universität wien

DISSERTATION / DOCTORAL THESIS

Titel der Dissertation /Title of the Doctoral Thesis

„THE IMPORTANCE OF RESEARCH AND INNOVATION POLICY FOR THE FUTURE OF THE EUROPEAN UNION“

verfasst von / submitted by

Dr. iur. Meinhild Hausreither

angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of

Doktorin der Philosophie (Dr. phil.)

Wien, 2017 / Vienna 2017

Studienkennzahl lt. Studienblatt / degree programme code as it appears on the student record sheet:	A 092 300
Dissertationsgebiet lt. Studienblatt / field of study as it appears on the student record sheet:	Politikwissenschaft
Betreut von / Supervisor:	Ao. Univ.-Prof. DDr. Ingfrid Schütz-Müller

ABSTRACT

The European Union (EU) is a political and economic union of currently 28 countries. The EU drives several common policies covering all its members. One of these policies is the policy for Scientific Research and Innovation, which, under certain circumstances, is open to non-EU countries as well. Under this policy the EU supports and funds scientific research through its multiannual Framework Programmes (FPs) since the 1980s. Currently the 8th FP, named Horizon 2020, is in implementation. It covers the years 2014-2020 with a budget of nearly 80,000 million Euro.

My dissertation analyses the importance of this policy at the time of Brexit, the UK leaving the EU. I wish to know the significance of this policy in the past, now, and for the future of the EU given the current political and economic developments. Further, I look for evidence for the contribution of this policy to European Integration. In doing these, my dissertation tries to answer four key questions:

1) What is the historical-political implication of this EU policy?
2) What is the connection of this policy to European Integration?
3) Why is research and innovation (R&I) crucial to an economy?
4) What might be the impact of Brexit on the future of this policy?

By answering these questions, I have systematically investigated the broader concept and idea behind this policy as well as its future direction. My study underlines that scientific research, innovation, and technological development are some of the most important factors driving economic growth, competitiveness, and prosperity of a society. Further, I argue that this policy is contributing significantly to European Integration along the theories of neo-functionalism and intergovernmentalism. In addition, my dissertation tries to prove that this policy has become politically and economically indispensable to the EU Member States. Finally, based on my research, I conclude that Brexit will not change the future course of this policy and, in fact, the UK will remain in this policy framework as an associated member.

ABSTRACT (deutsch)

Die Europäische Union (EU) ist eine politische und wirtschaftliche Union von derzeit 28 Mitgliedstaaten. Die EU hat zahlreiche gemeinsame Politiken, die sich auf alle Mitgliedstaaten erstrecken. Eine dieser ist die Politik für Wissenschaft, Forschung und Innovation, die unter bestimmten Voraussetzungen auch Nicht-EU-Mitgliedstaaten offensteht. Mit dieser Politik unterstützt und fördert die EU seit den 1980ger Jahren die wissenschaftliche Forschung durch ihre mehrjährigen Rahmenprogramme (Framework Programmes – FPs). Derzeit wird das 8. Rahmenprogramm, genannt Horizon 2020, umgesetzt. Es erstreckt sich auf die Jahre 2014-2020 mit einem Budget von beinahe 80,000 Millionen Euro.

Meine Dissertation analysiert die Bedeutung dieser Politik zur Zeit des Brexit, des Austritts des Vereinigten Königreichs von Großbritannien und Nordirland (UK) aus der EU. Ich möchte über die Signifikanz dieser Politik in der Vergangenheit, heute und in der Zukunft unter den aktuellen politischen und wirtschaftlichen Entwicklungen Bescheid wissen. Weiters suche ich Evidenz für den Beitrag dieser Politik zur Europäischen Integration. Dafür versucht meine Dissertation vier Schlüsselfragen zu beantworten:

1) Was ist die historisch-politische Implikation dieser EU-Politik?
2) Was ist die Verbindung dieser Politik zur Europäischen Integration?
3) Warum sind Forschung und Innovation (F&I) zentral für eine Wirtschaft?
4) Was können die Auswirkungen von Brexit für die Zukunft dieser Politik sein?

In Beantwortung dieser Fragen habe ich systematisch das breitere Konzept und die Idee hinter dieser Politik wie auch die künftige Richtung derselben untersucht. Meine Studie unterstreicht, dass Wissenschaft, Forschung, Innovation und technische Entwicklung eine der wichtigsten Faktoren für Wirtschaftswachstum, Wettbewerbsfähigkeit und Wohlstand

einer Gesellschaft sind. Weiters argumentiere ich an Hand der Theorie des Neofunktionalismus und der Theorie des Intergovernmentalismus, dass diese Politik signifikant zur europäischen Integration beiträgt. Darüber hinaus versucht meine Dissertation zu beweisen, dass diese Politik politisch und wirtschaftlich für die Mitgliedstaaten unabkömmlich ist. Basierend auf meiner Forschung folgere ich, dass Brexit nicht den künftigen Kurs dieser Politik ändern und UK vielmehr in diesem politischen Rahmenprogramm als ein assoziiertes Mitglied bleiben wird.

