation of social relations (Knoke, 1994). In this research, it is used to represent relational data between participants in the projects, and it offers a unique glimpse into the complex dynamics at play within the PESCO space.

In Chapter 4, I will dig deep into projects' assessment and evaluation performed by the Agencies (the first part of the function). In Chapter 5, I will present the collective action dilemma in defence cooperation and how PESCO institutional design overcomes it. The collective action-dilemma dynamics explained in Chapter 5 will elaborate a theory behind the findings about variations in preferential patterns of cooperation examined in Chapter 3.

[1]Though also modernist constructivism of the literature on CSDP recognises that material factors are important in inducing preference changes Meyer & Strickmann (2011)

[2]On 7 June 2017 the Commission launched European Defence Fund. The Fund addresses two distinct strands: the research and the development and acquisition. In the first case the EU is financing with 90 million until the end of 2019, with 25 million allocated for 2017, and 500 million per year after 2020. In the second case, the EU offers co-financing with 500 million in total for 2019 and 2020, under a dedicated defence and industrial development programme and 1 billion per year after 2020

2.1.1 Research's theoretical design

The European Union's rapid development of defence initiative has been largely attributed to external forces of change, see section 1.1. My research is examining how particular institutional dynamics, such as those embedded into Permanent Structured Cooperation (PESCO), may have influenced cooperative outcomes. Analysts are now turning their attention to theories about endogenous preference formation and internal sources of change, with rational choice approaches proving particularly helpful (Pollack, 2007). This has highlighted a gap in empirical studies about EU security and defence cooperation, which have so far failed to draw upon both constructivist and rationalist approaches as their main theoretical frameworks.

Despite the potential tensions between these two schools of thought, it seems reasonable to me to take a problem-oriented approach rather than a method-oriented one, therefore avoiding any missteps arising in research inspired by ontological debates only, (see Wendt & Fearon, 2002). In the realm of European Union studies, scholars have cautioned against getting caught up too much in theoretically oriented debates, see for example Fearon and Wendt (2002) where authors warned against potential pitfalls of organising a research around ontological debate because it may lead scholars to ignore important questions that do not fit into that grand debate. They urged instead for a dialogue between different perspectives and emphasized the importance of empirical work based on falsifiable hypothesis (G. King et al., 2021). my research relies on a two distinct dialogues between rationalist and constructivist (see Jupille, 2004). They are the *sequencing approach* and the *subsumption approach.*

The sequencing approach states that theory should be the one that best explains a particular feature of the process of action; and that ìone theoretical account temporally depends on the other to explain a given outcome" (Della Porta & Keating, 2008,

pag.66). Indeed, the formal PESCO provision may be accounted for by the thoery of liberal intergovernmentalism (Moravcsik, 1993). But the following phase of ëclearing house/clarification workshop', which put the place for the role of EU agencies, as required by the formal rules of procedures, is better captured by the theory of endogenous institutional change, based on bargaining theory, see (H. Farrell & Héritier, 2003; Héritier, 2007).

The subsumption approach states that one theory subsumes or incorporates the other (Jupille et al., 2003). In this research, rationalism embeds the credibility and reputation of EU agencies, plausibly explained by constructivism, that come into play whenever a submitted projects receive its assessment based on rational choice. Here, constructivism deepens our analysis about preferential patterns formation. The *subsumption approach* is particularly useful in the interpretation of the findings. because it avoids ontological pitfalls (Nielson et al., 2006). The added value in using this two distinct modes is that each theory better addresses variables that are pivotal in member state's preference formation that would otherwise be at the margin when using just one theory.

2.1.2 Research question

In the previous chapter, I explored how the tendency of institutionalizing state relations led to initiatives to solve the collective action problems involved in international coordination and cooperation. I highlighted that not all institutions are established to solve the same problem, conversely the 'institutional effect' is dependent on what kind of collective problem is to solve. I explained why, instead of being a pure solution to a collective action dilemma, PESCO addresses a typical coordination and cooperative game. This being said, we now considered how the institutional design can either increase cooperation and defence integration or have unintended consequences as differentiated

integration. These arguments bring me to our primary research queries: *What is the impact that the PESCO institutional design have on member states' defence cooperation? Under what conditions does this effect occur? And what is the role of the EU agencies to shape nations' decisions?*

Here, I specify my hypothesis more clearly:

H1: Any variation in preferential patterns of cooperation confirm the PESCO's institutional effect on state behaviours.

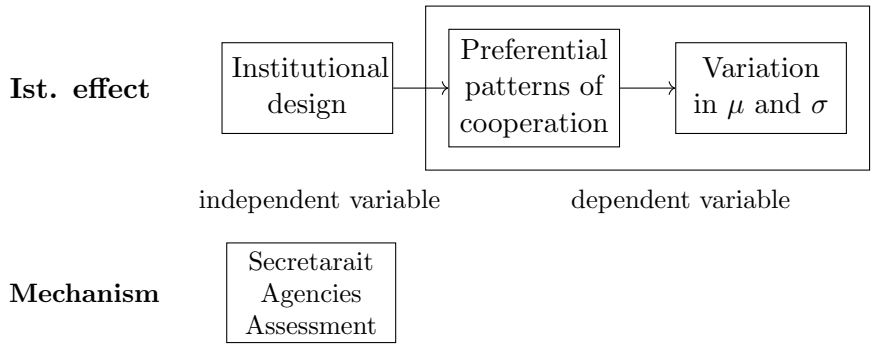
- **1a.** Differentiated integration occurs when variation in state behaviours lead to more scattered preferential patterns of cooperation.
- **1b.** Cooperation increases when preferential patterns of cooperation are less segmented.

H2: When submitted projects are evaluated, the agency of PESCO Secretariat can determine the following variations:

- **2a.** Whenever the EU agencies assessment diverge from State's preferences, mean and standard deviation increase and variation in preferential patterns cooperation occurs.
- **2b.** Whenever the EU agencies assessment converge with State's preferences, mean and standard deviation decrease and the variation in preferential patterns of cooperation are minimal.

The independent variable is linked to how PESCO was designed, its mechanisms and the agency of its actors involved and how they affect the dependent variable upon which we assess the effect on state behaviours. Thus, the dependent variable that we consider is the preferential pattern of cooperation, measured through the Jaccard index.

Figure 2.1: Research's analytical framework



The Jaccard index is measured before and after the projects approval and its variation, summarized in its average μ and standard deviation σ, let us interpret the role of the PESCO secretariat, namely, whether it contributed to increase or decrease cooperation, and how it affected the differentiate integration approach that distinguishes PESCO.

As regard the mechanism involved, the increased role of EU institutions asks some important questions: what is their discretion and autonomy vis-à-vis government submitted projects? What are the instruments and the mechanisms granted to EU agencies to develop the EU cooperation on defence and security? Beyond these questions, this research investigates the discretion and autonomy that EU agencies hold, and their impact on the government preferences in joining, supporting, and adopting projects. How do EU agencies operate in order to achieve a common Europe security and defence policy? Do they rely on credibility and reputation, such as the expertise in carrying out cooperative projects, or do they rely on the social process, that is an indicator of social ties? Therefore, is it possible to define an Europeanisation phenomena of security and defence at an intermediate level between the member states and the European Council, that stems from the agency of EU actors involved defined as an endogenous institutional change.

2.1.3 Access to data

As I focus on institutional effects over defense cooperation, my data will largely derive from EU working documents that are exchanged between institutions. These documents let me detect how the institutional design of PESCO worked in practice, how the agencies involved in the PESCO system collaborate between them to examine and evaluate submitted projects. These documents are pivotal for understanding two essential dependent variables of my model: variations of patterns of preferential cooperation and levels of participation in projects. They also help to understand how the mechanism resolves the collective action problem.

Even though my research is focused on the institutional design of PESCO, it broaches topics in the security and defense sector that can be sensitive. Questions about access to documents may arise, therefore it is necessary to remind Article 1 of the Treaty on European Union, which outlines principles of transparency, as well as Article 15(3) of the Treaty on the Functioning of the European Union, and Regulation 1049/2001 of the European Parliament and Council concerning public access to Parliament, Council, and Commission documents. This particular principle allowed me to access a large body of documents from EU agencies. Indeed, these entities must adhere to Article 15(3) and Regulation 1049/2001 as well. Moreover, many agencies have established open sources online as well as press releases which I have easily accessed for further material consultation.

The European Union's Regulation 049/2001 grants citizens the right to access documents from all of its institutions, bodies, offices, and agencies, including the External Action Service (EEAS) and European Defence Agency (EDA). This rights of access applies to all documents which EDA holds relating to policies, activities and decisions falling within the responsibility of EDA. The EDA and EEAS have already made some documents available on their websites through a special register of documents which I

have consulted. Moreover, I made formal requests to access classified or unpublished documents related to the agencies' areas of activity that have not been made public. As stated on its Access to Documents policy, EDA may disclose confidential information to third parties, if the recipients of the information are bound by an obligation of confidentiality. Same applies to EEAS agency and the access to their documents. EEAS also provides an access to all its Public Register which contains documents relatively to Proposal and recommendations transmitted by the agency to other EU institutions or bodies, as well as working documents and documents internally approved. Furthermore, the Public Register contains decision documents of the EEAS hierarchy of general application on administrative, staff, financial, procedural and other internal matters.

Chapter 3

Assessing the role of EU actors within defence initiatives

Introduction

In the realm of security and defense, a shift has been observed from an intergovernmental approach to one of multi-level governance. With regard to defense cooperation, classic theories of European integration have largely tended to focus on the reasons for its occurrence and neglected analyzing how the EU operates in this domain. Even less attention has been given to the role of EU agencies in this decision-making process. In order to estimate properly our terms w and $(1 - w)$ of our function 2.2., it is important to underly some theoretical concepts about influence, reputation and credibility that EU agencies deemed to hold when they are carrying out their tasks.

Constructivism presents an opportunity to investigate the concept of agencies' in-

fluence on EU security and defence, as well as the conditions and mechanisms through which the EU actors involved in PESCO exert their influence. In this light, a thorough examination of existing literature is necessary to understand how these actors contribute to the institutional effect and shape member states' decision-making. Empirical evidence for these arguments can be found in chapter 5. This approach is consistent with our goal of fostering dialogue between different schools of thought through the *subsumption approach* (see section 2.1.).

Furthermore, the chapter explains the rationale behind the selection of the European Defence Agency (EDA), and European External Action Service (EEAS) within the Permanent Structured Cooperation (PESCO) framework. It outlines how they uses its expertise to assess projects, what data is collected, and how it is analyzed. Ultimately, this chapter seeks to understand how these agencies exerting their knowledge influence the rational choice of member states to join or not a project, thus shaping decision-making selection processes.

Chapter's data collection

Having conducted thorough research into the PESCO mechanism, we have relied on both official documents and qualitative interviews with its actors for data collection and analysis. Here, we discuss the shortcomings and advantages of both sources of information.

Policy research often relies on two distinct sources of information: documents and people. We could argue that data falls into the first category and is frequently employed as a means to assess current political dynamics. In this chapter, official Council documents, along with those of other EU institutions and agencies, are considered primary sources for this type of research; they offer insight into the policy positions held by authors at a certain point in time, as well the purpose of these documents.

In order to gain a comprehensive understanding of the European Union's (EU) policies and regulations, this research utilized a variety of documents, such as expert advice reports and assessment, technical supports, guidelines, and annual reports. While some of these documents were accessible online through the Agencies' websites and EU document archives, other documents were not publicly available. To access these records, a formal request was submitted to the pertaining institution. In addition to the documents gathered through these channels, interviews were conducted to reconstruct certain parts of the documents that had been kept confidential due to their sensitive nature.

3.1 Assessing agencies' influence in coordination game

The EU agencies are self-sustaining mechanisms of expertise and knowledge, offering a unique opportunity to collect and analyze technical and scientific data, provide policy input, and help inform decisions. As the agencies perform their daily duties, they continuously accumulate more experience and knowledge to become increasingly useful for policy makers (Ossege, 2016; Gehring & Krapohl, 2007; Vibert, 2007; Majone, 1997). This makes them invaluable assets in making informed policies. Despite the limited research on the influence of EU agencies, a survey of existing literature on other policy actors—such as interest groups and bureaucracies—reveals some common determinants that can be used to assess how much weight member states give to agency assessments within PESCO. While distinct in their institutional setup from EU agencies, interest groups and bureaucracies share certain similarities in the way they attempt to exert influence, particularly in policy-making processes. Such actors can provide policymakers with information, expertise and specialized knowledge that is essential for informed decision-making (PESCO national representative, interview).

Scholars have attempted to develop frameworks to analyze the influence of inter-

est groups and agencies on decision-making processes stressing the importance of "intentional communication" of information by interest groups (Betsill & Corell, 2008; Chalmers, 2011; Kim, 2018). These intentional communication refers to both technical information and claims of legitimacy, which eventually lead to "alteration in state behaviour" in response to these information while confronting with a rational choice . Examples of how this approach has been used include examining the effects businesses have on European policy outcomes (M. K. Rasmussen, 2014). This method is effective in linking actor's use or non-use of data with its impact on the decision-making process.

Additional framework of analysis focuses on information processing, Chalmers (2011) develops two alternative dimensions: "information gathering" and "information transmission". Information gathering which analysis how policy actors seeking influence accommodate the demand for information by EU decision-makers, and information transmission, which focuses on the type strategies adopted to deliver it, and who are the addresses of the strategies. Chalmers argues that information-driven approach is essential to analyse the influence of policy actors, and that it appears useful when conducting comparative analyses of EU interest groups is required. Kim (2018) integrates the two previous framework by proposing a three-dimensional approach: the production dimension, the provision dimension and, finally, the influence dimension. The first dimension refers to agency capacity to producing knowledge; the second dimension concerns the paths through which expert advice are delivered to; the third dimension accounts for the degree of agency's influence during the decision-making process.

This three-dimensional approach better accounts for the agency of EU actors within a coordination game because it focuses on the relationship between production and provision of expert advice—omitted in the two dimensional framework—while analysing their effects on policy outcomes. By focusing on the nature and scope of agencies themselves, Kim's (2018) analysis is more comprehensive since it begins before the transmission of information occurs (Betsill & Corell, 2008). Her framework examines both the produc-

tion and provision of expert advice within EU agencies by questioning the nature and scope of agencies as well as their capacity to guarantee high standards of expertise.

Furthermore, expertise is not considered to be the only source of influence, since further conditions of influence have been added and analysed simultaneously. Compared to Chalmers (2011), this more comprehensive approach is important because it has the potential to explain from an earlier stage, such as the initial project proposals stage, the influence of EU agencies on defence and security cooperative projects. Moreover, it can explain why agencies succeed in their attempt to influence pMSs and European Council in the very first phase of decision-making process, 'the clarification workshop' or 'clearing house'. Chalmers acknowledges that is hard to find evidence of influence in "changed minds and policy outcomes" because actors tend to influence like-minded decision-makers while not engaging with those who have opposite view. However, this is not problematic in the cases when actors dealing with coordination game and porous to expert advice due to high technicalities content present in these security policies. These stakeholders are potentially more susceptible to agencies' influence that may shape their decisions and content proposals. Indeed, as a PESCO officials working on the first wave of PESCO confirmed: In the first wave almost none of the member states were equipped to deal with such a situation; no one had a clear idea on how to proceed, which is the reason why the first wave of proposals were underrated by the Secretariat (PESCO official, interview). In need of experts feedback, member states relayed heavily on Agencies as source of knowledge and information.

In their pioneering work on interest groups, Betsill & Corell (2008, p. 69) argue that clearer sign of influence are: *lobby activities* such as submitting information and reports to a particular stakeholders, *access to negotiations* and *resources* they bring to bear, such as financial assets, networks with other experts or relevant policy actors. Access (α), activities (β) and resources (ρ) are the three conditions (independent variables)

that constitute and affect the influence EU agency (dependent variable), which in our case represent the w term of the u_i function 2.2. for a given member states. The Agency's influence is thus translated as the weight a member state gives to the Agencies' assessment on PESCO projects. These three conditions, as expressed in equation 3.1. are crucial in the the utility function 2.2 because conceptually when one of them changes it changes the weight is given by a country to EU agencies' assessment of a project as well, consequently affecting state's rational choice.

$$\begin{aligned} u_i(X) = wA_i + (1-w)B_i + \sum_{j \in X} C_{i,j}V \\ w = f(\alpha + \beta + \rho) \end{aligned} \tag{3.1}$$

While maintaining their core assumption, as proposed by Betsill & Corell (2008), these conditions have been adapted for the purpose of this research and modified according to the context of EU cooperation on security and defence. Indeed, EU agencies dealing with security and defence policy are different in terms their status, mandates and role than other EU agencies and interest groups working on EU policy. Consequently there are three important questions to be raised in analysing EEAS and EDA when they work on PESCO project: What kind of opportunites do they have to provide expert advice ? How do they produce and provide expert advice? And, what kind of leverage can they bring to bear when they produce expert advice?

3.1.1 The selected EU actors involved in defence initiatives

Having examined the theoretical framework and conceptualisation of the research in previous sections, this article now turns its focus to the various actors implicated in PESCO's institutional designs and criteria used for identification. By exploring these

actors and their agency, we can gain insight into the potential variation of cooperation patterns. We offer an examination of these actors, including background information, details on our data collection process, primary sources and secondary sources as well as interviews.

Before heading into a detailed discussion on case study selection, it is essential to outline some caveats about the boundaries of this research. The study is confined within the *limes* of the EU institutional framework of defence cooperation initiatives, although it is a simplification of reality, it assumes that member states are rational and unitarian actor. Which means they are considered as monolithic entities in our theoretical framework. Other actors are the EU agencies but their agency under investigation here is limited to their role within the scope of PESCO. Therefore, the influence of EU agencies at the national or international level are not considered, nor is policy-making outside EU policy boundaries. EU agencies play a crucial role in the member state's rational choice to join, support and adopt a project by producing expert advice. Their evaluation and assessment of individual project are crucial as confirmed in a report titled '*Report on the initial lessons identified on PESCO projects*'. Indeed, pMS asked for a more structured and transparent selection of new PESCO projects and streamlined consultation process on the draft assessment report. This would have allowed them for a better informed national decision making (PESCO secretariat official, interview).

In this research, a two-level case selection is employed to investigate the influence of EU agencies on security and defence cooperation. First, the selection of the actor involved is performed: the European Defence Agency (EDA) and the European External Action Service (EEAS) are chosen as case studies over three waves of Permanent Structured Cooperation (PESCO) projects from 2017 to 2021. Second, the chapter seeks to demonstrate an empirical example of the agency of these actors by proposing a case

analysis

Agency selection

The selection of EU agencies for this research is relatively straightforward. The two chosen are the European Defence Agency (EDA) and the European External Action Service (EEAS). Both are referred to in the founding document of PESCO initiatives, which govern the adoption of cooperative project proposals. While many other actors and institutional bodies participate in the mechanism, these two were selected based on their roles in early stages of the process.

Since the focus of the research is the variation in patterns of behaviour it is assumed plausible to focus solely on those agencies that might influence member state's preferences since the very early stage of project proposals. To this regard, the EDA is primarily responsible for assessing capabilities, while the EEAS provides military expertise through its EU Military Staff (EUMS) on operational basis. Though their mandates differ slightly, both agencies have been deemed essential to understanding influence over policy proposals before they are formally adopted by the European Council. The distinction between the assigned tasks could provide useful insights into whether the capability assessment agency interacts with and accesses other relevant stakeholders differently from the operational assessment agency, as well as whether this distinction may affect or not their influence.

Of the numerous committees and agencies that work on defense and security, only three are part of the Common Security and Defense Policy: the European Defence Agency (EDA), the European Union Institute for Security Studies (EUISS), and the European Union Satellite Centre (EU SatCen). Of these, only one—the EDA—is considered crucial, as it directly contributes to policy proposals and decision-making processes. The other two agencies provide little or no direct input into their development.

Table 3.1: A cross-case analysis: Selection of EU agencies

Policy	EU agency	Year of creation	Classification	Parent Authority	Budget	Staff
CSDP	European Defence Agency	2007	Capability	HR/VP	39.4 mln	141
	European External Action Service	2009	Operational	HR/VP	611 mln	200

The selection of these two agencies is further grounded by their common oversight by the High Representative of the Union of Foreign Affairs and Security Policy, HR/VP. This ensures a reliable level of research, as differences in working methods, administrative cultures and policy views can lead to disparities between the agencies. This becomes even more critical when the agencies have distinct sectoral competences and "differ in their goals, interests, beliefs, strategies, resources" (Mitchell et al., 2006). Such discrepancies could influence the quality and quantity of expert advice provided by each agency. The size of selected agencies should reveal whether or not agency size might affect the level of influence; therefore, agencies with different sizes (referring to resource conditions) serve this purpose. Based on these criteria, EDA and EEAS are selected. Table 2.2. summarises the criteria used in relation to the selected agencies.

By applying the selection criteria, a different combination of EU agencies are possible. For example, the EDA with the European Union Military Staff (EUMS), the military expert branch of the EEAS, or the EDA and the SatCen. However, as argued previously, the selected agencies, whose work is an input on project proposals, are those deemed to be the most relevant for the research. Even though EEAS's and EDA's institutional structures have been widely studied by scholars, their influence and assessment role on cooperative project have been extremely limited.[1] This is partly due to the

[1]An exception to limited publication on agency's role on defence cooperative projects may be the article by *The Arms Collaboration Dilemma: Between Principal-Agent Dynamics and Collective Action Problems* by De Vore (2011).

EU's inability to advocate for a prominent role in security and defence projects since the end of the Cold War, whereas the long-standing sovereignty of nation states on security matters have prevented any further attempts. In order to extend the literature on the role of EU agencies, especially those operating in the security and defence cooperative mechanisms, EDA and EEAS have been selected.

EDA

The European Defence Agency was established by a Joint Action of the European Union on July 12th, 2004. On October 2004, it became operational and integrated into the EU's Common Security and Defence Policy (CSDP). EDA's primary aims are to put forward ambitious projects of cooperation in a wide range of technology, armaments, military capabilities, and defence industry. However, it is not an agency for European Defence, but a European agency for defence. This subtle difference conceals the agency's original scope: To supplement pMS attempt at strengthening their collective defence cooperation.

The EDA's founding document states that the agency should "support the Council and Member States in their effort to improve the Union's defence capabilities [...] and to sustain the ESDP". Furthermore, article 3 elucidates what are agency's goals: to identify, promote and satisfy operational requirements; to strengthen the defence industrial base and to "participate in defining a European capabilities and armaments policy, and assist the Council in evaluating the improvement of military capabilities".

EEAS

The European External Action Service was formally established on 1st December 2010—after the entry into force of the Lisbon Treaty one year earlier. The Service, led by the High Representative for Foreign Affairs and Security Policy (HR), carries out tasks in

the domain of Foreign and Security Policy (CFSP), and in the CSDP. It supports HR's mandates, ensuring the Union's external action and security policy's efficient development. [2]

To this extent, the EEAS—including its military branch EUMS—is one of the most preeminent actor for managing policy area in the EU with regards to the PeSCo. Indeed, the EEAS carries out advisory functions contributing thus to the HR's assessment on the annual report on PeSCo. Furthermore, as mentioned in the previous chapter, it coordinates the assessment of project proposals and it assess proposed projects' compliance with operational needs.

3.1.2 Caveats on measuring influence of PESCO Secretariat

The methodological decision in settling the indicators through which actual influence can be assessed is one of the most challenging assignment one may encounter in research focused on influence. Measuring influence of EU agencies in a complex decision-making system is a quite hard task (Arts & Verschuren, 1999), especially when it deals with security and defence policy. Measuring it objectively is even further.

Scholars working on the influence of policy actors, organisation and agencies have addressed this issue and, even though influence has been assessed somehow, they have acknowledged the difficulties on establishing criteria to identify what constitutes influence and how to measure it correctly (Weinlich, 2014). Despite this caveat, the following sections outlines what are the appropriate indicators of influence and how they can be used to operasionalised influence of EU agencies.

[2] Art. 2 *Tasks* 1. The EEAS shall support the High Representative in fulfilling his/her mandates as outlined, notably, in Articles 18 and 27 TEU: — in fulfilling his/her mandate to conduct the Common Foreign and Security Policy ('CFSP') of the European Union, including the Common Security and Defence Policy ('CSDP'), to contribute by his/her proposals to the development of that policy, which he/she shall carry out as mandated by the Council and to ensure the consistency of the Union's external action

Before heading to what constitutes influence, it is useful to remind the definition of influence itself. Agencies' influence is defined as the capacity to shape policy content, or policy outcomes, by providing a set of alternatives to decision-makers (Panke et al., 2015; Kim, 2018). The definition focuses on the content or outcomes of a certain policy proposal, or in this case project proposal; if we detect expert advice of EU agencies in a cooperative project after the Clarification Meeting, it will show EU agencies' influence. This conceptualisation of influence refers to what several scholars have identified as the most direct indicator of influence: 'goal attainment' or 'preference attainment' (Panke et al., 2015; Dür, 2008; Betsill & Corell, 2008; Bunea, 2012; Hönnige & Panke, 2013; Mahoney, 2007). The idea behind is that we can assess one actor's influence by measuring the distance between actor's preferences and the policy outcomes.

'Attributed influence' or 'reputation' are other indicators used to assess influence. Especially in those fields displaying a high level of technicalities and scientific know-how, as military and defence projects do—EU agencies' capacity to provide expertise and information constitute the basis for reliable reputation, and consequent capacity to influence decision-making (Arts & Verschuren, 1999; Dür, 2008). The indicator of reputation is often assessed through surveys and interviews aiming to provide self- and peer-assessment of the influence of actors seeking influence (Dür, 2008). Nevertheless, the perception that other policy actors involved in the decision-making process may have of their peers should be handle with care, say Arts & Verschuren (1999). Reputation as an indicator may improve the validity of influence measurement. Still, it should be considered only as an additional indicator to the primary one: the 'preference attainment' outlined above.

3.1.3 Framing PESCO Secretariat's influence on pMS rational choice

Agencies need to have access to a critical stage of the decision making process to exercise influence (Truman, 1951). As regards PESCO, the Secretariat exercises a meaningful role due to its active participation in the critical stage of the decision-making process: assessment of projects before their final adoption; and in its role concerning the production of the PESCO Strategic Review (PSR). The European Defence Agency (EDA) and European External Action Service (EEAS) have sought to utilize their expertise and knowledge to engaging with policy-makers before even the Council and national levels but through a direct link with officials entitled to carrying out project presentation to their peers and as a Point of Contact (PoC) for the Secretariat for a given project. Furthermore, Secretariat establishes contact with civil personals working at the projects as national seconded experts (PESCO official, interview). Despite the traditional centrality of governments in security and defense matters – resulting in limited formal representation – these EU agencies have found success in appealing to these national actors.

Their primary aim is to bring their specialized advice and knowledge to bear on EU actors in both the Council and in each particular nation. Moreover, these agencies are mindful of both formal regulations and informal practices while going through their duties, and strive for information-sharing and knowledge accumulation in order to maximize their weight in the assessment stage (Binderkrantz et al., 2016).

Agencies involved in the PESCO mechanism have direct access into a network of national stakeholders with likewise expertise and policy-making power. This enables them to maintain high standards of information and knowledge. Cooperation with other seconded national experts or independent experts, as those involved in the work committee of EDIDP, further bolster the EU agencies' capability to deliver accurate information. Though legal documents provide insight into an agency's formal networks, more informal ones can only be discerned through interviews with experts affiliated with them.

For example, Joint Action 2004/551/CFSP establishing the EDA states that it "may also collaborate with international organizations such as the North Atlantic Treaty Organization (NATO) or the Organisation for Joint Armament Cooperation (OCCAR)." This suggests that EDA's cooperation with NATO or OCCAR is one way through which increase its reputation and credibility.

The intricate network of connections EU agencies as part of the the new package of defence initiatives (PESCO and CARD) has been pivotal in providing advice and knowledge to shape member states decision whether to join a project or not. Formal and informal networking national authorities, and transnational organizations (NATO and OCCAR) has not only helped to create an epistemic community within the agency between members and officials, but also expanded its influence over policy-making processes. Moreover, the collaborations have contributed to the agency's organizational chart; many staff members are likely sourced from these associated organizations. Ultimately, through this access point of networking, these agencies can gain invaluable insight on current affairs—and in turn provide insight that is essential for informed decision making.

Finally, agencies can also be consulted in the legislative process, by submitting impact assessments and reports to the European Parliament and Council of Ministers. In the context of PESCO and EU agencies, there are various pathways through which they can enter the policy-making sphere and offer their specialized counsel. First, EU institutions may make formal requests for agencies to present reports and expert advice, as in the case of PESCO Strategic Review which was formally requested by pMS to the Secretariat. Second, these agencies might be part of a procedure that leads to a policy proposal being put into practice; in such cases, submitting their expertise is obligatory prior to the adoption of any decision, which is the case of the project assessment, a precondition for their final adoption. Thirdly, when attempting to initiate involvement on

their own accord, agencies might provide their learned opinion independently. Finally, during the legislative process – namely in front of the European Parliament or Council of Ministers – these institutions may be asked to deliver impact assessments or reports.

Despite their access to the policy-making process, the Secretariat must be mindful that the mere existence of access points does not guarantee influence. According to Hönnige & Panke (2013), it is not the origin of access that determines an agency's efficacy, but rather its active and proactive use of such access points. Kim (2018), further emphasizes that successful policy outcomes hinge on an agency's ability to effectively deploy its resources and activities. Therefore, in order to exert influence on European policy- making decisions, EU agencies must be strategic in leveraging their access points and utilizing their expertise.

In the case of PESCO, EU agencies such as the EDA and EEAS have recognized that access points can't extend beyond formal procedures. Nonetheless, at the time of writing, consideration is being given to endowing the Secretariat with stronger powers such as monitoring the project's development (PESCO official, interview). This is a clear sign on how by leveraging their connections with national authorities, and seconded national experts, these agencies seek to create an epistemic community within the PESCO institutional structure; one that can produce and sustain the highest possible standards of expert information and knowledge. Such informal networking has the potential to significantly enhance their capacity to produce expert advice, increasing the weight given by pMS to their assessment affecting thus pMS's rational choice.

In summary, the ability to access the policy-making process is essential for EU agencies to effectively provide their expertise and shape decisions within the scope of PESCO. Though the source of access may not have a major effect on its influence, it is critical for agencies to take advantage of formal and informal access points in order to maximize their impact on policy-making and ensure that they are providing high-quality advice to EU bodies. Networks are crucial for providing access to pertinent expertise and policy

actors, thereby bolstering their influence. Establishing connections with diverse players who share similar inclinations concerning a particular issue involves cultivating consistent relationships with both internal and external specialists and policymakers in order to remain abreast of the most up-to-date expertise and knowledge needed to meet policy goals Luitwieler (2009, p. 9). Yet, among scholars, there is still much dispute concerning the extent of contacts' effect on EU policies; Eising (2007) being among those dubious of such relationships' true power on policy outcomes. The regulations that create these agencies can provide data about their interactions with partners, as well as interviews with those involved in the policy-making process. By forming and keeping up networks, EU agencies can ensure access to pertinent knowledge and insights, thereby augmenting their potential influence in the policy-making procedure. For example, the editing of the PESCO Strategic Review required in the initial stage eleven meetings from November to February, where the Secretariat was networking with national pMS, other officials part of the Capability, Armament and Planning Directorate (CAP) and National Armament Directorate, the European Union Military Committee, Defence Planning Directorate (DPD) and the Steering Board-National Armament Directorate (SB-NAD). Other data on the interaction of the EU agencies in defence are postulated in their founding documents.

3.1.4 Credibility and Reputation for PESCO Secretariat

For EU agencies in PESCO, networking is vital for exerting influence. It takes many forms: formal talks with Member States, meetings between experts within and between agencies like the EDA and EEAS, conferences, workshops, like the 'Project Matching Workshop (see chapter 5), and the above mentioned 'clearing house workshop'. These are perfect occasions where to show agencies expertise and establishing networks as in all these workshops internal and external specialists, and seconded national experts

participate (PESCO officials, interview). Through such activities, agencies foster their credibility reputation by showing their expertise. They can gather the right information for member states' further decision on wether to support a project, but also on how to improve or modify the current institutional PESCO design. As Eising (2007) notes, this kind of efficient information is highly valued in the EU. Likewise, (Chalmers, 2011) emphasizes its importance—the greater the network of contacts an agency has access to, the more it can shape policy-making processes. Networking remains a key tool for EU agencies seeking to gain a foothold in decision-making circles and make their voices heard.

The provision of expert advice is indispensable for PESCO institutional effect on pMS decision process, and the regularity of Secretariat plays a critical role in this endeavor. This is especially pertinent for Agencies, which strive to alleviate the coordination game conundrum by informing pMS and alleviating their moral hazard. By frequently engaging with the EU institutions and national stakeholders, these agencies increase the probability that their advice will be acknowledged by national seconded experts in charge of national projects (PESCO official A, interview). Through making known the information they possess, they can have an impact on decision-making (Weinlich, 2014; Eising, 2007). Moreover, successful persuasion necessitates a cooperative relationship with all actors involved in the process and their willingness to heed advice from these experts. Consequently, it is essential for agencies not only to build trust with EU institutions and member states but also to procure funding, expand competences, hire staff and enhance effectiveness (Schout & Pereyra, 2011). Secretariat networking activities is therefore essential for cultivating relationships that allow agencies to exert influence over pMS decisions process. To guarantee that their input is taken into account and preferences are heeded by those crafting policies, PESCO agencies must maintain frequent contact with relevant parties (PESCO official B, interview).

3.2 Secretariat's resources

Amid the ongoing involvement of PESCO agencies in the policy-making process, resources are essential for them to exert their agency. But having resources alone is not enough to be effective; as evidenced by research, a variety of resources exist, depending on the policy area, context and decision-making process (Biermann et al., 2009; Calcara, 2017; Groenleer, 2009; Klüver, 2009, 2012, 2013; Panke et al., 2015). While trying to assess Secretariat resources, we look after the administrative capacity and expertise as two key factors that must be considered when it comes to accumulating resources. For instance, the EDA is a diverse and highly qualified transnational community, boasting a workforce of around 200 individuals from various backgrounds, nationalities and areas of expertise. Representing both civilian and military personnel, its staff consists of engineers, analysts, policy experts, project managers and administrative personnel - many of whom have obtained advanced degrees in fields such as engineering, international relations or military studies. Furthermore, the EDA is supported by a network of external experts from defence ministries, industry and academia who actively partake in working groups and committees to provide input on defence-related issues. Looking at the annual budget of the EDA gives us a better understanding of its resources and administrative capacities: According to the European Defence Agency's Annual Reports, their budget for the period of 2015-2020 in million Euro has seen a steady increase, ranging from 29.2 in 2015 to 34.9 in 2020. The budget breakdown in million Euro for each year is as follows: 2015: 29.2 , 2016: 32.2, 2017: 32.7, 2018: 32.3, 2019: 34.6 and 2020: 34.9. However, it is important to bear in mind that the EDA's budget may be subject to change depending on their shifting priorities and needs.

Even with these resources at hand, however, they EDA must also engage in effective networking to make sure they are heard by policy-makers. Through cooperative relationships with other EU institutions, member states and experts, PESCO make their

information known and advocate for desired outcomes or alternative solutions (PESCO official A, interview). Ultimately, a combination of resources and network building allow the Secretariat to shape pMS proposals and rational choices.

Financial resources and well-qualified staff are two conditions that grant the PESCO Secretariat with accredited reputation and credibility vis-à-vis member states (Schout & Pereyra, 2011). Both conditions are critical factors in determining the reach of PESCO institutional effect on pMS. With well-qualified staff, these agencies can provide reliable information to pMS and bolster their external reputation. Additionally, having sufficient financial resources allows for greater specialization of labor that can lead to more efficient performance and more influence when assessing projects (Arts & Verschuren, 1999; Meier, 1980). Clearly, the administrative capacity of these agencies is essential for them to effectively interact with pMS and shape their decisions.

Broadly speaking, the output of an agency can be considered a barometer of its resource capacity, as it reflects the agency's capacity to disseminate knowledge and information to policy actors. High volumes of expert outcomes are a sure sign that an agency is attempting to wield influence in EU policy-making and establish itself as an active and visible player among other stakeholders. Documents, reports, risk assessments, and technical reports provide an important measure for assessing the expertise available to agencies.

3.2.1 The agency of PESCO Secretariat: an empirical example

Let us now look empirically how the agency of the PESCO Secretariat really works and how they uses the above mentioned resources and capability to provide information knowledge and expertise for the sake of pMS. To better understand this process, we can look to the example of the PESCO Strategic Review (PSR)—as the projects' assessment

examples will be further analysed in chapter 5.

In article 4(2)(c) of Decision (CFSP) 2017/2315, it is said that the Council shall adopt decisions and recommendations *"updating, and enhancing if necessary, the more binding commitments set out in the Annex in light of the achievements made through PESCO, in order to reflect the Union's evolving security environment. Such decisions shall be taken in particular at the end of the phases referred to in point (b) of paragraph 2,* ***based on a strategic review process assessing the fulfilment of the PESCO commitments****"*. The PSR thus provided an opportunity for the Secretariat, the 'access point' in decision making process mentioned earlier, to influence the implementation aspects related to the more binding commitments, including the PESCO projects and the processes and working methods, though this opportunity is tempered by the pMS views expressed at the FAC/Defence Council level, (PESCO official A. interview). The Secretariat was granted the authority to launch a Consultation Process, during which member states gave their feedback. Subsequently, there was a further examination of the more binding commitments implementation (based on the HR's Annual Report on the Status of PESCO Implementation), where the Secretariat and Agencies deeply were involved as well. This exemplifies how deeply the Secretariat in involved in the whole institutional design, and not being solely relegated with coordination activities. Furthermore, this is an example of how networking opportunity for the Secretariat to bolster recognition and reliability really works, since it establishes a formal networking where discussions concerning PSR are conducted with the PMG and EUMC.

What is even more important in this example is that PSR results in a legal act, i.e. a Council Decision. Once this Decision is adopted by the end of 2020, the following year work should start to adapt the Council Recommendation on sequencing/more precise objectives. So the Secretariat satisfies also one of the conditions to exert meaningful influence: to operate in the early stages of a decision making process. The first stage of PSR process accounted for a questionnaire launched by the Secretariat. It was meant

to facilitate discussions and inputs by the pMS at the very early stage of the PSR. Furthermore, the Secretariat put together a scoping paper to facilitate further discussion with other stakeholder such as the PSC, PMG, EUMC and DPD. This scoping paper has been used at ministerial level (PESCO official B, interview).