CONTENTS

Lists of Figures and Charts

Academic and Personal Acknowledgments

The subject of my dissertation was a natural choice but not before long time of deliberation. I have attended many EU related lectures, seminars, and workshops at Vienna University and other institutions. In addition, the subject EU was familiar to me because of my job at Austrian Federal Ministry of Health and subsequent work related attendance of meetings in Brussels. I came across the subject of EU Research and Innovation at Vienna University during my studies. My knowledge and interest in UK Political System stems from a stimulating pro-seminar on British Parliamentarism by Professor Dr. Melanie Sully years ago at Vienna University. Finally, the choice was based on my two convictions that science and scientific knowledge is crucial for human development and the EU as a political entity has contributed tremendously to peace and stability in Europe.

I was enrolled for a doctorate at the faculty of Political Science of Vienna University quite a few years back. I pursued this study besides my full time and demanding job as a head of a legal department at Austrian Federal Ministry of Health. With this additional study in Political Science I wanted to broaden and deepen my knowledge in other areas besides law and find more understanding for the political work in a ministry.

The University of Vienna offered me the flexibility of working in my own time and at my own pace. It gave me the possibility of attending numerous seminars and lectures of my choice. It also gave me the access to its vast infrastructure of libraries and other utilities. Without this positive environment at University of Vienna I possibly could not have attempted and completed this dissertation in conjunction with my full-time employment. Therefore, I would like to express my gratitude to the University of Vienna for the wonderful opportunity it gives to its students to pursue their studies and to conduct research.

In addition, I am immensely indebted to the Faculty of Political Science and all the professors and staff there. The Department has enriched my

life not only academically, but also through rich learning experience I got there.

I want to thank explicitly three teachers. To begin with, I am particularly grateful to Univ.-Professor Dr. Hannelore Eva Kreisky who taught me how to write a good dissertation in Political Science. The co-students in her "Dissertantenseminar" – special classes in small groups for doctoral students – always gave me critical feedback. This helped me to refine my work continuously.

I am most grateful to my academic supervisor Professor DDr. Ingfrid Schütz-Müller for his competent advice throughout the course of my studies and my dissertation. His classes are unforgettable. Unfortunately, due to his ill-health he is unable to evaluate my completed dissertation. I sincerely wish and pray that he recovers from his illness.

Special thanks to Dozent Dr. Gernot Stimmer, who readily and warm heartedly accepted my request to evaluate my work in lieu of DDr. Schütz-Müller. He gave me very important feedbacks on my draft work.

I would also like to thank all those EU experts and EU officials at the commission who provided me with information. Thank has to be given to my colleagues at Ministry of Health as well as of the Ministry of Science, for the information I got.

Most important was the loving help of my family by the encouragement and support in very different ways. For this help I want to give special thanks to my husband and to my son. As a symbol of my thankfulness, I want to dedicate my dissertation to my husband.

Meinhild Hausreither
University of Vienna, Austria
May 2017

CHAPTER 1
SUBJECT, HYPOTHESES AND METHODOLOGY

> Research has a long history in Europe, but the emergence of what is now the European Union has created a novel concept of European research. Over recent decades, it has gradually acquired the sense of deliberate collaboration between European countries linking first their research activities, then their policies in this field.
>
> European Commission, 2015

1.1 THE SUBJECT

The topic of my study is the European Union's (EU) policy for promoting scientific research and technological innovation among its Member States – the Research and Innovation Policy (R&I).

Since its existence, this policy has been conveniently and officially called with different names at different times: Scientific Research Policy, Research and Technological Development Policy (RTD), or R&I Policy.[1]

Under this policy, the EU has defined hundreds of research objectives, set priorities, and funded tens of thousands of research projects in various scientific fields. The main instrument for implementing this policy is the multiannual Framework Programmes (FPs), the first of which covered the years 1984-1987. The current FP – Horizon 2020 – spans a period of 7 years from 2014 to 2020 and has a budget of 80,000 million Euro. In 2015, the yearly spending on FP was 9,007 million Euro.[2] This makes 6.36% of the total EU budget for that year.[3]

Research institutions, universities, private enterprises, and even individual scientists from an EU country are eligible to participate in these EU

[1] All these 3 terms refer to one and the same EU Policy. The policy name has undergone (slight) changes since the first FP in 1984. For a long-time the official name remained as "RTD". In recent years, especially since 2014, it has been termed "Research and Innovation", which I have used in my paper as a general term. For a particular instance, I have used the term that was official at that time.
[2] Source: European Commission 2016, EU budget 2015 Financial report, p 74
[3] In relation, the budget for two Agricultural Funds in 2015 was 55,311 million Euro, which comes to 39% of the EU budget of 141,586 million Euro in that year.

sponsored and funded[4] research projects. A fundamental pre-requisite for participation is to build a consortium of members from across the EU countries. The ownership of the research findings remains with the project participants, which they can make use of, generally without restrictions.