Interestingly, the Scoping paper emphasized the need for pMS to establish a PESCO forum, wherein national defense planners and other stakeholders could collaborate and debate future defense plans and funding possibilities, viewed by some as an essential tool (PESCO official A, interview). Furthermore, as regards the Secretariat role in the evaluation of projects, the Scoping paper pointed how pMS supported the idea of an evaluation process based on clear, transparent criteria and indicators as a common reference for project's coordinators and participants. However, some countries believed that the assessment should be conducted through a combination of bottom-up self-assessment and top-down review from the PESCO secretariat (PESCO official A, interview). Finally, some pMS believe that, in order to properly capture all aspects without prejudice to the PESCO Secretariat's responsibility, project proposals assessment criteria should be discussed and reviewed on a periodic basis, with dedicated workshops.

These are examples of provision of information knowledge and production of information that testify the role of EU actors within PESCO. Furthermore, in preparing the questions, the Secretariat embarked itself in subject's matter expert's meetings, workshops on the lessons learned by the selections of the projects and inputs by pMS (PESCO official B, interview). A in depth look at the questionnaire highlights the pivotal role of the Secretariat in the assessment of projects. Indeed, two questions were directly linked to its role as they asked: *[...]Do you see the need to introduce an evaluating PESCO project process performed by the PESCO secretariat? How could the supporting information provided by the PESCO secretariat be reshaped to better serve pMS [...]?*. The adoption of the PSR was rolled out in three distinct phases. In the first phase, the

Secretariat attended a series of ten meetings that spanned three months. During these meetings the Secretariat has engaged in networking with national and EU stakeholders at different levels. The Questionnaire was the first step, followed by a Workshop which facilitated CAP/NAD meetings. These led to the drafting of a Scoping paper to pMS, which was then discussed by PSC and EUMC alike. The scoping paper aims to facilitate further discussions and to be used as an input for the ministerial level exchange. In addition to formal meetings, informal gatherings were held with DPDs and an additional PSR workshop took place. The final meeting presented its progress report on PESCO projects following an informal meeting with SB-NADs.

The second and third phases of PSR adoption saw dramatically fewer meetings, with only four in the second stage and three in the third. This indicates a significant amount of work has already been completed; notably, the Secretariat was only officially present for the first meeting of the third stage when it submitted the first draft of CD on PSR to RELEX. More specifically, the second phase was characterised by an informal meeting on FAC defence, where the HR presented the stat of play of PSR based on the inputs the Secretariat had received. Afterwards, a PSC level meeting took to discuss the HR proposals and tasking to EUMC (Mil Advice) and to PMG. Then, before the final FAC Defence, this time formal one, a DPDs Meeting took place to discuss final guidance. The third phase sees initially again the PESCO secretariat deeply involved in preparing the first draft of CD on PSR and sending it to RELEX. The latter started workin on Council decision that will bring to FAC Defence for its final adoption.

Although the EU agencies involved in the PSR cannot legally compel the EU Council or the pMS to follow their advice, included in the PSR, they can still have an indirect influence. Since pMS and Council final decision take into consideration the advice and formulate policy proposals based on it, it is a testament to both Secretariat ability to persuade them and their willingness to accept this guidance. Ultimately however, the full process lies in the hands of member states.

3.2.2 The agency of PESCO Secretariat on proposed project

The influence of EU agencies on cooperative projects is much straightforward: when a project is rejected, modified, or resubmitted, it often incorporates expert advice from the agencies. Still, some submitted projects may not reflect this advice or position—in which case, no influence can be sensed. To measure this influence, one must compare the projects initially proposed by the pMS and those that reach the EU Council after the Clarification Meeting. If there are discrepancies between these lists in terms of their number, nature and scope—this should be taken as a sign of EU agencies' impact. While there may be instances where accepted projects do not reflect any advice from these agencies, such cases remain outliers. Any modification likely occurred after the assessment procedure performed by EU agencies and discussed during the Clarification Meeting between them and pMS.

The agency of the Secretariat to shape and alter projects is a complex question, but can be divided into three categories: strong, moderate, and low influence. In cases where influence is low, EU agencies provide evaluations and expert advice to participating Member States (pMS) but the modifications to projects are often limited to general aspects. In moderate influence cases, the evaluation outcomes and expert advice of the agency are incorporated into modified projects. Finally, in cases of strong influence, a project may be either rejected or significantly altered in scope or nature.

Scholars have argued that EU agencies wield significant influence over pMS, even if it is not formally visible. Despite this, there is still the possibility that such influence may be the result of coincidences or other factors in play, the so called equifinality problem (Weinlich, 2014). To get to the root of this problem, Dür et al. (2015); Klüver (2009) have asserted that although coincidences can occur, there is an undeniable statistical association between lobbying success and actors' characteristics and influence attempts. Therefore, to ascertain the true cause-effect relationship between EU agencies

and pMS another approach must be taken[3]. Activities between both parties must be investigated—particularly those which take place during assessment processes by EU agencies and post-Clarification Meetings. This will confirm whether any influence was anything beyond a mere coincidence.

In order to discount any other potential explanations for the observed effects of influence, it is essential to address counterfactual argumentation. For instance, *how would the project have progressed had EU agencies not gotten involved during the evaluation process and provided expert insight in policy-making*? As Dür (2008, p. 569) pointed out, salience is a noteworthy concern. Although agencies may be devoted to just a few issues while collaborating on projects, this doesn't imply they are without influence. It's possible that their influence is more powerful on issues that are especially relevant to them—because certain projects are paramount for the EU's goal or need more resources invested in them. Thus, salience must be assessed when scrutinizing EU agencies' impact. Below, our case selected project represents how Agencies have influenced the pMS to resubmit their projects, after being proposed for the first wave, accordingly to their technical suggestions.

Project: Helicopter Hot and High Training (H3 Training)

The Helicopter Hot and High Training (H3 Training) is a projected initially presented for the first wave of PESCO project and not included in the final list of project as the Secretariat did not recommend to put the main focus on the project. Initially named as "Helicopter 'Hot-and-High' Training", from capability View the EDA assessed a low impact on the capability landscape, in as did not improve the coherence of the European capability landscape and did not satisfied the CDP priorities. From an operational point

[3]Similarly, scholars investigating the influence of agencies on European Commission have argued that it is important to look whether the Commission looked at agencies' advice and whether it had meetings and negotiations with the agencies before or during the policy-drafting-process (Panke et al., 2015)

of view, also the EEAS judged the project not worthy enough as it did not satisfied the Requirements Catalogue (RC) and Progress Catalogue (PC) that serves as a measure of EU military capabilities and provides an assessment on its short and medium term evolution (see Chapter 5). EEAS assessed that the project was inconsistent with the latest RC which identifies the military capabilities required to achieve the EU Level of Ambition (LoA). And that project was not supporting the fulfillment of the most binding commitments that consider the necessary capability for achieving the LoA. Furthermore, the Agencies evaluate the project inconsistent with the latest PC, and the project could not fill any capability shortfalls in the short and medium-term.

The project was submitted a second time during the second wave of PESCO projects, and this time the Secretariat recommended to put the main focus on the project. Although one of the reason why it was initially discarded was because it didn't receive enough support from other MS, from the new assessment report we can understand how the Agencies positively influenced MS. Indeed, the report stress the idea that "[...] it was recommended to clarify the links with the MHTC [Multinational Helicopter Training Center] concept, in order to capitalise on ongoing activities. The issue is being addressed in the new proposal and now, from the capability perspective, it is assumed that the project could contribute to the work strands within the EDA's current Helicopter Exercise Programme (HEP), providing an alternative venue to the current training conducted in Portugal under the HOT BLADE exercise." The improvement of the project was praised by the Agencies as it clearly addresses the EU CDP priority of Air mobility. In this new assessment, the project has increased from low to medium its impact on the Capability Landscape. Also the coherence has been judged positively as it will be linked with the EDA's current Helicopter Exercise Programme (HEP) Moreover, the Secretariat stated that it fit well into the concept for the full operational capability (FOC) of the Multinational Helicopter Training Centre (MHTC), which looks to federate helicopter training facilities across Europe in the early 2020s.

3.2.3 Caveats in Agencies' reputation and credibility analysis

Both above mentioned cases, the PSR and the project case of H3 Training have illuminated the significance of reputation as a driving force of influence in the PESCO process. Because of the high praised expertise and credibility the Secretariat has been able to affect the PESCO's institutional design. Scholars have all investigated how one's perceived importance among peers and other stakeholders can shape the dynamics of decision-making (Arts & Verschuren, 1999; Luitwieler, 2009; Ingold & Leifeld, 2014). The elusive nature of reputation makes its assessment difficult, but Arts & Verschuren (1999) proposed a method known as 'EAR instruments' for triangulating policy actors' self perception, others' perception, and process analysis to evaluate EU agencies' clout. Through continued research on this topic, experts hope to gain clarity on how reputation affects the way policy is crafted.

Nonetheless, this research's purpose was not to explore properly the self-perception of EU agencies dealing with security and defence, but to offer empirical examples on how accraditated reputation of the Agencies may affect decision making. With a focus on evaluating the influence of EU agencies on specific project proposals, it aims to assess how these agencies are viewed post-adoption. Additionally, EU agencies are considering whether they are regarded merely as expert authorities or seen as an indispensable part of policy-making. As Hall (1992) has argued, this approach to gathering data has methodological advantages: it allows for multiple respondents to answer the same questions in order to test reliability. In cases where EU agencies are seen not only as expert authorities but also essential actors, their expertise can be utilized most effectively in policy-making.

The potential inaccuracies of self-perceived and peer-assessed influence levels have been highlighted by Dür (2008), who warns that these estimates can be swayed by

either overrating or underrating the true level of influence. Arts & Verschuren (1999) have similarly cautioned against using reputation as the sole measure of an EU agency's power. To mitigate these issues, this study relies on project comparison, before and after the final project adoption, as its primary indicator of influence, while also utilizing reputation as a secondary means to confirm the results.

In recent years, the role of reputation in the European Union (EU) has become a subject of much debate (Parsons, 1963; Beach, 2004; Jakobsen, 2009; Ingold & Leifeld, 2014). Scholars have been attempting to determine whether reputation should be regarded as an independent or dependent variable, and many have argued that it should be seen as an independent one (Parsons, 1963; Beach, 2004; Jakobsen, 2009; Ingold & Leifeld, 2014). This theory is based on the idea that 'perception influences action' and actors with a good reputation for reliability, competence and expertise can more easily influence collective decision-making. As such, Parsons (1963, p. 50) and Jakobsen (2009)) both agree that a statement made by someone with a good reputation is worth more than one from someone without it. Similarly, Beach (2004) notes how the Council Secretariat may be influential due to its advantageous institutional position, expertise and trustworthiness. Ultimately, it seems clear that reputation can play an essential role in PESCO institutional design as well.

In contrast, other scholars have posited that reputation can be used as a dependent variable to measure the influence of EU agencies (Kim, 2018). Two factors primarily support this argument: the age of an agency and its public image. It is logical that older agencies with a well-established reputation would be more likely to exert more influence and offer more persuasive expert advice than young or newly established ones (Fraussen & Beyers, 2015). This is especially pertinent in the case of security and defence cooperation, where two specific entities – EDA and EEAS – were formed relatively recently but have struggled to gain traction due to their lack of reputation. Both were established in

2004 and 2010 respectively, yet had long been marginalized within security and defence circles until recently.

3.3 Conclusion

The chapter here presented outlined the methodology used to assess Agencies influence. This is crucial for our overall analysis of PESCO institutional effect as Agencies' assessment over cooperative projects are part of member state utility function. Thus it is necessary to investigate how w the weight given to agencies' assessment is rooted. That is done by analysing the EU agencies' reputation and credibility deductivly by investigating the extent to which Secretariat, EDA and EEAS were given credit by member state. Hence, the chapter presents the conditions used to assess EU agencies' credibility and reputation: through the agency's capacity to produce expert advice; the agency's ability to transmit its expertise to policy-making actors; and, the actual impact on the outcomes of policy proposals on EU cooperation on security and defence. The chapter outlines what are the more prominent EU actors and what mechanisms highlight their expertise and reputation, that best fit into the underway process of PESCO decision-making. To that extent, the research examine the way in which actors interact with one another and how their agency influence not only state's behaviour but also the institutional design by promoting change and transformation (see PSR).

Finally the chapter examines reputation as an independent variable and considers Secretariat collective reputation as given. It assumes that is an an 'epistemic community' of pooling expertise to perform advice, studies, and reports (Trondal & Jeppesen, 2008). To assess empirically this Agencies capacity to produce expertise and information two cases were brought, the Secretariat agency in the PSR and the agencies' involvement in project assessment: reputation and project comparison are used to evaluate the weight

of their variable in a member state's utility function. Ultimately, this informs rational decision making by member states in regards to joining, supporting or not participating in a given project.

Chapter 4

Analysing co-affiliation network in Permanent Structured Co-operation

Introduction

Since 2017, the Permanent Structured Co-operation (PESCO) initiative has enabled EU member states to improve their military capabilities and defense capacity by joining common defense projects. As of now, sixty projects have been launched, encompassing a wide range of military areas and involving twenty-five EU nations. From the beginning of the project, the European Commission highlighted that cooperative defense initiatives are intended to help countries reduce the high expenses associated with defense and security strategies managed at the national level only, and to favor to scale economies and

shared investments. Nevertheless, despite the aim of 'pooling and sharing' to achieve a homogeneous European landscape in terms of military capability, the projects under PESCO reveal an unequal and fragmented participation from EU member states.

In this chapter, using co-affiliation network analysis, a complex constellation of participating states in the Permanent Structured Cooperation (PESCO) is mapped out. To assess the depth of involvement and participation among European Union Member States (EUMS), we analyze the two mode network whose classes are nations and PESCO projects, and there is a link between nodes of different classes whenever a nation participated in a project. This analysis could reveal two layers of fragmentation: the first is based on co-membership participation, the second is based on the kinds of projects in which participant states are involved. The analysis is conducted though complex network statistics and methodologies, see (Borgatti & Halgin, 2014), and it let establish which countries are the more prominent PESCO actors, what are the cluster they form, whether agencies played an active role in promoting the European cooperation. Moreover, it let us asses whether projects can be clustered as nations do, namely, if they could form separate defense policies or whether they form a consistent unified framework.

The formation of communities of the participating EUMS is revealed by network community detection and following the maximum modularity approach, conducted in two phases. The first phase is when nations join together to submit for a common project, the second phase is when projects are finally accepted by the agency which has allowed for the detection of multiple communities from the project proposal to its final adoption. It can be seen that these communities have changed between the first and the second phase. These results improve on the analysis conducted on affiliation or co-membership data only.

The chapter delves into the empirical evidence of unbalanced relations between capability and operability. It emphasizes the pitfalls of the debate between member states, some of them interested in the PESCO operational dimension, others interested in de-

veloping or upgrading their military capabilities only. The balance between these two ends is often used to assess PESCO's success and eventual realization of its intent to achieve a common and shared defense capability.

This chapter will proceed as follow: we will explore the complex network methodologies used in the social sciences and discuss how it can be applied to investigate the relationships between EU states. We will focus on the two-mode or bipartite network data representation, as it provides the most advanced tool to obtain relevant information from our dataset and we will explain the network statistics that are used in our study. Next we describe our dataset and why its two-mode or bipartite network representation is the most appropriate to obtain meaningful results. Finally, substantive analysis of the EUMS community structure is carried out.

4.1 Co-affiliation structure in European defence initiatives

The actors involved in the new European defense initiatives are the EU agencies, the EU institutions, EUMS and private national and supranational companies. Most peculiarly, the PESCO initiative involved twenty-five EUMS cooperating within sixty projects. Every EUMS taking part in one initiative creates a link with other states, forming hierarchies, since a state can be an observer, a partner or a project leader. Joint project participations form complex intertwined links among EUMS that can be represented as networks, then analysed using social network analysis methods.

In the last decade, social network analysis has become increasingly popular in natural and social sciences (see. M. G. Everett 2016; Borgatti et al. 2009). Central to this analysis is to study how actor's network position affects its social or political outcome, such cultural orientation, economic performance, and so on. The common understanding of network depicts it as a web formed by *nodes*, who are connected through interaction

described by *edges*. These connections can take various forms, in our case they are the joint partnership in a PESCO project. One of the main statistics devised for networks analysis regards the concept of *centrality*, namely, how to determine the importance of a node within the network(see M. Everett et al. 2013; Scott & Carrington 2014; Borgatti & Everett 2006). The centrality of a node is a node global property, as it depends on the whole structure of the network connections, while the *degree* of a node, representing its number of direct connections with other nodes within a network (M. G. Everett, 2016), is a node local property. The interaction of node local and global properties characterize the different characteristics of a node. A node connecting two separated parts of the network will display a high centrality despite having a low degree and it will acts as a bridge between two structures. A high-degree node might represents an actor who could influence other actors thanks to its many links, but it is not always the case, as it depends an its structural position too, namely, its centrality. Centrality is a controversial issue that has been defined and used to answer the question: *Given a network, what is the node holding the most influential position?* Otherwise: who has the most control over the information that circulates between nodes? No definitive definition has been provided yet, as it depends on the network nature, (Freeman, 1978). While some scholars define centrality as an actor's popularity as well as his or her ability to access and control information, others stressed other prominent characteristic of an actor, for example its ability of being identified as a visibile member within a specific social system (Knoke & Burt, 1983). Nonetheless, it is necessary to distinguish between centrality and centralisation, see Freeman (1978). While the former refers to each node's relative position, the latter refers to the network's overall structure that might display more or less hierarchical structure. Therefore, a specific node occupies a network prominent position depending on the overall structure of the network itself.

The dialectic between global and local node properties affects the distinction between local centrality and global centrality. As Scott (2000) says: The more direct links

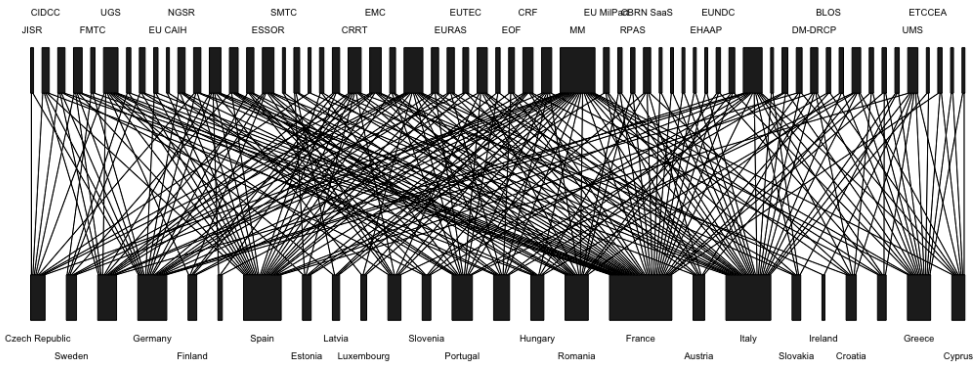
a node has to adjacent nodes, the more is central locally, whereas its degree of global centrality is determined by its position in the overall network-distance to all other nodes in the network.

These different tools for a network analysis are important to mention because the network that is cast out from our data has high density, as every actor has a link with many others, since every one cooperates at least in one project. The subsequent graph that comes out is very similar to a complete or all-channel network. From this, the necessity of defining appropriate weights to arcs (or nodes).

In network analysis, an all-channel network is a network in which every node is connected to every other node. This means that there is an edge between every pair of nodes in the network, and that all nodes have the same number of connections. All-channel networks are also sometimes referred to as complete networks or fully-connected networks. One of the key characteristics of all-channel networks is their high density, which is defined as the ratio of the number of connections in the network to the number of nodes. In an all-channel network, this ratio is maximized because every node is connected to every other node.

This kind of network are also highly symmetrical, meaning that the connections between nodes are distributed evenly across the network. This lack of structural hierarchy makes all-channel networks relatively simple to analyze, as all nodes have the same number of connections and there are no dominant nodes or clusters.

In addition to their high density and symmetry, all-channel networks are highly redundant. This means that there are multiple paths between any two nodes in the network, which makes the network resistant to failures or disruptions. If one node in the network fails, the other nodes can still communicate with each other through alternative paths. In this context, the high density and redundancy of all-channel networks can be seen as a measure of the strength of the social ties within the network.



Bipartite network PESCO

4.1.1 PESCO a two-mode data network

As said in the previous section, the bi-mode network describing the participation to PESCO project is a dense network. Indeed, all EUMS participating in the PESCO initiative have participated in a project at least once with every other member. Therefore, when the bi-mode network is projected in the nations or project subspace, every node is connected to other nodes.

A typical way to represent networks is through the adjacency matrix. An adjacency matrix is a square matrix with dimensions equal to the number of nodes, in which the entries a_{ij} of the matrix indicate whether there is an edge between the nodes i and j: $a_{ij} = 1$ if there is an edge between i and j, $a_{ij} = 0$ otherwise. This matrix can be used to easily represent and analyze a graph. For example, the degree of a node i can be calculated by the sum of the entries of row i (or of column i).

The structure of a one mode network with N nodes will be represented by a N x N binary adjacency matrix with $A = \{a_{ij}\}$, whose element a_{ij} equals 1, when there is a link joining node i to node j and 0 otherwise $(i, j = 1, 2, ..., N)$. The PESCO network is considered "undirected", which means the edges have no specific direction and the edges

can be traversed in either direction. For example, in the PESCO network, an undirected edge between two MS indicates that they are project partners with each other. This means that if MSi is partner with MSj, then MSj is also partner with MSi.

The data used to describe the PESCO projects allows their representation as bipartite or two-mode network. Bipartite networks are graphs in which there are two classes of vertices and edges only connect nodes of different classes. More formally the node classes V_1 and V_2 are composed by nations and projects respectively, and there is a link a_{ij} between nation i and project j if i takes part to project j. A two-mode network is more complex to analyze than a simple one-mode network, as there are no arcs between nodes of the same class. Rather, their connections are only implicitly established, for example if two nations participate to the same project, or two projects are participated by the same nation.

A bipartite network is better represented by a rectangular matrix called incidence matrix. The incidence matrix B is a n x m rectangular matrix in which the rows and columns refer to the two different classes of vertices, with $n = |V_1|$ and $m = |V_2|$. Then, $b_{ij} = 1$ if nation $i \in V_1$ takes part to project $j \in V_2$, and $b_{ij} = 0$ otherwise.

If it were more convenient to represent the bipartite graph as an adjacency matrix, then the matrix would take a peculiar structure with B playing an important role. Denote the bipartite graph as H, with nation nodes labeled as $1, 2, ..., n$ and project nodes labeled as $n + 1, n + 2, ..., n + g$, let B be the g x n incidence matrix of H, then the adjacency matrix A of H is a symmetric $(n + g)$ x $(n + g)$ matrix of the form:

$$A = \begin{pmatrix} 0 & B^T \\ B & 0 \end{pmatrix} \tag{4.1}$$

where 0 are square matrices of size n x n (in the upper left) and g x g (in the lower right).

The incidence matrix represents the connections between the two types of nodes in a bipartite network. The rows corresponding to one type of node and columns corresponding to the other type of node. Therefore, the elements of the matrix are either 1 or 0, indicating whether a particular node is connected to a particular node of the other type. For example, the bipartite network consisting of States and Projects, the incidence matrix could be used to represent which State participate to which Project. The rows of the matrix would correspond to the groups, and the columns would correspond to the people. If a particular person is a member of a particular group, the corresponding element in the matrix would be 1, otherwise it would be 0.

Incidence matrices are often used to represent and analyze bipartite networks because they provide a concise and easily interpretable representation of the connections. They can be used as inputs of many computational analysis, such as calculating node degrees, detecting clusters or network communities, measuring node centralities, and so on.

In Table 4.5 we present the affiliation matrix of the sixty PESCO project data, displaying the EUMS participating in PESCO projects and the projects being adopted. The data are represented as an affiliation matrix, with the rows representing the EUMS and the columns representing the PESCO projects. A value of 1 in row i and column j indicates that MS i takes part to project j. If two nations take part to the same project, then it should be an indicator of a social or political tie between the two nations. If two projects are participated by the same nation, than it should be an indicator of a political or strategic link between the two projects, see (Borgatti & Halgin, 2014). Moreover, as projects provide opportunities for establishing social ties among participants, co-participation could describe paths for the flow of ideas between actors.

4.1.2 Affiliation data of PESCO projects

The data on affiliations consists of a set of binary relationships between members of two sets of items. In the case of PESCO projects, the two sets of items are member states (MS) and projects, and the binary relationship that connects them is "participation" in one of the projects. This affiliation can be represented mathematically as a graph, in which nodes correspond to entities (such as EUMS and projects) and lines correspond to the ties of affiliation between these entities.

Affiliation data are easy to obtain: they can be gathered simply taking the records of the EUMS participation in specific projects. Next, grom the affiliation bipartite data we can obtain data about the so-called co-affiliation, that is the structure of the connection between groups V_1 or V_2. (Borgatti & Halgin, 2014). In our application, co-affilition between two nations is when they partipate to the same project, while co-affiliation between projects is when the same nation takes part to both. So, co-affiliation can provide insights into the structure or behavior of projects or nations. For example, co-affiliation data can reveal patterns of collaboration among the EUMS participating into PESCO, such as what nation tends to work with what, what EUMS tends to collaborate more frequently, and how these collaborations are related to the project structures. This information is useful to identify key players, understanding their dynamics, and predicting future trends as in the long periods nations could show preferential relations.

When using co-affiliation as a proxy for social relations, an important caveat is how to sample the affiliation events (Borgatti & Halgin, 2014), as very large events seldom provide useful information. For instance, the PESCO project Military Mobility almost entails every single EUMS part of the initiative, except for Ireland. Nonetheless, that does not indicate any useful information about eventual social tie between a given pair of members, and for that reason it has been excluded in our analysis. Whenever applying co-affiliation as a proxy for social relations we should also state clearly that there

is a fundamental distinction between 'social proximity' and 'social similarity'. Indeed, scholars (Burt, 1987; Friedkin, 1984) treated them separately.

From the adjacency matrix, which represents the state-by-project affiliation network, we can calculate a measure of the similarity between pairs of states based on their shared affiliations. To calculate this measure, we examine the rows corresponding to each state and count the number of times they co-partecipate to the same project, that is, their rows have value 1 in the same column, and taking into account how many times they do not co-participate. These numbers are then presented in the form of a 2x2 contingency table for each nations pair of states. In table 4.1, it can be seen that the value a represents the number of projects that both EUMS attended together and d the number of projects to which none of them participate. Next, $a + b$ is the total number of project that the pMS i attended, whereas $a + c$ is the total number of projects that pMS j attended, with n the total number of projects of the dataset. In order to facilitate comparison across nation pairs, we can divide a by n, so $a^* = \frac{a}{n}$to obtain the frequency of projects in which both nations participated.

Table 4.1: Contingency Table

		pMS j		
		1	0	
pMS i	1	a	b	a + b
	0	c	d	c + d
		a + c	b + d	n

The value a represents the number of projects that both EUMS attended together; $a + b$ represents the total number of project that the pMS i attended, whereas $a + c$ represents the total number of projects that pMS j attended. The value 'n' represents the total number of project in the dataset, or the number of columns in the incidence State-by-project matrix. In order to standardise the value of 'a' and facilitate comparison

across datasets, we can divide it by 'n' which will result in a value between 0 and 1.

$$a^* = \frac{a}{n} \tag{4.2}$$

To further standardize the value of a of the co-participation, additional standardizations can be taken into account, for example considering the characteristics of the pMS. For example, two pairs of states may participate in the same number of projects together, but if one pair has a much higher total number of projects participated in, we can then conclude that the pair with a greater percentage of shared projects has a stronger connection. Consider this scenario: if pMS i and j participate in three projects together out of three total attended, and another pair, say composed of States k and h, participated in three projects together out of 14 total attended, we would view the 100% overlap between pMS i and j as a stronger signal of closeness than the 21% overlap between State k and h. In this way, standardization that take into account project attendance data can help to further standardize values of a.

While normalising the value that indicates the number of time a pair of State co-participate in a PESCO project we essentially shift the nature of co-affiliation data from frequencies of co-occurrences to tendencies or revealed preferences to co-occur.

4.1.3 Jaccard coefficient index of PESCO affiliation data

Normalizing co-affiliation data, or adjusting the values based on additional factors, changes the focus from the raw frequency of co-occurrences, representing the greatness of a nation, as larger nations applies for more projects, to the probability of co-occurrence, representing the preferential pairing of two nations, (Borgatti & Halgin, 2014). Therefore, in order to accurately measure the frequency between member states participating

into PESCO, it is important to consider the appropriate data. Non-standardized data, which reflects the raw count of co-occurrences, is most suitable when attempting to ascertain the number of opportunities for interaction between nations. However, if one seeks to identify relationships between actors that may not be immediately obvious (such as sociometric preferences), then normalized data is preferable. Standardized measures indicate how often two States co-participate in a project relative to the total number of times they could have co-participated, thus providing a measure of tendency or preference for co-occurrence. In the following, using both raw and standardized data, we can accurately gauge and understand the interactions of participating States within the PESCO.

There are several ways on how to calculate a standardized version of a, see for a survey (Bonacich, 1972; Borgatti & Halgin, 2014), here, we consider the *Jaccard coefficient*. It is a method for standardizing a value by calculating the number of projects attended by two states divided by the number of projects that either of two states could have attended. The number of projects to which two nations could have participated together are determined by the fact that at least one of the two nations should have taken part to the project. The formal calculation of the Jaccard index (Tanimoto, 1958) is reported in the following formula, in which parameters a, b and c come from the two way table above.

$$a^*_{ij} = \frac{a}{a+b+c} \tag{4.3}$$

The value of the index ranges from 0 and 1, where 1 indicates the maximum possible overlap of the events participated by i and j, while a value close to 0 suggests the opposite.

In Table 4.2, the Jaccard coefficient index is reported in a state-by-state matrix.

Countries such as Bulgaria displays higher Jaccard coefficients with Croatia and Cyprus than with France and Italy, even though they co-participated in more projects with the latter countries. This suggests that the collaboration between Bulgaria and Italy is more likely driven by a high number of projects Italy participates rather than being a clue of Italian social ties with Bulgaria, see the Jaccard index of 0.121 compared to 0.300. Interestingly, four major countries – France, Italy, Spain and Germany – have high Jaccard coefficients, most likely due to their large presence in shared projects, nevertheless Jaccard indexes can be high for small countries as well, as Estonia and Latvia have coefficient at 0.571. In their attempt to analyze preferential patterns of cooperation between member states involved in PESCO, authors of Blockmans & Crosson (2019) confused the concept of frequencies of co-occurrences with tendencies or revealed preferences to co-occur. By merely counting the overlaps to obtain a percentage of collaboration with each other out of their total participation, they have treated the co-affiliation as an opportunity. However, when using these data as an indicator for social ties and pattern of preferential pairing, the variable should be standardized.

By using the Jaccard coefficient Index Table 4.2, it is possible to differentiate between preferential cooperation patterns among countries. To further explore this phenomenon, we used hierarchical clustering to partition the dataset into a varying number of clusters (k). This technique allows for clustering objects in such a way that objects within each cluster are as similar as possible (high intra-class similarity), while those from different clusters are dissimilar (low inter-class similarity)[1]. Exploring the dendo-

[1]It employs the pairwise dissimilarities between $N = x_1, \cdots, x_N$ in a proximity matrix. There are initially N clusters, each containing a single object. It creates a new cluster by merging the least dissimilar pair of clusters, or the pair with the lowest fusion cost, and updates the proximity matrix. After that, the procedure is repeated until just one cluster is left ($N - 1$steps).

The pairwise dissimilarity between the recently merged cluster $C' \cup C''$ and each of the remaining clusters C is only determined in terms of the pairwise dissimilarities between $C' \cup C''$ and C, i.e., in terms of the information from the prior proximity matrix, during the aggregation process. The single-linkage HAC algorithm is the most fundamental. Defined as the fusion cost between two clusters C and

	AT	BE	BG	HR	CY	CZ	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	NL	PL	PT	RO	SK	SI	ES	SE
AT	1	0.118	0.077	0.250	0.133	0.125	0.167	0.077	0.133	0.167	0.143	0.214	0.111	0.182	0.083	0.222	0.333	0.167	0.133	0.222	0.200	0.077	0.167	0.133	0.154
BE	0.118	1	0.133	0.125	0.176	0.235	0.133	0.214	0.227	0.240	0.125	0.250	0.083	0.167	0.231	0.077	0.154	0.412	0.250	0.190	0.174	0.133	0.133	0.276	0.200
BG	0.077	0.133	1	0.300	0.250	0.067	0.200	0.200	0.114	0.083	0.222	0.154	0.143	0.121	0.222	0.125	0.250	0.118	0.071	0.053	0.100	0.200	0.200	0.103	0.083
HR	0.250	0.125	0.300	1	0.231	0.062	0.182	0.182	0.111	0.080	0.278	0.231	0.125	0.118	0.091	0.250	0.100	0.176	0.143	0.050	0.095	0.182	0.300	0.179	0.077
CY	0.133	0.176	0.250	0.231	1	0.056	0.071	0.071	0.106	0.115	0.389	0.200	0.100	0.143	0.077	0.091	0.083	0.100	0.059	0.095	0.042	0.154	0.154	0.094	0.067
CZ	0.125	0.235	0.067	0.062	0.056	1	0.143	0.143	0.152	0.364	0.040	0.188	0.091	0.139	0.154	0.083	0.167	0.438	0.118	0.091	0.130	0.143	0.143	0.241	0.133
EE	0.167	0.133	0.200	0.182	0.071	0.143	1	0.500	0.140	0.040	0.048	0.154	0	0.088	0.571	0.286	0.250	0.188	0.250	0.053	0.158	0.091	0.091	0.103	0.083
FI	0.077	0.214	0.200	0.182	0.071	0.143	0.500	1	0.140	0.083	0.048	0.154	0	0.121	0.375	0.286	0.250	0.357	0.364	0.111	0.100	0.091	0.091	0.143	0.083
FR	0.133	0.227	0.114	0.111	0.106	0.152	0.140	0.140	1	0.370	0.113	0.130	0.023	0.396	0.091	0.070	0.093	0.244	0.130	0.163	0.283	0.089	0.114	0.408	0.163
DE	0.167	0.240	0.083	0.080	0.115	0.364	0.040	0.083	0.370	1	0.091	0.160	0.048	0.244	0.042	0.095	0.143	0.375	0.160	0.214	0.241	0.130	0.238	0.353	0.125
GR	0.143	0.125	0.222	0.278	0.389	0.040	0.048	0.048	0.113	0.091	1	0.136	0.059	0.237	0.105	0.056	0.053	0.115	0.136	0.154	0.143	0.158	0.100	0.105	0.045
HU	0.214	0.250	0.154	0.231	0.200	0.188	0.154	0.154	0.130	0.160	0.136	1	0	0.081	0.167	0.091	0.083	0.222	0.286	0.095	0.087	0.154	0.364	0.167	0.143
IE	0.111	0.083	0.143	0.125	0.100	0.091	0	0	0.023	0.048	0.059	0	1	0.065	0	0	0.200	0.071	0	0.067	0.059	0	0	0.077	0.125
IT	0.182	0.167	0.121	0.118	0.143	0.139	0.088	0.121	0.396	0.244	0.237	0.081	0.065	1	0.059	0.030	0.094	0.158	0.111	0.216	0.175	0.156	0.057	0.267	0.056
LV	0.083	0.231	0.222	0.091	0.077	0.154	0.571	0.375	0.091	0.042	0.105	0.167	0	0.059	1	0.143	0.286	0.200	0.273	0.118	0.167	0.100	0.100	0.069	0.091
LT	0.222	0.077	0.125	0.250	0.091	0.083	0.286	0.286	0.070	0.095	0.056	0.091	0	0.030	0.143	1	0.400	0.231	0.200	0.062	0.188	0.125	0.125	0.115	0.111
LU	0.333	0.154	0.250	0.100	0.083	0.167	0.250	0.250	0.093	0.143	0.053	0.083	0.200	0.094	0.286	0.400	1	0.214	0.083	0.125	0.176	0.111	0.111	0.111	0.222
NL	0.167	0.412	0.118	0.176	0.100	0.438	0.188	0.357	0.244	0.375	0.115	0.222	0.071	0.158	0.200	0.231	0.214	1	0.294	0.174	0.261	0.188	0.188	0.345	0.111
PL	0.133	0.250	0.071	0.143	0.059	0.118	0.250	0.364	0.130	0.160	0.136	0.286	0	0.111	0.273	0.200	0.083	0.294	1	0.278	0.190	0.071	0.154	0.094	0.067
PT	0.222	0.190	0.053	0.050	0.095	0.091	0.053	0.111	0.163	0.214	0.154	0.095	0.067	0.216	0.118	0.062	0.125	0.174	0.278	1	0.250	0.053	0.111	0.290	0.167
RO	0.200	0.174	0.100	0.095	0.042	0.130	0.158	0.100	0.283	0.241	0.143	0.087	0.059	0.175	0.167	0.188	0.176	0.261	0.190	0.250	1	0.100	0.100	0.235	0.150
SK	0.077	0.133	0.200	0.182	0.154	0.143	0.091	0.091	0.089	0.130	0.158	0.154	0	0.156	0.100	0.125	0.111	0.188	0.071	0.053	0.100	1	0.200	0.143	0.182
SI	0.167	0.133	0.200	0.300	0.154	0.143	0.091	0.091	0.114	0.238	0.100	0.364	0	0.057	0.100	0.125	0.111	0.188	0.154	0.111	0.100	0.200	1	0.103	0.083
ES	0.133	0.276	0.103	0.179	0.094	0.241	0.103	0.143	0.408	0.353	0.105	0.167	0.077	0.267	0.069	0.115	0.111	0.345	0.094	0.290	0.235	0.143	0.103	1	0.222
SE	0.154	0.200	0.083	0.077	0.067	0.133	0.083	0.083	0.163	0.125	0.045	0.143	0.125	0.056	0.091	0.111	0.222	0.111	0.067	0.167	0.150	0.182	0.083	0.222	1

Countries: AT Austria, BE Belgium, BG Bulgaria, HR Croatia, CY Cyprus, CZ Czech Republic, EE Estonia, FI Finland, FR France DE Germany, GR Greece, HU Hungary, IE Ireland, IT Italy, LV Latvia, LT Lithuania, LU Luxembourg, NL Netherlands, PL Poland, PT Portugal, RO Romania, SK Slovakia, SI Slovenia, ES Spain, SE Sweden

Table 4.2: Jaccard coefficient index of Member States participating into PESCO

gram of Figure 4.1, we found $k = 3$ a reasonable choice of the number of clusters.[2]. By

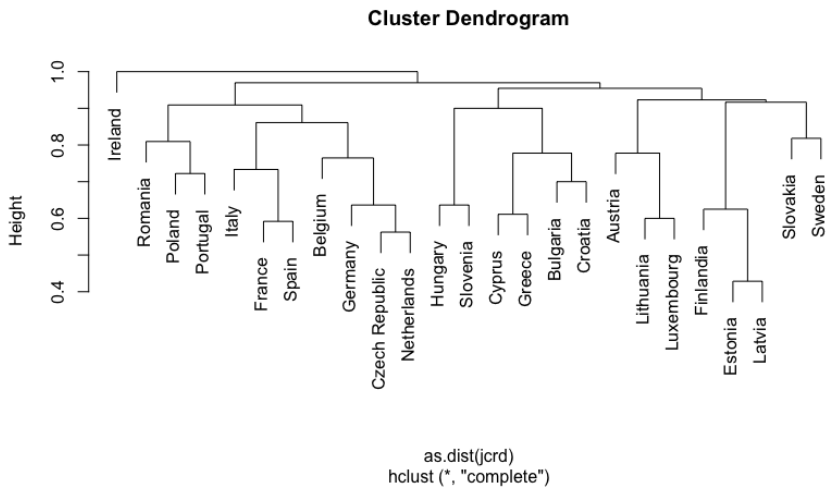


Figure 4.1: Communities in PESCO projects

applying this clustering algorthim we obtain the following subgroups:

- Belgium, Czech Republic, France, Germany, Italy, Netherlands, Poland, Portugal, Romania, Spain.
- Bulgaria, Croatia, Cyprus, Greece, Hungary, Slovenia
- Austria, Estonia, Finlandia, Latvia, Lithuania, Luxembourg, Slovakia, Sweden.

It has created three group clusters: group 1 with a size of 10 members is the largest one; group number 2 with 6 members and group number 3 with eight members.

C' as the distance between the nearest pair of points, the formula is the following:

$$\begin{aligned} D(c, C') &= \min_{x \in C, x' \in C'} d(x, x') \\ D(C' \cup C'', C) &= \min\{D(C', C), D(C'', C)\} \end{aligned} \tag{4.4}$$

[2]A representation of hierarchical agglomerative clustering techniques is a dendrogram. It looks like a tree with branches connecting terminal nodes (leaves). Clusters are represented by branches, and fusion costs are represented by the heights at which the branches are connected. The leaves are the objects. The difference in fusion costs between the time a branch first appears and the time it is aggregated is the branch's lifetime. When a dendogram is cut at a specific height, τ, it produces clusters whose fusion costs are either less than or equal to τ.

For each country, the the height of the cutoff point determines its groups belonging. So in the case of Austria (AT), the height of the cutoff point is in the interval]0.75, 0.8[which means to belong to clustering group number 3. Hence, table 4.3. shows off the set of countries for each cluster's group.[3] The results of *HAC* clustering have indicated

Table 4.3: *HAC* Clustering Results

	cluster_vector
Belgium	1
Czech Republic	1
France	1
Germany	1
Italy	1
Netherlands	1
Poland	1
Portugal	1
Romania	1
Spain	1
Bulgaria	3
Croatia	3
Cyprus	3
Greece	3
Hungary	3
Slovenia	3
Austria	2
Estonia	2
Finlandia	2
Latvia	2
Lithuania	2
Luxembourg	2
Slovakia	2
Sweden	2

three distinct groups, two of which are distinctively heterogeneous in terms of country's features such as GDP, income per capita, and country size. For example, Group 3 — comprised of Austria, Estonia, etc. — exhibits considerable differences in terms of PPS (Purchasing Power Parities) and military expenditures. According to Eurostat 2021

[3]For instance to obtain a partition into 3 clusters we have to cut the dendogram at some height in the interval]0.9, 1.0[, yielding the cluster C = RO, PO, PT, IT, FR, ES, BE, DE, CZ, NL and C' = HU, SI, CY, EL, BG, HR and C'' = AT, LT, LU, FI, EE, LV, SK, SE. It is also interesting to notice how C' and C" displays higher proximities since the cutoff to obtain two clusters are slightly higher. This denotes a clear cleavages between C and the other groups.

data, Austria has the PPS at 24.450 while Bulgaria and Greece have the lowest at 9.375 and 9.917 respectively. Similarly, SIPRI's 2023 report on Military Expenditures shows that Austria spent 0.76% as a share of GDP in military expenditures in 2017 compared to 2.01%, 1.35%, and 1.59% for Estonia, Finlandia and Latvia respectively. Even the growth rate for the time interval 2017-2021, is completely unbalanced being 1.59% for Austria, 2.4% for Estonia and 13.4%, 11.9%, for Estonia, Finland and Latvia respectively. It is unlikely to ascertain that country's choice to participate in a determined project is due to country similarities in terms of defence and military expenditures.

The the *hierarchical* clustering results, baed on Jaccard coefficient index, has revealed patterns of cooperation among Member States within PESCO. To further bolster the robustness of these results, a complex networks methodology called 'modularity maximisation' will be employed (Agarwal & Kempe, 2007; Newman & Girvan, 2004). This method tests the implicit null hypothesis of the modularity function that items are chosen at random, without any implicit preferential pairing. By testing the hypothesis through p-values and comparing them to hierarchical clustering results, we will be able to ascertain whether or not there are preferential patterns of cooperation and whether they hold true.

4.2 PESCO communities detection with modularity maximisation

As discussed above, the PESCO co-affiliation data set can be interpreted as a two-mode network, in which the two node classes are nations and projects and there is an arc a_{ij} whenever nation i takes part to project j. In the following, we will analyses the projections of the two-mode network to the nations graph and the project graph. The

Table 4.4: The PeSCo affiliation matrix: States-by-projects matrix

	AIF	BLOS	C-UAS	CBRN SaaS	Co-basing	CRRT MACS	Cyber Threats	DIVEPACK	DMDRCP	EHAAP	EMC	EOF	ESSOR	EU IntSchool	EU TCC	EU TEC	EU TIGER Mark	EU TMCC	EU-SSA-N	EUFOR Crisis	EURAS	Eurodrone	GMSCE	H3 Training	HARMSPRO	IFS	JISR	MAS MCM	Military Mobility	NLHSuOp	SOF C2CP	Strategic C2	UGS	Upgrade MS
Austria	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Belgium	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	1	0	0	1	0
Bulgaria	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
Croatia	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
Cyprus	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	1
Czech Republic	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0
Estonia	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Finland	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
France	0	1	0	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0
Germany	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	1	1	0	0	0	1	0	1	1	0	1	1	0
Greece	1	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	0	1
Hungary	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Italy	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	0	0	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	1
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0
Lithuania	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Netherlands	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0
Poland	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	0
Portugal	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0
Romania	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0
Slovakia	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
Slovenia	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Spain	0	0	0	0	1	1	0	0	1	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	1	1
Sweden	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Based on the first three batch of PESCO projects

Table 4.5: The PeSCo affiliation matrix: States-by-projects matrix

	Eurosim	EU Caih	SMTC	CBRNDTR	EUNDC	MUSAS	EPC	AEA	CIDCC	TWISTER	MAC-EU	ECoWAR	RPAS	MBT-SIMTEC	EU MilPart	4E	M-SASV	SATOC	NGSR	Rotocraft	SSW	Air Power	FMTC	CRF	AMIDA-UT	CoHGI	DoSA
Austria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
Belgium	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0
Finland	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
France	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1
Germany	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	1
Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Hungary	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Netherlands	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Poland	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Portugal	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1
Romania	0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1
Slovakia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Spain	0	1	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0
Sweden	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Based on the 4th and 5th batch of PESCO projects

nation graph $G^n = (V^n, E^n)$ is coms and and there is an adge $e_{ij} \in E^n$ whenever nation i and j take part to a same project. Note that there could be multiple edges between i and j, as mush as the total number of projects in which they take part together. The project graph $G^p = (V^p, E^p)$ is composed by nodes V^p representing projects and there is an edge $e_{ij} \in E^p$ whenever there is a common nation that takes part to both project. As before, note that there could be multiple edges between i and j, as mush as the total number of nations that jointly participate to i and j.

The structure of G^n (or G^p) may reveal some form of *preferential attachment* between nations (or projects), namely, the tendency of nations (or projects) of grouping together and forming communities. Communities are defined as clusters of highly interconnected groups with looser connections between them (Chen et al., 2009). A preliminary analysis has been carried out through the Jaccard coefficient index and hierarchical clustering. Nonetheless, the validation of these results are difficult as there is no statistical evidence that should let someone decide what is the correct number of clusters between 1 and n available. Therefore, the main question remains: How do we know whether the communities discovered by the algorithms are truly good?

In order to answer this question, in recent years, *community mining* has become a prominent research area in the social sciences. Scholars are searching to improve their understanding of the network structures and to identify the preferential relations between actors. Detecting links between entities and locating them within particular communities has become essential in gaining insights of the social groups. In the case of PESCO, uncovering preferential cooperation between states can be fundamental importance to understand how the Communitarian common defense policies unfold and are implemented. Understanding how states connect to each other through preferential relations is critical for unlocking the dynamics of nations as a social group (Chen et al., 2009).

Methods for network communities detection can be mainly divided into two types: *optimization methods* or *constructive methods*. Though they attempt to answer to the same question, that is, finding the hidden community structure of the networks, they use different technical approaches (Newman, 2006b). Constructive methods, as the *hierarchical clustering*, merge similar nodes to obtain graph of smaller size, in which clusters are the groups of merged nodes. Then the optimal partition is guessed by researchers using some rule-of-thumb. Unfortunately, the rule-of-thumb can be quite arbitrary, as there is no mathematical method, for example, statistical hypothesis testing, that can resolve the problem of what is the correct number of clusters. Optimization methods resolves the problem of selecting the best clustering using some objective function, that must be optimized. Usually objective functions are some statistical indicators of properties of the partitions, for example the $k - means$ algorithm minimize the sum of square, e.g. the partition variability. An index that has being successfully applied to ntworks is the modularity function, see (Newman & Girvan, 2004; Duch & Arenas, 2005; White & Smyth, 2005; Newman, 2006b,a). The guiding principle behind the modularity measure is that a network should not just be partitioned between nodes in such a way that there are large numbers of edges within groups. Rather, within group there should be a large number of edges respected *to what is expected*.

The following sections will introduce the definition of modularity and its mathematical rational. Then, we will apply the modularity optimization to the PESCO networks, both G^n and G^p, to identify the possible presence of communities. The results will eventually confirm or refute the exploratory findings of community clusters in section 4.1.

4.2.1 The modularity measures

In Newman & Girvan (2004), it is proposed a new statistic found a reliable metric to assess the quality of a network community clustering, that is called the modularity index. The originality of that approach is that a function calculates on the actual empiric network is compared to the same function, that would be calculate on a hypothetical network characterized by the absence of any community structure. The hypothetical network can be interpreted as the 'null model' of inferential hypothesis testing, and the most the measures are different, the most likely is that empiric communities are significant. . Following Newman & Girvan (2004), in empiric terms the modularity measure can be described as:

$$Q = (\textit{number of edges within communities}) - (\textit{expected number of such edges}) \quad (4.5)$$

(Newman & Girvan, 2004; Chen et al., 2009)

In mathematical terms, the modularity measure can be represented by a k x k symmetric matrix e, in which each element e_{ij} is the fraction of edges that link vertices of community i with vertices in community j. The trace $Tr(e) = \sum_i e_{ii}$ of this matrix gives the fraction of edges connecting vertices within the same community, while its row sum, $a = \sum_j e_{ij}$ gives the fraction of edges with at least one end in that particular community i. Though a high trace value is surely indicative of a sound division of a community, it should not be taken as the sole measure of quality. For it may be that, though the trace value is maximal at 1, all the vertices are grouped in one single community ñ thereby giving no insight into its structure. Thus, defining a_i^2 as the expected fraction of edges within community i on the condition that edges were distributed randomly, e.g. assuming the null model of a network with no community structure, the modularity index is:

$$Q = \sum (e_{ii} - a_i^2) = Tr(e) - ||e^2|| \tag{4.6}$$

where the symbol $||x||$ indicates the sum of the elements of the matrix x. Hence, the modularity Q gauges the fraction of edges connecting vertices of the same community edges subtracting the expected fraction of edges that would connect the same pair of nodes, were the network be without structure, see (Girvan & Newman, 2002) for details. If the amount of within-community edges is equivalent to randomness, then Q is 0. The maximum value for Q is 1, which indicates the strongest community structure. Empiric findings determine that Q can fall between 0.3 and 0.7, with higher values being rare (Girvan & Newman, 2002).

To calculate the node partition with the highest modularity, an optimization problem mist be solved, see Benati & Puerto (2022). There, it is shown that the optimal modularity problem is equivalent to clique partition, a combinatorial problem that can be represented by Integer Linear Programming and solved by specialized software. Therefore, we will apply modularity optimization to the PESCO co-affiliation network, projected into the nation network G^n and the project network G^p.

4.2.2 The projection method of a two-mode data matrix

First, we will show how the projected network G^n and G^p can be calculated from the PESCO affiliation network. The latter network is expressed through an incidence matrix: if n is the number of Member States participants in the PESCO network and g is the number of projects, then the incidence matrix B is a g x n matrix having elements

$B_{ij} = 1$ if project i contains participant j and $B_{ij} = 0$ otherwise.

$$B_{ij} = \begin{cases} 1 & \text{if vertex } j \text{ belongs to group } i \\ 0 & \text{otherwise} \end{cases} \tag{4.7}$$

Since a bipartite graph is a special case of undirected graph, hence it can be represented with a symmetric adjacency matrix as well. Let G be our bipartite graph with n being the Member State nodes numbered 1,2,...,n and g project nodes numbered $n+1, n+2, ..., n+g$. Let B be the gXn incidence matrix of G. Then the adjacency matrix A of G is a symmetric $(n+g)$ X $(n+g)$ matrix form:

$$A = \begin{pmatrix} 0_{r,r} & B \\ B^T & 0_{s,s} \end{pmatrix} \tag{4.8}$$

where B is an $r \times s$ matrix and $0_{s,s}$ represents $r \times r$ and $s \times s$ zero matrices. Matrix B uniquely represents the graph. Formally, PESCO items graph can be defined as follows: let the items graph being an undirected bipartite graph $G = (U, V, E)$ where $U = \{u_1, ..., u_r\}$ and $V = \{v_1, ..., v_s\}$ and edges $\in E$. The adjacency matrix is $r \times s$ 0-1 matrix B in which $b_{ij} = 1 \iff (u_i, v_j) \in E$. [4]

To analyze the data shown in the affiliation matrix we will apply the "projection method" (Breiger, 1974). Our two-mode matrix represents the relationships between EUMS and the projects they have participated. Each row in the matrix represents a MS, and each column represents a project. The entries in the matrix indicate whether a EUMS has participated into a particular project, with a value of 1 indicating that the EUMS has participated into that project, and a value of 0 indicating that they have

[4] Alternatively $G = (V, E)$ where $V = V_1 \dot{\cup} V_2$ and each arc $\in E$ is $\{v_1, v_2\}$ with $v_1 \in V_1$ and $v_2 \in V_2$.

not. The "projection method will convert the two-mode into one-mode data matrix. For the MS, it creates a matrix representing the relation participated into project with", represented by the graph G^n. Similarly, for the projects it creates a matrix representing the relation "one MS participated in both projects". These matrices are given by the matrix products AA^T and A^TA, where A is the affiliation matrix and A^T is the transpose of A. To find a transpose matrix, for a matrix A with dimensions m x n, where m is the number of rows and n is the number of columns, the transpose of A (denoted as A^T) will have dimensions n x m.

One way to find the transpose of a matrix is to use the following formula:

$$A^T_{i,j} = A_{j,i} \tag{4.9}$$

where A^T is the transpose of A, A_{ij} is the element in the i-th row and j-th column of A, and $A_{j,i}$ is the element in the j-th row and i-th column of A.

The two one mode projection matrices AA^T and A^TA are shown in Table 4.6 and Table 7.4 in Appendix B. The rationale behind this matrices are simple: in Table 4.6, State by State affiliation matrix in which the (i, j)th entries are the number of projects MSi and MSj participate together, whereas Table 7.4. the Project by Project co-affiliation matrix in which the (i, j)th entry is the number of EUMS who participated in both project i and project j.

Both projection matrices AA^T and A^TA are undirected networks with no self-links (links connecting a node to itself), and are symmetric, since they are adjacency matrices, ($a_{ij} = a_{ji}$) and all elements of the main diagonal are equal to 0 ($a_{ij} = 0$).

Table 4.6: PeSCo: State-by-State co-affiliation matrix

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg	Netherlands	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden
Austria	0	2	1	3	2	2	2	1	6	4	3	3	1	6	1	2	3	3	2	4	4	1	2	4	2
Belgium	2	0	2	2	3	4	2	3	10	6	3	4	1	6	3	1	2	7	4	4	4	2	2	8	3
Bulgaria	1	2	0	3	3	1	2	2	5	2	4	2	1	4	2	1	2	2	1	1	2	2	2	3	1
Croatia	3	2	3	0	3	1	2	2	5	2	5	3	1	4	1	2	1	3	2	1	2	2	3	5	1
Cyprus	2	3	3	3	0	1	1	1	5	3	7	3	1	5	1	1	1	2	1	2	1	2	2	3	1
Czech Republic	2	4	1	1	1	0	2	2	7	8	1	3	1	5	2	1	2	7	2	2	3	2	2	7	2
Estonia	2	2	2	2	1	2	0	4	6	1	1	2	0	3	4	2	2	3	3	1	3	1	1	3	1
Finlandia	1	3	2	2	1	2	4	0	6	2	1	2	0	4	3	2	2	5	4	2	2	1	1	4	1
France	6	10	5	5	5	7	6	6	0	17	6	6	1	21	4	3	4	11	6	8	13	4	5	20	7
Germany	4	7	2	2	3	9	2	3	18	0	3	4	1	10	2	2	3	10	5	6	7	3	5	13	3
Greece	3	3	4	5	7	1	1	1	6	3	0	3	1	9	2	1	1	3	3	4	4	3	2	4	1
Hungary	3	4	2	3	3	3	2	2	6	4	3	0	0	3	2	1	1	4	4	2	2	2	4	5	2
Ireland	1	1	1	1	1	1	0	0	1	1	1	0	0	2	0	0	1	1	0	1	1	0	0	2	1
Italy	6	6	4	4	5	5	3	4	21	10	9	3	2	0	2	1	3	6	4	8	7	5	2	12	2
Latvia	1	3	2	1	1	2	4	3	4	1	2	2	0	2	0	1	2	3	3	2	3	1	1	2	1
Lithuania	2	1	1	2	1	1	2	2	3	2	1	1	0	1	1	0	2	3	2	1	3	1	1	3	1
Luxembourg	3	2	2	1	1	2	2	2	4	3	1	1	1	3	2	2	0	3	1	2	3	1	1	3	2
Netherlands	3	7	2	3	2	7	3	5	11	9	3	4	1	6	3	3	3	0	5	4	6	3	3	10	2
Poland	2	4	1	2	1	2	3	4	6	4	3	4	0	4	3	2	1	5	0	5	4	1	2	3	1
Portugal	4	4	1	1	2	2	1	2	8	6	4	2	1	8	2	1	2	4	5	0	6	1	2	9	3
Romania	4	4	2	2	1	3	3	2	13	7	4	2	1	7	3	3	3	6	4	6	0	2	2	8	3
Slovakia	1	2	2	2	2	2	1	1	4	3	3	2	0	5	1	1	1	3	1	1	2	0	2	4	2
Slovenia	2	2	2	3	2	2	1	1	5	5	2	4	0	2	1	1	1	3	2	2	2	2	0	3	1
Spain	4	8	3	5	3	7	3	4	20	12	4	5	2	12	2	3	3	10	3	9	8	4	3	0	6
Sweden	2	3	1	1	1	2	1	1	7	3	1	2	1	2	1	1	2	2	1	3	3	2	1	6	0

4.2.3 The modularity maximisation

Given the state-by-state G^n or the project-by-project G^p networks, to ascertain if they have a cluster or community structure, they must be compared to imaginary survey graphs $G' = (U, V, E)$ that do not have preferred pairing. In statistical jargon, as discussed in (Benati & Puerto, 2022), the graphs G' are the benchmarks for the null hypothesis of no community structure is in G^n, or G^p. The empiric and the theoretiacl networks are compared through the modularity value of $z(G)$. Loosingly speaking, if $z(G^n)$, or $z(G^p)$, are way larger than the values calculated on theoretical $z(G')$, then this is a hint that the community structure is real. More formally, the hypothesis can be tested using simulated p-values and z-scores. We must simulate a theoretical bipartite graph $G' = (U, V, E)$ with no preferential groupings: it is done using the configuration model, that is, for G^n the it is a random graph G' in which every state participate to the same number of project, so that the node degrees of G^n are the same as G', but nation pairings are recombined randomly. Similarly, the configuration model for G^p is is a random graph G' in which every project is participated by the same number of nations, so that the node degrees of G^p are the same as G', but project pairings are recombined randomly. Values $z(G')$ are outcome of a random variable characterized by a probability distribution. If we knew the distribution, we could calculate the exact p-values. Unfortunately, the analytical distribution is unknown, but it can be simulated empirically making a large number of simulated graphs G' with no preferential groupings. Let $G'_i, i = 1, ..., N$ be an i.i.d. sequence of simulated random graphs and $I\{\omega\}$ the indicator function of event $\omega[z(G^n) \leq z(G'_i)]$; then the test p-value can be approximated by the formula:

$$\hat{p} - \text{value} = \frac{1}{N} \sum_{i=1}^{k} I\{z(G^n) \leq z(G'_i)\} \tag{4.10}$$

(Benati & Puerto, 2022). The configuration model proposed by Newman (2010) provides a means of simulating the G' artificial graph: given a bipartite graph $G' = (U, V, E)$ with n nodes and degree sequence $\delta = (\delta_1, ..., \delta_n)$, this null model for the modularity measure maintains the same degree sequence but prevents preferential pairings. By randomly reassigning each nation to different projects, eventual preferential pairings are eliminated while still preserving the original degree sequence δ. In Benati & Puerto (2022) it is proposed that the p-value of the test can be calculated by the following steps. Calculate $z(G'_i)$ i times, where $i = 1, ..., N$ using the rewiring method, see (Newman, 2010), to generate i.i.d. random graphs G_i and calculate their $z(G_i)$. This procedure generate a sample of $z(G_i)$, $i = 1, ..., N$, which will ultimately determine the empiric distribution of $z(G)$ under the null hypothesis. Finally, apply Formula 3.11 to calculate the p-value of the no-community tets. To obtain our results, integer linear solver GuRoBi has been used, LLC (2022), with $N = 100$..

Applied to the G^n network, the optimal modularity was $z(G^n) = 0.04138666$ which corresponded to a three community structure:

- Group 1: Belgium, Czech Republic, France, Germany, Ireland, Italy, Netherlands, Portugal, Romania, Spain, Sweden
- Group 2: Estonia, Finland, Latvia, Lithuania, Luxembourg, Poland.
- Group 3: Austria, Bulgaria, Croatia, Cyprus, Greece, Hungary, Slovakia, Slovenia;

As can we see, the three groups confirmed the clustering results of the *hcl* clusters, Table 3.4, based on the Jaccard's coefficient applied on our PESCO affiliation data. There is quasi perfect match between the two results (except for the positioning of Sweden and Ireland). Group 1 has eight elements, Group 2 has ten and Group 3 six.
The experimental p-value is 0.0, that is, we obtained $z(G'_i) \leq z(G^n)$, while the exper-

imental z-score is 3.479578, way more larger then the 1.96 minimum threshold used to bound the acceptance region. Therefore, the EUM are forming communities in their participation to common defense projects.

4.2.4 The communities within Europen defence initiatives

The analysis of PESCO initiatives (section 4.1.3 and 4.2.3) has revealed the existence of preferential relationships between Member States, which could affect their decision-making and finally the outcome of their cooperation that will be examined in chapter five as a cooperative game. The clustering have underpinned some geographically cleavages between northern countries, such as the Baltic States and Finland—who tend to cooperate preferentially between them, or the PESCO frontrunners, which are countries that tend to participate the most in projects and belong mainly to Western Europe, next a broad group of countries characterized by *mittleurope* dimension and geographical proximity between its members. More specifically, Benelux cooperation is strong, at least between Belgium and Netherlands, both countries are part of the same cluster and their cooperation is further confirmed by the Jaccard coefficient index: 0.412 between Belgium and Netherland. Their participation in project is above the average, with 11 and 13 participation in projects respectively, see Table 4.8. Nonetheless, Luxembourg is not part of that group and its Jaccard coefficient is low with both countries, only 0.154 with Belgium and 0.214 with Netherland. On the other hand Nordic and Visègrad (V4) cooperation is low if compared to their past histories. Indeed, members of V4 are quite fragmented, Slovakia and Hungary are both part of the third group, while Poland belongs to the second group and Czech Republic is in the first. Sweden is clustered with Spain and PESCO frontrunners while Finland preferential cooperation occurs with Baltic states.

As regard to the Baltic states, despite an increase in defence budgets, the low in-

volvement in PESCO is due to their reluctance to engage in major European defence collaborations: a behavior that contradicts the narrative of Structural realism, which argues that weaker states are more likely to cooperate in the defence industrial domain due to their lack of self-sufficiency (Walt, 2005). Instead, they prefer to import weaponry rather than investing in European security supply (Weiss & Biermann, 2018). Nevertheless, Structural realism offers an alternative explanation for this tendency considering it as bandwagoning. According to this concept, smaller countries are more likely to side with a powerful state whose strength they are attracted to, as claimed in (Thiem, 2011; Walt, 1985). This is certainly the case for Baltic countries, who have chosen to rely on US security rather than thoroughly cooperate with other European powers. The gap between US and EU military capability persists and therefore any EU initiative is not seen as a sufficient protection against a possible Russian attack (Mearsheimer & Walt, 2016). Same consideration holds for Poland, which is indeed clustered with the Baltic states. In a joint letter addressed to the High Representative for Foreign Affairs and Security Policy, the Ministry of Foreign Affairs and National Defence of Poland outlined three conditions for its participation in the PESCO initiative. These conditions focus on ensuring that NATO's defence planning process retains primacy, that European defence industry development is balanced, competitive and innovative to suit the needs of all member states involved, and that security threats are addressed through a 360-degree approach with particular attention paid to the eastern flank[5]. The letter stressed the so called non-duplication and non-competition with NATO principles. Therefore, a strong pro-NATO narrative brings these EU member states together enhancing the Polish-Finnish-Baltic cooperation, confirmed as well by their common vision for third country participation, as an opening to the US involvement (Blockmans, 2017).

However, this does not explain why other small countries such as Croatia, Cyprus

[5] A joint letter to HR/VP Federica Mogherini presented by Polish foreign minister W. Waszczykowski and Defence Minister M. Macierewicz. Available on-line: Meeting of Defense Ministers of European Union, Ministry of National Defence, 13 November 2017, en.mon.gov.pl

and Portugal have chosen to cooperate within the PESCO framework. It is likely that different threat perceptions and geopolitical considerations come into play here. An explanation lies an a document titled "Relevance of regional or clustered cooperation for PESCO Benelux Food For Thought paper." A joint statement in 2017, before the adoption of PESCO, where Benelux countries underscored the benefits of regional and clustered cooperation between small and medium-sized nations, particularly those that inhabit the same geographical region. Such an arrangement, it was claimed, allows for more effective defence cooperation with larger Member States and partners on an even playing field (Netherlands PoC, interview). As one representative from the Netherlands explained: "this kind of cooperation encourages small and medium-sized countries to develop capabilities at a higher rate and in a more efficient manner–bolstering the value these nations possess".

Concerning the first grouping, the four defence frontrunners of the European Union, namely France, Germany, Italy and Spain, have displayed a remarkable level of participation to PESCO projects. They are above the average of participation in projects and they are in the first five positions of project involvement (see Table 4.8.). Moreover, according to data from SIPRI Database, this quartet accounts for more than half (53%) of total EU military expenditures between 2017 and 2021[6]. Furthermore, as reported by SIPRI in 2019, fifteen companies from these four countries are among the top 100 arms-producing and military services companies in the world. These include such renowned names as Airbus[7], Leonardo, Thales and Fincantieri; while according to figures on arms export licenses issued by European External Action Service, these four countries, between 2017 and 2021, topped all other EU states. In light of these findings it is clear that structural and economic factors have shaped these states's capacity

[6]SIPRI Database, time interval 2017-2021 top four EU countries in military expenditures, in millions of US dollars at current prices and exchange rates. France: 49195,7$ 51409.8$, 50118.9$, 52747.1$, 56647.0 $; Germany: 42210.3$, 46423.0$, 49007.5$, 53211.0$, 56017.0$; Italy: 26447.9$, 28420.1$, 26380.7$, 28921.3$, 32006.1$; Spain: 16043.5$, 17823.3$, 17189.3$, 17431.8$, 19544.5$.

[7]Technically Airbus is considered a Trans-European company

for active engagement in defence projects within the EU framework, as Blockmans & Crosson (2019) observed. On the other hand, if we consider other indicators such as the military expenditures by country as percentage of government spending in the same time interval, 2017 - 2021, the top four EU countries are not those mentioned before but surprisingly are Romania, Greece, Lithuania, Estonia and Latvia. Thus, while the economic and structural rationale may help explain the motivations behind one grouping's formation in PESCO projects, it fails to provide a consistent explanation for all other clusters. Other variables must be taken into account to better understand the patterns of preferential co-operation.

We advance that geography is the critical factor and the most consistent to understand the preferential patterns of participation to PESCO projects. The G2 and G3 groups, for example, are largely comprised of neighboring countries with close geographical proximity, such is the case for Austria and Croatia, and Estonia's neighboring countries. This has resulted in the strong cluster of states from the Balkans and Baltics that

Table 4.7: Number of project per Member States

Countries	*Below the mean*	*Countries*	*Above the mean*
Belgium	11	France	43
Czech Republic	10	Italy	31
Cyprus	9	Spain	27
Hungary	9	Germany	21
Poland	9	Greece	16
Austria	8	Romania	16
Croatia	7	Portugal	14
Sweden	7	Netherlands	13
Bulgaria	6		
Estonia	6		
Finland	6		
Slovakia	6		
Slovenia	6		
Latvia	5		
Luxembourg	4		
Lithuania	3		
Ireland	2		

$N = 25$, $Tot.prj = 61$, $mean = 11$, max 43, min 2

have particularly strong relationships with each other. Furthermore, by accounting for geography, we can more accurately explain the nature of cooperation in specific projects and hence the reason why certain countries decided to join it. Consider for instance the projects to develop maritime capabilities, where all the countries involved are seafaring states. The logic imposes that geography and territory not only determine preferential cooperation with member states but also determine the scope of their projects. It is certainly the case of G3, which has a *mittleurope* dimension and a remarked geographical proximity between its members. Hence, linguistic and cultural proximity could explain not only the clustering among Balkan states but also the French-Belgian-Dutch cohesion within PESCO (all three countries are part of the same cluster), and the Greek-Cypriot cooperation as well.

Another variable that explains the clustering of nations involved in PESCO has to do with their strategic cultures and foreign policy orientations. The analysis reveals a distinct rift between pro-Atlantic countries, such as the Baltic states, which rely heavily on NATOís security umbrella, and Western European countries that have shown higher levels of participation. Central and Eastern European member states stand in the middle between these two poles, exhibiting moderate involvement in PESCO. In a 2013 study, scholars Biehl, Giegerich, & Jonas argued that clustering among EU member states is caused by varying strategic cultures determined by different ambitions in international security policy, the scope of action for the executive branch in military decisions and foreign policy operations and willingness to employ military force. While this categorization of EU members mimics our groupings of PESCO member states to an extent, it does not completely mirror them. Nonetheless, such authors have highlighted an institutional tendency towards cooperation in those countries that use their security policy as a tool for international bargaining (Blockmans & Crosson, 2019). Again, the correlation between strategic culture and institutional tendency towards cooperation cannot fully explain the clustering occurred at PESCO level. A more accurate analysis examines

previous frameworks for bilateral or multilateral defence cooperation in Europe and sees if it matches with PESCO clustering. Examples of this pre-PESCO cooperation are the Lancaster House Treaties or the NORDEFCO (Nordic Defence Cooperation); another example is the Benelux Defence Cooperation[8] and the Central European Defence Cooperation among Hungary, Czech Republic, Slovakia, Austria, Croatia and Slovenia. By using the Defence Cooperation Agreement Dataset (DCAD) by Kinne (2020) filtered for only the twenty-five EU countries participating into PESCO, with a time span 1989-2010 (DCAD data are limited to 2010) it emerges a tendency to cooperate that follows the same preferential patterns occurred in our PESCO analysis. Both analyses have confirmed what a representative of a member state said: "If we seek to involve other countries in our project our first attention is towards our historical partners with whom we shares same strategic interest. Often those countries are our neighbors" (interview to Project Officer, PESCO Estonia). This is also motivated by the difficulty to enforce MS's compliance with commitments, since the unfriendly act of suspending it a member states is very unlikely even when peer pressure are not sufficient (Blockmans, 2018). Therefore, in a condition of mistrust states prefer to engage with whom have more confidence. Preferential patterns of cooperation in PESCO has more to do 'with whom' I cooperate than 'on what'; what drives the interest of a member state to join a project presented by another PESCO country is the strength of ties that it has with the latter. To this extent, our analysis is consistent with the ECFR's Coalition explorer findings by Janning, Zunneberg, & Klavehn (2017).

While these variables attempt to describe why those clustering ever occurs *ab initio*, they fail to provide a consistent explanation across all groups. Instead, our analysis sug-

[8]For decades, the Benelux countries have worked closely together when it comes to defense cooperation and integration. In 2012, this relationship was formalized with the signing of the Declaration on Defense Cooperation. Since 2017, Belgian and Dutch combat aircrafts have been alternating shifts protecting Benelux airspace. In 2018, the Benelux region took a lead of EUBG stand-by forces. Additionally, the region is involved in multilateral programs such as MRTT and A400M, as well as naval cooperation between Belgium and The Netherlands, satellite communications between Luxembourg and Belgium, and educational training domains. This intense collaboration has been a hallmark of the Benelux countries for years.

gests that another independent variable affects these clusters. The role of EU as agency enhance an inter-cluster cooperation and integration among its members, but to some extent effects also the inter-clustering, thus changing some patterns of cooperation. This is the 'institutional effect' that occurs within PESCO mechanism.

4.2.5 Communities variation in PESCO: from project proposals to project adoption

In the previous sections, we have investigated preferential cooperation patterns between member states in PESCO. Nonetheless, this analysis revolved around those projects which have been officially adopted, but at the preliminary stage, projects are submitted by different groups of applicants, and only after some bargaining the definitive group of applicants is established. Therefore, different results and communities structure could be obtained if we examine the proposals at the early stage, instead of the definitive. Then, to assess whether EU agencies had a role in fostering cooperation and integration, we could compare the results before and after their activity as 'clearing house', which finally led to projects final adoptions. The limited time span between proposals submission and their final adoption means that any variation in preferential patterns of cooperation and clustering is likely that occurred for the EU agencies' assessment, evaluation, and sharing of information on submitted projects, which that affected member states decision to join or not a specific project. As we will discuss in chapter five, this does not mean that member states' decisions are based uniquely upon Agencies' assessment, but that the assessment have a weigh in their rational choice.

The narrative over Agencies' role would be incomplete without examining the communities formed around proposed projects. An important *caveat* is needed here. Unfortunately, it was not possible to retrieve information on the fourth batch of PESCO

proposals, but, due to their similar size, this should have little effect on the results. We remain with sixty-five projects out of the initial ninety-five proposals, but those sixty-five project proposals encompass all the three PESCO waves. In assessing project participation, I have only counted main entities and additional entities as these were the only categories reflected as 'participants' in the data frame, while 'Project observers' were not included as they are considered non-participatory actors. Indeed, in the document 'PESCO Project Proposals' under the category 'level of interest', the reference is only to 'possible project coordinator' and 'potential project members'. This is consistent with the compiling of dataset method that I used for the analysis of approved PESCO projects were project leader and project members are only mentioned as having an active role.

As demonstrated by the comparison between Table 7.2 (Appendix B) and Table 4.2., in the Appendix, the application of the Jaccard algorithm to the preliminary proposals reveals some variation of the coefficients. For example, the coefficient between Austria and Bulgaria increased from 0.07142857 to 0.07692308, and we registered a variation in 562 of overall 625 inputs, as almost every member state had changed its coefficient with more than twenty-two participants, except for Hungary and Ireland. This indicates how changes in state participation shape the structure of subgroups, with a more scattered formation of member states clusters in proposed projects compared to adopted projects. What determines these variation is obviously the increased or decreased participation of a member state in project from their proposals to their adoption. Therefore, a first effect that we account for is the the subgroups formation: more nested and separated subgroups in the latter, more scattered in the former. The thorough analysis of subgroups formation follows:

Following the same methodological process used in section 4.2.2 and section 4.2.3: I have now created a PESCO 'proposal' affiliation matrix in the form of a bipartite network. Than I created a state-by-state co-affiliation projection matrix AA^T (see formula

4.8) based on PESCO proposals, and applied formula 4.10 to compare the clustered graph obtained against a sample of theoretical survey graph characterized by no preferential pairings. The sample graphs are our benchmark for the null hypothesis and we compare the actual modularity value of $z(G)$ from the actual PESCO projects against the benchmarks graphs $G'_i, i = 1, ..., 100$ to calculate the p-value of the test. The cluster obtained from the PESCO proposal co-affiliation matrix are the following:

- Group 1: Belgium, Estonia, Finland, France, Germany, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Spain;
- Group 2: Czech Republic, Hungary, Luxembourg, Slovakia, Slovenia, Sweden.
- Group 3: Austria, Bulgaria, Croatia, Cyprus, Greece, Ireland, Italy;

The empirical modularity is $z(G) = 0.03643225$, the experimental p-value is 0.03 and the z-score is 2.225352. Both values indicate that the null hypothesis is to be rejected and that communities are statistically significant.