Figure 1: Spending in Framework Programmes
(in Euro, at prices of 2015. Compiled from Euro Statistics, 2015)

Framework Programmes	Planned years	Last project ended in	Total spending (Million[5])
FP 1	1984-1987	1990	3,271
FP 2	1987-1991	1995	5,357
FP 3	1990-1994	1995	6,552
FP 4	1994-1998	1998	13,121
FP 5	1998-2002	2002	14,871
FP 6	2002-2006	2006	19,256
FP 7	2007-2013	2013	55,806
FP 8 (Horizon 2020)	2014-2020		80,000*
		Total	198,233

*Budgeted (Source: European Commission 2015, Horizon Special Issue)

The policy has its origin in the provisions provided in the European Coal and Steel Community (ECSC, 1951) and in European Atomic Energy Community (EURATOM, 1958) treaties. The first cooperative research activities were started in the 1970s. This spearheaded to the Framework Programmes, the first of which was in 1984. Subsequently there were eight FPs, each having a different focus. The current FP (Horizon 2020) focuses on innovation.[6]

The Article 55 of ECSC Treaty encouraged technical and scientific research for increasing efficiency and safety in the iron and steel industry. The

[4] Generally, a part of the project cost is funded by the EU. The percentage of contribution varies depending on the type of project. The rest is mobilised by the project participants.
[5] 1000 million = 1 billion. In continental Europe, a billion is 10^{12}. In UK, a billion is 10^{9}, which is in continental Europe termed "milliard". The EU uses the UK convention of billion that is 10^{9}.
[6] For an explanation of "innovation" see chapter 1.5.

EURATOM Treaty established the Joint Research Centre (JRC), and laid down procedures for the coordination of national research projects. The 1957 European Economic Communities (EEC) Treaty made provision for research intended to boost agricultural productivity (Article 41). It also provided a general legal basis (Article 235) for research in different sectors.

Figure 2: A brief history of EU Research Policy
Source: European Commission 2016, The EU explained: Research and Innovation, p 5

1950s: Provisions for research are included in the European Coal and Steel Community (ECSC, 1951) and European Atomic Energy Community (Euratom, 1958) treaties.	2000: The EU agrees to work towards a European research area: a unified research area open to the world and based on the internal market, in which researchers, scientific knowledge and technology can circulate freely.
1957: The treaty setting up the European Economic Community (the EEC or 'Common Market') leads to a number of research programmes in areas considered priorities at the time, such as energy, the environment and biotechnology.	2007: The European Research Council is created as part of the seventh framework programme (FP7). Its mission is to support frontier research across all fields, on the basis of scientific excellence.
1983: The European strategic programme on research in information technology launches a series of integrated programmes in information technology research, as well as development projects and industrial technology transfer measures.	2008: The Budapest-based European Institute of Innovation and Technology is created. It is the first EU initiative to fully integrate all three sides of the 'knowledge triangle' (higher education, research and business) through support for knowledge and innovation communities. It became operational in 2010.
1984: The first 'framework programme (FP)' for research is launched. These programmes will become the EU's main funding instrument for research. FP1 focuses on research in biotechnology, telecommunications and industrial technology.	2014: Horizon 2020, the biggest EU research and innovation framework programme ever, is launched. Running from 2014 to 2020 and with a budget of € 77 billion, Horizon 2020 is part of the drive to create new growth and jobs in the EU and tackle our biggest societal challenges.
1986: Research becomes a formal Community policy, with a specific chapter in the Single European Act. The objective is to 'strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level'.	

The EU Research Policy had gone through many years of evolution starting in the early 1950s with research and development attributed to ECSC. But a comprehensive policy in its current form started only in the 1980s after the first Framework Programme.

The terms "EU", "RTD", "Research and Innovation" are relatively recent ones. For example, the term "EU" started appearing only after the Maastricht Treaty of 1992. However, for my study I have chosen to analyse entire period right from the time of the ECSC in 1951. This is necessary in order to better understand the political significance of this policy by looking at its historical development. Naturally, I will also concentrate liberally on the recent developments in the EU, especially the Brexit issue and its consequence to this policy.