Comparing the results of the clustering analysis of the PESCO proposals before and after their approval reveals an intriguing difference between preliminary groups and definitive groups. While certain clusters display high similarities, for example Group 3 (G3) in both cases has Austria, Bulgaria, Croatia, Cyprus and Greece, still there are differences. For instance, Benelux cooperation remains strong and has not changed, as confirmed by Jaccard index based on proposals. This confirms what was the initial Benelux thought about PESCO. In a document titled "*Relevance of regional or clustered cooperation for PESCO Benelux Food For Thought paper*" September 2017, before the formal adoption of PESCO, Benelux countries already envisaged the importance of regional projects and initiatives and "clustered cooperation for PESCO, based on the Benelux cooperation experience" (Netherlands representative, interview).

On the other hand, Italy is not part of the frontrunner group, and Visegrad V4 member states are less scattered, as Czech Republic, Hungary and Slovakia are grouped together in the preliminary applications. The largest cluster is the most heterogeneous, as it includes both the frontrunner member states and the Baltic states. These differences between clusters are attributed to something that occurs during the time span between proposal submission and their adoption: the EU agencies responsible for evaluating submitted proposals deliver their report and assessment during a 'clearing house' workshop that serves as a forum for information sharing among its participants. The Agencies' assessment provides insights about each project and it makes easier to countries to decide about the participation to a project. The 'institutional effect' not only resolves the problem of the moral hazard by encouraging real and interested (and not utilitaristic) cooperation among members, but encourages countries to search cooperation to avoid project's dismissal just at the early stages of evaluation. Comparing the preliminary and definitive communities reveals that co-operation is enhanced and a differentiated integration occurs. For instance Baltic states and pro-NATO countries integration is fostered, as well those in Central Europe with neighbouring countries following geographical patterns. To conclude, 'intra-subgroup' co-operation is enhanced while 'inter-subgroups' co-operation has been reduced, the institutionalised co-operation has led to a higher convergency for those member states that already have higher probability to co-operate. Nonetheless, it has led to some divergence between member states that were supposedly to be more co-operative such as the V4 group.

4.2.6 Project by project communities detection

n subsection 4.2.2 we have constructed project network G^p, represented by the project-by-project matrix $A^T A$. We can apply modularity optimization described in subsection 4.2.3 to G^p and ascertain if there is clustered structure between projects that is statis-

tically significant. Once again, we consider the graph to be our benchmark for our null hypothesis and compare the actual modularity value of $z(G)$ against an assumed survey graph G' which has no preferred coupling (Newman, 2010). The $z(G')$ is characterized by a probability distribution that is used to calculate the p-value of the test through the 4.10 formula. In the case of project-by-project preferential pairings the optimal modularity that emerged was $z(Gi) = 0.04737628$ which corresponds to a partitioning into 3 groups:

- Group 1: AIFV/AAV, CBRN SaaS, CTIRISP, DIVEPACK, DM-DRCP, JEIS, ETCCEA, GMSCE, H3 Training, HARMSPRO, MAS MCM, MM, NetLogHubs, SOF C2CP, UMS, SMTC, MBT-SIMTEC, AirPower;
- Group 2: BLOS, C-UAS, EHAAP, EU-SSA-N, EUFOR CROC, EuroArtillery, CBRNDTR, EUNDC, EPC, RPAS, EU MilPart, M-SASV, Rotocraft, SSW, CRF, DoSA;
- Group 3: Co-basing, CRRT, EMC, EOF, ESSOR, EUTEC, TIGER MARK III, EU TMCC, EURAS, EURODRONE, JISR, EUMILCOM, UGS, EUROSIM, EU CAIH, MUSAS, AEA, CIDCC, TWISTER, MAC-EU, ECoWAR, 4E, SATOC, NGSR, FMTC, AMIDA-UT, CoHGI.

The hypothesis testing is done by network rewiring and simulation: theoretical graphs $G_i, i = 1, ..., 100$ are simulated under the null hypothesis given by the configuration model and the optimal modularity $z(G_i)$ is calculated. The empirical p-value resulted in $p = 0$ for an estimated z-score $= 4.67$. Both values points that the null hypotesis is to be rejected. Statistically speaking, the results indicate that meaningful clusters can be discerned from the project by project co-affiliation network. This suggests that there are preferential patterns between projects, as there are between nations. As claimed to Blockmans & Crosson (2019) analysis that over-emphasised the industrial

cotè and economy of scale as an member state's incentive to join a specific project, the analysis clearly establishes that member states tend to engage in preferential patterns of collaboration based on both on "with whom" (state-based patterns) and "on what" they will cooperate (preferential patterns project-based) The "state-based' patterns is also permitted by to the PESCO cooperation mechanism itself, which requires unanimity for adopting submitted projects, as well as the condition than one state must be deemed valuable by EU agencies' assessment. Such mechanism, implicitly pushing member states to join together to avoid their project dismissal, creates conditions for further integration and cooperation at the cost of more meaningful capability delivery and results, but with less members cooperating. It is evident that this decision making perpetuates horizontal rather than vertical integration. Statistically speaking, no meaningful clusters can be discerned from this pattern of collaboration. As one member states representative interviewed has confirmed: if a project is deemed very important for a member state, they will seek partners among the member states to which they are are the closest. Ultimately, their interest to participate is paired as an act of reciprocity to avoid the dismissal of the project rather than a true meaningful interest. It confirms once more how important are the political aspects of PESCO mechanisms rather than its true capacity to deliver effective results. Despite the EU's commitment to a unified defense policy, PESCO initiative has been developed with an eye towards "flexible integration", which allows member countries to cooperate in "coalitions of the willing" (Janning et al., 2017), but this has triggered an uneven and unbalanced integration among its participants: it has created or reinforced preferential patterns of cooperation and clusters among member states. Many of the European Union's member states are aware that a European defense core would be dominated by only a few countries. Marcin Terlikowski, of Poland's PISM thinktank, warns that such an arrangement could enable a small group of nations to manage the most important defense initiatives and industrial endeavors, as well as essentially dictate the terms of participation for other countries.

It is worth to outline a methodological approach that I decided to follow: When it comes to normalizing 2-mode affiliation data that is actor-by-event, the question of which approach is most appropriate depends on one's attitude toward the nature of the co-affiliation data. In this context, the actors and rows are referred to as 'variables' and the events and columns as 'cases'. This leads us to two types of normalization: variable normalization and case normalization. The choice between them rests on how one views their roles in constructing an actor-by-actor co-affiliation matrix (Borgatti & Halgin, 2014). The reasons why I did not applied any normalisation algorithm is consistent with the literature which states that whenever the ëcase' co-affiliation (our project-by-project) is treated as an opportunity. no normalisation is needed and simply overlap counts is sufficient. Nonetheless, it will be possible to use the case normalisation: weighting inversely by event sizes (Borgatti & Halgin, 2014).

4.2.7 Network centrality measurements

The last part of this chapter is dedicated to common network analysis such as centrality measures. In the field of network analysis, centrality has become a key measure for understanding the structure and behavior of a network. It is fundamental for identifying the most influential or important nodes, and to assessing the overall makeup of a network. The section will explore different measures such as degree centrality, closeness centrality, and betweenness centrality to quantify the importance of specific nodes in the PESCO network.

The first measurement is the degree centrality, used to measure the number of connections a node displays. It is an easy metric for understanding the significance of different nodes in a network, and an effective reference point for comparison as with other nodes. Nodes with a high degree of centrality have many other nodes connected to them - they are often referred to as "hub" nodes, and their position within the network

is seen as particularly important.

Since our PESCO network is a bipartite graph that represents affiliations, the degree centrality of a node can be determined by the number of ties it has with members of another node set (contrary to Freeman et al. (2002)). For example, in the PESCO data, for member state is the number of projects they attended and for projects it is the number of member states who attended. Through this method, degree centrality can be computed as usual and can provide clear values concerning raw counts. In graph theory, centrality measures are usually normalised by dividing them by the maximum value possible in a given graph: $n-1$, where n is the number of nodes. However, this needs to be corrected for affiliation graphs. This is because a node cannot have ties to its own node set; the maximum degree is always the size of the other node-set (Borgatti & Everett, 1997). In the PESCO dataset, the maximum possible degree for a member state is 61 (as the number of projects). Conversely, if we were looking at event nodes, aka the projects, their maximum possible degree would be 25 (the total number of participants into PESCO). Thus to normalise degree centrality in these cases, we must apply two separate normalisations depending on which node set a node belongs to:

$$\begin{aligned} d_i^* &= \frac{d_i}{n_2}, \text{for } i \in V_1 \\ d_j^* &= \frac{d_j}{n_i}, \text{for } j \in V_2 \end{aligned} \tag{4.11}$$

Having normalised degree centrality we can assess the relative centrality of a member states or a project, but also whether a a given member states is more central than a given project (Table 7.3.). Indeed, the normalised degree helps us to compare node's degree even though their node sets have different size. This argument brings to bear two important consideration: since PESCO proposals are opened to everyone at the start, the number of ties in the affiliation graph reflect's member state's willingness to join a specific project. It results that a member state with a degree centrality higher than

a given project means that its sociability is greater than the project's appealingness, though it implies that degree centrality measures different things for member states and projects. On the contrary, when the projects are finalised, additional member states participation is not granted, projects are not open, and both member states and project have kind of agency (Borgatti & Halgin, 2014). In the latter situation, both mathematical and substantive interpretation of member state's centrality relative to project's are consistent when normalised degree centrality is applied.

The next two measures are closeness centrality and betweenness centrality. While the former [9] is a measure of the distance between a node and all other nodes in the network, the latter measures the extent to which a node lies on the shortest path between other nodes in the network. Nodes with a high level of closeness centrality are those that are relatively close to all other nodes in the network, and are often considered to be important for facilitating communication and information flow within the network. Since they are closer to all other nodes in the network, they have greater ability to access and disseminate information, and will therefore be more influential within the network. In our PESCO network, the so-called PESCO frontrunners display the highest closeness centrality: almost every member state part of the cluster G1—France, Italy, Germany, Spain etc.—have the highest closeness degree, see Table 7.3. in the Appendix. Nonetheless, closeness centrality can be influenced by the size and shape of the network, and since PESCO network is very dense and interconnected these measures do not give us much of help of interpretation since many member states have similar centrality measures.

[9] Both measures have been normalised for bipartite graph as proposed by (Borgatti & Halgin, 2014). For closeness centrality the formula used is the following:

$$\begin{aligned} c_i^* &= \frac{n_2 + (n_1 - 1)}{c_i}, \text{for } i \in V_1 \\ c_j^* &= \frac{n_1 + (n_2 - 1)}{c_i}, \text{for } j \in V_2 \end{aligned} \tag{4.12}$$

As regards betweenness centrality, nodes with a high level of betweenness centrality are those that are often used as intermediaries or brokers between other nodes in the network, and are considered to have a central role in the flow of information or resources within the network. The idea behind this measure is that nodes that are located on the shortest path between other nodes will have a greater ability to control the flow of information or resources within the network, and will therefore be more influential. However, betweenness centrality can be sensitive to the presence of multiple shortest paths between nodes, and may not accurately reflect the influence or importance of a node in cases where there are multiple paths with similar lengths, as the case of our PESCO network.

Table 7.3. in the Appendix B illustrates normalised centrality scores for the three different centrality measures discussed above for the PESCO bipartite graph network. We should note that three member states (France, Italy and Spain) are more central than any of the projects on all the measures except for normalised degree centrality, since project Military Mobility has DC = 0.96. It is worth mentioning that the project Military Mobility has 24 ties, while France, Italy and Spain have respectively 43, 31, and 26. Having only a maximum of 25 ties (the total number of participants), the project has a higher normalised degree centrality because there are fewer member states than projects: 24 ties for Military Mobility, the EU-TMCC project's 13 ties, represents a greater percentage of possible ties.

Overall, centrality measures have offered an additional insights to understanding the structure and behavior of PESCO network. This measures have identified key players and influential nodes of the PESCO network, and gave insights to understanding the patterns of connectivity and communication within it.

4.3 Assessing the variance in PESCO differentiated integration: from proposals to final projects

After having conducted a thorough analysis of the variation in the preferential patterns of cooperation in the previous sections, we now turnes to the second dependent variable: μ (mean) and σ (standard deviation) of cooperation between member states. To measure these figures, we compared the data of μ_t, σ_t based on project proposals with those on adopted projects, μ_{t_1}, σ_{t_1}. Both are derived from our Jaccard coefficient table on State-by-state co-affiliation matrix. The results offer an illuminating glimpse into the variance of interstate collaboration. Let us recall the use of Jaccard algorithm in this research. Jaccard algorithm has been used to measure the 'degree' of relationship beteween member states; it indicates how often two States co-participate in a project relative to the total number of times they could have co-participated, thus providing a measure of tendency or preference for co-occurrence, thus understanding the interaction of participating States. Therefore, by measuring the mean and the standard deviation of the data prior and after the adoption of projects, as if they were two finite population, we can measure the variation that has occurred. [10] The existence of this variation confirms

[10] I calculate the mean μ, the standard deviation and the standard error through the following formulas

$$\begin{aligned} m &= \frac{(m-1)(m-2)}{2} \\ \sigma &= \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i-\overline{x})^2} \\ \frac{\hat{\sigma}}{\sqrt{m}} &= \sigma_M = se|\hat{\mu}| \\ me &= 1.96(se|\hat{\mu}|) \\ \hat{\mu} - me \leq \mu &\leq \hat{\mu} + me \\ H_0 : \mu_a = \mu_b; H_1 &: \mu_a \neq \mu_b \end{aligned} \tag{4.13}$$

$$\begin{aligned} z_x = \frac{\hat{\mu_a} - \hat{\mu_b}}{\sqrt{\sigma_M|\mu_a|^2 + \sigma_M|\mu_b|^2}} &\in [-1.96, +1.96] \text{ accept } H_0 \\ &\notin [-1.96, +1.96] \text{ reject } H_0 \end{aligned} \tag{4.14}$$

our hypothesis that PESCO institutional effect change member state's behaviour, but the increase or decrease of the dependent variable, μ (mean) and σ, confirms or refute whether this variation has a positive effect on overall integration and cooperation or it has segmented even more the cooperation thus reinforcing the differentiated integration.

As can be seen in Table 3.8, statistical analysis of the Jaccard indices reveals a decrease in the mean μ and standard deviation σ, as well as the median and third quartile, from proposals to final projects. This suggests that cooperation has become more homogenous, and less segmented. This variation happened as a consequence of PESCO's institutional design that sees the involvement of EU agencies in project assessment from proposal to completion.

So the variation before and after the agency of instiutional design which see the role of EU agencies crucial in the passage from the proposed projects to the adopted projects. It demonstrates again the validity of our hypothesis and that institutional effect does change member states patterns of behaviour.

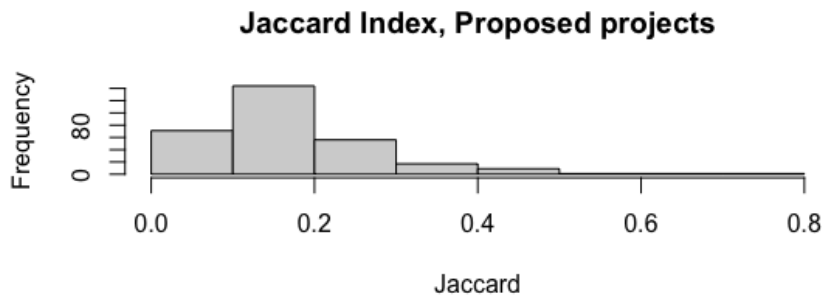
Table 4.8: Summary Jaccard data analysis

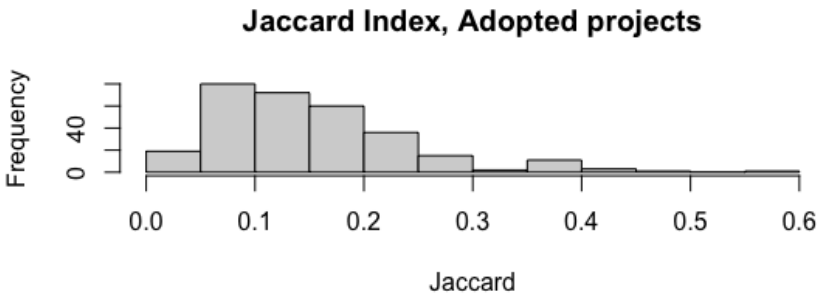
Statistic	Median	Mean	St. Dev.	Min	Max	1st. Qu.	3rd. Qu.
Jacc. propsl.	0,154	0,175	0,1074	0,00	0,75	0,107	0,217
Jacc. adopt.	0,133	0,154	0,09	0,00	0,57	0,090	0,571

For Jac. propsl standard err. = 0.006464946, margin err. = 0.01267129; for Jac. adopt. standard err. = 0.00548574, margin err. = 0.01075205. Zscore z_x = -2.480449 therefore the hypothesis that both mean are similar is rejected

4.3.1 Conclusions

The clustering results calculated using the Jaccard coefficient index in subsection 3.1.3 of this chapter indicate preferential patterns of cooperation among participating Member States in PESCO. These patterns have been further validated and proven to be





likely through a modularity maximisation approach (section 3.2). Once that we have constructed the two matrices, State-by-state and Project-by-project matrices, and calculated the typical network analysis measurements, the following step was to investigate unveiled patterns of co-operation among participating MS. For this purpose the approach used was the so-called maxim modularity approach.

In network analysis, modularity is a measure of the extent to which a network can be divided into distinct modules or communities. It is typically utilized to recognize potential patterns or structures within a network, such as the emergence of clusters or groups of nodes that are more densely interconnected than with nodes in other groups. The goal of maximizing modularity is to identify the partitioning of a network into modules that maximizes separation between groups while still maintaining an elevated level of connectivity within each group. This can help to uncover natural divisions or patterns inside a network and can be useful for applications such as recognizing subgroups within

a social network or comprehending the architecture of a system of interactions such as the case of PESCO mechanism.

However, why these patterns occurred in the first place is yet to be understood. Two variables that may have influenced a country's choice of project have occurred: the preference/interest regarding each project based on their strategic culture or security concerns; the alliances/predetermined preferential relationships between countries due to territorial proximities or cultural/military heritage. Through a network analysis, this chapter has revealed clustering around a Western/Central European group of countries, a Northern European group of countries and an Eastern/Central group of countries; signifying clear historical path dependency and cultural proximities among participating Member States.

The chapter has revealed a significant variation in patterns of preferential cooperation between proposed and adopted projects. Hierarchical clustering showed how cooperation after the 'clarification workshop' became less dispersed and more consistent. This result is further corroborated by an analysis of the mean and standard deviation of Jaccard coefficients, which decreased from proposed to adopted projects. This suggests that PESCO's institutional effect has caused cooperation among member states to become more homogenous and segmentation to be minimized. The findings demonstrate that mean and standard deviation decrease from proposed to adopted projects, thus indicating minimal variation in preferential patterns of cooperation, reinforcing the Agencies' assessment in line with states' preferences.

In the coming chapter, we will delve further into the first variable by examining the projects themselves and exploring what Member States may have had vested in certain projects depending on whether they were leaders, partners or observers. We will also explore the part played by EU agencies in evaluating these projects. Different collaborative clusters are usually aligned by factors that either join or separate participants;

however, so far no research has been conducted on how EU agencies can contribute to horizontal, yet differentiated, convergence.

Chapter 5

European defence initiatives: the Permanent Structured Cooperation and the European Defence Fund

Introduction

The following chapter outlines the role of European institutions and agencies within the new defense and security cooperation initiatives. In particular, the chapter dwells on the new instruments with which the EU has endowed itself, namely, the European Defense Fund (EDF); its precursor, the European Defence Industrial Development Program (EDIDP); and the European Permanent Structured Cooperation (PESCO). Several reasons led to the choice of these initiatives as case studies on European cooperation in the field of defence. Although different in nature, these initiatives share same major objectives such as addressing capabilities shortfalls at European level, fostering EU strategic autonomy and strengthening the European defence industry. Furthermore, EDF may enhance PESCO cooperation through the so called PESCO bonus whenever a joint project satisfies certain requisites.

Nonetheless, PESCO and EDF are governed by two distinct legislative and institutional frameworks: Common Security and Defence Policy (CSDP) and intergovernmental approach for PESCO, and EU industrial policy and the EU community approach for EDF[1]. As a result, the relationship between PESCO and EDF cannot be legitimate on legal basis. Moreover, whenever both elements are present in a joint project or cooperative endeavor, the institutional elements of both initiatives (for example, their respective area of application) must be preserved. The need for these two instruments to work in synergy is also underlined by the European Council note "for a coherent and output-oriented implementation of the security and defence iniatives"[2]. They are by far the most conspicuous and capability-oriented initiatives that the EU has ever triggered in the last decades. They may appear, at first glance, to be highly complimentary and

[1]Even their adoption processes have been different. On the one hand PESCO has been established by a Council decision, on the other hand the EDF has been adopted through the ordinary legislative procedure (COD) Procedure 2018/0254/COD COM (2018) 476: Proposal for a Regulation of the European Parliament and of the Council establishing the European Defence Fund.

[2]Council Conclusions on Security and Defence in the context of the EU Global strategy, 17 June 2019

in support of a capability-based strategy aimed at meeting European capability shortages and demands but they respond to different logic and aim to different objectives. Comprehending their nature and interaction is fundamental for the next chapter as well. Indeed, on a later stage, by using a game theory approach as a theoretical framework for conceiving social situations between competing players, this research shows what comes out of their interaction, and how it affects coordination among participants in a joint project. This chapter is fundamental to comprehend the setting of 'collective action dilemma' and the concept of 'cheap talks' that will be addressed in the the next chapter. In particular, the former will help us understand what differences brings to bear the adoption of both regulations—the EDIDP and the EDF—on joint project, shading lights on why these regulations could facilitate co-ordination among pMS to attain cooperative outcomes.

Before delving into the connecting of the EDF and PESCO to meet Europe's capabilities needs, the parts that follow will examine each initiative's institutional, legal, and policy structure. It will address the role of institutional actors such as European agencies and EC. Then, it will examine how these initiatives might be related. The last section of this chapter will dig deep into 2018-2019 46 projects that have been approved within PESCO and it will investigate on the interaction that have occurred during meetings and workshops wherein the parties involved—Directorate-General, European Defence Agency, European External Action Service and Member States—compared their respective interests and positions.

The data used in the chapter are taken from official working documents, reports, and notes retrieved from the European Commission and European agencies. Moreover, fieldwork data collection have been performed, coupled with hands on experience thanks to a direct participation in meeting and workshops within the European Commission. Semi-structured interviews were conducted too, though they do not constitute the primary source from which the chapter draws its data, and the building blocks of the

analysis, they have been used as an additional support to validate the Chapter's conclusions. With regard to PeSCo mechanisms 18 semi-structured interviews were conducted with European officials from the European Commission, European External Action Service, European Defence Agency and national seconded expert in Brussels and national diplomates. Secondary literature, as think-thank policy papers and media reports were also used in the analysis. Due to its sensitive nature, and lack of transparency compared to other EU policy areas, it is noteworthy that these secondary sources are fundamental too in order to

5.1 Framing the PESCO initiative

PESCO and EDF are two separate approaches of EU defence cooperation. While the former uses a traditional intergovernmental governance structure, the latter moves within the 'community method' featuring a supranational approach. This distinction is critical not only because it suggests separate legal and political logic and institutional frameworks for both initiatives, but also because it makes it harder to establish a relationship among them. Indeed, security and defence falls under the legal provision of Common Foreign and Security Policy (CFSP) governed by articles 42 and 46 of the Treaty of the European Union (TEU), where PESCO finds its own legal roots and *raison d'être*. More precisely, Permanent Structured Cooperation is part of the CFSP's Common Security and Defense Policy (CSDP). As such, it is regulated by the peculiar institutional and legal framework that governs CSDP (and CFSP). The PESCO's exact legal roots are Article 42 (6) TEU and Protocol 10, which is expressly dedicated to this unusual type of cooperation. Following these requirements, the fundamental act for establishing PESCO is a Council resolution made by a qualified majority vote.

As regards its governance, Article 46 TEU defines it broadly, while detailed provi-

sions are included in the Decision Establishing PESCO[3]. The governance is multi-layered; one level has the responsibility of ensuring that PESCO is implemented in a consistent and successful manner. It relies on pre-existing structures such as the Foreign Affairs Council and Defence meetings but gathered in PESCO format which means only Member States (pMS) that have joined PESCO can participate. Decisions are made unanimously (Article 46(6) TEU), except when confirming another Member State's membership in PESCO and suspending the participation of a Member State that no longer meets the criteria. The second level of governance is the project level, which is defined by a specific Council decision. Overall, unanimity remains the core of voting system as regards the project level, with minimal disclosure to and scrutiny by the Council.

Because PESCO is embedded in the CSDP rules, neither the European Commission (EC) nor the European Court of Justice (ECJ) have the authority to guarantee its proper implementation (article 24(1) TEU). Similarly, resort to legislative acts is not permitted either. As a result, the 'binding' nature of commitments envisaged in the mechanism is more a political than a legal question and the ECJ cannot enforce them. However, peer-pressure mechanisms such as the PESCO Secretariat's yearly review of the National Implementation Plan (NIP), submitted by each MS, and the recurrent PESCO strategic Review, are considered political instruments aiming to enforce the respect of biding commitments. Nonetheless, the risk persists as if a pMS fails to to fulfill its commitments can not be legally challenged by supranational party as the ECJ or EC. Nonetheless, not all twenty commitments are in the spirit of project collaboration. Some of their goals are as simple as increasing the defense budget to meet agreed-upon benchmarks. Others have little to do with developing defence products and technology through joint research and are consequently ineligible for EDF support. For example, the PESCO project Military Mobility is not a collaborative effort to enhance capabilities but tries to standardise cross-border military transport operations. Thus, the EDF, which solely

[3]Council Decision (CFSP) 2017/2315 of 11 December 2017 establishing permanent structured cooperation (PESCO) and determining the list of participating Member States, OJ L 331, 14.12.2017.

funds research and capability development initiatives, covers none of the steps necessary to attain this aim. Although PESCO intended to be primarily a capacity-building initiative aiming at developing 'autonomous capacity for action' (Mauro, 2018), it seems that PESCO's operational aspects are getting more traction, alongside the capability development initiatives eligible for EDF funding[4].

5.1.1 The multi-layered PESCO governance

In the framework of PESCO, member states are at the core of the decision-making process. Therefore, participating member states must unanimously endorse every decision and recommendation made within PESCO. The selection procedure for projects submitted to the PESCO Secretariat by one or more member states is laid out in Article 5 of the Council's Decision. Once a project proposal is received, it is evaluated by the High Representative (HR) with assistance from both European Defence Agency (EDA) and European External Action Service (EEAS), in addition to advice from EU Military Committee (EUMS). This review process aims to ensure no unnecessary duplication with other existing projects (Council Decision (CFSP) 2017/2315). After this evaluation, HR may suggest that this initiative be designated as a PESCO project.

Nonetheless, other important actors are involved in the effort to ensure proper coordination of the PESCO framework. Above all, the High Representative which does not only coordinate PESCO framework but is also fully engaged in the management of the annual assessment. In his duties, the HR is assisted by two other key actors: the European Defence Agency (EDA) and the European External Action Service (EEAS), which includes the European Union Military Staff (EUMS), his military branch. Indeed, both the EDA and the EEAS support the High representative in the scrutiny of PESCO projects. The former as regards the capability development aspects of PESCO, whereas the lat-

[4]Council Conclusions on the PESCO Strategic Review 2020, 13188/20, November 20th, 2020

ter support the High representative on the operational aspects of PESCO—through the EU Military Staff (EUMS). PESCO project scrutiny are based on High Representative's assessment, who will rely on EEAS, including EUMS and EDA. The reticence of pMS against the newly acquired key role of EU agencies is well documented in the *Report on the initial lessons identified on PESCO*. The pMS asked for a more 'Structured' and 'transparent' assessment of new projects, while asking for a streamlined consultation process on the draft report by the PESCO secretariat.

Since the focus is on EU agencies that have increased their role within the recent development of the EU Cooperation on defence and security, notably the EEAS, EDA, EUMS—all gathered into the new PESCO Secretariat—it appears obvious to epitomize them as agents, while the principal are the governments. This kind of relationships known as *collective principal-agent model* (Nielson & Tierney, 2003) may not fit perfectly with the present case.

Another way of proceeding is by referring directly to the European Council decision that establishes the PeSCo mechanisms to unravel who is accountable for what and how its role is embedded into the policymaking process. From the scrutiny of the Council's decision, it is possible to infer that a single agent is in a primary position over the others or has more discretion compared to the other agents. This idea is motivated by the fact that the new cooperation mechanism presents projects with a unique secretariat that works as a hub for all other agencies.[5] The Council's decision (CFSP 2017/2315) of 11 December 2017, which has established the PeSCo, had determined the list of pMS and shed light on the governance and main actors involved in the mechanism. This decision adopted by the Council by a qualified majority, immediately highlights the prominent role of the High Representative of the Union for Foreign Affairs and Security Policy.

[5]Under the responsibility of the High Representative, also in his or her capacity as the Head of the European Defence Agency (EDA), the European External Action Service (EEAS), including the EU Military Staff (EUMS), and the EDA jointly provide the necessary secretariat functions for PESCO other than at the level of the Council, and in this regard a single point of contact https://pesco.europa.eu/pesco-secretariat/

Indeed, in according to Article 46(2), the qualified majority is required after consulting the HR.

However, the European Council, being itself an active player in this process, cannot be relegated to a position of mere spectator. Indeed, at point (e) of Article 4(2) of the Council's decision, provides that the Council is to adopt a decision or recommendation establishing the list of projects to be developed under PeSCo. Thus, only the Council can approve a new set of projects by amending and updating Decision (CFSP) 2018/340—which has established the first set of projects—after consulting the HR under Article 46(6) TEU and Article 5 of the Council's decision, the Council decides by unanimity. [6]

On the other hand, the Council's decision text spotlighted the role of the pMS were having on the implementing phase of the cooperation, which begins after the pMS have submitted their national implementation plan (NIP)—reviewed and updated if necessary. Thus, participating member states have to demonstrate their ability to fulfil PeSCo binding commitments. Furthermore, the pMS taking part in a project agrees on the arrangements, scope, and management of that particular project. Simultaneously, the monitoring and assessment aspect is delegated to HR, which presents an annual report on PeSCo to the Council under the art. 6(3) (CFSP) 2017/2315. The HR's report describes PeSCo implementation's status, including the fulfilment, by each pMS of its commitment within a project. Based on this annual report, the Council reviews (once a year) whether the pMS continue to fulfil the more binding commitments they have made to one another within the PeSCo framework.

These tasks have been delegated to various EU agencies and institutions: the HR makes recommendations concerning the identification and evaluation of PeSCo projects

[6] Following proposals by the pMS which intend to take part in an individual project, the High Representative may make a recommendation concerning the identification and evaluation of PESCO projects, on the basis of assessments provided in accordance with Article 7, for Council decisions and recommendations to be adopted in accordance with Article 4(2)(e), following military advice by the Military Committee of the European Union (EUMC)

based on assessments provided in accordance with Article 7, (CFSP) 2017/2315. Those recommendations provide inputs for the Council to decide on the PeSCo projects' list to being adopted within the PeSCo framework. Two major agencies are involved in this part of the evaluation and assessment procedure: the EDA and the EEAS. The former contributes to the HR's assessment annual report on PeSCo, concerning capabilities projects, art. 7(3)(a) (CFSP) 2017/2315. It facilitates capability development projects and contributes to the assessment of projects proposals in capability development. While the latter, the EEAS, contributes to the HR's assessment annual report on PeSCo regarding operational projects, art. 7(2)(a) (CFSP) 2017/2315, as well as coordinating the assessment of project proposals in the area of availability, interoperability, flexibility and deployability of forces, and it assesses proposed projects' compliance with operational needs.

Other institutions contribute to the assessment and evaluation procedure: the EUMC and the EUMS. The EUMC provides military advice for the Council decision and recommends what kind of projects should be embedded into the new PeSCo projects list. It further provides the PSC with military advice and recommendations regarding the annual PeSCo assessment process—art. 6(3)(par.2) (CFSP) 2017/2315. While officials of the EUMS are operating within the EEAS for the assessment of operational projects.

This very complex and intertwined relationship among different actors—on the various hierarchical level of authority—poses some difficulties in identifying who is/are the principal/s and who is/are the agent/s. There are few doubts around the EU agencies as agents because of a clear act of delegation by the European Council which means a transfer of authority—a necessary requisite in a PA relationship—but also pMS do act as agents to some respect. Indeed, it seems that two different agents are entitled to perform a separate step of the cooperative mechanisms. On the one hand, the participating member states on PeSCo are entitled to implement the Council's decision and

recommendations and establish rules for managing each unique project in which they participate. On the other hand, European agencies are entitled to contribute to the assessment report and evaluate projects' compliance concerning capability and operational aspects. As stated below, they advocate for changes in projects and indicate what might be further projects.

Nevertheless, because of the crucial twofold role played by the MS, both in the European Council—due to its intergovernmental nature—and as the main actor in the PeSCo project, as stated by the Council decision establishing the mechanism, MS act as a principal. They have decided to activate such device for defence and security co-operation; they are the ultimate manager of this cooperation, and they decide, through the European Council, the final list of project. Therefore, the PA relationship occurs between the pMS and the EU agencies.

After identifying the pertinent actors involved, it is time to unravel the undergoing interaction between them into a model that can give a more or less reliable representation of the processes at work. We will see how the new co-operation mechanism encompasses two phases, a non-co-operative one between the principal and the agent and a co-operative one between the various principals. This dichotomy underpins the ability of the European agency to exert its influence.

5.2 European agencies in defence cooperation

What role for the European agencies in defence cooperation, do they contribute to transforming the existing setting of defence? Do they contribute to moving ahead from the inherited intergovernmental order, which has characterized European defence cooperation, or do they contribute to sustaining this by being vessels for nation-state control? Parts of the literature appear to support the view that EU agencies are tools of national

governments—due to their legal basis. Nonetheless, according to the analysis, they are attempting system reform to the extent that they can operate independently of national governments. Their role in information sharing and assessing proposals is carried out independently. The study objective in analysing European defence cooperation is not to assess whether EU actors are autonomous in general, but to identify the extent to which they enable collaboration by operating independently from crucial components of an intergovernmental system. Indeed, the Secretariat's role in gathering and sharing information among pMS to PESCO is critical in overcoming the fallacies inherent in collective action problems, of which defence cooperation is one.

Not all agencies tend to have a stronger bond with the European Commission than any other EU institution (Egeberg & Trondal, 2011). In the defence sector for instance, were intergovernmental approach is dominant, this behaviour is less likely. Nonetheless, the launch of the EDIDP and the EDF highlighting the EC's critical role in defence. Strong EU defence agencies have been rare in the past, as they were subject to many political institutions such as the Council and Member State representatives, the well-known Coreper. Still, as the EU's involvement in defence cooperation has grown, so has its ability to operate relatively independently, thanks to their role as knowledge suppliers (Groenleer, 2009). The formal structure of EDA and EEAS may reflect agencies firmly rooted in national governments and very intergovernmental in nature. Indeed, in terms of composition, steering boards are likely to be dominated by member state representatives, and the agency's mandate are traditionally focused on information and data gathering. But being rooted in an intergovernmental structure does not undermine their role as independent player in the process. Majone (1997) and Shapiro (1997) warn against underestimating an agency's role since its true value lies more in being expertise providers than simply network facilitators. The following section digs deeper into this role of expert provider by showing up how European agencies involved in the assessment procedure of PESCO proposals have a fundamental role.

5.2.1 The EU's agencies assessment criteria for PESCO proposals

As stated in the previous chapter, the assessment procedures is held by the EDA for the capability view, and the EEAS, sustained by the EUMS, for the operational viewpoint. As regards the capability perspective assessment, the criteria used have been grouped into 4 categories: Coherence of capability Landscape, Maturity, Coherence of Output (JD), and External support. Each one of these categories encompasses two criteria. Whereas the operational perspective has grouped its criteria only in two category: Bridging Operational Gap, and Operational Benefits. The agencies' assessment of PESCO project is performed against the more binding commitments. Indeed, for each criteria used in the assessment process is a assigned a reference to one of the more binding commitments agreed by pMS to PESCO initiative. The Table 3.1 summarises the criteria used for the assessment.

Table 5.1: Agencies' assessment criteria for PESCO proposals

Capability View						
Coherence of Capability Landscape		Maturity		Coherence of Output (JD)		External Support
CDP Priority	Expected Impact	EU		Nato		EDIDP/EDF
		Harmonized Requirements	Projects ongoing	Priority	Projects Ongoing	

Operational view					
Bridging operational gaps		Operational benefits			
Requirements Catalogue	Progress Catalogue	Employment	Interoperability	Availability	MS' Lesson identified

Source: Author's own compilation, information retrieved from Document Annex 3 to PESCO20180012

The Capability Perspective

The capability perspective examines the ideas with a mid- to long-term goal of defining future structures and the coherence of the European pool of forces and capabilities. The evaluation criteria seek answers to four main questions: will the initiative improve the

coherence of Europe's capacity landscape? How developed is the project? Will the initiative help to NATO output coherence? Finally, is the financial and industrial aspects developed sufficiently to warrant financial support from European institutions such as the EDIDP?

The first category, 'coherence of capability landscape', is based on two criteria: CDP priority and 'impact on the capability landscape'. The EDA gathers information on how far the planned PESCO project follows the agreed-upon goals, including national defence plans that contribute to meeting some of the 20 more binding commitments. It assess which CDP priorities the project is aiming for, and it reveals which Generic Military Tasks (GMT) the project is satisfying. In parallel, the analysis on coherence of capability landscape aims to assess which of the three strategic goals outlined in the EU Global Strategy would the project proposal target.

As regards the second criteria used, agency analysis aims to gather information on how much (High/Medium/Low) the proposed PESCO project will influence the European capabilities landscape in terms of time and scope, as well as how much the project would help to meeting some of the binding commitments. In this part the project is scrutinised against its coherence and impact on EU's Defence and Technological Industrial Base (EDTIB). This includes an assessment of the project's intended scope and magnitude (its ambition) as well as an assessment of its strategic importance, including how far it reaches into the future and what the magnifying effects are. Furthermore, the analysis includes an assessment on how the cooperation is structured (project-based approach only or also supporting the more binding commitments); and, more importantly, an assessment on the expected contributions from pMS, both human and financial resources.

The second category, 'maturity', entails two additional criteria: Harmonised Requirements and Coherence with ongoing activities. Both tries to determine how developed the proposed PESCO project is and to make specific recommendations to enhance

the project proposal further. More specifically, the former tries to assess whether there are existing harmonised requirements for the proposed project and the project's maturity level. This would indicate the time required to deliver these harmonised requirements and related capability, the potential for support and participation from other MS, the existing building blocks from which the project's implementation can benefit, and any potential overlaps with basic activities ongoing in the same or similar area. Furthermore, it will assess whether projects offer a more global approach to capability development; the EDA also looks at how far a whole life cycle approach has already been built while providing for adequate flexibility for pMS to participate. The other criteria of the maturity category, "Coherence with ongoing activities', tries to assess whether there are existing active collaborative initiatives in the EU setting aimed at the same capabilities, such as OCCAR activities. Again, assessing if the project can eventually benefit from other similar projects is essential.

Furthermore, It will also provide evidence on how the proposal makes the best use of EDA tools and if OCCAR is regarded as the ideal collaborative programme managing organisation. This part of the assessment is fundamental as the EDA investigates the impact of a PESCO project on the EDITB, whether it strengthens it or not, and whether it exploits existing synergies. The ultimate aim is to avoid unnecessary duplication (Art. 7, Council Decision, December 2017).

The 'Coherence of effort and output' category focuses on obtaining evidence on the coherence of effort with activities in a NATO context further to implement the JD principle (coherence of output) and to provide specific recommendations to the project proposal. Ultimately the 'financial support' category investigates the links with additional financing instruments such as the EDIDP and the EDF. This category is crucial to assessing to what extent is the project proposal's economic dimension already developed, and whether the industrial dimension is described adequately. More importantly, the EDA assesses whether or not the pMS in the proposed project have planned and bud-

geted financial resources for the years to come; and whether or not the pMS intends to request financial support through the EDF (Research Window and Capability Window). Suppose the proposed PESCO Member States express their intention to seek financial assistance through the EDF. In that case, the EDA will assess whether the industrial character of the project is appropriately outlined, taking into account commitments 3 and 8.[7] This assessment is critical because it serves as the foundation for the relationship between these two instruments, EDF and PESCO. As we shall see in the following chapter, this is one of the factors that lead to a more cooperative environment as it facilitate coordination among pMS. Indeed, the EDF regulation requires projects to include at least three entities from three different MS. As a result, EDF already attempts an embryonic European, mini-lateral collaboration, which might serve as the incubator for a PESCO initiative by the same MS (Simon & Marrone, 2020).

The Operational Perspective

The operational perspective examines project proposals in order to assess whether they overcome operational gaps and generate operational advantages to meet EU LoA. In carrying out this task, the EEAS is supported by the EUMS. The criteria upon which the evaluation is based cover proposal conformity and contribution to the operational needs of the EU and its MS. Moreover, they try to assess if the project improves or provides accessible, interoperable, and deployable forces for CSDP operations and missions.

The criteria have been grouped into two category: 'bridging operational gaps' and 'operational benefits'. The former category tries to assess the consistency with the so-called 'requirement catalogue': a catalogue that outlines the military capabilities needed to achieve the EU level of ambition (LoA). It also attempts to analyse the coherence with the most recent Progress Catalogue (PC), which gives a complete picture of the

[7]Commitment number 3 states: "Increasing joint and 'collaborative' strategic defence capabilities projects. Such joint and collaborative projects should be supported through the European Defence Fund if required and as appropriate." Whether, commitment number 8 says: "Commitment to the intensive involvement of a future European Defence Fund in multinational procurement with identified EU added value." Council Decision (CFSP) 2017/2315, December 2017

priority capacity deficiencies in the short and medium-term, as well as their operational risks. The PC examines the EU's military capabilities and their short and medium-term evolution.

Instead, in the category 'Operational benefits', the assessment addresses the possible deployability of the proposed project. There is to say, project's ability to support the strategic and operational levels in deployable capabilities, as well as the project's delivery of a deployable capabilities. Furthermore, the evaluation seeks to determine if the project addresses the capability gaps necessary to complete the most challenging task outlined in the EU level of ambition (LoA), and if it supports the CSDP missions and operation through its Force Generation and HQ.

Other criteria used to assess the operational benefits of the projects focuses on the availability of capability developed by the project for CSDP military operations and missions; their interoperability and ability to operate coherently and efficiently to achieve EU's operational goal and strategic objective. This criteria is based on the pMS proposed project capacity to share common doctrine and procedures, and information as well as acting in synergy with other organisation such as MPCC, ESDC and EuroCorps. According to EEAS's assessment, the operational benefits of a proposed project should have an impact on the fulfillment of the EU LoA—defined as a high, moderate or Low (H/M/L).

However, it must be taken into account that the assessment procedure has changed over time. Indeed, the Secretariat report added additional criteria in the capability perspective when assessing the third wave of PESCO projects. The updated capability perspective is now aiming to assess whether the intended implementation of the project is in line with the Avenues of Approach as laid down in the relevant Strategic Context Cases[8]. This includes an evaluation of the project proposal's coherence with

[8]In June 2018, EDA's Steering Board in Capability Directors formation approved the revision of the Capability Development Plan (CDP) and its 11 European Capability Development Priorities. They

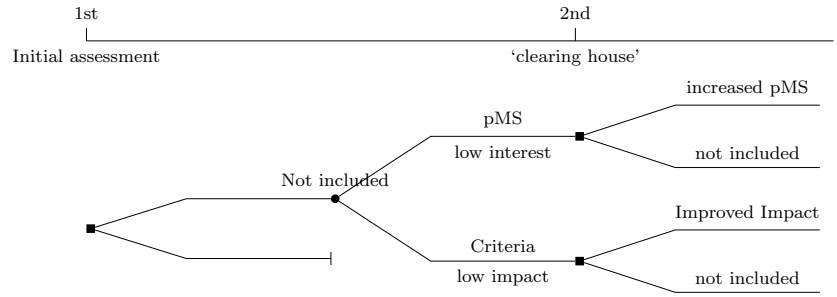
R&T elements and possible links with critical defence technologies, innovation/disruption technologies, and Security of Supply (Doc, Annex 3 PESCO20190027). A sign of the EU's need to solve its technological lagging behind, which is critical for achieving strategic autonomy in an era of technological rivalry (Damjanovski, 2022). In conclusion, it tries to assess which of the three strategic goals derived from the EU Global Strategy would the project proposal address.

Financial assessment aspects have changed too as it has become sharper. It asks no more simply whether the pMS have planned and allocated financial resources but also the initial breakdown of planned and expected budget of the project, encompassing contributions from pMS and industry. A sort of 'business case' plan. Furthermore, this category has broadened its criteria, which no longer refers exclusively to EDF but also to the European Defence Industrial Development Program (EDIDP) and Preparatory Action on Defence Research (PADR). The aim is to assess whether or not the proposing pMS' entities have the intent to request financial support within these frameworks.

Nonetheless, the most important criteria remain those assessing the project's potential impact on the European capability landscape (high, medium, or low) and the potential impact on the the operational benefits needed to fulfil the EU CSDP LoA (High, medium or low). Based on that, and on the interest demonstrated by other pMS, the Secretariat states whether a project should be recommended or not as a main focus at that stage.

The figure below summerises the assessment procedure.

also stated that those priorities should be implemented in an output-oriented manner "to facilitate the generation of cooperative projects aimed at closing identified capability shortfalls, while striving to contribute [to greater] coherence of the European capability landscape." To that end, it was agreed that the CDP implementation process would be aided by the development of so-called 'Strategic Context Cases' (SCCs) by EDA in close collaboration with a broad network of experts from Member States, EU institutions, other relevant multinational stakeholders, and defence industry representatives. The SCCs have a defined goal: to oversee the implementation of the 11 European Capability Development Priorities in a way that improves the coherence of the European capability landscape and leads to collaborative projects that help to resolving recognised capability deficiencies. European Defence Agency, Strategic Context Cases (SCCs) Fact sheet, www.eda.europa.eu



Squares represent Agencies' assessment.

1st assessment — Whether or not to include the project in the recommendation as a main focus.

2nd assessment — After the 'clearing house', Secretariat's assessment on whether or not to include the project in the recommendation as a main focus.

Let us now consider how the assessment is organised in a more detailed and real way taking as an example the third wave of PESCO projects. The proposals were submitted by the end of July 2019, and in order to ensure a timely decision-making process by the Council, the PESCO secretaria needed to submitted its final project assessment report for consideration by the High Representative by no later than October 2019. HR recommendation on project proposals were sent to the Council, followed by PSC discussion, and where the EUMC provided its Military Advice. This very stringent time constraints were caused also by the Council preparatory bodies necessities to conduct their work in preparation of the FAC-Defence. Several meetings occurred between the initial project assessment report and the final one that led to the FAC-Defence. Indeed, in the first two weeks of September a first project assessment was sent to pMS followed by the first Clarification Workshop meeting on project proposals at the EDA premises. The clarification workshop led to a new refined project assessment report that was sent back to the pMS. This procedure was subsequently followed by a joint NAD/CAP meeting at Director's level, where also Point of Contact level officials participated. The meaning of these several meetings was to facilitate the exchange of information between the pMS on new project proposals. Indeed, pMS in the "*Report on the initial lesson*

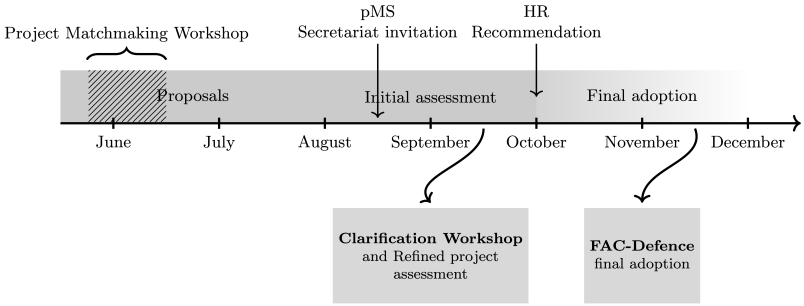


Figure 5.1: 3rd wave PESCO timeline adoption

identified on PESCO projects" stressed the need for additional support with regard to the matchmaking events and training sessions. The PESCO secretariat had organised an additional 'Project Matchmaking Workshop', June 2019, with the specific purpose to facilitate the exchange of information between pMS (PESCO secretariat officials, interview). The following time table summerises the various step that led to the final adoption of the 3rd batch of PESCO.

5.3 From the EDIDP to the EDF

5.3.1 The EDF

The EU has shared competence as regards the industrial policy. It can take out acts to assist, coordinate and support the actions undertaken by Member States in this regard. This shared competence, however, did not prevent the EU from passing legislation such as the European Defence Fund, adopted through the ordinary legislative procedure (COD). The legal basis of the EDF lies in Articles 173 and 182 TFEU—which are dedicated to industrial competitiveness, research and innovation and EU industrial policy.

As regards its governance, the EDF leaves little space for unanimous decisions, which differentiates it even further from the PESCO. Indeed, at the core of its governance lies the qualified majority though it has been counterbalanced by the so-called double comitology system. The "double-comitology" approach guarantees that MS have a degree of control over the EC. Furthermore, MS are represented in the Work Programme Committee entitled to support and assists the European Commission in implementing the EDF.

Due to its legal origin, the EDF'a implementation is under the ECJ jurisdiction which results in a more harden form of cooperation. EDF parameters are indeed enforceable as in the case of development initiatives, for example, where law mandates that applicant industrial consortia explain that the remaining costs of an activity that are not covered by Union support will be funded by other forms of funding, such as by MS (article 23, EDF). As a result, MS's co-funding of capability development operations is subject to ECJ legal oversight, which was not the case under PESCO. Defence collaboration initiatives inside the EDF must also comply with other EU rules, particularly financial obligations put in place to protect the interests of the Union overall. The EDF Work Programmes are the initiative's cornerstone, and the Commission creates them after receiving a positive opinion from the Work Programme Committee, which is made up of representatives from each EU member state[9]

5.3.2 The EDF selection and award process

The EDF's project selection is framed by the traditional 'comitology' procedures, though they have been slightly modified. As soon as a proposed project is included in the EDF's Work Programme, it might be chosen. The Commission is responsible for establishing

[9]Article 34, TEU Regulation (EU) 2021/697 of the European Parliament and of the Council of 29 April 2021 establishing the European Defence Fund and repealing Regulation (EU) 2018/1092 PE/11/2021/INIT, OJ L 170, 12.5.2021

the Work Programme, according to article 27 of the EDF rule. However, it can only do so when the Work Programme has given its approval. In contrast to the traditional comitology procedure, the failure of a committee to express an opinion on the Commission's proposal does not give it the authority to approve the Work Programme on its own. This grants MS special authority, which is balanced by the qualified majority voting norm and the EC's right of initiative. The same process is used for allocating EDF funding to proposed projects. But, much depends on the Commission's and member states' efforts to agree on the Work Programme and project selection in this context.

To better understand the various steps intertwined of the EDF mechanisms, the decision-making process and awarded activities may be broken down into five basic steps: the Work Programme; calls for proposals; the assessment process; award financing; and the signing of the grant agreement. Every year, the Commission adopts an annual Work programme with funding priorities. In carrying on its task, the Commission is assisted by Member States, plus European External Action Service (EEAS) and the European Defence Agency (EDA) as observers. Then, based on the annual Work Programme, the Commission publishes the Calls for proposals. Only if duly justified and in exceptional circumstances the Work programme may allow funding directly to entities, as a part of a 'direct award' scheme. The evaluation process starts once the proposals are submitted. The Commission checks the admissibility and eligibility of the proposals against the conditions set in the EDF regulations. Hence, the Commission evaluates the proposals received assisted by independent experts (working ad persona, they are paid by the Commission after a none conflict of interest disclosure). After having ranked the proposals, the Commission submits the draft award decision (the list of action to be funded) to the Committee of Member States for opinion, the so-called 'comitology' procedure. The Commission can only adopt the award decision after a positive opinion of the Committee. Also European Parliament and the European Council may eventually

intervene to check if decision does not go beyond the Regulation.

Once the award decision is adopted, the Commission informs the selected entities and signs a grant agreement. The grant agreement is directly managed by the Commission, only in justified cases and as forseen in the Work programme, the Commission may entrust project management tasks to a project manager, such as in the case of *Organisation Conjointe de Coopération en matière d'Armement* (OCCAR).

5.4 PESCO's interaction with the EDF

Although, the choice of these two initiatives as case studies on European defence cooepration dwells on the substantial coherence between theme, the examination of both defence programmes reveals that the EDF and PESCO hold substantial differences resulting in a distinctive legal regime for each instrument. Any relationship between PESCO and EDF must adhere to the governance of both initiatives and article 40 TEU ensures that none of these initiatives may interfere with the governance of each other. Nonetheless, though distinct legally are they, European Defence Fund and the PESCO are both part of Capability Development Plan (CDP) domains and thus attempts to link them have been made. For instance, the EDF provides an additional financial bonus for projects that are linked to PESCO project. This might be interpreted as toughening collaboration while ensuring its elements are obligatory to get EU co-funding (Simon & Marrone, 2020). Indeed, pMS gathered into PESCO format can not decide autonomously whether a project shall or shall not be financed through the EDF scheme. This is not due solely to the EDF's different governance but also due to the more specialised goals that are not always in line with PESCO criteria.[10] Indeed, co-financing a PESCO project through

[10]This is true, for example, of expanding cross-border collaboration among defence SMEs and mid-caps. Even if this aim represents the perspectives and interests of various MS, a relationship between PESCo and EDF will not necessarily serve it.

the EDF might be interpreted as toughening collaboration while ensuring its elements are obligatory to get EU co-funding (Simon & Marrone, 2020).

The EDF's support to the PESCO initiatives, clearly stated in one of the more binding commitments of the latter,[11] has produced some empirical results. Among the first EDIDP call for proposal in 2019, the precursor of the EDF, nine out of sixteen projects were related to PESCO—which represented the 80% of the EDIDP budget of the first calls—and two EDIDP projects selected for direct award, namely MALE drone and ESSOR, were PESCO projects. In the second call in 2020, fifteen out of twenty-six of the selected projects were also addressed within the PESCO framework. On the other hand, even the EDF regulation in article 14 foresees a link with the PESCO initiative as it allows a co-financing rates.[12] This provision is likely to provide a considerable incentive for MS to submit PESCO projects, since they may be subsidised to a larger (+10%) degree by EDF than non-PESCO projects. With the launch of the EDIDP and EDF, the EU is for the first time supporting with the Union budget collaborative research and development of defence products and technologies. What is likely to occur is while developing a PESCO project proposal focused on capacity development, pMS consider the EDF possibilities from the start in a way that maximises the chance of EDF co-funding. But even other way round, as a result of activities funded by the EDF that may initiate PESCO projects to provide required skills. The high rate of PESCO initiatives based on the outcomes of an EDF-funded research study should be viewed as confirmation of the use of EDF research financing (Simon & Marrone, 2020). While the

As a matter of fact, in the second batch of projects, almost 90% of those submitted to the Secretariat asked for EDF or EDIDP funding.

[11] More binding commitment n3, Annex I, Council Decision, 2017/2315, December 2017.

[12] "An activity developed in the context of PESCO [...] may benefit from a funding rate increased by an additional 10 percentage point", Art. 14, Regulation (EU) 2021/697 of the European Parliament and of the Council of 29 April 2021 establishing the European Defence Fund and repealing Regulation (EU) 2018/1092

These industrial programmes are co-funded project by research and industrial consortia from at least 3 entities from at least 3 Member States. The funding priorities of the EU defence industrial programmes are defined by the Commission, together with Member States, as they need to contribute to the defence capabilities priorities commonly defined within the EU. In the preparatory documents leading up to the adoption of the EDF, it is clear that the Commission engaged in an active dialogue with national experts from the Member States to make sure that a common shared vision on the strategic direction of the EDF was framed by the CDP priorities. Those priorities have to focus on projects with clear EU added value (e.g. better interoperability) and with the broad scope of reducing the fragmentation in defence industry, thus fostering a more integrated defence cooperation among EU countries. A shared vision between EU institutions and Member States was meant to be fundamental as it helped to prepare the annual Work programmes for the EDIDP, first, and EDF, then, which are the basis upon the full process dwells.

In the research design I also differentiate among pMS leader of the project, contributors and potential contirbutors or observer as clarified by pMS themselves in the Clarification Workshop. This distinction is very useful as it permit to differentiate pMS in the collective action problem according to their 'type': different 'type' of pMS sends different message to other partner. This difference is useful in the messaging sub-game pivotal for cheap talks in collective action dilemma. As stated in the chapter 3 section ??? pMS in a PESCO project that are considering the chance of EDF co-funding, already play in a different game. There is no more the case of a continuous action dilemma but instead a threshold action problem. First because certain specific criteria should be met but second because to reach the 10% bonus a threshold of 90% contribution should be met by pMS, otherwise the project is not granted by the EDF.

Different levels of interest are defined based on whether the project itself or the

persons participating in the project is being discussed. As regard the project itself, I used three different category to determined the level of interest to a project based on the number of participant in a single project. The three category are 'Low', 'Moderate' and 'High'. When a project proposal is determined having a low participation it means one or two MS; a moderate participation means three or five pMS; while a high participation means more than five pMS in a project. To that purpose, potential observers to a project are not taken into account as they are not really contributing into the project.[13] This categorisation is intimately intertwined with the modelling of collective action dilemma. Indeed, as chapter 4 will demonstrate, different type of pMS sends different message in the contribution sub-game. Therefore, a second level of categorisation is necessary. The 'type' of pMS is assigned according to their individual level of interest vis-à-vis a specific project. A pMS that is identified by the others, or by itself, as a project leader delivers a message that is willingness to commit to the joint project is real; a pMS defined as 'potential observer', its willingness to contribute in the joint project is 'moderate', while a pMS defined as 'observer' has zero or very low intention to contribute into the joint endeavor. Table 4.2 summerise this conceptual framework.

To operationalise this part I have confronted, where possible, the first assessment of the initial set of project proposals with their final approval. Whenever there is discrepancies between the number of projects initially submitted with the number of projects adopted we are going to assess whether is due to an increased number of pMS in the same project or an improved evaluation of the project itself, as a consequence of more shared information by pMS. Indeed, often the PESCO secretariat has rated as 'Low-to-moderate' a specific project due to pending clarifications by proposing MS of specific deliverables. When this pending clarification were dismissed the project was evaluated

[13] "Observers shall have no obligation to contribute to a project with their own resources and expertise. They may seek to become a project member at a later stage without delaying progress in implementing the project", Article 6, of the Council decision establishing a common set of set of governance rules for PESCO projects.ST/9660/2018/INIT OJ L 161, 26.6.2018, p. 37–41

Table 5.2: Categorisations based on pMS level of interest

Project interest	**Number of pMS**	**Level of Interes**
	5 ≥	High
	3 – 4	Moderate
	1 – 2	Low
Individual interest	**Type of pMS**	**Level of Interest**
	Project Coordinator	High
	Potential Project member	Moderate
	Observer	Low

Source: Author's own compilation

positively having fulfilled additional criteria, leading to a reassessment of the project's European capability landscape and operational impact.

Table 5.3: Illustrative example of operationalisation

Proposals	**1st Assessment**	**2nd Assesment**	Modifier
2.1.11.	No	Yes	δ pMS
3.2.	Yes	No	δ pMS
12.1.	No	Yes	δ Criteria

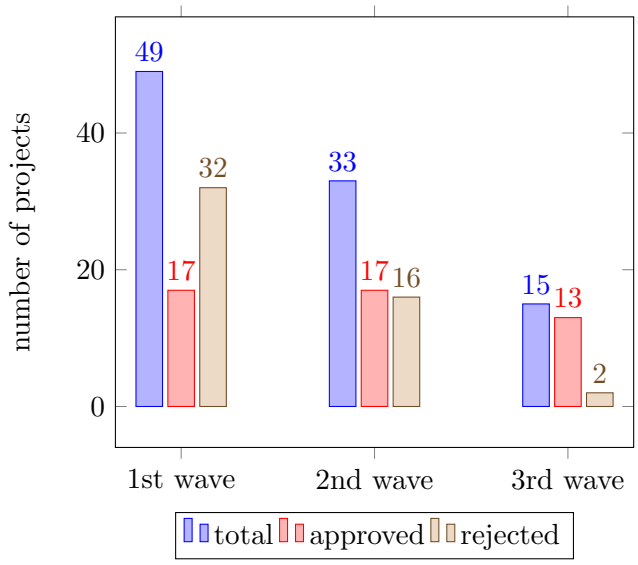
5.5 The PESCO projects: an empirical evaluation

Since its establishment in December 2017[14], the PeSCo program has launched forty-seven projects in total, broken into three batches: an initial list of seventeen projects was approved by the Council on March 6, 2018[15], followed by a second batch of seventeen

[14]Council Decision (CFSP) 2017/2315 of 11 December 2017 establishing permanent structured cooperation (PESCO) and determining the list of participating Member States, OJ L 331, 14.12.2017.

[15]Council Decision (CFSP) 2018/340 of 6 March 2018 establishing the list of projects to be developed under PESCO, OJ L 65, 8.3.2018.

Figure 5.2: PESCO projects



Source: Author's own compilation

projects to be implemented under PESCO on November 19, 2018[16] Finally, on November 12, 2019, the Council approved the third batch of thirteen further PESCO projects to be developed. However, the total number of projects submitted by member states since the start of the first wave amounts to ninety-seven projects overall: forty-nine projects proposed in the first wave, thirty-three for the second wave and fifteen initial projects submitted for the third wave. Almost half of all projects submitted by member countries were turned down. Although some initiatives were later re-submitted and eventually adopted, others that received favourable feedback from European agencies were not. The figure 3.1. shows a decreasing number of submitted projects throughout the three batches of PESCO, and a decreasing number of rejected projects in the same period. On the contrary the absolute number of approved projects remained constant. To better comprehend the involvement of EU agencies, a thorough examination of the kind of projects that were rejected is required. It will help to determine whether EU

[16]Council Decision (CFSP) 2018/1797 of 19 November 2018 amending and updating Decision (CFSP) 2018/340 establishing the list of projects to be developed under PESCO, ST/13939/2018/INIT, OJ L 294, 21.11.2018

agencies took an active role in the review system or simply followed government disposition. The PESCO projects were organized into functional groupings: Training and Facilities, Maritime System, Land and Formation System, Air System, Cyber Defence and C4ISR System and Joint enabling, and Space. It should be noted, however, that not all categories were present from the outset, but some were added at a later date. For instance, the first batch of projects did not consider 'space' category.

As shown in the Table 3.1., the first wave of PESCO projects saw thirty-two projects rejected in the following categories: twelve into Training and Facilities; six in Air systems; one in both Maritime and Cyber systems; ten in Joint enabling and two in Land system. In the second wave of projects, five projects of the Traning and Facilities were rejected; both Land and Maritime category had one project rejected; Air system cat. had 4 project rejected, while Cyber defence and Joint enabling had respectively two and 3 projected rejected. For the third batch of projects, the two projects rejected in the final phase belong to Traning and Facilities group and a project from the Joint enabling group.

Table 5.4: Number of approved/rejected projects per category

Project category	**1st wave**		**2nd wave**		**3rd wave**	
	approved	rejected	approved	rejected	approved	rejected
Training	2	12	3	5	5	1
Maritime	3	1	2	1	2	0
Air sys	0	6	3	4	1	0
Cyber def.	2	1	2	2	1	0
Joint enabling	6	8	3	3	4	1
Land	4	2	2	1	0	0
Space	0	0	2	0	0	0

Source: Author's own compilation

Figure 3.1., visually summaries the two tendencies that can be drawn from the gathered data: a) the number of project rejected have decreased, while those approved were

constant; b) the number of total project submitted decreased as well. Thereof, the percentage of successful projects soared apparently more as a consequence of the decreased total amount of PESCO projects submitted than the ratio of successful projects submitted[17] Another distinct consideration can be made by looking at the kind of project submitted.

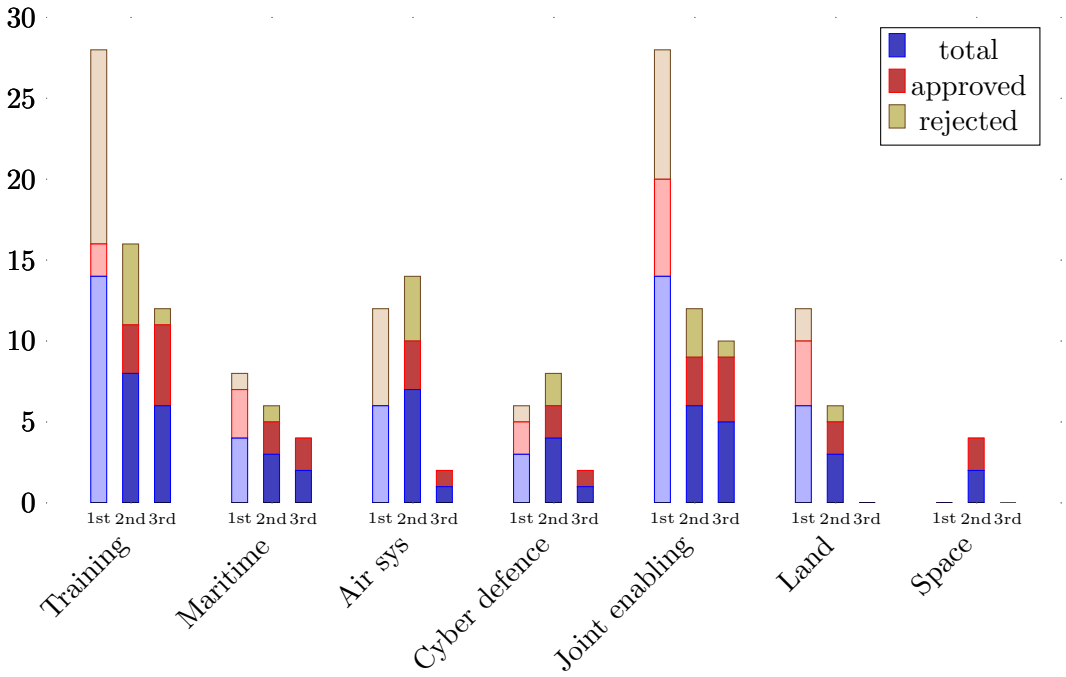
The reasons for this decline are manifolds: among others, member states' willingness to launch new projects every two years rather than annually, and the time it takes to develop defense capabilities which leads to a gradual slowing down in outputs. According to Blockmans & Crosson (2021) this will even further increase the delegation of PESCO management from the political to the technical level. Their analysis, which is based on the total amount of projects approved, is not totally correct as it does not consider the total amount of submitted projects (those approved and rejected). While it is true that as projects mature, their management becomes more technical rather than political issue, it is also true that the reduced number of projects—the 3rd batch compared to the 1st one—has a political explanation. As regards the initial assessment phase, the technical aspect was pivotal preponderant, but then began to slow down in the face of political pressure from the states for a more transparent and structured assessment.

As shown in the Figure 3.2, the major share of project rejected belongs to Training and Facilities and Joint/Enabling functional groups.

What are the causes of these shifts in the overall number of projects and the number of rejected initiatives? And why is it that, although certain categories have witnessed a decrease in project numbers, others have seen an increase? What is important to understand for the purposes of the research is whether these changes are due to the European institutions involvement. As for instance the interaction with the EDF and therefore the

[17]The successful rate for the 1st wave of project is 34%, for the 2nd wave is 50%, and for the 3rd wave is almost 80%. But in on the same time, the number of submitted proposal has decreased by 80%. Overall, the successful rate based on all project submitted is 48%

Figure 5.3: Project: total/approved/rejected per category and batch, October 2018 - November 2019



Source: Author's own compilation

major involvement of the EC, or the active role in the assessment procedure by European agencies. To answer this question, a more in-depth examination of the evaluations projects, they link with the EDF, and evaluation by European agencies on particular projects is performed. An attempt is made to understand whether European institutions by setting a threshold on the assessment have had an impact on pMS preferences and payoffs. This will confirm or not if they do have a leverage on the decision making process. The empirical results of the analysis will then be confronted with our modeling on collective action dilemma, to confirm or rebut the consistency with the empirical findings. Let's now considering the assessment of PESCO projects.

As mentioned previously, the PESCO secretariat's assessment report of the project proposals reflects, in particular, the capabilities view by the European Defence Agency

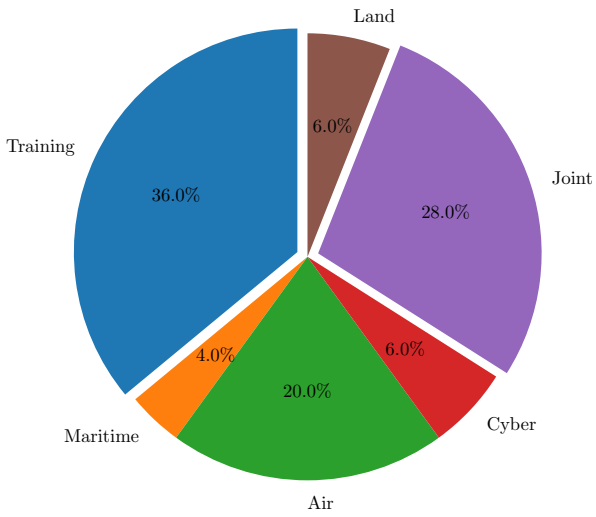


Figure 5.4: Proportion of rejected projects based on categories

Source: Author's own compilation

and the operational view delivered by the EU Military Staff.The assessment report is a necessary step in the path towards the adoption of the final list of projects. Indeed, it serves to prepare the expert level reunion, known as the 'clarification workshop'[18] The EDA organises the workshop at expert level to facilitate an exchange of information between the pMS on the project proposals received. It functions as a 'clearing house' as it provides also more detailed information on the assessment, (interview, EDA official D) , it provides assistance for pMS queries and a more refined evaluation of the project ideas. During the 'clarification workshop' the Agency tries to facilitate a common understanding among pMS on the proposals, emphasising the synergies and commonalities among project proposals and to map the interest of the pMS for individual PESCO project proposals. *In nuce*, the EDA acts as a facilitator. Furthermore, in this second stage of the

[18]Council Decision 2017/2315; Council Recommendation 2018/C88/01, March 2018 cocerning a roadmap for the implementation of PESCO

project selection process, pMS update their interests in participating or not in a specific project, or the extent to which this participation occurs—more involved participation or simply as an observer of the project. During this second step, after reading the report assessment, pMS are leveraged to show their real interest in a specific project, which might be dismissed otherwise in the case of low interest shown by the others.

5.5.1 The 2nd set of PESCO projects

For the second set of PESCO projects, pMS have submitted thirty-three project proposals, comprehending twenty participating MS. The Secretariat organized the projects into seven functional groupings for the purpose of the assessment report, with an additional category, 'space', added as a testimony to the importance of space declined in its strategic-military dimension. However, the category received only two project proposals. The most significant number of projects were submitted within the categories 'training, facilities' (eight submitted projects), 'air system' (seven submitted projects), and 'joint enabling' (six projects submitted). Overall, eight project were multinational project proposal which means these were not individual projects hended by a single MS but they were submitted by a group of at least two pMS. Among these multinational projects, five had an initial 'moderate' participation of MS, two a 'low' participation and only one project had a 'high' participation of MS. The remaining projects were submitted on the initiative of individual states, seeking for support afterwards. There were three project proposals by France, two by Germany, eight by Italy, six by Romania, and three by the Czech Republic. While Greece, Bulgaria, and Sweden proposed one project each. In the first phase of proposal submission, the second batch of PESCO projects as whole had three proposals with a 'high' level of interest, seven with a 'moderate' level, and twenty-three with a 'low' level of interest.

The initial proposals' assessment has shown only eleven projects included in the

main focus by the Secretariat. Twelve projects were not included because they lacked evidence of expressed interest and engagement from other pMS. The remaining nine projects were not included because they do not satisfy a sufficient number of criteria besides the lack of declared interest of other pMS. After the clarification workshop, the second assessment presented some differences from the first. Indeed, seven projects had an assessment changed, either due to a change in the number of pMS–a decreased level of attendance, lack of interest, or no confirmed interest—or in the assessed criteria. Among those seven projects, five were subsequently included in the main focus due to a renewed increase of interest by pMS. Two projects' assessments changed positively due to an increased level of satisfied criteria. However, one still experienced a lack of pMS.

What can be inferred from this analysis is that level of participation in a specific project is one of the main discriminants for having that project recommended for the main focus. Lack of pMS means exclusion from the list. Even if a project is regarded as having the potential to contribute to many PESCO commitments and has a distinct influence on the capabilities landscape, it will not be recommended for the main emphasis if MS do not participate. Thereof, the reasons why a project is recommended in the second assessment must have explanations other than an increased number of criteria satisfied.

As shown by the analysis, most of the time the reason lies in the increased number of pMS in a specific project. But why does it occur? Since there is no correlation between participants in a projects and the number of criteria satisfied (see Appendix A). Even though a project in the first stage of assessment might have a moderate to high impact on capability landscape it might still not attract pMS. But then, it might experience an increased number of pMS, or confirmed interest by observer pMS, and so be included in the main focus. But this occurs also with relatively low impact projects that have experienced an increased number of participants after the clarification workshop, leading to their inclusion in the main focus. As we will see in the next chapter, this research

suggests that is the European agencies that leverage pMS to reveal or unveil their intentions to participate. Thus a different message is sent by a pMS to project coordinator. This is also motivated by the fact that potentially, a project outcome increases as the number of pMS increase, though the risk of transforming it in a continuous action problem is higher. But, the latter might be overcome with the implementation of another EU mechanism, the EDF, which transforms it into a more manageable threshold action problem (see Chapter 4).

5.5.2 The 3rd batch of PeSCo projects

For this third wave of projects the, fifteen project proposals have been submitted to the Secretariat. Secretariat had invited the participating MS to the Clarification Workshop on Project proposals that had been previously submitted by Member States in July 2019. The initial assessment report, developed by the Secretariat, entailed the capability perspective delivered by the European Defence Agency (EDA) and the operational view delivered by the EU Military Staff (EUMS).

Based on the assessment of the PeSCo project proposals conducted by the PeSCo Secretariat, the report was an initial overview on which projects should have been taken forward as the main focus for further work, including its rationale, and which one should have been discarded. The purpose of this initial 'Assessment Report' was to pave the way for the afterwards Clarification Workshop, hold in the EDA premises, that took place in autumn, 2019. By doing so, the PeSCo Secretariat not only assessed the project proposals but also tailored for each projects recommendations for Member States. Indeed, the Clarification Workshop, worked as 'clearing house' function, using an expression from an EDA officer to refer to the workshop, as it was meant to help to answer open questions and to provide a refined assessment of the project proposals.

The Clarification workshop is thus represented as the second round of interaction

in a principal-agent model, as it represents an opportunity for the participating Member State to challenge some of the European agencies' assessment; for example by expressing a further level of interest to participate in dedicated projects. Indeed, the PeSCo is a Member States driven initiative where the EU has no formal power to stop or veto a project, even though it was meant to be discarded by the agencies. Clarification provided during this second round of interaction may lead to an update of the initial assessment report, as the level of participation in a particular project—often considered the most important criterion upon which the agencies base their assessment—may change. The refined assessment report of the PeSCo project proposal will thus constitute more likely the final list of the adopted projects.

By comparing the initial assessment report with the final report after the Clarification workshop it is possible to assess whether the agencies had a say and whether they had exercised a leverage towards the member states. If positive, this will prove that the agencies do act as a 'gatekeeper'. As stated previously, for the 3rd batch of PeSCo project fifteen initial project have been submitted by participating Member States to the PeSCo Secretariat; only two out of fifteen were discarded in the final list of the third batch of projects. Although this may indicate a certain influence from European agencies, a closer look at the initial 'Assessment Report' accounts for a much more complex story. Apart for those two rejected project, 3.1.17, and proposal 3.1.30 —five additional project had received negative feedback by the EU agencies. The table shows that none of the five projects had jointly achieved a level of impact that justified its resurgence. In each project, at least one of the two aspects was judged to have a low impact, nevertheless the projects were still recommended for the main focus and included in the Council decision. The reason lies in the increased capability and operational impact assessed by the Secretariat after the Clarification workshop. Participating Member States following Secretariat's indications have clarified their pending positions. This has proved the leverage by the European agencies acting as a gatekeepers.