1.1.1 SUBJECT OF POLITICAL SCIENCE AND ECONOMICS

What is the European Union? In the literature one would find several, interconnected explanations. According to the information on EU official website, the EU is described as:

> "The European Union is a unique economic and political union between 28 European countries that together cover much of the continent."[7]

If we look at what the outsiders say, a recent paper[8] from United States Congressional Research Service gives the following explanation:

> "The EU is a political and economic partnership that represents a unique form of cooperation among sovereign countries."

The US paper states further:

> "The EU is the latest stage in a process of integration begun after World War II, initially by six Western European countries, to foster

[7] See https://europa.eu/european-union/about-eu/eu-in-brief_en, accessed on 28 May 2017
[8] Archick Kristin (2017), 'European Union: Questions and Answers' (Washington, DC: Congressional Research Service)

> interdependence and make another war in Europe unthinkable. The EU currently consists of 28 member states, including most of the countries of Central and Eastern Europe, and has helped to promote peace, stability, and economic prosperity throughout the European continent."[9]

Although there can be basic differences in the definitions of the EU (which are not the subject of my study), the two aspects – political science and economics – are fundamental for studying any EU subject. Bearing this in mind, I enquire the relevance of the EU R&I Policy both politically and economically.

Since the inception of this policy, the EU has spent billions of Euro in funding R&I. Hence, the EU R&I Policy has significant economic importance and relevance, apart from its integral political purpose.

1.2 PURPOSE OF THE STUDY

The main purpose of my study is to understand and to explain the existence and the continuation of EU R&I Policy with the help of suitable political science theories, supported by economic explanation.

In addition to the above I wish to know the significance of this policy from current political perspective, especially in light of the ongoing Brexit.

I begin my study by investigating if the R&I Policy has been contributing to the European political, social, and economic integration. Further, I wish to shed light on the rational of government intervention in funding and supporting scientific research, a subject of economics. Naturally, I aim to bring new insights that can be helpful to academics as well as non-academics in understanding the pros and cons of this policy.

As Luca Guzzetti (1995, p 2) points out, in the immediate post-Second World War period in Europe, which was physically and morally in ruins, science and technology were not a major focus for European

[9] ibid

governments. However, because of the untiring endeavour from some eminent political figures at this time, such as the Frenchman Jean Monnet, a European Policy for scientific research was initialised.

At that time, it was expected that this Policy would contribute to the reconstruction of Europe and promote integration. Through my study, I wish to get a feeling for the extent of European integration that can be attributed to EU R&I Policy since its origin.

The EU says that the main driver of economic growth in the EU is innovation.[10] It further states that USA, Japan, and South Korea are spending more (as a percentage of their GNI[11]) on innovation and wishes to catch up. In this regard, the purpose is also to investigate how the spending on R&I is supportive of EU political agenda.

The subject of Brexit is going to accompany the EU Politic for coming years. So, one other purpose of my study is to put forward some qualified assumptions about UK's role in the future of this policy.

1.3 THEORETICAL APPROACH AND HYPOTHESISES

My research contains two key issues: 1) The relevance of EU R&I Policy to Integration 2) The future of this policy in light of UK leaving the EU.

Hence, I have postulated two hypotheses that accompany my study.

The relevant theories applied are described in detail in chapter 2.

1.3.1 THE INTEGRATION ASPECT OF EU R&I POLICY

The study of European integration, which concerns the relations between the EU Member States, is a study in international relations. For that I follow the theories of integration such as neo-functionalism (Ernst B. Haas, 1958). Neo-functionalism, and its precursor functionalism, challenged the dominant paradigm of realist theory in international

[10] Statements of this message can be found in many EU documents. For example: The European Union (2013), 'Innovation Union, A pocket guide on a Europe 2020 initiative'
[11] Gross National Income

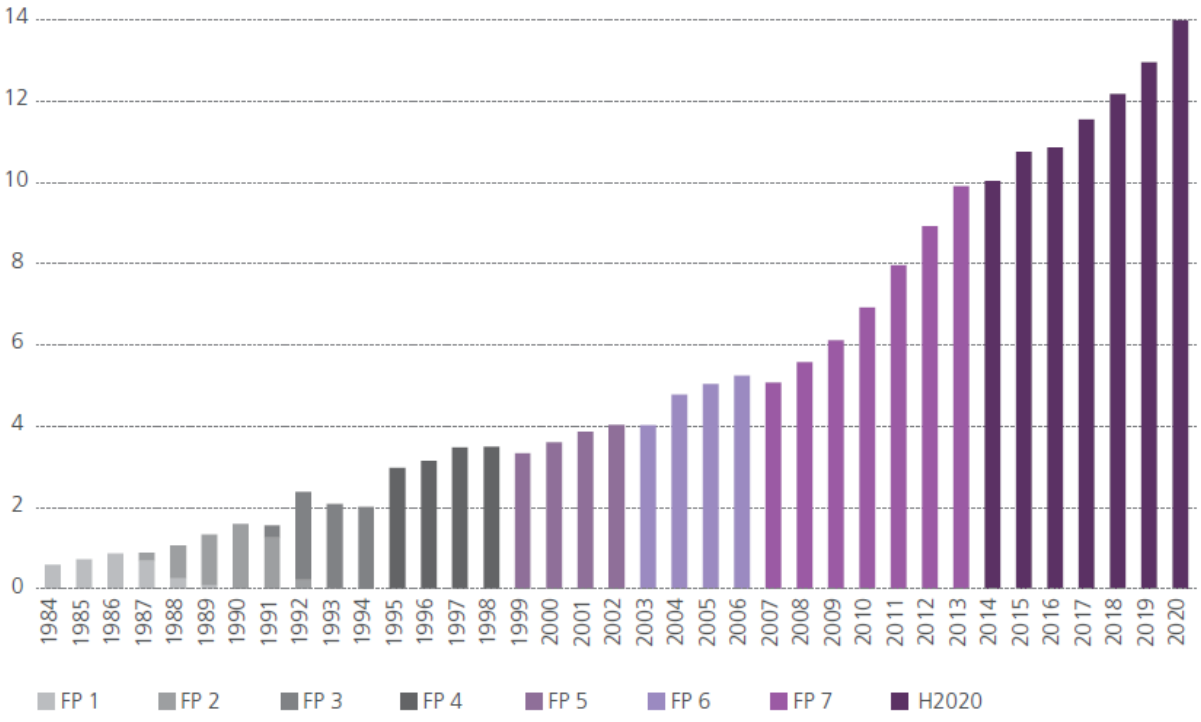
relations, which focuses on the nation-state as a central political actor and a main analytical unit in the international system. The neo-functionalism considers other issues and actors than governments of individual states. For planning, endorsing, and implementing the EU R&I Policy, not only the governments interact, but also universities, institutions, firms, and individuals of Member States.

After the Second World War ended in 1945, some of the Western European nations came together and started working on their shared political views and tendencies. These shared views and tendencies have evolved since then and have created a strong geo-political entity, which we call today the European Union.

The EU R&I Policy is a part of the political process that originated in the late 1950s among a group of sovereign states. At each instance of this political process, shared policies for the area of shared interests were drawn, re-oriented or sometimes simply left without developing further. Simply said, the EU R&I Policy has changed and evolved depending on the political, economic and social situation in Europe as well as in other parts of the world since the policy began in the 1950s.

The chart below shows the year by year increase on R&I expenditure by the EU on its Framework Programmes. It started with less than a million Euro for the year 1984. For the year 2020 it would reach to 14 million Euro. This makes us very clear the importance given to this policy and its growth.

Figure 3: Growth of annual budget for Framework Programmes
(In million Euro. Source: Swiss Federal Department of Economic Affairs, p 12, original source: EU Commission)



Scientific research and technological development activities require risky financial investment. When private enterprises do this investment, they do so based (solely) on the criterion of profit maximisation and risk minimisation. However, quite often, this profit maximisation is not useful to the society as a whole. This leads to the question whether the state should intervene and fund research and technological development.

My first hypothesis:

The EU R&I Policy is a factor of spillover dynamics that can be best explained with neo-functionalism theory, albeit always combined with, or interrupted by, intergovernmentalistic approach.

In addition, the Policy is justified on the basis of economic relevance.

1.3.2 THE BREXIT AND EU R&I POLICY

In recent years, a number of political parties in different EU countries are openly and continuously campaigning that they want their country to leave the EU and take an independent road to their future. But, it was the United Kingdom (UK) that held a referendum in June 2016 which resulted in a narrow "yes" vote to leave the Union. As result, the UK government officially notified the European Commission on 29 March 2017 its decision to leave the EU.

While we talk enthusiastically about the European integration, an important member has decided to leave the Union and to go its own way. This might be a setback for the "project EU".

Therefore, I long to investigate and analyse what might be the effect of Brexit on EU R&I Policy. I wish to know if the policy might suffer because of Brexit, or, if the UK is going to remain within the framework of EU R&I policy by other means and the policy itself will continue without any drawback.