Table 5.5: 3rd Batch PeSCo project

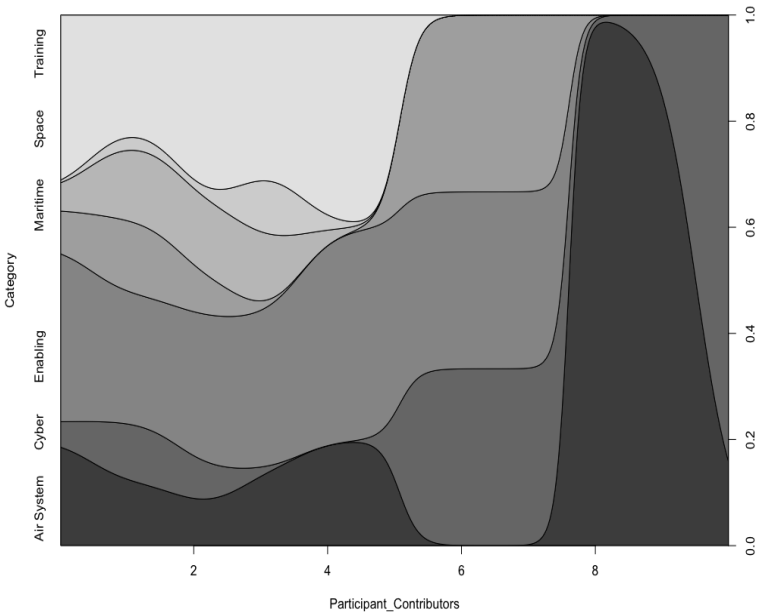
Project Title	Capability Impact	Operational Impact
3.1.18	Low	Low
3.1.20	Low	Low
3.1.28	Medium	Low
3.1.22	Low	Medium
3.1.27	Low	Low
EPRC	Low	Medium
EU-Training StaffOff.	Low	Low

Source: Author's own compilation

Even though PESCO is considered the most adaptable manifestation of the Treaties' differentiated integration mechanism, it has produced the most comprehensive expression of greater defence cooperation. The relevant question is whether this outcome is to be credited to member states or EU institutions. What role do the EU agencies play in this? Have they made an effort to be inclusive in the spirit of the EU's ideals, or not? An answer to this question provides us with the direction that European defence cooperation will take in the following years, demonstrating whether we will move further and further away from intergovernmental order within EU defence cooperation. Surprisingly, PESCO promoted cooperation among nearly all member states in what appeared to be the most inclusive representation of enhanced cooperation (Blockmans & Crosson, 2021). Even though it was conceived to allow a small number of countries to explore a more deeper cooperation, it has not resulted in differentiated integration.

This density plot represents smoothed proportions of each PESCO project category

Figure 5.6: Density plot: project categories and n pMS



Source: Author's own compilation

within various levels of the continuous variable 'Participant contributors' (which are the pMS in a joint project). In order to interpret them you should look across at the x-axis and see how the different proportions for each category (represented by different colors) change with the different values of the numerical variable 'Participant contributors'. For example if we consider the plot in Figure 3.4., it is quite easy to see that when when the number of potential contributors reaches 7 pMS or above you are most likely dealing with Air system kind of project. On the other hand, across 2 and 6 'Participant contributors', the 'joint enabling' category dominates. And at four pMS there are about 40% 'training' category, 40% 'enaibling' and 10% 'Air system' (judging by eye according to the scales on the y-axis on the right.)

5.5.3 The Work programme committee and the Secretariat: the 'gatekeepers'

The following section will focus on the third batch of PeSCo projects submitted by the participating Member States to the Secretariat in the mid 2019. More specifically, it will shade light on the process that bring to bear the adoption of the first wave of PeSco projects by showing the assessment criteria and the number of projects that have been discarded by the Secretariat initial assessment report. Thus, it will constitute an empirical evidence that will confirm the leverage of the European agencies vis-à-vis the participating Member States. If the kind of projects that have been discarded are not present in the final list of the 3rd wave batch of PeSCo project, this will confirm the 'gatekeeper' role of the EU agencies in this particular initiatives of defence cooperation.

Chapter 6

The case of PESCO: a coordination game dilemma

6.0.1 Within-case analysis

The European Union's Permanent Structured Cooperation (PESCO) has been seen as a model for multilateral coordination games, allowing the Secretariat and its agencies to shape member state preferences. To illustrate how this works, Table 6.1 provides two examples of collaborative projects: one with high externalities, and one with low externalities. An analysis of the high-externality project — which is most likely to fall under the "capability case" — suggests that it is more susceptible to the influence of an agency dealing with capability than an operational-oriented project would be. This method may be used to test theoretical expectations or assumptions about agencies' influence (Levy, 2008).

The EU agencies have the potential to exert a significant influence on policy areas

where their expertise is pertinent. However, their ability to shape policy in other areas is less certain due to the limited scope of their knowledge. For instance, cooperative projects that seek broader goals and far-reaching changes in governance may be less impacted by EU agencies' influence. Such policies often contain embedded political considerations, making it more difficult for the agencies to provide meaningful input and thereby diminishing their capacity to shape outcomes. In conclusion, while EU Agencies may be influential in narrower policy areas where they possess expertise, this influence is likely to be significantly reduced when considering more complex proposals with far-reaching implications.

When addressing highly technical matters, policy-makers often find themselves in uncertain territory and unable to make informed decisions. As such, project proposals involving technical issues are more susceptible to the influence of EU agencies (PESCO official A, interview). Capability-oriented projects that require technical assessments, for example, are particularly reliant on external experts and are thus more likely to be shaped by the expertise of these agencies. In this regard, EU agencies have a distinct advantage in providing reliable sources of support that can ensure successful project development Lindvall (2009). It is therefore unsurprising that such agencies have been able to exert considerable influence over policy-making in this area.

At Table 6.1., the Secretariat's ability to successfully change member states' preferences towards an optimal outcome is demonstrated in the most and least likely cases of PESCO projects. Military Mobility and European Military Command, both of which have high externalities, are well-suited for the Secretariat's agency, whereas European Attack Helicopters TIGER is less porous to influence due to its low externalities. The European Defence Agency (EDA), created to facilitate and coordinate capability projects, might be able to make an impact on projects such as TIGER due to its formal tasks attributed by Council Decision concerning assessment of proposals in the area of capability development. However, Military Mobility entails political decisions that make it

less susceptible to EDA influence.

Table 6.1: An example of Most- and Least-likely case for coordination game solution

EU agency	High Externalities	Low Externalities
European Defence Agency	Military Mobility	European Attack Helicopters TIGER
European External Action Service	European Military Command	Counter Unmanned Aerial System (C-UAS)

6.1 PESCO as coordination game 2.0

In Section 1.3.1. of our study, we have explained why PESCO's institutional design reflects a coordination problem that EU is trying to solve. Indeed, this European defence initiative can be seen as a coordination game in which member states must align their military capabilities and strategies to achieve a common goal. To accomplish this, they must first overcome the classic situation such as Prisoners' Dilemma (PD) and battle of the sexes scenarios, which represent two kinds of coordination games. We have also contended that PESCO does not necessarily represent a collective action dilemma since member states do not have an incentive to free ride on the contributions of others, leading to a suboptimal outcome for everyone. Overall PESCO does not represents a PD scenario either since defection from the 20 more binding commitments that constitute the baseline of active involvement does not grant any comparative advantage to others. Nonetheless, each PESCO project could be characterised by a level of externalities or interdependence (see Botcheva & Martin, 2001; Schelling, 1958). And the ability of PESCO institutional design, and the role of Secretariat, to affect patterns of member state behaviour is dominated by whether they face a situation of high or low externalities, and not only whether they face a battle of sex or PD scenario. Example of high

externalities in international studies are those regulating trade, environment, but even technical standards that might affect every participants. On the contrary, low externalities situation are those where the choices of some pMS have minimal consequences for others. If we consider for instance a PESCO project that aims to develop a specific new tank, this will not affect anyway another participant which for instance has already an advanced tank in its armament capability. The reason why PESCO projects participation has decreased (see Chapter 5) over time is because the lack of interest in projects that could be also seen as projects that are characterized by low externalities, so unless all member states share same preferences for that project they would not be attracted by.

When a PESCO project features a situation with high positive externalities, in that states can benefit from choosing the same course of action, that coordination is more likely to occur. If we consider the payoff (a) and (b) in Figure 6.1. illustrates a classic coordination problem where two states, each with just two possible courses of action, must decide how to act in order to maximize their payoffs. In the payoff (a) both stand to benefit from coordinating their choices. The payoff matrix reveals two pure-strategy equilibria either (4,3) or (3,4); they can maximize their gains if both players choose the bottom right corner or the upper left corner of payoff (a) . However, outcomes where the states choose different actions are not equilibria; incentives exist for both parties to switch and coordinate. Although the exact outcome of this scenario remains unclear due to the presence of multiple equilibria, one thing is certain: states will eventually converge on a single solution. Given the complexity of the situation, it's unsurprising that uniformity in state behavior has been difficult to maintain, but it does appear that a single outcome will be reached. But we taking for granted that this game is characterised by full-information. Which is not likely to occur.

$$\begin{pmatrix} (4,3) & (1,2) \\ (2,1) & (3,4) \end{pmatrix}$$

(a) Coordination Game

$$\begin{pmatrix} (4,4) & (0,5) \\ (5,0) & (2,2) \end{pmatrix}$$

(b) Prisoners' Dilemma

$$\begin{pmatrix} (2,1) & (2,2) \\ (1,1) & (1,2) \end{pmatrix}$$

(c) Low externality game

Figure 6.1: High and low externality game

6.1.1 Coordination game: the most likely successful scenario

Amid several cooperative projects within PESCO, specific ones have the characteristics of high externalities for all pMS in PESCO, which most likely led to preference uniformity and the maximisation of payoff. In particular, Military Mobility has those characteristics. This project seeks to serve as a platform for initiating, coordinating, and guiding the work necessary to enhance military mobility in Europe. As part of a larger set of initiatives designed to ease the movement of military assets across the EU, NATO, and individual countries, this project provides an opportunity for the capitals to remain connected and collaborate on military mobility issues. Proposed by the Netherlands as Lead Nation, it includes all pMS in PESCO, therefore it has been called by many the "Schengen of Defence" (Rettman, 2016). In the words of the Netherlands PESCO Spokeperson: "this project is committed to facilitating the swift movement of military forces across its borders; to simplify and standardize cross-border military transport procedures while breaking down legal, bureaucratic, and infrastructural barriers that impede the efficient transit of personnel and assets." (Netherlands Spokeperson, interview). Such roadblocks include lengthy bureaucratic processes, passport checks at some border crossings, and roads and bridges unable to bear the weight of large military vehicles. By eliminating these obstacles, this project enables Member States to more expeditiously military move personnel and equipment between countries within the EU.

Nonetheless, rather than establishing an unrestricted zone of travel for European armies, or even a visa-free space for third-country militaries, the proposed project seeks to facilitate the cross-border movement of troops, services and goods by standardizing

rules and procedures among participating states[1]. This includes aligning regulations such as customs laws, dangerous goods codes, and trans-European transport networks. Such harmonization would enable military exercises and other activities to take place more freely across Europe's borders (see Blockmans & Crosson, 2019; Blockmans, 2018). But this kind of choice of technical standards, or international regulatory agreements (Chayes & Chayes, 1998) are the exact scenarios where policy preferences converge among member states.

Since in Military Mobility nearly every pMS is participating in the project then coordination, harmonisation and development of technical standards are more likely; nonetheless, complete information remains elusive and actual interaction between states is far more complex, though convergence in preferences is more likely. But persistent problems of bargaining and enforcement may arose, bringing in a role for the Secretariat (Botcheva & Martin, 2001). Hence, even though this case is characterised by high externalities with high incentives for everyone to choose the same direction, there is still match for the coordination role of the Secretariat and agencies. In this scenario the role of the Secretariat will be to assist states to overcoming coordination problem thus converging pMS preferences toward one particular outcome.

In a coordination game, the Secretariat is tasked with resolving coordination problems between states. To do so, it provides the information necessary for states to effectively bargain and reach a cooperative equilibrium. PESCO institutional design is well equipped for this scenario as it provides a clearing house forum to facilitate the sharing of pertinent information during negotiations. It is a misinterpretation of PESCO's institutional design to assess its success based on the assumption that it should be able to handle scenarios where monitoring state behavior is necessary, such as PD (see Martin, 1992a). Instead, through clarification workshops like this, pMS can gain insight into

[1]See the joint communications of the Commission and the High Representativetothe European Parliament and the Council, "Improving military mobility in the European Union", JOIN(2017)41 final, 10 Nov. 2017, and "Action Plan on military mobility", JOIN(2018)5 final, 28 March 2018.

their partner's points of view, cost of non-compliance and level of patience. PESCO institution then become an invaluable source of information which is needed to tackle coordination dilemmas (Botcheva & Martin, 2001). The Secretariat and agencies can be used to further negotiations by creating a closely-knit network between countries' representatives - which is why we have given so much attention to networks as one way for Agencies to exert influence.

PESCO's projects, such as the Network of Logistic Hubs in Europe and Support to Operations, and European Military Command and Co-basing projects, have generated high positive externalities, setting the stage for PESCO to influence the preferences of participating Member States. Although these initiatives are typically larger in scope than those focused on industrial production, they can bring significant rewards for all involved (Blockmans & Crosson, 2019). By providing a platform for collaboration between nations in areas such as logistics and military co-basing, PESCO is helping to build bridges that will improve the European Union's security capabilities.

Other projects have instead do not display high positive externality but simply low externalities. The majority of PESCO projects, despite being praised by national representatives, do not affect the rest of the pMS which is why overall participation is low and differentiated integration is soaring. While making their rational choice on whether participate or not in a project with low externalities, pMS are in the situation of payoff (c) in Figure 6.1. There, the payoffs of each state are not connected; instead, each has an advantageous strategy, with one state being more likely in the upper row—think about the PESCO frontrunners who have the tendency to participate more—and state 2 more likely to be in right column not interested to participate, think about Baltic states. Given that mobility between states is limited, the payoffs should not rely on one another's decision making (Botcheva & Martin, 2001). And the only equilibrium is the upper right corner, where one state participate the other does not.

In low-externality projects, states preferences are divergent, the reason why DI occurs, provided that all states don't prefer the same course of action. Although low externalities are necessary for this divergence, they are not enough. To understand the patterns of divergence, one must look to the sources and nature of state preferences. Conversely, when externalities are high, states' behavior will be much more responsive institutional effect and EU actors' agency in changing states behaviours.

6.2 Cheap talks

Despite the more binding commitment put on by MS into Council Decision establishing the PESCO mechanism, some of them lacked delivering true output, though some projects have involved the majority of its participants. The problem lacks more on the structure of the PESCO mechanisms, which is based on the voluntary base contribution to joint projects, rather than on the its governance, which is based on an intergovernmental approach. Indeed, PESCO mechanism entails the typical coordination problem that brings to bear two major fallacies: ambiguity and uncertainty.

If participants in a project are unaware of each other's preferences, they will be unable to coordinate their activities effectively. The governance of PESCO attempted to address this issue by enforcing more transparent information sharing about national's defence goals via National Implementation Plan (NIP) and CARD. Nonetheless, the limited scope of these instruments did not prevent the soaring of uncertainty and ambiguity among pMS. Moreover, as seen in the previous chapter, there is high variation between pMS in the initial stage of a project's submission to the Secretariat compared to the final stage, which means that regular communication among pMS failed to overcome mutual ambiguity and uncertainty.

The role of the Secretariat in providing information and setting stage for meaningful

communication, or cheap talks, among participants, should help overcome mutual ambiguity on each other's preferences. Nevertheless, communication effectiveness depends on the link between contributions and the participants' value placed on the cooperative project (Kenkel, 2019).

6.2.1 Cheap talks mechanisms

In a game of incomplete information, communication between players can be surprisingly effective in helping them reach their desired outcomes. Cheap talk, as it is known to economists, refers to the costless exchange of information which does not directly affect the payoffs of a game (Banks & Sobel, 1987). A new area of study has emerged for game theorists that looks at how much information can be credibly transmitted when language is free-flowing and unrestricted (Krishna & Morgan, 2008). Signaling games are one form of this exploration, where players' desires may differ from one another making communication even more important; while in cheap-talk games, players' preferences can align harmoniously enabling smoother conversations and agreement.

In an experiment to gauge the effectiveness of cheap talk, game theorists and economists studied how individuals acted in an entry-deterrence game with one-sided incomplete information when cheap talk was not allowed or allowed. The results indicated that, even when players have limited incentive to lie, cheap talk can drastically improve possible equilibrium outcomes (J. Farrell & Rabin, 1996a). This poses a fascinating question: given the directness and costlessness of communication, how much information can be credibly transmitted through such a medium? As it turns out, plenty (Tingley & Walter, 2009). Crawford and Sobel (1982) showed that while there are informative equilibria, there is always a 'babbling' equilibrium in which participants deem all communication to be uninformative (Krishna & Morgan, 2008).

In recent years, political scientists have focused on the implications of cheap talk in

terms of equilibrium when an informed agent has the freedom to use both costless and costly signals (Austen-Smith & Banks, 2002). Joshua St. Pierre's Cheap Talk: Disability and the Politics of Communication delves into how speech has been rendered cost-free to satisfy the insatiable demands of capital (St Pierre, 2022). Cheap talk is generally understood as communication that is neither expensive nor binding, yet still unverifiable. Research has also been conducted into how candidates self-select their promises to voters during election campaigns through such cheap talk (Fehrler et al., 2020)

In the world of international diplomacy instead, cheap talk can be invaluable in averting crises between countries and determining the outcome of bargaining games (Ramsay, 2011). By coordinating actions, revealing information, and altering the probability of war, diplomatic cheap talk has a potential to influence the set of possible equilibrium outcomes. Experiments have shown that when there is no incentive to lie, cheap talk can effectively convey private information; however, when lying is too rewarding for either party involved in a negotiation, it renders any such communication meaningless (J. Farrell & Rabin, 1996a).

In our research we have highlighted the PESCO necessity to engage pMS in workshops, formal and informal meetings that precede the final adoption of PESCO projects. Those meetings constitutes a cheap talks opportunities and serve as *fora* where pMS and PESCO secretariat, agencies as well, can communicate freely to exchange information. Even in the most likely scenario described in the previous section, incomplete information might obstacle the policy convergence in pMS preferences. So, meaningful communication is necessary in order to coordinate states behaviours toward a higher payoff.

6.2.2 Incomplete information in defence cooperation

Defence cooperation among MS is an apical example of a collective action dilemma. Due to the incentives to free ride, even in the best circumstances, voluntary contributions to collaborative endeavours are likely to be insufficient to achieve the specific scope of the cooperation (Olson, 1998). This collective action problem is not limited to defence cooperation for industrial purposes; it also affects the security domain. Indeed, countries sharing security concerns may not be fully aware of the amount of effort their allies are willing to mobilize to face a particular threat. Another factor impeding collaboration is mutual ambiguity among potential contributors to the common good (Kenkel, 2019). States with a similar security aim may be uninformed of the extent to which their allies are willing to mobilize to accomplish that goal. A potential contributor can't adjust her behavior if she doesn't fully know the incentives of other participants. Uncertainty makes it even more complex the problem of collective action, especially in the areas of defence procurements and security where MS tend not to fully disclose their information. Cooperation in defence, such as joining a cooperative program as in the case of PESCO, raises a further question: if is it worth contributing at all?

Thus, every PESCO project arises two problems: the first one is whether a project is worth contributing at all? Project that requires everyone's participation to succeed may fail if one player's unwillingness to contribute makes everyone else's contributions worthless. Since there is incomplete information, potential participants may refrain for fear that their partners are insufficiently committed. The second one is the optimal division of labour. Due to incomplete information, players may not know who values the project the most and thus may not be able to coordinate on an optimal division of labor (Palfrey et al., 2017), which does not happen when the participants are fully informed (Olson & Zeckhauser, 1966).

Uncertainty is a key variable in collective action problems, especially in collective

security and defence initiatives. PESCO project initiatives are no immune to this conundrum. Nonetheless, there are several ways to which uncertainty can be resolved, though expensive are they: costly signaling one's intent to participate in a project, direct monitoring by external actors or binding commitment. The better off scenario would be a direct revealing through direct communication by actors involved, on whether they are keen to participate or not in a project. This ordinary communication has been often formalised by theorists in a model called *cheap talk* (Crawford & Sobel, 1982; J. Farrell & Gibbons, 1989; J. Farrell & Rabin, 1996b). But, as said previously, the sheer nature of defence and security refrain participants from revealing credible information thus preventing any efficient coordinated action through cheap talks. Scholars have investigated how a meaningful communication in a collective action under incomplete information depends critically on the relationship between individual contributions and the outcome of collective action (Kenkel, 2019). To that purpose we must differentiate collective action problems in two different kind: continuous and threshold problems.

In a continuous collective action problem, participants are encouraged to not be honest in their communication since everyone will marginally benefit from the outcome, regardless of their genuine involvement or not. Whereas, in threshold problem, a honest form of communication is more likely in equilibrium, since participant's contribution may be insufficient if other partners do not contribute enough.[2]

A collective action problem presumes that each participant would prefer greater contributions by others. This tendency to burden others with more commitment is more severe in continuous problems. Since every contribution has positive marginal value, everyone would wait for others to give more rather than less, thus affecting honest communication through cheap talks. Indeed, participants in a project may overstate or understate their contribution if that would induce their partner in a project to contribute the most.

Different forces operate in a collective action problem that entails a fixed threshold for

[2] A classical example of threshold contribution is the building of a bridge. The success depends on both parts of the shore, since if one do not contribute sufficiently the bridge cannot be completed.

a project in order to succeed. Below the fixed threshold, the marginal benefit of a contribution is null. On the one hand, if a threshold is met, a potential contributor to a project might be indifferent whether others give more or less. On the other hand, participants that are not sure to contribute sufficiently for the threshold to be met—because they do not believe that the project is sufficiently worthy—are indifferent about others' contributions. Counterintuitively, this indifference is what makes cheap talks successful. Participants are encouraged to reveal that they will not contribute sufficiently to meet the threshold, at the risk of encouraging others to contribute even less than they otherwise would. The opposite happens in continuous collective action problem where participants are better off not revealing something that can induce others contribute less.

PESCO initiative, like all initiatives that attempt to increase collective security, features classic aforementioned collective action problems (Olson & Zeckhauser, 1966). Furthermore, its pronounced intergovernmental approach double down the fact that this initiatives takes place in an environment of high uncertainty (Fearon, 1995). Although the scheme of PESCO mechanism permits free communication among possible participant in a project, uncertainty hinders cooperation to deliver successful outcome as outlined by the last report on unsuccessful PESCO deliveries. The iniatives attempted to resolve this uncertainty through more expensive tools such as the delivery of National Implementation Plan (NIP), aimed to reveal some participant's information circa its real commitment to a project, and the CARD mechanism. Furthermore, through ex post direct monitoring by external actors, such as the European agencies—EDA and the EEAS in their monitoring and assessing role. Even biding commitment principle is present in the PESCO status. But the main upshot of this research is that European agencies leverage MS to reveal through cheap talk when they are unwilling to contribute, that the project is doomed to be worthless. However, this can only happen if there is

a definite, well recognized threshold for contribution beyond which the project has no value. European agencies with their clarification workshop address this problem and help to limit uncertainty and problems inherent in collective action dilemma.

In a typical continuous collective action dilemma, such as defence cooperation in which all participants' contribution might have positive marginal value, cheap talks cannot offset part of the efficiency loss due to incomplete information. The lack of supranational authority within PESCO mechanism, due to its pronounced intergovernmental nature, impedes to commit participants to a transfer scheme by which efficient results might be achieved, as proposed by mechanism design literature (Clarke, 1971; Groves, 1973; d'Aspremont & Gérard-Varet, 1979). It is impossible to achieve cooperation in this setting by solely voluntary information disclosure. As shown by Kenkel (2019) in his analysis, when we shift from a public good to a voluntary contribution situation, the consequences of incomplete information for effective collective action become far more severe.

This rationale explains the reticency by the French government to include all MS to the PESCO mechanism, and is the basis upon which the differentiated integration on security and defence is further based.

6.3 The model

Let assume that a PESCO project has only two player, therefore a model similar to the one proposed by Kenkel (2019), a two-player collective action problem with incomplete information, because no one has a complete idea about other's willingness to be fully committed in the project. Furthermore, the initial stage of PESCO mechanisms, before the project's submission to the Secretariat, is here presented as the pre-play communication stage among potential pMS. Let's see what happen in the model when there are

no communication useful to affect the selection of contributions.

6.3.1 Contribution game

Since PESCO project involve at least two member states, for the purpose of the model we can assume that a joint project is presented and two pMS, 1 and 2, simultaneously choose the amount of effort to place in the cooperative project. Let assume i denotes a generic pMS and j its project partner. The pMS's contribution is therefore x_i; while the feasible set of contribution for each player is a compact interval, $X_i = [0, \overline{x}_i]$.

Each pMS's contribution influences the value of the joint projects or its chances of success. The contributions by pMS 1 and 2 are therefore x_1 and x_2, the joint project's value is $p(x_1, x_2) \geq 0$. If we interpret the cooperative projects as a common good for European Union defence, then p is its production function. Furthermore, p is upper semicontinuous, as in every contribution sub-game that assures the existence of a pure strategy equilibrium. For the sake of this study, it is necessary to double down the difference between when p is strictly increasing in its arguments, implying that all contributions are worthy, and when p has flat spots, implying that some contributions are worthless.

Each pMS has private information about its real willingness or capacity to contribute to the joint project. Let t_i denote a pMS's *type*, and let its cost of contribution x_i, according to its type, be $c_i(x_i, t_i)$. The model assumes that each cost contribution function is strictly increasing in x_i, and that eventually pMS may always avoid costs by contributing nothing to the joint project. In the letter scenario, its cost function would be $c_i(0, \cdot)$. Again, in order for the equilibrium to come, the model assumes each c_i is lower semicontinuous in x_i.

As regards the information structure, each pMS's type is drawn from a finite set of T_i with N_i elements, ordered from $t_{i1} < \cdots < t_{iN_i}$. The prior distribution of t_i is

$\pi_i \in \Delta T_i$ which is common knowledge. It is also assumed that each $\pi_i \gg 0$. For stronger results, it is considered the case of a game with only one-sided incomplete information. In this letter scenario, it is assumed that pMS 2 is the one whose type is common knowledge: therefore $N_2 = 1$ and $\pi_{21} = 1$. It is worth noting that the types of pMS influence their individual cost functions but not their combined production function. The assumption that one's private information exclusively influences one's personal payout is conventional in public goods with imperfect information (see J. Green & Laffont 1977).

As a result, each pMS in a joint project are solely concerned with her partner's type since it influences how much her partner will contribute to the project. Taking into account these consideration one can expect for each pMS the utility function as it follows:

$$u_1(x_i, x_j, t_i) = p(x_i, x_j) - c_i(x_i, t_i) \tag{6.1}$$

Having this payoff structure, the contribution game features Bayesian characteristics (Monderer & Shapley, 1996; van Heumen et al., 1996) and its function become:

$$P(x_1, x_2, t_1, t_2) = p(x_1, x_2) - c_1(x_1, t_1) - c_2(x_2, t_2) \quad ^{3} \tag{6.2}$$

But how does payoff change if a proceeding communication stage is included in the game. This is in line with the normal mechanism governing PESCO. Indeed, states initially meet before submitting a project to the secretariat. At that very early stage, states look for potential partners for a joint project.

[3] see also Myatt & Wallace 2008

6.3.2 pMS within cheap talk communication

Communication among pMS is presented as a 'messaging subgame' that occurs prior to the contribution game. Indeed, even before a project is submitted to the PESCO secretariat, MS start dialoguing among themselves for potential contributors and joint partners in a project. This has been confirmed by several officials and government representatives interviewed and clearly stated in the Council Decision establishing PESCO mechanism.

When they acknowledge their types, each pMS simultaneously sends a message m_i from the message space M_i. Here, one of the assumption is that $|M_i| \geqslant 2$. The messages are publicly seen by other potential participants before anyone decide their contribution to the project. At this stage of the process, messages are *cheap talks*: every potential contributor may send any message, and the perceived messages have no effect on both participants' payoff structure (Crawford & Sobel, 1982; J. Farrell & Rabin, 1996b). Communication may affect payoffs via its effect on participant's belief. Each massage sent by other participants contribute to form her partner's beliefs concerning her type. Eventually, this belief may turn out to affect the equilibrium of the contribution subgame. For instance, a pMS's contribution will be determined by how much he expects his partners will contribute in return. If he expects his partner is unwilling than he may contribute more and vice-versa.

For every $m_i \in M_i$, the j's updated beliefs about i's type after receiving the message (m_i) is: $\hat{\pi}_i(m_i) = (\hat{\pi}_{i1}(m_i), \ldots, \hat{\pi}_{iN_i}(m_i)) \in \Delta T_i$. However, a fundamental concern for defence collaboration amongst project participants remains: Why should a pMS reveal its type, or share some information regarding it, when doing so triggers a shift in the partners' beliefs?

Therefore, following our model, the sequence of PESCO mechanism could be represented as it follows:

Table 6.2: Sequence of play

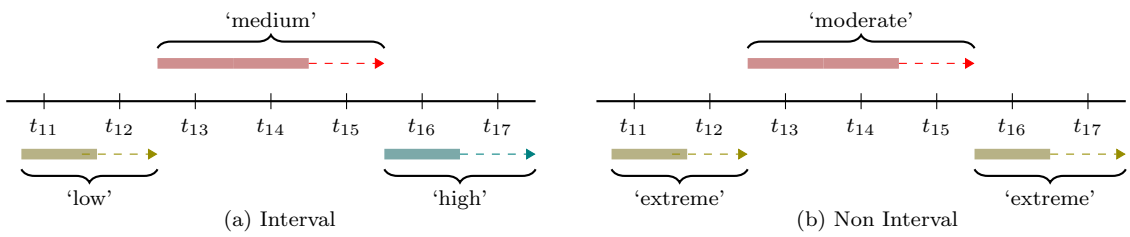
Pre-communication Each pMS knows his type, $t_i \in T_i \Rightarrow$	*Effects* Each pMS sends a message, $m_i \in M_i$
Post-communication Each pMS updates his belief about t_j to $\hat{\pi}_j(m_j) \Rightarrow$	*Effects* Each pMS simultaneously decides a contribution, $x_i \in X_i$

At the end of the sequence, the game ends and payoffs are realized.

As regards the messaging strategy, it is a function $\mu_i : T_1 \to M_i$; it prescribes a message for each type of each player. Whereas, a *contribution strategy* is a function $\omega_i : T_i \times M_i \times M_j \to X_i$, this function shows how much each type of pMS contributes after each pair of messages. The following function contains both pMS' strategies and belief systems: $(\mu_i, \omega_i, (\hat{\pi}_i(m_i))_{m_i \in M_i})_{i=1,2}$.

Common in cheap talks communications models, *interval messaging strategies* (Crawford & Sobel, 1982; J. R. Green & Stokey, 2007; Kenkel, 2019) is used to determine where pMS's messaging strategy lies in an interval of type space. When μ_i is interval messaging then for all $t_i, t_i', t_i'' \in T_i$ such tat $t_i < t_i' < t_i'', \mu_i(t_i) = \mu_i(t_i'') = m_i$. Figure 4.1. illustrates the difference between interval and non-interval messaging strategy.

Figure 6.2: Messaging strategy types with $N_1 = 7$



6.3.3 pMS and influential communication in PESCO projects

The adoption of a PESCO project features a multistage game of incomplete information characteristics with observed actions, since meetings are open to every participant to PESCO overall. Therefore, the correct solution in this kind of game would be a perfect Bayesian equilibrium (Fudenberg & Tirole, 1991). But, in order to be considered in 'equilibrium', each pMS's strategy should be sequentially rational given its beliefs and the other state's strategy. Furthermore, when it occurs, beliefs should be updated in respect of Bayes' rule. For the sake of a project, revealing pMS's private information is beneficial as it is also understanding if coordinating activities would benefit also from this sharing. The literature of cheap talks is straightforward in this regard: an equilibrium in which a player reveals information that affects the payoff is an 'influential equilibrium'. In the model representing the proposal of a PESCO project, an equilibrium is influential if at least one type of pMS contributes differently according to the messages it receives. The following expression defines this equilibrium:

An equilibrium is influential if there is a type $t_i \in T_i$ and types $t_j, t'_j \in T_j$ that

$$\omega_i(t_i, \mu_i(t_i), \mu_j(t_j)) \neq \omega_i(t_i, \mu_i(t_i), \mu_j(t'_j)) \tag{6.3}$$

As a result, if every pMS to a project sends the same message, then equilibrium cannot be influential. In an influential equilibrium, one pMS's message should dictates what other participant will do. If a pMS reacts to a different message, it means that it prefers a different action from its partners. Therefore, it is critical to distinguish between those projects that reflect examples of collective action in which this uniformity of preferences occurs from those that do not. Indeed, not all PESCO projects features 'continuous problems' where uniformity in messages is inherent, but where it does, as the

research shows later on, the European agencies through collecting and sharing information publicly succeed in transforming the problem from a continuous one to a threshold problem, thus changing its payoff structure. But, before embarking into this analysis, the following section will dig deep into formal modeling continuous action problem and threshold problem.

6.4 Continuous problem in European defence endeavors

Military as defence cooperation is another example of collective action problem in which all contributions are somehow valuable since every participant state can marginally contribute to its success. Indeed, the precise amount of effort required to complete a PESCO project is unlikely to be understood ahead of time. Especially for those belonging to 'joint enabling' category, a greater participation should simply soar the chances of its success, provided that the probability of success is continuous in the contribution (similar to all-or-nothing projects described in Nitzan & Romano, 1990). Therefore, these projects displays a continuous and increasing function of the contributions.

If a PESCO project features continuous collective action problems, then the communication part among pMS in the initial stage either does not occur or does not affect the contribution behaviour. The rationale is that if all pMS to a joint project are valuable for its success, then each pMS will prefer others to make a greater contribution so they will send a message that will induce its partner to contribute more. Nothing can prevent MS to do so, since talk is chap in this stage of the negotiation, though it hinders influential communication which cannot be sustained as an equilibrium. In this scenario what any pMS wants is a major contribution from other partners regardless their own willingness to contribute.

The game in question to be formalised needs some assumptions first:

(a) p is strictly increasing, twice continuously differentiable, and strictly concave

(b) x_1 and x_2 are substitutes so that $\delta^2 p/\delta x_1 \delta x_2 \leq 0$

(c) each c_1 is twice continuously differentiable and convex in x_i

(d) each $\delta c_i/\delta x_i$ is increasing in t_i

As stated in the assumption, pMS's contributions are substitutes, this propriety is based on the high variation among pMS in the same project on later stage. More importantly, a consequence of this propriety is that: the more a pMS is convinced that it will be others who will contribute, the less inclined it will be to do so. So this is a game of strategic substitutes where influential communication in equilibrium does not occur because everyone's incentive to understate willingness to contribute. To prove that there is no influential equilibrium in this game of strategic substitutes the research uses a transformed contribution subgame (Kenkel, 2019) by transforming a substitutes game into a game of strategic complementarities. Now a pMS's action is the additive inverse of its contribution.

- contribution subgame: $\Gamma(\hat{\pi}_1, \hat{\pi}_2)$
- pMS 1's belief: $t_2 \sim \hat{\pi}_2$
- pMS 2's belief: $t_1 \sim \hat{\pi}_1$
- transformed contribution subgame: $\hat{\Gamma}(\hat{\pi}_1, \hat{\pi}_2)$ a two player strategic game with strategy spaces

$$\begin{aligned} \tilde{X}_1 &= \{\tilde{x}_1 \in X_1^{N_1} | \tilde{x}_{11} \leq \cdots \leq \tilde{x}_{1N_1}\} \\ \tilde{X}_2 &= \{\tilde{x}_2 \in X_2^{N_2} | \tilde{x}_{21} \leq \cdots \leq \tilde{x}_{2N_2}\} \end{aligned} \tag{6.4}$$

and utility functions

$$\tilde{u}_1(\tilde{x}_1, \tilde{x}_2) = \sum_{n=1}^{N_1} \left[\sum_{m=1}^{N_2} \hat{\pi}_{2m} p(\overline{x}_1 - \tilde{x}_{1n}, \tilde{x}_{2m}) - c_1(\overline{x}_1 - \tilde{x}_{1n}, t_{1n} \right], \tag{6.5}$$

$$\tilde{u}_2(\tilde{x}_1, \tilde{x}_2) = \sum_{n=1}^{N_2} \left[\sum_{m=1}^{N_1} \hat{\pi}_{1m} p(\overline{x}_1 - \tilde{x}_{1m}, \tilde{x}_{2n}) - c_2(\tilde{x}_{2n}, t_{2n} \right] \tag{6.6}$$

The transformed contribution subgame presents pMS's 1 action as the inverse of its contribution, so $\hat{\Gamma}(\hat{\pi}_1, \hat{\pi}_2)$ is a game of strategic complements. Since $\tilde{x}_i$ represents the inverse of pMS's 1 contribution, it results that a major $\tilde{x}_i$ means a greater optimal choice for $\tilde{x}_j$ because each partner will prefer to contribute less if they expect others to do so. If assumptions are correct then $\hat{\Gamma}(\hat{\pi}_1, \hat{\pi}_2)$ is supermodular and thereof:

$$\begin{aligned} \tilde{x} \in \tilde{X}_1 \times \tilde{X}_2 \textit{ is a Nash equilibrium of } \hat{\Gamma}(\hat{\pi}_1, \hat{\pi}_2) \textit{ if and only if} \\ \textit{the strategy profile defined by} \\ x_1(t_{1n}) = \overline{x}_1 - \tilde{x}_{1n}, \qquad n = 1, \dots N_1 \\ x_2(t_{2m}) = \tilde{x}_{2m}, \qquad m = 1, \dots N_2 \\ \textit{is a Bayesian Nash equilibrium of } \hat{\Gamma}(\hat{\pi}_1, \hat{\pi}_2) \end{aligned} \tag{6.7}$$

In this kind of cheap talk model, $\hat{\Gamma}(\hat{\pi}_1, \hat{\pi}_2)$ has a unique equilibrium which is important for defining whether or not influential communication is possible. To assess the possibility for influential communication to occur we should look at the pMS's response on its partner's messages. Indeed, the message that causes some type to increase their contribution must otherwise cause other type to decrease theirs. Fore example if a type of player i send a distinct messages m_i and m_i' such that it causes more contribution in player j after receiving message m_i' and no increased contribution after receiving message m_i, than this strategy cannot be an equilibrium. Because, sending message m_i' guarantees a major contribution response by j and every player type i will be better off in sending message. The fact that everyone has an incentive to send the same message prevents an influential communication in this category of contribution subgame with interval messaging (holding the assumption aforementioned). In equilibrium, after getting a 'low type' message from player i every kind of player j contributes weakly less than after

receiving a 'high type' message from player i.