Based on the subject background just mentioned, I have formulated another hypothesis:

My second hypothesis:

UK is highly likely to remain in EU R&I activities as an associate country after leaving the EU.

1.4 METHODOLOGY, SOURCES AND STRUCTURE OF THE STUDY

I have tested my set of hypothesis using theoretical and functional analysis. To begin with, I have explored the nature of European integration and cooperation and related the same to activities taking place in the FPs for research and innovation. This gives an insight into the reasons, motives and purposes of the integration and the approaches taken to achieve this integration. For a better understanding, I have looked at the theories and assumptions on European integration. As

European integration is a subject of international relations, the theories and the institutional framework of international relations are also looked into.

As a primary source of literature, I have examined the numerous EU official publications and reports on research activities. They are readily available for downloading from EU websites as well as can be obtained in printed version from the EU publication office. These publications also contain policy statements from top EU officials and politicians over the years. These statements are answers to specific questions I would have asked them in a direct interview. Hence, the primary literature from the EU substitutes one-to one interviews with EU officials. In addition to EU publications I have also studied primary literature from some Member States (UK, Germany, Austria …) as well as from third-countries (Switzerland, Norway …).

As secondary source, I have referred to publications by experts and academics in three main areas: the EU in general and the EU R&I Policy in particular, theories of integration, and economics of research and development.

For clarity, I have divided my paper into three parts – the theoretical, substantial, and the analytical one. Throughout my writing, I have tried to keep a straight line connecting these three parts and their chapters.

Chapter 1 introduces the subject and presents the hypotheses giving brief information on theoretical background and informs about the methodology.

Chapter 2 is dedicated to the political theories which are used in my study. Here I analyse the assumptions and hypothetical views on European integration. For that, I make use of a good supply of secondary literature available, adding to it my own assumptions. The chapter begins with an overview of European integration and ends with a deeper analysis of the same.

In chapter 3, I give background information on the economics of R&D and need for state intervention in support of R&I. Here I have also referred to a good deal of literature available explaining the effect of innovation, research and technology development on the economy.

The following four chapters (4, 5, 6, and 7) are dedicated to the substantial part. These chapters present an elaborate picture of research activities, programmes and policies at the EU level right from the very beginning until now.

Chapter 4 begins with the developments in the field of science and technology in the period following the end of Second World War. The forming of two Communities, European Coal and Steel Community (ECSC), and the European Atomic Energy Community (EAEC or EURATOM) are described here.

Chapter 5 continues with the progressive development of the policy in the 1970s. It contains the programmes such as ESPRIT and EUREKA, and the start of the FPs in the 1980s. In addition, drawing from secondary literature, the analyses of these developments are simultaneously added.

In chapter 6 further development of the policy and its impact is looked into and analysed. It is dedicated to the developments after Maastricht, and especially to the current FP, the Horizon 2020 programme.

Chapter 7 is dedicated to the question of Brexit and its consequence to the EU in general and the R&I Policy in special. First, I inform about the background of Brexit. Secondly, I explain the EU law on Brexit and the legal consequences. In addition, I investigate UK research and the role of the EU in funding UK research. Then I investigate possible future scenarios for a UK-EU relationship with the help of case studies. For chapter 7, I have used primary and secondary literature. Further, I have made internet investigations and tried to catch up with the breaking news. For the case studies, I have referred to publications from the UK, Switzerland, and Norway.

The third part, in chapter 8, is devoted to an analysis of the policy by looking at several of its aspects. These aspects include the goal of integration and the economic objective as well as other aspects, which influence a fully-fledged EU R&I Policy. For this analysis, a number of secondary literature is referred to. The sources in this chapter concerning facts, figures and empirical data come mostly from primary literature published by the European Commission. Also, certain policy orientations will be taken from the primary literature. Because of the complexity and diversity of the subject there is not a "classic" or "standard" work published on EU R&I Policy that covers each and every aspect. There is, however, a good deal of scientific studies covering particular aspects and published in reputed journals, which make valuable sources.

The final chapter (chapter 9) makes the conclusions of my studies. The three hypotheses are answered in this chapter. In doing so, I have connected the theories with the substantial part of my research.

1.5 TERMINOLOGY

In the literature, there is considerable deviation in terms assigned, used and interpreted with regard to the European Union as well as Research and Innovation – the two subjects of my paper. Within this study, unified terms are used as far as possible and attempt is made to relate the terms used in the different sources to the unified terminology suggested here.

Regarding the terms related to innovation and technology I have given detailed explanation in order to give a deeper glimpse of the content of my dissertation.

1.5.1 TERMS RELATED TO THE EU

There is a popular tendency to subsume the "European Union" to the "Communities". In this paper, I have adopted this tendency. However, a distinction is made between the "European Union" and the "European Communities" to differentiate the historical, legal and institutional aspects.

The term "European Communities" or "European Community" is used with reference to the legal entity established by the 1951 Paris Treaty and the 1957 Rome Treaty, and to highlight the institutional structures, legislation, and policies based on these Treaties.

The term "the European Union" is used while referring to Community issues after the 1992 Maastricht Treaty. This term is also used as a geographical and political expression with reference to the Member States and their territory. Whenever the term "the European Union" appears in connection with policy matters, it should be understood as referring to "Community" policies, unless otherwise specifically distinguished.

General references to the European Union (EU) or the European Community (EC) denote to the membership of 28 states, which is from 1 July 2013 onwards. If a reference is made to the EU/EC at a specific date, the number of members is as it was at that date.

1.5.2 TERMS RELATED TO R&I (FRASCATI MANUAL)

The terms R&D[12] and R&I are used in this study in a broad context, without differentiating the various types of research or other activities (such as education and training) related to scientific research.

Concerning the terms "science", "research", or "technological development", the best source for standard terms and methodologies related to R&I is the Frascati Manual[13] published by the OECD. The manual emerged after a meeting of OECD national experts in June 1963 in Frascati, Italy. The result was the first official version of the *Proposed Standard Practice for Surveys of Research and Development*.

The Frascati Manual gives guidelines for "collecting and reporting data on research and experimental development". This guide has been widely used by the EU for measuring scientific, technological, and innovative activities.

[12] The OECD has the acronym R&D for "Research and Experimental Development" (OECD: Frascati Manual 2015, p 43).
[13] OECD (2015), Frascati Manual 2015: 'The Measurement of Scientific, Technological and Innovation Activities'

By providing internationally accepted definitions of R&D and classifications of its component activities, the Manual contributes to intergovernmental discussions on "best practices" for science and technology policies. As a result of initiatives by the OECD, the European Union and various regional organisations, it has become a standard for R&D surveys worldwide.

According to the Frascati Manual 2015, R&D comprise

> "Creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge."

The term R&D covers three activities: basic research, applied research and experimental development.

The Frascati Manual defines three types of Research and Development:[14] a) basic research b) applied research c) experimental research.

The basic research has been defined as follows:

> "Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view." (Frascati Manual, p 50)

Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws. The reference to no "particular application in view" in the definition of basic research is crucial, as the performer may not know about actual applications when doing the research or be responding to survey questionnaires. The results of basic research are not generally sold but are usually published in scientific journals or circulated to interested colleagues.

The results from basic research are used for further specific use. According to Mark Funk[15] (2002) basic research generates much larger

[14] OECD (2015), Frascati Manual, p 50

international spillovers than applied research and argues in favour of increased international coordination of basic research policies.

The applied research has been defined as follows:

> "Applied research is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective." (Frascati Manual, p 51)

Applied research, or developmental research according to some scholars, is also original investigation according to the OECD and is undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems.

In the business enterprise sector, the distinction between basic and applied research is often marked by the creation of a new project to explore the promising results of a basic research programme.

The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. Applied research gives operational form to ideas. Applied research, unlike basic research, can be easily appropriated by the research performer, and thus has a stronger effect domestically (Mark Funk, 2002). The knowledge or information derived from it is often patented and may be kept secret. The applied research can also be described as strategic research.

The experimental development has been defined as follows:

---

[15] Funk Mark (2002), 'Basic Research and International Spillovers', in International Review of Applied Economics, Vol. 16, Nr. 2, pp 217-226

> "Experimental development is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes." (Frascati Manual, p 51)

The three terms just mentioned are used in my paper in accordance to the above given meaning. However, in the literature one can find other terms with similar meanings. One of such term is "scientific research". I have used all similar and other terms according to the given context in the original literature.

The EU has introduced the term "innovation" replacing "technological development" in its FP8 (Horizon 2020). The Frascati Manual states the following about the term "innovation":

> "Innovation is currently defined for measurement purposes in the third edition of the Oslo Manual (OECD/Eurostat, 2005) with a sole focus on the Business enterprise sector (see a definition for this sector in Chapter 3). In summary, it has to do with putting new or significantly improved products on the market or finding better ways (through new or significantly improved processes and methods) of getting products to the market. R&D may or may not be part of the activity of innovation, but it is one among a number of innovation activities. These activities also include the acquisition of existing knowledge, machinery, equipment and other capital goods, training, marketing, design and software development. These innovation activities may be carried out in-house or procured from third parties." (Frascati Manual, p 60)

Apart from the above definitions, the Frascati Manual also speaks about "borderline cases" and gives examples for the same (Frascati Manual, pp 60).