If all assumptions listed above hold then:

$$\hat{\pi}_1^L, \hat{\pi}_1^H \in \Delta T - 1, \hat{\pi}_2 \in \Delta T_2, and\ \alpha, \beta \in [0,1]$$

Assume the support of $\hat{\pi}_1^H$ *consist of higher types than that of* $\hat{\pi}_1^L$; *i.e.*

$$min\{n|\hat{\pi}_{1n}^H > 0\} > max\{n|\hat{\pi}_{1n}^L > 0\}.\ Let$$

$$\hat{\pi}_1^\alpha = \alpha\hat{\pi}_1^H + (1–\alpha)\hat{\pi}_1^L$$

and define $\hat{\pi}_1^\beta$ *analogously. Let* $\tilde{x}^\alpha$ *and* $\tilde{x}^\beta$ *be the equilibrium of* $\tilde{\Gamma}(\hat{\pi}_1^\alpha, \hat{\pi}_2)$ *and* $\tilde{\Gamma}(\hat{\pi}\beta_1, \hat{\pi}_2)$ *respectively. If* $\alpha \leq \beta$, *then* $\tilde{x}^\alpha \leq \tilde{x}^\beta$.

According to the results, it can't be influential communication when interval massaging strategies and assumptions holds. Consider an equilibrium where player 1's message strategy divides her type into two intervals ('low cost' and 'high cost'). According to the preceding calculations, every type of player 2 must contribute weakly more after the high-cost message than after the low-cost message throughout the course of play. If the equilibrium is significant, then at least one sort of player 2 must contribute much more. However, even the low kinds of player 1 would choose to transmit the high-cost message to encourage the greatest possible contribution from player 2, defying the equilibrium assumption.

To conclude, if the assumptions listed above are correct, therefore it cannot be influential equilibrium in interval messaging. It implies that uncertainty is not the only hinderance to overcome while talking about collective action problems since voluntary based contribution are an additional impediment in the context here analysed. Private knowledge may aggravate the situation because participants who do not know how much each other is ready to give cannot even agree on a second-best division of labour.

The settings assume incomplete private information among all participants in a joint project. Nonetheless, as seen in chapter three, when a pMS presents itself as a leader project, it is possible to assume that it is revealing its willingness to contribute heavily. Therefore, one of the assumptions listed previously can be further relaxed, assuming that only one pMS has private information about its willingness to contribute, holding that the project is increasing in the contribution of the pMS whose willingness is common knowledge (p increasing in x_2).

With one-sided incomplete information no influential communication is attainable. Consider an influential strategy profile in which different type of pMS 1 deliver different messages, prompting different responses from pMS 2. Because there is only one type of player 2, one of its replies must lead to a greater contribution—and hence strictly better for all forms of pMS 1. By the same rationale, every type of pMS 1 would choose to transmit the message that resulted in the greatest contribution from its partner. As a result, an influential strategy profile cannot be consistent with incentives. This line of argument leads to the following conclusion that if there is one-sided incomplete information, holding all other assumption up, no influential equilibrium is reached out.

So far, the model has demonstrated that communication in a continuous collective action problem has no effect on pMS behaviour and does not improve cooperation among joint project participants. The logic is that every participant will benefit more if their partner contributes more; hence, there is an incentive to stray from a successful message strategy or to say whatever encourages one's partner to contribute more. So three elements aggravate the cooperation in PESCO joint projects that are defined here as an example of continuous action problems: uncertainty, private information and voluntary base contribution. In these settings, information sharing may improve collective action outcomes only through costly signaling or via institutions that may independently request information about members' desire to contribute (Kenkel, 2019). The latter is

exactly what occurs when European agencies via clarification workshop try to exchange information to improve collective action outcomes. Indeed, the expert-level workshop facilitates the exchange of information between the pMS on the project proposals received and provides more details on the assessment conducted by the secretariat, as the pMS can take a better decision on whether or not join a project (interview EDA official B). The next section explains what occurs when the European agency by through their assessment of submitted projects transform a continuous action dilemma in a threshold problem.

6.5 The European agencies' transformative effect on collective action problems

The model presented in the above section has shown how cheap talk may not help pMS to efficiently coordinate their action in a presence of incomplete information contrary on what other scholars have claimed in similar settings (Agastya et al., 2007; Palfrey et al., 2017). Nonetheless, compared with continuous collective action problems, in the threshold problem the difference are such that influential communication are possible. In the PESCO mechanism there are two ways through which we may consider a threshold joint PESCO project: first, when a PESCO project in order to attain funds by the European Defence Fund must have at least three different pMS join a project, otherwise the project is not deem to EDF grants; second, more importantly, when European agencies asses and evaluate the pitfalls of some project they make the participating states have to reveal their intentions without which the project cannot succeed. The value of such projects are zero unless substantial contribution meet a threshold fixed by the Agencies, though they cannot veto or rebut the project ultimately they do present

their assessment in assertive way.

In a threshold problem pMS's preference for other's greater contribution is weaker. If a player is hesitant to contribute enough to meet the threshold, then it is indifferent between its partner contributing nothing and its partner contributing more since the threshold in any case won't be meet. This rationale is fundamental for communication being influential. Indeed, not all contribution are needed, some of them are worthless, unless threshold is meet. Let consider for example a PESCO project that needs grand from the EDF or EDIDP which requires at least three entities from three different Member States, so the project grant is provided only if $x_i + x_2 \geq \theta$, then a contribution of $x_i \in (0, \theta)$ is wasted if $x_j < \theta – x_i$. More broadly, a collection of contributor profiles for which the project fails and has no value is expressed in the following assumption: a set of $Z \subseteq X_1 \times X_2$, with $|Z| > 1$, such that $p(x_1, x_2) = 0$ if and only if $(x_1, x_2) \in Z$. This assumption conveys the kind of additive threshold problem when $Z = \{(x_1, X - 2)|x + x_2 \leq \theta\}$.

6.5.1 Numerical example

This section considers a PESCO project to demonstrate how communication in threshold problems is possible. The game assumes the action space of $X_1 = X_2 = [0, \frac{1}{2}]$ the function takes the thresholded quadratic form:

$$p(x_1, x_2) = \begin{cases} 0 & x_1 + x_2 < \frac{1}{2}, \\ 1 - (1 - x_1 - x_2)^2 & x_1 + x_2 \geqslant \frac{1}{2}, \end{cases} \tag{6.8}$$

while the cost function takes the linear form $c_i(x_i, t_i) = x_i t_i$. Consistent with the hypothesis that a pMS who is leader project has revealed its willingness to contribute in the project, in this game there is, therefore, one-incomplete information: then let $t_2 = 3$

and let $T-1=\{t_1^L, T_1^M, T_1^H\}$ where $\frac{3}{2} < t_1^L < t_1^M \leq 3 < t_1^H$. Joint project's value at the threshold is $\frac{3}{4}$, therefore the amount a player type t_i is to spend to make the difference between meeting or failing to achieve the threshold is:

$$\overline{x}(t_i) = \begin{cases} \dfrac{1}{2} & t \leq \dfrac{3}{2}, \\ \dfrac{3}{4_{t_i}} & t > \dfrac{3}{2} \end{cases}$$

Once the threshold has been reached, only pMS of type $t_i < 1$ would contribute as the marginal benefit of any additional contribution is 1 or less. The influential equilibrium is only attainable if both pMS coordinate their actions to meet the threshold and find it rational.

- messaging stage pMS 1 sends
  - 'low' message $\rightarrow m_1^L$ if $t_1 \in \{t_1^L, t_1^M\}$
  - 'high' message $\rightarrow m_1^H \neq m_1^L$ if $t_1 = t_1^H$
- contribution sub-game following 'low message' $\rightarrow$:
  - pMS 1 contributes $\rightarrow x_1 = \overline{x}(t_1^M) \geqslant \frac{1}{4}$
  - pMS2 contributes $\rightarrow x_2 = \frac{1}{2} - \overline{x}(t_1^M)$,
- contribution sub-game following the 'high message': both pMS contribute $x_1 = x_2 = 0$ project has no future but pMS have not wasted their efforts.

This strategy is consistent with a Bayesian Nash equilibria in their respective subgames. Both types t_1^L and t_1^M prefer not sanding anything else than m_1^L, this would trigger a lower contribution from other pMS. What is more important here is that even t_1^H has no incentives in sending a different message from the low message as it will trigger more pMS 2's contribution which has no value for high type of pMS 1. Indeed, the letter as

it maximum would only contribute:

$$\overline{x}(t_1^H) = \frac{3}{4}_{t_1^H} < \frac{1}{4}$$

to meet the threshold. Combined with the pMS's 2 contribution of $X_2 \leq \frac{1}{4}$ is not enough. The indifference between its own strategy and deviation from it permits influential communication to occur.

To conclude, in class of threshold collective action situations, cheap talk communication may aid players in disclosing information to better coordinating theirs contributions. The option arises because, unlike in the preceding class' study of continuous problems, a player may be indifferent at the margin about whether her partner contributes more or less. In particular, showing that a pMS is reluctant to provide enough to fulfill the threshold costs nothing. This brings us to the second point: even when influential cheap talk is possible in threshold class problems, its effectiveness may be limited. Once pMS realises that the threshold has been reached, it will again have an interest in seeing others contribute more. A state may therefore convey its sincere interest in the project, but it will still have incentive barriers to to provide further details about its contribution.

6.6 European Cooperation a continuous problem

As shown by the model, the structure of the collective action problem determines whether communication affects or not collective action outcomes. Since PESCO projects feature characteristics similar to the wide class of continuous problems, every MS participation in a project is valuable causing a strong incentive for MS to misrepresent their contribution thus hindering any effective communication. This conundrum is limited by the intervention of European agencies. Thanks to their role in assessing and evaluating

project submitted by MS, European agencies operate by changing the structure of the collective action by transforming it from continuous to threshold problems, in which contributions may have zero marginal value. By doing so, the European agencies attempt to create greater chance for influential communication, though its effect might be limited.

A longstanding question in European cooperation on defence and security is how to facilitate the provision of collective defence projects. Since defence and security has always been addressed through an intergovernmental approach without central authority to enforce contracts or mandate cooperation, as in the anarchical international system (Waltz, 1979), the ambiguity that states have about one other's commitment to contribute to the common project exacerbates the free-ride dilemma (Jervis, 1976; Keohane, 1984). As a result, we can assume cheap talks to be ineffective to coordinate MSs' efforts to this regard. Scholars in IO theory emphasised the role of international institutions in facilitating cooperation among MS (Keohane, 1984; Martin, 1992b; Martin & Simmons, 1998). As shown by the model, in a continuous collective action problem, as the ones of PESCO initiatives, the inefficacy of cheap talk among pMS is itself an argument in favor for institutional involvement. The Agencies' role played out in the clarification workshop and through the Secretariat operate in two ways: on one hand it brings state together—the so called 'forum effects' as proposed by Mitzen (2005); on the other hand, the degree of autonomy granted to EU agencies from its MS makes the work of the Agencies more effective (see Abbott & Snidal 1998).

European agencies lacked the authority to enact a binding transfer scheme comparable to those discussed in the mechanism design literature (d'Aspremont & Gérard-Varet, 1979). However, the PESCO mechanism allows them to enhance collaboration by gathering information independently regarding the project's viability and sharing their results with pMS via a clarification workshop. This changes participants' payoff structures as it changes the collective action problem from a continuous problem to a threshold problem,

making subsequent cheap talks more effective and positive cooperation outcome more likely.

6.6.1 Interpretation of the model

Similarly to Olson & Zeckhauser (1966) conclusion on modeling military coalition as collective action problem, when states share defence building up capability goals, one state's effort works to the benefit of all, in particular in the context of soaring European defence capabilities. Nonetheless, the precise amount of effort necessary to complete cooperative projects is frequently unclear ahead of time. Since defence cooperation features typical collective continuous problems, the success of it is a probabilistic function of contributions. Each additional effort increases the likelihood of success of the project. In the alliance literature there is the shared assumption that partners freely share information with one another (Bearce et al., 2006; Konrad, 2011). So far, the model provided put doubt on this premise. Shared interests in defence cooperative project success are not enough to compel allies (or coalition partners in general) to share intelligence that will help the endeavor, as they are not during military cooperation endeavor as well. Indeed, the Libyan crisis in 2011 has shown how much NATO was unaware about the real willingness of its members to contribute and who would lead the joint effort (Michaels, 2013). This analysis presents PESCO projects as a typical example of collective action problems. It underpins that chances of influential cheap talks among pMS in a project depend on its social production function. When all pMS have positive marginal value by participating in a project, each actor would always want others to give more, diminishing thus the effect of cheap talk communication, creating an incentive problem and lack of delivering. On the contrary, when the project features characteristics similar to a threshold problem, some pMS may be indifferent about others' contributions at the margin. This indifference confirms the existence of equilibria with influential communi-

cation.

Communication has no strategic effect in the presence of complete information among participants, as in the case of the typical collective action scenario (Ostrom, 1998). However, the actual challenge in European defense cooperation is that communication among pMS cannot eliminate the incentives to free-ride, which remains the basic issue of any collective activity as such. Furthermore, like in the case of PESCO, insufficient information among pMS demonstrates that communication before to submitting projects to the Secretariat fails to avoid further failures owing to ambiguity. The defection of pMS, which were part of project, demonstrates that if potential participants do not completely grasp their partner's incentives—how much they value the project, how expensive it is for them to contribute—then they cannot even collaborate on the contribution scheme that would prevail under complete information.

The case of PESCO projects are here presented as an example of continuous collective action problem, in which cheap talk communication cannot create for pMS the complete information that would be necessary for an optimal coordination and efficient deliveries. Nonetheless, an increase knowledge of pMS preferences are created by the European agencies as they contribute to transform the continuous problem into a threshold problem through independently collecting information about its feasibility, and sharing their findings to pMS via clarification workshop. Once the project is perceived as a threshold problem, communication through cheap talks may help pMS avoid wasting their effort on hopeless projects, or convince others to join the previously discarded project. What happens then, is that European agencies by changing the structure of the social production function, they change also government preferences vis-à-vis specific projects. But, beyond that they cannot fully inform the pMS about a socially optimal division of labour within a project which causes a delay in delivering tangible output and attaining rapid-oriented objectives.

6.7 The EDF transformative effect on PESCO's continuous action dilemma

Article 40 TEU assures that none of the EU defence initiatives may interfere with each other's governance, But how does EDF favourably impact the PESCO project's cooperative outcome? As the model has demonstrated, it does so via altering the payout structure and pMS's preferences. It converts a continuous action problem, frequent in defence and security cooperation, into a threshold problem.

The very interesting synergies produced by these two initiatives on defence cooperation, though theoretically different, are causing a change in the preferences of the participating member states. The EDF does not change their preferences because the operating EU institution or agency exercises direct influence but rather because by setting threshold criteria it changes pMS payoff. Thus the game changes as well and cooperation is more likely to occur.

The previous chapter addressed how the EDF and PESCO interact with each other and what are the limits and advantages of this relationship. Their interaction is fundamental as it constitutes the backbones of the threshold action model. Indeed, while the EDF provides some additional criteria for pMS in a joint project and this hardening criteria foster better coordination among pMS and therefore a more cooperative outcome, by linking the EDF to PESCO and adding these new criteria there is also a passage from a continuous action problem to a threshold action problem. As the co-financing rate is meant to be 10% of the actual spending plan means that at least three pMS should arrive to contribute the rest of 90%. This threshold force pMS to coordinate better and comunicate better in the cheap talk format.

The European Commission's participation in this relationship is critical, from the creation of Work Programmes through the drafting of particular calls, up to the review

of selection criteria and project results. The EC role is fundamental for PESCO project too as depending on Work Programmes a project might be granted with funds or not. In the definitions of Work Programmes another interaction occurs between EU actors and national representatives. It is an interaction that occurs in a principal-agent relationship format, which necessitate identifying clearly who are the principal and the agent involved. There is a remarkable difference in the outcomes if the model implies more than one principal and a single agent or more than one agent and a single principal. The Work Programme Committee, which is made up of members from all 27 EU member states and assists the European Commission in implementing the EDF, is particularly essential. The so-called 'double comitology' arrangement guarantees that Member States have some authority over the European Commission. Therefore, the EC is presented as the agent and the Work Programme Committee the principal.

As soon as a proposed project is included in the European Defence Fund's Work Programme, it might be chosen. The Commission is responsible for the adoption of the Work Programme, according to article 27 of the EDF rule. However, it can only do so when the Work Programme Committee has given its approval. In contrast to the "traditional" comitology procedure, the failure of a committee to express an opinion on the Commission's proposal does not give it the authority to approve the Work Programme unilaterally. Obviously, this provides Member States special authority, which is balanced by the qualified majority voting rule and the Commission's right of initiative. The section adopts the *Challange model* (Bueno de Mosquita) to represent the relationship that occurs in the bargaining process between the EC and the Work Programme Committee.

Figure 6.3 represents a scenario in which an hypothetical actor i has to face decision made by each actor. In the following case by adopting the argumentation proposed by Javier Arragui we can develop a similar model for our case: actor i—the EC—faces with respect to each other actor, actor j—in our case a pMS—on any pending issue such as case a—which is a project proposal to be introduced in a Work programme.

Actor i may challenge actor j, or may avoid to challenge him. In the former scenario, when actor i challenges actor j—the right side of the Figure 3.1—the latter can decide either to accomodate or to resiste the challenger (actor i). When the actor j decides to resist there are two possible alternatives: the challenger i wins or the opponent (actor j) wins. In the latter scenario instead, actor i might decide not to challenge j—the left side of the Figure 3.1—which results on actor j not moving due to challenges by defiant actor i. Nonetheless, actor j can still decide to move due to challenges posed by other actors—other pMS member of the Committee—which might result in a better or worse outcomes. This eventuality might occur because of the nature of the Committee which entails all representatives of member states.

The expected utility for i challenging j is computed as follow. The probability that actor j might resist a challenge posed by i, is based upon the salience actor j gives to a specific issue a, denoted by s_{ja}. On the contrary, the probability that actor j gives in is equatl to $(1 - s_{ja})$. In this last scenario, when actor j supports actor i's policy outcomes, the utility faced by actor i is denoted by $u^i \Delta x^{+}_{ja}$.

If actor j resist the challenge, then actor i might either win or lose. In the first scenario, because actor i wins, it has a utility of $u^i \Delta x^{+}_{ja}$ and actor j shifts its position toward that of the challenger. On the contrary, if actor i looses, she would be forced to support j's requests. This will result on a negative utility for actor i, denoted by $u^i \Delta x^{--}_{ja}$. P_{ij} denotes the relative powers of stakeholder, for actor i and j, which determines the success or failure of an actor in such dispute. In turn, the value of p_{ij} depends on the influence each actors is able to bring to bear.

What determines the relative success or failure of stakeholders in their disputes is actor's relative power: p_{ij}. This value depends on the influence each actor is capable to bring to bear and the support each actor might receive from third actors. The influence is described as follows: capability times salience. Thus, we can compute the expected

utility for an European actor (i) challenging a pMS (j), on a proposal project (a), as it follows:

$$E^i u^i \Delta x_{ja} | Challenge = \\ s_{ja}\{p_{ij}[u^i \Delta x_{ja}^{+}] + (1 - p_{ij})[u^i \Delta x_{ja}^{--}]\} + (1 - s_{ja})[u^i \Delta x_{ja}^{+}] \tag{6.9}$$

The expected utility for actor i when it does not challenge the position of actor j is expressed in the equation 6.9. The equation takes into account also that actor j is not expected to shift its position due to challenges from other actors, so it will remain on its position without moving. It turns that the utility for actor i when no change occurs in the position of the stakeholders on that specific issue a is denoted by $u^i \Delta x_{ja}^{0}$

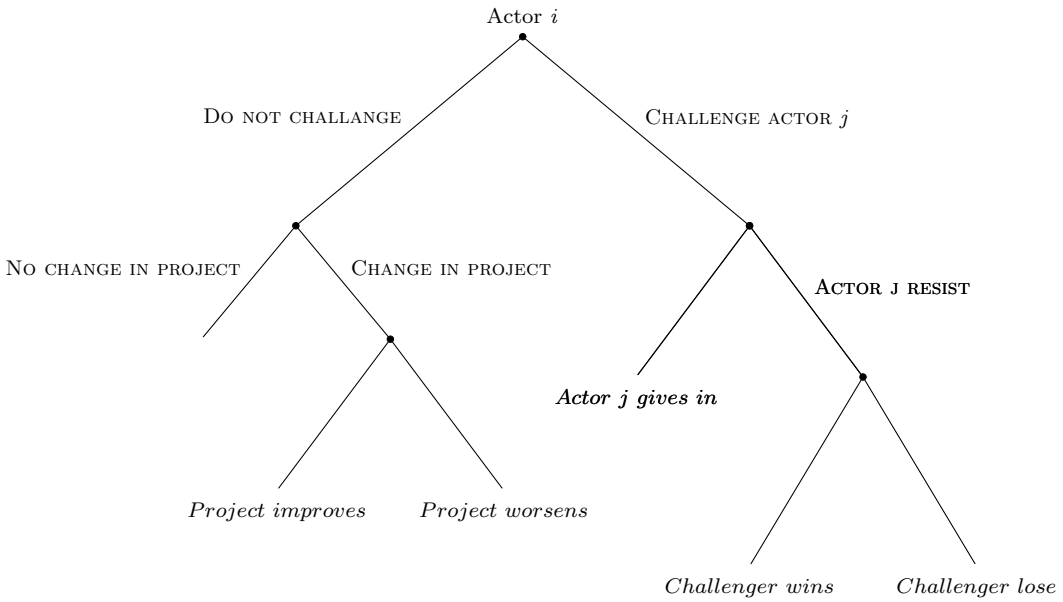
Therefore, actor i's expected utility of not challenging another actor (j) is the following:

$$E^i u^i \Delta x_{ja} | No\ Challenge = u^i \Delta x_{ja}^{0} \tag{6.10}$$

The total expected utility for actor i with respect to challenge of actor j is now equal to:

$$E^i u^i \Delta x_{ja} = E^i u^i \Delta x_{ja} | Challenge - E^i u^i \Delta x_{ja} | No\ Challenge \tag{6.11}$$

Figure 6.3: The expected utility model: the decision facing actor i regarding actor j



Source: Bueno de Mesquita's challenge model (the expected utility model, 1985) The decision facing actor i regarding actor j.

This model is characterized by a game of give and take, with multiple rounds of negotiation. Each actor presents the other participants with a selection of choices, and the recipient must select the one that requires the least deviation from their initial policy preferences. If they challenge in response, it can lead to a conflict; if they accept, they may reach a compromise or one party may have to surrender to the other's position.

At the end of the first round of bargaining, known colloquially as the "clarification workshop," stakeholders may change their positions. This could create a multitude of new perspectives that must be taken into account by those involved in this process. For instance, if a project proposal assessment is contested by a pMS, triggering the negotiation process mentioned above, and then challenged by another pMS in the new setting, actors may again repeat the same procedure. This cycle continues until all parties reach an agreement or until none of them adjust their stance.

6.8 Conclusion

This chapter applied a continuous collective action model to depict the conundrum that pMS are facing while joining a proposals. On the same time it reveals how the EU agencies are successful in their attempt to leverage pMS to transmit more clearly their willingness by sharing information independently gathered and reliable thanks to their expertise based knowledge. According to these models, in the PESCO mechanisms for instance cooperation among actors is more likely to occurs during the second stage of informal bargaining, after the initial assessment report presented by the Secretariat. Because the Secretariat shared these information and pMS start to send different messages to project coordinators with regards their true intentions. Although cooperation, indeed, to some extent is present in the very initial phase when actors willing to pool resources decide to cooperate thus proposing a project, it is in the second round of negotiation that

cooperation is more likely to occur. When participating Member States feel compelled to change their position due to agencies feedback, they are more likely to make a hones decision because the game has changed into a threshold action model. Furthermore, the interaction between the PESCO and EDF proposes an additional incentive to cooperate and it fosters the transformation from a continuous action problem to a threshold ones. Precisely because the EDF puts a threshold criteria, the minimum of three pMS from different countries and the 90% or 50% of national financial allocation to get the European financial grant, its transformative effect towards a threshold action game is even more straightforward. This has a positive impact on cooperation as it facilitate meaningful cooperation in equilibrium. It had overcome collective action problem thanks to a third party involved in the mechanisms which independently assessed the well-being of a project and leveraging over an increased involvement of other pMS. On the other hand, far from helping pMS to unveil their through message circa their willingness to joint a project, problems relative to contribution remained. Indeed, these conundrum might be overcome only by transforming it from a continuous to a threshold problem. The interaction with the EDF and EDIDP operates in that way, by establishing a threshold to obtain financial support pMS interested in reaching it cooperate even more while others are indifferent to it, making message a valuable in equilibrium.

Chapter 7

Conclusions

In the European Union, the introduction of Permanent Structured Cooperation (PESCO) in the defence cooperation framework has sparked debate and raised questions about its potential impact. While PESCO is seen as a major step towards greater defence and security integration in the EU, there is still uncertainty surrounding its effectiveness and institutional implications. This study sought to examine how PESCO has altered patterns of behavior among member states, as well as to explore what role EU actors might play in influencing member states' decisions over whether to join individual projects. The study employed a mixed-methods approach that combined qualitative and quantitative data analysis.

Amidst a backdrop of theoretical contestation surrounding European defence cooperation and the differentiated integration of EU defence and security, Rational Choice Institutionalism (RCI) was utilized to assess the rationality of EU actors in PESCO. Through a methodological approach informed by the research question and data access, the study's empirical analysis incorporated data on PESCO project proposals, adop-

tion, and its co-affiliation network. The study used a mixed-method approach, combining quantitative network analysis and qualitative interviews to answer the research question.

Furthermore, the research found that EU agencies played an essential role in PESCO's coordination game, their influence depending on resources, credibility, and reputation. The work of PESCO Secretariat's agency was evaluated through an example of its impact on a proposed project. Additionally, modularity maximisation was used to detect communities within European defence initiatives in a co-affiliation network analysis. This analysis showed variation between proposals and adoption of projects in PESCO. Furthermore, the study observed the interdependence between PESCO and EDF - with EU agencies assessing proposals based on EDF criteria while awarding funding accordingly - as well as providing empirical evidence for two sets of projects from the Work Programme Committee and Secretariat acting as gatekeepers for said projects. Ultimately, this research has shown how significant EU agency involvement is in PESCO's coordination game.

The study has also shed light on the institutional impact of this emerging form of defence and security integration in the European Union. By examining how EU actors interact with PESCO, from project proposals to adoption, along with the role of resources, credibility and reputation within these interactions, an empirical evaluation was provided as to its effectiveness in achieving greater integration. Furthering our understanding of PESCO's institutional impact and its effectiveness, it was revealed that PESCO's coordination game is heavily reliant on the rationality of EU actors as well as their resources, credibility and reputation. Moreover, this research has provided a much-needed insight into the interaction between PESCO and the European Defence Fund (EDF), their interdependence being key in assessing its overall effectiveness. In conclusion, this study has added significant evidence to the existing literature on PESCO's role in defense and

security integration in Europe.

Future research could focus on assessing the impact of PESCO's projects on EU defence and security, evaluating the effectiveness of PESCO's decision-making processes, and analysing the role of EU member states in PESCO's coordination game. Further research could also examine the impact of PESCO's institutional design on EU defence and security integration and evaluate the role of PESCO in the EU's emerging defence and security architecture.

The research is embedded within the crucial contestation between constructivism and rationalism, that was explored in the light of Rational Choice Institutionalism. The Defence collective action dilemma was also discussed in depth, and a particular point of interest was the potential impact on PESCO institutional design. Furthermore, differentiated integration in EU defence and security was considered with particular attention paid to PESCO. The research design and methodology were thoroughly outlined by the study, including an elucidation of their conceptualisation and operationalisation processes, their research question and access to data. Additionally, the study dig deeper into how EU actors influence coordination games as well as investigated the authority wielded by PESCO's Secretariat with regards to its resources and reputation.

Analyzing the co-affiliation network in the Permanent Structured Cooperation (PESCO) with a focus on its communities detection and modularity maximization, a two-mode data network study assessed the variance in PESCO's differentiated integration, from proposal to final project. The European defense initiatives of PESCO and the European Defence Fund were also discussed, highlighting PESCO's multi-layered governance and EU agencies' assessment criteria for proposals. Examining their interaction, empirical evaluation of PESCO projects focused specifically on its Work programme committee and Secretariat as gatekeepers. Finally, analyzing it as a coordination game dilemma revealed the main challenges and limitations of PESCO—namely insufficient resources,

communication issues among EU actors, and difficulty promoting differentiated integration—and suggested solutions to overcome them.

7.1 Findings

In recent years, the European Union launched several defence initiatives to pursue its goal of an increased defence integration among its member states. One initiative in particular, the Permanent Structured Cooperation (PESCO), has been pivotal in this new strategy. Nonetheless, PESCO has adopted a differentiated integration approach that has been met with both praise and criticism. In particular, empirical and theoretical progress required to develop a more in-depth analysis of the institutional effects of PESCO on member state's cooperation, and to specify whether has increased or not defence integration. From a methodological standpoint, PESCO's institutional design has enabled a flexible and modular approach to cooperation as shown by our findings in the variation of preferential patterns of cooperation. Empirical evidence however, suggests that this approach has not resulted in a significant convergence among member states even within same clusters. Even though some scholars, and representatives of member states have lauded the value of DI this claim does not appear to stand up to reality. Analysis of proposed projects versus adopted projects reveals that despite preferential patterns of cooperation has been followed, differentiation has not led to the desired enhanced integration amongst member states. As shown by the lack of convergence in those same countries. In conclusion, while DI may appear beneficial on paper, in practice it may be lacking in its ability to bring about the desired results.

Nonetheless, judging the results of PESCO institutional effect might be misleading as many scholar base their premises on wrong assumption. For instance, they assume PESCO faces a collective action dilemma thus posits a solution within the standard def-

inition of cooperation. This assumption lead to think that the lack of strong monitoring mechanisms and enforcement rules are a symptom of PESCO inefficiencies. But PESCO can be seen as a coordination game, as it involves member states aligning their military capabilities and efforts to achieve a common goal of a stronger European defence. PESCO is designed to promote cooperation and coordination and its success will depend on the ability to coor- dinate member state's actions to work together effectively towards common goals. This being said, from a methodological standpoint, to assess the success or not of PESCO a more accurate measurement of institutional effects is needed, since the simple definition of cooperation as a resolution of collective action dilemma does not fit in here.

In conclusion, the chapter has explored the methodology used to assess the influence of EU agencies in the PESCO mechanism. It is crucial to understand the weight given to agencies' assessment as it forms part of the member state utility function. By investigating the credibility and reputation of the EU agencies, the chapter has provided insights into the way in which actors interact with one another and how their agency influence promotes change and transformation in the institutional design.

The analysis of the clustering results and the modularity maximisation approach has revealed patterns of cooperation among participating member states in PESCO. These patterns have provided an understanding of the historical path dependency and cultural proximities among participating member states. The significant variation in patterns of preferential cooperation between proposed and adopted projects suggests that PESCO's institutional effect has caused cooperation among member states to become more homogenous and segmentation to be minimised.

Furthermore, the empirical analysis has examined the projects and explored what member states may have had vested in certain projects depending on whether they were leaders, partners or observers. The EU agencies' contribution to horizontal, yet differ-

entiated, convergence has been explored.

The continuous collective action model used in final chapter has depicted the conundrum that participating member states are facing while joining a proposal. It has revealed how EU agencies are successful in their attempt to leverage participating member states to transmit their willingness by sharing independently gathered and reliable information based on their expertise. The chapter has ultimately demonstrated the importance of EU agencies in the PESCO mechanism, and their role in promoting cooperation among participating member states. Their expertise and reputation provide a critical variable in the decision-making process for member states. The analysis of the EU agencies' credibility and reputation provides valuable insights into the underlying mechanisms of PESCO decision-making and the factors that influence it.

In conclusion, the research has provided an in-depth understanding of the methodology used to assess the influence of EU agencies in the PESCO mechanism. It has provided valuable insights into the credibility and reputation of the EU agencies, and how their influence promotes change and transformation in the institutional design. The research has also revealed patterns of cooperation among participating member states and the EU agencies' contribution to horizontal, yet differentiated, convergence. Overall, the research has demonstrated the critical role of EU agencies in promoting cooperation and facilitating decision-making among participating member states in the PESCO mechanism.

To further expand on the analysis presented in the research, it is important to note that the methodology used to assess the influence of EU agencies on PESCO institutional effect has important implications for understanding the dynamics of decision-making within the European Union. The use of network analysis, modularity maximisation, and hierarchical clustering allowed for a more nuanced understanding of the patterns of cooperation among participating member states, as well as the factors that may

have influenced a country's choice of project. The research highlights the importance of investigating the reputation and credibility of EU agencies, as their assessments of cooperative projects are part of member state utility functions. This means that understanding how the weight given to agencies' assessments is rooted is crucial for informed decision-making by member states in regards to joining, supporting, or not participating in a given project.

To assess the credibility and reputation of EU agencies, the research focused on three conditions: the agency's capacity to produce expert advice, its ability to transmit its expertise to policy-making actors, and its actual impact on the outcomes of policy proposals on EU cooperation on security and defence. By investigating these conditions, the research was able to identify the more prominent EU actors and mechanisms that highlight their expertise and reputation, and how they fit into the underway process of PESCO decision-making. Moreover, the thesis examines reputation as an independent variable and considers Secretariat collective reputation as given. It assumes that there is an 'epistemic community' of pooling expertise to perform advice, studies, and reports. This is an important assumption, as it suggests that the expertise of EU agencies is a valuable resource that member states rely on to make informed decisions.

The findings of the thesis also suggest that the institutional effect of PESCO has caused cooperation among member states to become more homogenous and segmentation to be minimized. This is evident in the clustering results, which indicate preferential patterns of cooperation among participating member states in PESCO. The thesis also identifies a significant variation in patterns of preferential cooperation between proposed and adopted projects, highlighting how cooperation after the 'clarification workshop' became less dispersed and more consistent.

The analysis presented in the research also underscores the importance of exploring what member states may have had vested in certain projects depending on whether they were leaders, partners or observers. Different collaborative clusters are usually aligned

by factors that either join or separate participants, and investigating these factors can shed light on the factors that influence member state decision-making in the context of PESCO.

Overall, the thesis offers important insights into the factors that influence decision-making within the European Union and how the expertise and reputation of EU agencies can play a critical role in shaping member state behavior. It also highlights the importance of network analysis and modularity maximisation in uncovering patterns of cooperation and identifying factors that may have influenced a country's choice of project. Moving forward, it will be important to continue exploring the dynamics of decision-making within the European Union and how they are shaped by institutional design and the expertise of EU agencies.

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Appendix A: list of codings

R studio source codes to display Density Plot of 'Categories' PESCO project and pMS.

```
> PESCO
# A tibble: 95 x 5
   Criteria_Capability Criteria_Operationality Participant_Contribu...
                 <dbl>                   <dbl>                  <dbl>
 1                   6                       6                      0
 2                   7                       6                      0
 3                   7                       6                      0
 4                   3                       6                      0
 5                   6                       3                      0
 6                   5                       2                      0
 7                   6                       6                      4
 8                   5                       6                      2
 9                   5                       6                      9
10                   2                       3                      1
# ... with 85 more rows, and 2 more variables:
#   Participant_Observers <dbl>, Category <chr>
> data(PESCO)
> pescoData = data.frame(PESCO)
> data(pescoData)
> names(pescoData)
[1] "Criteria_Capability"      "Criteria_Operationality"
[3] "Participant_Contributors" "Participant_Observers"
[5] "Category"
> str(pescoData)
'data.frame': 95 obs. of  5 variables:
 $ Criteria_Capability     : num  6 7 7 3 6 5 6 5 5 2 ...
 $ Criteria_Operationality : num  6 6 6 6 3 2 6 6 6 3 ...
 $ Participant_Contributors: num  0 0 0 0 0 0 4 2 9 1 ...
 $ Participant_Observers   : num  0 0 0 0 0 0 1 0 11 0 ...
 $ Category                : chr  "Air System" "Air System" "Air System" "Air System" ..
> class(pescoData)
[1] "data.frame"
> pescoData2 <- pescoData
> class(pescoData2$Category)
[1] "character"
> pescoData2$Category <- as.factor(pescoData2$Category)
> class(pescoData2$Category)
[1] "factor"
```

```
> cdplot(Category ~ Criteria_Capability, data=pescoData2)
> cdplot(Category ~ Participant_Contributors, data=pescoData2)
```

R Codes correlation

The R code below computes the correlation between two variables in PESCO project dataset: on the x axis there is the variable 'criteria capability'—defined as the number of criteria satisfied from a capability perspectives; on the y axis is the number of pMS in a project variables.

```
> PESCO
# A tibble: 95 x 5
   Criteria_Capability Criteria_Operationality Participant_Contribu...
                 <dbl>                   <dbl>                  <dbl>
 1                   6                       6                      0
 2                   7                       6                      0
 3                   7                       6                      0
 4                   3                       6                      0
 5                   6                       3                      0
 6                   5                       2                      0
 7                   6                       6                      4
 8                   5                       6                      2
 9                   5                       6                      9
10                   2                       3                      1
# ... with 85 more rows, and 2 more variables:
#   Participant_Observers <dbl>, Category <chr>
> data(PESCO)
> pescoData = data.frame(PESCO)
> data(pescoData)
> library("ggpubr")
> ggscatter(pescoData2, x = "Criteria_Capability", y = "Participant_Contributors",
+           add = "reg.line", conf.int = TRUE,
+           cor.coef = TRUE, cor.method = "pearson",
+           xlab = "Miles/(US) gallon", ylab = "Weight (1000 lbs)")
`geom_smooth()` using formula 'y ~ x'

R = 0.062, p = 0.55

 shapiro.test(pescoData2$Participant_Contributors)

Shapiro-Wilk normality test
```

```
data:  pescoData2$Participant_Contributors
W = 0.81172, p-value = 1.151e-09
```

Appendix B

Lemma 1

Appendix C: list of interviews.

The majority of interviews were conducted on the condition of anonymity. As a result, interview sources have not been named within the text. Instead, they are presented alphabetically below as a token of appreciation and to provide the reader some insight into the sources.

Chapter 3

1. Spokesperson, Permanent Representation of Estonia to the EU
2. Project Officer, PESCO Project iMUGS
3. Policy analyst, MoD Lithuania
4. Chief Adviser, Euroatlantic Cooperation Department, MoD Lithuania
5. Project Officer, Netherlands
6. Spokesperson, MoD Austria
7. Project Officer, Czech Republic
8. Official A, European Commission
9. Official B, European Commission
10. Official C, European Commission
11. Official A, DG DEFIS, European Commission
12. Official B, DG DEFIS, European Commission
13. Official C, DG DEFIS, European Commission
14. Official D, DG DEFIS, European Commission
15. Official A, European External Action Service
16. Official B, European External Action Service
17. Official C, European External Action Service
18. Official E, European External Action Service
19. Official F, European External Action Service
20. Official G, European External Action Service
21. Official H, European External Action Service
22. Official A, European Defence Agency
23. Official B, European Defence Agency

24. Official C, European Defence Agency
25. Official D, European Defence Agency
26. Official E, European Defence Agency

Appendix D: PESCO data frame

Table 7.1: PESCO data frame with four variables.

	Proposal	Cap_crt.	Oper_crt.	Part_Contri.	Part_Obser.	Category
1	4.1	6.00	6.00	0.00	0.00	Air System
2	5.4	7.00	6.00	0.00	0.00	Air System
3	7.3	7.00	6.00	0.00	0.00	Air System
4	4.11	3.00	6.00	0.00	0.00	Air System
5	5.2	6.00	3.00	0.00	0.00	Air System
6	6.3	5.00	2.00	0.00	0.00	Air System
7	2.1.6	6.00	6.00	4.00	1.00	Air System
8	2.1.14	5.00	6.00	2.00	0.00	Air System
9	2.2.7	5.00	6.00	9.00	11.00	Air System
10	2.4.15	2.00	3.00	1.00	0.00	Air System
11	2.4.17	3.00	3.00	1.00	0.00	Air System
12	2.4.19	5.00	3.00	1.00	0.00	Air System
13	2.10.9	3.00	5.00	1.00	0.00	Air System
14	3.1.24	4.00	4.00	3.00	1.00	Air System
15	6.4	7.00	4.00	0.00	0.00	Cyber
16	6.5	5.00	4.00	1.00	7.00	Cyber
17	8.1	5.00	6.00	1.00	3.00	Cyber
18	2.4.22	5.00	0.00	1.00	0.00	Cyber
19	2.6.7	5.00	5.00	6.00	0.00	Cyber
20	2.10.8	2.00	0.00	1.00	0.00	Cyber
21	2.15.3	2.00	6.00	10.00	0.00	Cyber
22	3.1.25	2.00	5.00	2.00	2.00	Cyber
23	1.3	3.00	3.00	1.00	1.00	Enabling
24	11.4	0.00	2.00	0.00	0.00	Enabling
25	4.10	0.00	4.00	0.00	0.00	Enabling
26	2.1	6.00	5.00	1.00	4.00	Enabling
27	2.2	4.00	5.00	1.00	4.00	Enabling
28	12.2	4.00	5.00	0.00	0.00	Enabling
29	11.2	1.00	4.00	0.00	0.00	Enabling
30	2.3	3.00	5.00	0.00	0.00	Enabling
31	3.1	4.00	4.00	0.00	0.00	Enabling
32	6.1	5.00	5.00	0.00	0.00	Enabling

Continued on next page

Table 7.1 – *Continued from previous page*

	Proposal	Cap_crt	Oper_crt.	Part_Contri.	Part_Obser.	Category
33	7.4	5.00	5.00	0.00	0.00	Enabling
34	7.1	5.00	4.00	1.00	1.00	Enabling
35	3.2	5.00	6.00	0.00	0.00	Enabling
36	12.3	6.00	3.00	1.00	2.00	Enabling
37	5.5	2.00	2.00	0.00	0.00	Enabling
38	12.1	1.00	1.00	1.00	5.00	Enabling
39	2.1.5	4.00	5.00	4.00	2.00	Enabling
40	2.1.11	4.00	5.00	3.00	0.00	Enabling
41	2.1.15	4.00	0.00	4.00	0.00	Enabling
42	2.2.6	4.00	6.00	6.00	0.00	Enabling
43	2.4.21	4.00	1.00	1.00	0.00	Enabling
44	2.10.10	1.00	0.00	1.00	0.00	Enabling
45	3.1.26	4.00	6.00	2.00	2.00	Enabling
46	3.1.27	1.00	1.00	3.00	0.00	Enabling
47	3.1.28	2.00	1.00	2.00	1.00	Enabling
48	3.1.29	2.00	5.00	2.00	0.00	Enabling
49	3.1.30	2.00	5.00	2.00	0.00	Enabling
50	1.2	5.00	5.00	1.00	4.00	Land System
51	2.4	6.00	4.00	0.00	0.00	Land System
52	4.3	2.00	4.00	1.00	1.00	Land System
53	4.12	4.00	4.00	0.00	0.00	Land System
54	4.13	5.00	5.00	1.00	2.00	Land System
55	13.1	5.00	4.00	1.00	7.00	Land System
56	2.1.12	5.00	5.00	2.00	0.00	Land System
57	2.1.7	5.00	6.00	6.00	0.00	Land System
58	2.4.16	4.00	1.00	1.00	0.00	Land System
59	1.4	4.00	5.00	2.00	3.00	Maritime
60	4.14	4.00	5.00	1.00	4.00	Maritime
61	6.2	7.00	4.00	1.00	0.00	Maritime
62	11.3	1.00	4.00	0.00	0.00	Maritime
63	2.4.20	4.00	3.00	1.00	0.00	Maritime
64	2.10.5	4.00	3.00	1.00	0.00	Maritime
65	2.14.1	5.00	3.00	1.00	0.00	Maritime
66	3.1.22	5.00	4.00	3.00	1.00	Maritime
67	3.1.23	7.00	6.00	2.00	0.00	Maritime
68	2.1.13	5.00	6.00	3.00	1.00	Space
69	2.4.18	4.00	3.00	1.00	0.00	Space
70	1.1	1.00	3.00	1.00	1.00	Training
71	2.5	3.00	3.00	0.00	0.00	Training
72	4.2	1.00	4.00	1.00	2.00	Training
73	10.2	1.00	3.00	0.00	0.00	Training

Continued on next page

Table 7.1 – *Continued from previous page*

	Proposal	Cap_crt	Oper_crt.	Part_Contri.	Part_Obser.	Category
74	11.1	1.00	3.00	0.00	0.00	Training
75	9.1	0.00	3.00	0.00	0.00	Training
76	10.1	1.00	3.00	0.00	0.00	Training
77	6.6	2.00	3.00	0.00	0.00	Training
78	7.2	2.00	2.00	0.00	0.00	Training
79	4.5	2.00	3.00	0.00	0.00	Training
80	10.4	3.00	4.00	0.00	0.00	Training
81	10.3	1.00	3.00	0.00	0.00	Training
82	2.1.8	3.00	1.00	3.00	0.00	Training
83	2.1.9	1.00	0.00	4.00	2.00	Training
84	2.10.6	4.00	1.00	1.00	0.00	Training
85	2.10.7	2.00	2.00	1.00	0.00	Training
86	2.15.1	4.00	2.00	1.00	0.00	Training
87	2.15.2	2.00	2.00	1.00	0.00	Training
88	2.9.2	2.00	0.00	1.00	0.00	Training
89	2.1.10	5.00	3.00	2.00	0.00	Training
90	3.1.17	0.00	0.00	4.00	0.00	Training
91	3.1.18	3.00	0.00	3.00	0.00	Training
92	3.1.19	5.00	6.00	2.00	2.00	Training
93	3.1.20	3.00	2.00	2.00	0.00	Training
94	3.1.21	2.00	6.00	2.00	0.00	Training
95	3.1.31	4.00	5.00	2.00	0.00	Training

Source: Author's own compilation.

	AT	BE	BG	HR	CY	CZ	EE	FI	FR	DE	GR	HU	IE	IT	LV	LT	LU	NL	PL	PT	RO	SK	SI	ES	SE
AT	1	0.105	0.071	0.300	0.250	0.167	0.111	0.100	0.067	0.091	0.176	0.214	0.125	0.167	0.111	0.125	0.250	0.118	0.056	0.231	0.143	0.083	0.222	0.148	0.300
BE	0.105	1	0.158	0.111	0.158	0.167	0.133	0.200	0.393	0.409	0.174	0.200	0.067	0.135	0.214	0.067	0.214	0.444	0.300	0.211	0.148	0.176	0.200	0.188	0.111
BG	0.071	0.158	1	0.273	0.455	0.154	0.100	0.091	0.138	0.190	0.312	0.200	0.111	0.125	0.100	0.111	0.222	0.176	0.176	0.062	0.136	0.273	0.333	0.103	0.077
HR	0.300	0.111	0.273	1	0.273	0.083	0.286	0.250	0.107	0.095	0.267	0.231	0.143	0.133	0.125	0.333	0.125	0.200	0.200	0.071	0.095	0.200	0.429	0.200	0.200
CY	0.250	0.158	0.455	0.273	1	0.154	0.100	0.091	0.179	0.250	0.400	0.200	0.250	0.241	0.100	0.111	0.222	0.176	0.111	0.214	0.136	0.167	0.200	0.231	0.167
CZ	0.167	0.167	0.154	0.083	0.154	1	0.111	0.100	0.143	0.200	0.053	0.214	0.125	0.094	0.111	0.125	0.429	0.267	0.118	0.143	0.143	0.300	0.222	0.107	0.300
EE	0.111	0.133	0.100	0.286	0.100	0.111	1	0.750	0.120	0.111	0.067	0.083	0	0.033	0.500	0.667	0.200	0.154	0.154	0.091	0.111	0.125	0.167	0.080	0.125
FI	0.100	0.200	0.091	0.250	0.091	0.100	0.750	1	0.160	0.167	0.062	0.077	0	0.067	0.400	0.500	0.167	0.231	0.231	0.182	0.105	0.111	0.143	0.120	0.111
FR	0.067	0.393	0.138	0.107	0.179	0.143	0.120	0.160	1	0.400	0.086	0.129	0.038	0.233	0.077	0.080	0.120	0.321	0.194	0.172	0.167	0.148	0.115	0.581	0.148
DE	0.091	0.409	0.190	0.095	0.250	0.200	0.111	0.167	0.400	1	0.154	0.350	0.056	0.216	0.111	0.056	0.176	0.381	0.261	0.182	0.172	0.211	0.167	0.281	0.150
GR	0.176	0.174	0.312	0.267	0.400	0.053	0.067	0.062	0.086	0.154	1	0.211	0.071	0.281	0.143	0.071	0.067	0.190	0.316	0.222	0.154	0.188	0.133	0.194	0.056
HU	0.214	0.200	0.200	0.231	0.200	0.214	0.083	0.077	0.129	0.350	0.211	1	0	0.118	0.083	0.091	0.182	0.222	0.375	0.118	0.125	0.333	0.400	0.133	0.231
IE	0.125	0.067	0.111	0.143	0.250	0.125	0	0	0.038	0.056	0.071	0	1	0.071	0	0	0.250	0.077	0	0.100	0.056	0	0	0.083	0.143
IT	0.167	0.135	0.125	0.133	0.241	0.094	0.033	0.067	0.233	0.216	0.281	0.118	0.071	1	0.033	0.034	0.069	0.176	0.111	0.194	0.125	0.172	0.067	0.333	0.097
LV	0.111	0.214	0.100	0.125	0.100	0.111	0.500	0.400	0.077	0.111	0.143	0.083	0	0.033	1	0.250	0.200	0.154	0.154	0.200	0.111	0.125	0.167	0.038	0.125
LT	0.125	0.067	0.111	0.333	0.111	0.125	0.667	0.500	0.080	0.056	0.071	0.091	0	0.034	0.250	1	0.250	0.167	0.167	0.100	0.118	0.143	0.200	0.083	0.143
LU	0.250	0.214	0.222	0.125	0.222	0.429	0.200	0.167	0.120	0.176	0.067	0.182	0.250	0.069	0.200	0.250	1	0.250	0.154	0.200	0.111	0.286	0.400	0.080	0.286
NL	0.118	0.444	0.176	0.200	0.176	0.267	0.154	0.231	0.321	0.381	0.190	0.222	0.077	0.176	0.154	0.167	0.250	1	0.412	0.235	0.208	0.286	0.231	0.286	0.200
PL	0.056	0.300	0.176	0.200	0.111	0.118	0.154	0.231	0.194	0.261	0.316	0.375	0	0.111	0.154	0.167	0.154	0.412	1	0.235	0.160	0.200	0.231	0.200	0.059
PT	0.231	0.211	0.062	0.071	0.214	0.143	0.091	0.182	0.172	0.182	0.222	0.118	0.100	0.194	0.200	0.100	0.200	0.235	0.235	1	0.130	0.071	0.083	0.320	0.154
RO	0.143	0.148	0.136	0.095	0.136	0.143	0.111	0.105	0.167	0.172	0.154	0.125	0.056	0.125	0.111	0.118	0.111	0.208	0.160	0.130	1	0.095	0.050	0.139	0.150
SK	0.083	0.176	0.273	0.200	0.167	0.300	0.125	0.111	0.148	0.211	0.188	0.333	0	0.172	0.125	0.143	0.286	0.286	0.200	0.071	0.095	1	0.429	0.111	0.200
SI	0.222	0.200	0.333	0.429	0.200	0.222	0.167	0.143	0.115	0.167	0.133	0.400	0	0.067	0.167	0.200	0.400	0.231	0.231	0.083	0.050	0.429	1	0.077	0.250
ES	0.148	0.188	0.103	0.200	0.231	0.107	0.080	0.120	0.581	0.281	0.194	0.133	0.083	0.333	0.038	0.083	0.080	0.286	0.200	0.320	0.139	0.111	0.077	1	0.154
SE	0.300	0.111	0.077	0.200	0.167	0.300	0.125	0.111	0.148	0.150	0.056	0.231	0.143	0.097	0.125	0.143	0.286	0.200	0.059	0.154	0.150	0.200	0.250	0.154	1

Countries: AT Austria, BE Belgium, BG Bulgaria, HR Croatia, CY Cyprus, CZ Czech Republic, EE Estonia, FI Finland, FR France DE Germany, GR Greece, HU Hungary, IE Ireland, IT Italy, LV Latvia, LT Lithuania, LU Luxembourg, NL Netherlands, PL Poland, PT Portugal, RO Romania, SK Slovakia, SI Slovenia, ES Spain, SE Sweden

Table 7.2: Jaccard coefficient index based on PESCO project proposals

Table 7.3: PESCO network centrality measures: empirical illustration

Member State	DC	CC	BC	Projects	DC	CC	BC
France	0.70491803	0.04054054	0.0652	MM	0.96	0.01824818	0.0281171420
Italy	0.50819672	0.04054054	0.0652	EU TMCC	0.52	0.01779197	0.0096756879
Spain	0.42622951	0.04054054	0.0652	NetLogHUbs	0.52	0.01824818	0.0552258833
Germany	0.32786885	0.04054054	0.0652	UGS	0.40	0.01733577	0.0235934029
Greece	0.26229508	0.04054054	0.0652	CRRT	0.36	0.01703163	0.0128964048
Romania	0.26229508	0.04054054	0.0652	EMC	0.32	0.01779197	0.0109619893
Portugal	0.22950820	0.04054054	0.0652	ESSOR	0.32	0.01794404	0.0180967890
Netherlands	0.21311475	0.04054054	0.0652	CoHGI	0.32	0.01703163	0.0128757223
Belgium	0.18032787	0.04054054	0.0652	MAS MCM	0.28	0.01581509	0.0005677948
Czech Republic	0.16393443	0.04054054	0.0652	UMS	0.28	0.01733577	0.0245971938
Hungary	0.14754098	0.03969595	0.0000	CRF	0.28	0.01718370	0.0081070983
Cyprus	0.14754098	0.04054054	0.0652	DoSA	0.28	0.01794404	0.0348680527
Poland	0.14754098	0.03969595	0.0000	Co-basing	0.24	0.01687956	0.0054897079
Austria	0.13114754	0.04054054	0.0652	CTIRISP	0.24	0.01672749	0.0179681791
Croatia	0.11475410	0.04054054	0.0652	ECoWAR	0.24	0.01703163	0.0092419723
Sweden	0.11475410	0.04054054	0.0652	CBRN SAAS	0.20	0.01642336	0.0118307400
Bulgaria	0.09836066	0.04054054	0.0652	Dm-DRCP	0.20	0.01703163	0.0215604409
Estonia	0.09836066	0.03969595	0.0000	EURAS	0.20	0.01779197	0.0377526323
Finland	0.09836066	0.03969595	0.0000	Eurodrone	0.20	0.01763990	0.0235934029
Slovakia	0.09836066	0.03969595	0.0000	EUMILCOM	0.20	0.01779197	0.0004536720
Slovenia	0.09836066	0.03969595	0.0000	EUROSIM	0.20	0.01657543	0.0300469641
Latvia	0.08196721	0.03969595	0.0000	CIDCC	0.20	0.01490268	0.0055688442
Luxembourg	0.06557377	0.04054054	0.0652	TWISTER	0.20	0.01763990	0.0123384544
Lithuania	0.04918033	0.03969595	0.0000	SATOC	0.20	0.01627129	0.0026177724
Ireland	0.03278689	0.03378378	0.0000	NGSR	0.20	0.01551095	0.0085689421
				EOF	0.16	0.01763990	0.0235934029
				EUTEC	0.16	0.01672749	0.0095367819
				EUFOR CROC	0.16	0.01779197	0.0109619893
				GMSCE	0.16	0.01748783	0.0222551665
				HARMSPRO	0.16	0.01611922	0.0169995031
				MUSAS	0.16	0.01687956	0.0028709521
				MAC-EU	0.16	0.01703163	0.0180967890
				EU MilPart	0.16	0.01703163	0.0215604409
				M-SASV	0.16	0.01596715	0.0099410282
				AIFv/AAV	0.12	0.01490268	0.0104848039
				BLOS	0.12	0.01627129	0.0161969112
				DIVEPACK	0.12	0.01703163	0.0345943337
				TIGER MARK III	0.12	0.01657543	0.0100987513
				H3 Training	0.12	0.01581509	0.0317709604
				CBRNDTR	0.12	0.01733577	0.0003736482
				EUNDC	0.12	0.01611922	0.0133892214
				AEA	0.12	0.01642336	0.0109619893
				RPSA	0.12	0.01733577	0.0175892537
				MBT-SIMTEC	0.12	0.01703163	0.0133892214
				4E	0.12	0.01596715	0.0109619893
				Air Power	0.12	0.01703163	0.0109619893
				FMTC	0.12	0.01596715	0.0215604409
				AMIDA-UT	0.12	0.01687956	0.0121322149
				C-UAS	0.08	0.01444647	0.0061100418
				EHAAP	0.08	0.01703163	0.0277191621
				JEIS	0.08	0.01170925	0.0348680527
				ETCCEA	0.08	0.01475061	0.0004536720
				EU-SSA-N	0.08	0.01703163	0.0235934029
				EuroArtillery	0.08	0.01383820	0.0287693268
				JISR	0.08	0.01231752	0.0003866102
				SOF C2CP	0.08	0.01170925	0.0552258833
				EU CAIH	0.08	0.01368613	0.0170203895
				SMTC	0.08	0.01110097	0.0011340365
				EPC	0.08	0.01703163	0.0081070983
				RotoCraft	0.08	0.01703163	0.0087536656
				SSW	0.08	0.01703163	0.0109619893

Table 7.4: Project–by–project co-affiliation matrix

	AIFV/AAV	BLOS	C-UAS	CBRN SaaS	Co-basing	CRRT	CTIRISP	DIVEPACK	DM-DRCP	EHAAP	EMC	EOF	ESSOR	JEIS	ETCCEA	EUTEC	TIGER MARK III	EU TMCC	EU-SSA-N	EUFOR CROC	EURAS	Eurodrone	GMSCE	H3 Training	HARMSPRO	EuroArtillery	JISR	MAS MCM	MM	NetLogHubs	SOF C2CP	EUMILCOM	UGS	UMS	EUROSIM	EU CAIH	SMTC	CBRNDTR	EUNDC	MUSAS	EPC	AEA	CIDCC	TWISTER	MAC-EU	ECoWAR	RPAS	MBT-SIMTEC	EU MilPart	4E	M-SASV	SATOC	NGSR	Rotocraft	SSW	Air Power	FMTC	CRF	AMIDA-UT	CoHGI	DoSA
AIFV/AAV	0	0	1	0	0	0	2	1	2	1	2	1	1	1	2	1	0	1	1	1	1	1	1	2	2	2	0	1	3	3	1	1	0	2	0	0	0	1	0	0	1	0	0	1	0	0	1	1	1	1	0	0	0	1	1	1	0	1	0	0	1
BLOS	0	0	0	1	2	1	1	1	0	1	1	2	2	1	0	1	1	2	1	2	2	1	1	0	0	0	0	1	3	3	1	1	2	1	1	0	0	1	1	1	1	0	1	1	2	1	2	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1
C-UAS	1	0	0	0	1	0	1	0	1	1	2	1	1	0	1	0	0	2	1	1	1	2	0	1	1	1	0	2	1	0	1	1	1	0	0	0	1	0	0	1	0	1	1	0	0	1	0	1	1	0	0	1	0	1	1	0	1	0	1	1	0	0
CBRN SaaS	0	1	0	0	1	2	2	1	2	1	1	1	1	0	0	1	1	2	1	1	1	1	1	0	0	0	0	0	5	4	0	1	2	1	3	0	1	1	1	1	1	1	1	1	2	1	1	2	0	1	2	1	1	1	2	1	1	1	2	2
Co-basing	0	2	1	1	0	3	0	1	1	1	5	3	4	0	0	2	3	6	1	2	4	4	2	0	0	0	2	2	6	5	0	3	5	1	2	1	0	1	1	2	1	2	4	3	2	3	1	1	1	1	4	2	1	1	1	2	1	2	4	2
CRRT	0	1	0	2	3	0	0	1	2	1	4	2	4	0	0	2	2	4	1	1	2	2	2	1	1	0	0	3	9	4	0	2	6	2	2	1	1	2	2	2	1	2	2	4	3	3	2	1	2	1	3	2	2	1	1	2	1	3	2	5	3
CTIRISP	2	1	1	2	0	0	0	1	3	1	1	1	2	2	2	0	0	3	1	2	1	1	1	2	3	1	0	2	6	4	2	2	1	3	1	1	1	1	0	1	1	0	1	1	1	1	1	2	2	2	0	0	1	1	1	1	0	1	1	1	3
DIVEPACK	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	0	0	1	3	3	1	1	1	2	1	0	0	1	2	1	1	1	0	1	1	1	1	2	1	0	1	1	0	1	1	2	1	2	1	1	1
DM-DRCP	2	0	1	2	1	2	3	1	0	1	2	2	1	1	2	1	1	3	1	1	2	2	1	2	2	1	0	1	5	4	1	2	1	4	0	1	0	1	0	1	1	1	1	2	1	1	1	1	2	2	0	0	1	1	1	2	0	1	1	2	2
EHAAP	1	1	1	1	1	1	1	1	1	0	2	2	0	1	1	1	1	2	2	2	2	2	1	1	1	0	0	2	2	0	2	1	1	1	0	0	2	1	1	2	1	0	2	1	1	2	1	2	1	1	1	0	2	2	1	1	2	1	1	2
EMC	2	1	2	1	5	4	1	1	2	2	0	3	4	0	1	3	3	7	2	3	4	5	3	2	1	2	2	2	8	6	0	4	4	2	2	1	0	3	2	2	2	2	4	4	3	3	3	1	2	2	2	4	3	2	2	1	2	2	2	5	4
EOF	1	2	1	1	3	2	1	1	2	2	3	0	3	0	1	2	2	4	2	2	4	3	1	1	1	0	1	2	4	4	0	3	3	2	1	1	0	2	1	2	2	2	1	3	2	3	2	1	2	2	1	1	1	2	2	1	1	2	2	2	2
ESSOR	1	2	1	1	4	4	2	1	1	2	4	3	0	0	1	1	2	6	2	3	4	3	2	1	3	1	1	4	8	5	0	4	5	1	3	1	1	2	1	2	2	1	2	4	2	2	2	1	2	2	1	3	2	2	2	1	2	3	2	3	5
JEIS	1	1	0	0	0	0	2	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	1	2	2	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
ETCCEA	2	0	1	0	0	0	2	1	2	1	1	1	1	0	0	0	0	1	1	1	1	1	1	2	2	1	0	1	2	2	1	1	0	2	0	0	0	1	0	0	1	0	0	1	0	0	1	1	1	1	0	0	0	1	1	0	1	0	0	1
EUTEC	1	1	0	1	2	2	0	1	1	1	3	2	1	0	0	0	2	3	1	1	2	2	1	0	0	1	0	0	4	3	0	2	2	1	1	1	0	1	1	3	1	3	1	2	2	3	1	1	1	1	1	1	1	1	1	2	1	2	2	1
TIGER MARK III	0	1	0	1	3	2	0	1	1	1	3	2	2	0	0	2	0	3	1	2	3	3	2	0	0	0	1	0	3	3	0	3	2	1	2	1	0	1	1	2	1	2	2	2	2	2	1	1	1	1	2	2	1	1	1	2	1	2	3	2
EU TMCC	1	2	2	2	6	4	3	1	3	2	7	4	6	0	1	3	3	0	2	3	5	5	3	2	2	1	2	4	12	6	0	5	5	3	2	2	0	3	2	4	2	3	4	4	4	5	3	1	3	3	2	4	4	2	2	1	3	3	3	7	6
EU-SSA-N	1	1	1	1	1	1	1	1	1	2	2	2	2	0	1	1	1	2	0	2	2	2	1	1	1	1	0	0	2	2	0	2	1	1	1	0	0	2	1	1	2	1	0	2	1	1	2	1	2	1	1	1	0	2	2	1	1	2	1	1	2
EUFOR CROC	1	2	1	1	2	1	2	1	1	2	3	2	3	1	1	1	2	3	2	0	3	3	2	1	1	1	1	0	4	4	1	3	1	2	2	0	0	2	1	1	2	1	1	2	1	1	2	2	2	1	1	2	2	1	2	2	1	2	2	1	2
EURAS	1	2	1	1	4	2	1	1	2	2	4	4	4	0	1	2	3	5	2	3	0	4	2	1	1	1	1	1	5	5	0	4	3	2	2	1	0	2	1	2	2	2	2	3	2	3	2	1	2	2	1	2	2	2	2	1	2	2	2	3	3
Eurodrone	1	1	2	1	4	2	1	1	2	2	5	3	3	0	1	2	3	5	2	3	4	0	2	1	1	2	0	5	4	4	0	4	3	2	2	1	0	2	1	2	2	2	3	3	2	2	2	1	2	2	1	3	2	2	2	1	2	2	2	3	3
GMSCE	1	1	0	1	2	2	1	2	1	1	3	1	2	1	1	1	2	3	1	2	2	2	0	2	1	0	1	2	4	3	1	2	1	1	2	0	0	2	2	1	1	1	1	2	2	2	2	1	0	2	2	2	1	1	2	2	1	1	3	3
H3 Training	2	0	1	0	0	1	2	1	2	1	2	1	1	1	2	0	0	2	1	1	1	1	1	2	0	2	1	0	2	3	2	1	1	0	2	0	0	2	1	0	1	0	0	1	1	1	2	1	1	1	1	0	1	1	1	1	0	1	0	1	2
HARMSPRO	2	0	1	0	0	1	3	1	2	1	1	1	3	1	2	0	0	2	1	1	1	1	1	2	0	1	0	3	4	2	1	2	1	2	1	1	1	0	1	1	0	0	1	1	0	1	1	1	2	0	0	1	1	1	0	1	1	1	0	1	3
EuroArtillery	2	0	1	0	0	0	1	0	1	1	2	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	0	0	2	2	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	0	0	1	1	0	0	1	0	0	1
JISR	0	0	1	0	2	0	0	0	0	0	2	0	1	0	0	0	1	2	0	1	1	2	1	0	0	0	0	0	2	1	0	1	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0	0	0	1	0	0	1	1	1
MAS MCM	1	1	0	0	2	3	2	1	1	0	2	1	4	1	1	0	0	4	0	0	1	0	2	2	3	0	0	0	7	3	1	1	4	1	1	1	1	1	1	0	0	1	1	2	2	1	1	0	1	2	1	2	0	0	1	0	1	1	2	3
MM	3	3	2	5	6	9	6	3	5	2	8	4	8	2	2	4	3	12	2	4	5	5	4	3	4	2	2	7	0	13	2	5	10	6	5	2	2	3	3	4	2	3	5	5	4	6	3	3	4	3	4	5	5	2	2	3	3	7	3	8	7
NetLogHubs	3	3	1	4	5	4	4	3	4	2	6	4	5	2	2	3	3	6	2	4	5	4	3	2	2	2	1	3	13	0	2	4	5	6	4	1	1	2	2	2	2	4	4	2	4	2	3	2	2	1	4	3	2	2	3	2	3	4	3	2	4
SOF C2CP	1	1	0	0	0	0	2	1	1	0	0	0	2	1	0	0	0	0	0	1	0	0	1	1	1	0	0	1	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
EUMILCOM	1	1	1	1	3	2	2	1	2	2	4	3	4	0	1	2	3	5	2	3	4	4	2	1	2	1	1	1	5	4	0	0	2	2	2	0	2	1	3	2	2	2	3	3	2	2	1	2	3	1	2	3	2	2	1	2	2	3	3	4
UGS	0	2	1	2	5	6	1	1	1	1	4	3	5	0	0	2	2	5	1	1	3	3	1	0	1	0	1	4	10	5	0	2	0	1	3	1	2	1	1	2	1	2	4	4	2	4	1	1	2	1	3	3	1	1	1	1	4	2	3	2
UMS	2	1	1	1	1	2	3	2	4	1	2	2	1	2	2	1	1	3	1	2	2	2	1	2	2	1	0	1	6	6	2	2	1	0	0	1	0	1	1	1	1	1	2	1	1	1	2	1	2	0	0	1	1	1	2	0	2	1	1	1
EUROSIM	0	1	0	3	2	2	1	1	0	1	2	1	3	0	0	1	2	2	1	2	2	2	2	0	1	0	1	1	5	4	0	2	3	0	0	2	1	1	1	1	2	1	1	2	1	1	1	0	1	3	2	1	1	1	2	1	1	2	3
EU CAIH	0	0	0	0	1	1	1	0	1	0	1	1	1	0	0	1	1	2	0	0	1	1	0	0	1	0	0	1	2	1	0	2	1	1	0	0	0	0	2	0	1	1	1	2	1	0	0	0	2	0	0	2	0	0	0	0	0	2	1	1
SMTC	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	1	0	0	2	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CBRNDTR	1	1	1	1	1	2	1	1	1	2	3	2	2	0	1	1	1	3	2	2	2	2	2	2	1	1	0	1	3	2	0	2	1	1	1	0	0	2	1	2	1	0	2	2	2	3	1	2	1	2	1	1	2	2	1	1	2	1	2	3
EUNDC	0	1	0	1	1	2	0	2	0	1	2	1	1	0	0	1	1	2	1	1	1	1	2	1	0	0	0	1	3	2	0	1	1	1	1	0	0	2	0	1	1	1	0	1	2	2	2	1	1	0	2	1	1	1	1	1	2	1	2	2
MUSAS	0	1	0	1	2	2	1	1	1	1	2	2	2	0	0	3	2	4	1	1	2	2	1	0	1	0	0	1	4	2	0	3	2	1	1	2	0	1	1	0	1	3	1	2	3	3	1	1	2	1	1	2	1	1	1	2	1	3	2	2
EPC	1	1	1	1	1	1	1	1	2	2	2	0	1	1	1	2	2	2	2	2	2	1	1	1	1	0	0	2	2	2	0	2	1	1	1	0	0	2	1	1	0	1	0	2	1	1	2	1	2	1	1	1	0	2	2	1	1	2	1	1	2
AEA	0	1	0	1	2	2	0	1	1	1	2	2	1	0	0	3	2	3	1	1	2	2	1	0	0	0	0	0	3	2	0	2	2	1	1	1	0	1	1	3	1	0	1	2	2	3	1	1	1	1	1	1	1	1	1	2	1	2	2	1
CIDCC	0	0	1	1	4	2	1	0	1	0	4	1	2	0	0	1	2	4	0	1	2	3	1	0	0	0	2	1	5	4	0	2	4	1	2	1	1	0	0	1	0	1	0	2	1	2	0	0	0	1	0	3	2	0	0	0	1	0	1	3	1
TWISTER	1	1	1	1	3	4	1	1	2	2	4	3	4	0	1	2	2	4	2	2	3	3	1	1	1	0	1	1	5	4	0	3	4	2	1	1	0	2	1	2	2	2	2	0	2	2	2	1	2	2	1	2	2	1	1	3	2	3	2
MAC-EU	0	1	0	1	2	3	1	1	1	1	3	2	2	0	0	2	2	4	1	1	2	2	2	1	1	0	0	2	4	2	0	3	2	1	1	0	2	1	2	2	3	1	2	1	2	0	3	2	1	1	2	2	1	3	1	1	1	1	3	3
ECoWAR	0	2	0	2	3	3	1	1	1	1	3	3	2	0	0	3	2	5	1	1	3	2	2	1	0	0	0	2	6	4	0	2	4	1	2	1	1	2	2	3	1	3	2	2	3	0	2	1	1	1	2	1	2	1	1	1	2	1	2	3	2
RPAS	1	1	1	1	1	2	1	1	1	2	3	2	2	0	1	1	1	3	2	2	2	2	2	2	1	1	0	1	3	2	0	2	1	1	1	0	0	3	2	1	2	1	0	2	2	2	0	1	2	1	2	1	1	2	2	1	1	2	1	2	3
MBT-SIMTEC	1	2	0	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	0	0	1	3	3	2	1	1	2	1	0	0	1	1	1	1	0	1	1	1	0	1	0	1	0	1	1	0	1	2	1	1	1	1	1	1
EU MilPart	1	1	1	2	1	2	2	1	2	2	2	2	0	1	1	1	3	2	2	2	2	1	1	1	1	0	0	4	2	0	2	2	1	1	0	0	2	1	1	2	1	0	2	1	1	2	1	0	1	2	1	0	2	2	1	1	3	1	2	3
4E	1	0	1	0	1	1	2	0	2	1	2	2	2	0	1	1	1	3	1	1	2	2	0	1	2	1	0	1	3	2	0	3	1	2	0	2	1	0	2	1	1	2	2	1	1	0	1	0	0	2	1	1	0	0	1	2	1	2	1	2
M-SASV	0	1	0	1	1	3	0	1	0	2	1	1	0	0	1	1	2	1	1	1	1	2	1	0	0	0	2	4	1	0	1	3	0	1	0	0	2	2	1	1	1	0	1	2	2	2	1	2	0	0	1	1	1	1	1	3	1	2	2	2
SATOC	0	1	1	2	4	2	0	1	0	1	4	1	3	0	0	1	2	4	1	2	2	3	2	0	0	0	2	1	5	4	0	2	3	0	3	0	0	1	1	1	1	3	2	1	1	1	1	0	1	0	2	1	1	1	2	1	1	3	2	2
NGSR	0	0	0	1	2	2	1	0	1	0	3	1	2	0	0	1	2	4	0	1	2	2	2	1	1	0	1	2	5	3	0	3	1	1	2	2	0	1	1	2	0	1	2	1	3	2	1	0	0	2	1	2	0	0	0	0	1	0	2	3	3
Rotocraft	1	1	1	1	1	1	1	1	1	2	2	2	0	1	1	1	2	2	2	2	2	1	1	1	1	0	0	2	2	2	0	2	1	1	0	0	2	1	1	2	1	0	2	1	1	2	1	2	1	1	1	0	0	2	1	1	2	1	1	2
SSW	1	1	1	1	1	1	1	1	2	2	2	2	0	1	1	1	2	2	2	2	2	1	1	1	1	0	0	2	2	2	0	2	1	1	0	0	2	1	1	2	1	2	1	2	1	1	1	0	2	0	1	1	2	1	1	2	1	1	2	1	2
Air Power	1	1	0	2	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	0	0	1	3	3	1	1	1	2	1	0	0	1	1	1	1	0	1	1	1	2	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1
FMTC	0	1	0	1	2	1	0	1	0	1	2	1	2	0	0	2	2	3	1	2	2	2	2	0	0	0	1	0	3	2	0	2	1	0	2	0	0	1	1	2	1	2	1	1	1	2	1	1	1	0	1	2	1	1	1	1	0	1	2	2	2
CRF	1	1	1	1	3	1	2	1	2	2	2	3	0	1	1	1	3	2	2	2	2	1	1	1	1	0	1	7	3	0	2	4	2	1	0	0	2	2	1	2	1	0	3	1	1	2	1	3	1	3	1	0	2	2	1	1	0	1	2	2
AMIDA-UT	0	1	0	1	2	2	1	1	1	1	2	2	2	0	0	2	2	3	1	1	2	2	1	0	1	0	0	1	3	2	0	3	2	1	1	2	0	1	1	3	1	2	1	2	3	2	1	1	2	1	1	2	1	1	1	1	1	0	2	2
CoHGI	0	1	0	2	4	5	1	1	2	1	5	2	3	0	0	2	3	7	1	2	3	3	3	1	0	0	1	2	8	4	0	3	3	1	2	1	0	2	2	1	2	3	3	3	3	2	1	1	2	1	2	3	3	1	1	2	2	2	0	4
DoSA	1	1	1	2	2	3	3	1	2	2	4	2	5	0	1	1	2	6	2	3	3	3	3	2	3	1	1	3	7	3	0	4	2	1	3	1	1	3	2	2	2	1	1	2	3	2	3	1	3	2	2	2	3	2	2	1	2	2	2	4	0