CHAPTER 2

WHICH THEORIES EXPLAIN EUROPEAN INTEGRATION?

> At the time of increased strains and contestation for the EU, it is more important than ever to understand the range of theoretical perspectives that have helped explain its evolution and present state and provide the resources for addressing new development and challenges.
>
> Sabine Saurugger (2014)[16]

2.1 INTRODUCTION

Theories are used in political science to evaluate a subject deeper and to give it as meaningful explanation. Studying the EU R&I Policy historically, or other undertakings of the EU as historians and lawyers do, is not sufficient enough for a deeper understanding. It is important to structure our observances for a proper understanding of EU activities. For that, theories and conceptual frameworks allow us to comprehend how a specific hypothesis can influence the interpretation of a given research question.

In this chapter, the EU R&I Policy is analysed with the help of two prominent and contemporary theories of integration: 1) Functionalism, and neo-functionalism 2) Intergovernmentalism.

In addition to these, a few other theories briefly presented to forward views expressed by other authors regarding the EU integration.

2.2 THE BEGINNING OF EUROPEAN INTEGRATION

With the signing of the Treaty of Rome in 1957 by six European countries (France, Germany, Italy, Belgium, the Netherlands, and Luxembourg) began the process commonly referred to as European integration. Hence, the EU R&I Policy is only a part of a broader political process in Europe that begun soon after the end of Second World War.

[16] Professor of Political Science at Sciences Po Grenoble, France

Although the integration of Europe was proposed as early as the fourteenth century[17], it was not until the period of economic, political, and military reconstruction following the Second World War that it was put first time in real practice.

After the War, there was a strong need for a new type of political association in Europe. Churchill, in his great Zurich speech of September 1946, had called for a "kind of United States of Europe".

> "There is a remedy which (...) would in a few years make all Europe (...) free and (...) happy. It is to re-create the European family, or as much of it as we can, and to provide it with a structure under which it can dwell in peace, in safety and in freedom. We must build a kind of United States of Europe."[18]

And in March 1950, German Chancellor Adenauer, who was a great proponent of the ECSC, had suggested a complete political and economic union of France and Germany.

But, the decisive steps towards European integration are attributed to a band of leading statesmen with a shared vision: Monnet, Schuman, Spaak,[19] de Gasperi ... The form taken by the integration was strongly influenced by the historical experience of these great men.[20] And it was propelled by a distinct 'mix' of circumstances and impulses, which can be summarised as:

---

[17] The Dutch humanist scholar and writer Erasmus, Desiderius (1466-1536) said to have been the first to propose an integration of European kingdoms.

[18] European Commission 2013, 'The founding fathers of the EU', p 11

[19] Paul-Henri Spaak was a Belgien Minister. He was the chairman of the committee that drafted the Spaak Report. This report, tabled in April 1956, remains a key document. It is the main philosophical antecedent of the approach to economic integration which has been prevalent in the Community ever since (Harrison, 1995).

[20] It is not difficult to explain how and why these pragmatists envisaged the Community way of European integration, with limited surrender of national sovereignty: Spaak was Belgian, who became foreign minister at the age of 37 in 1936. In 1940 he went into exile, and was later convinced that Europe must be politically united because no military defence of the nation-states was by now possible. Robert Schuman came from the disputed territory of Alsace-Lorraine. This province and its iron ore deposits changed hands between France and Germany in 1871, 1918, 1940 and 1945. Schuman fought in the German army in 1914-1918, had German as his first language and became a French citizen only in 1919 (Harrison, 1995; Dedman, 1996).

- the defeat of Nazi Germany and of the Axis powers;
- the wish to avoid a repeat of the excesses of nationalism and of the nation-state system by creating a new system of European international relations;
- the division of Europe and the wish in the West for security from the Soviet threat;
- the desire for Franco-German reconciliation as the bedrock of stability within Western Europe;
- the need to base Western security and defence on economic reconstruction and well-being.

In short, European integration was motivated by political, economic, and security considerations.

However, overwhelming was the desire for co-operation and integration among the leading political figures, there was not a unanimous plan as how to achieve this. The two main views were of those of *"Federalists"* and of *"Functionalists".*

The Federalists placed primary emphasis on the superseding of nation state with a larger democratic structure. Their vision of European cooperation was aimed at creating a United States of Europe, inspired by the modern North American federation.

The Functionalists shared the Federalists' objective of a united Europe but adopted a more pragmatic approach to its realisation. They saw the need for economic co-operation as a starting-point for achieving their political goals. One stepping stone was to be the creation of a real common market.

2.3 FUNCTIONALISM

The main assumption of functionalism is that international organisations, governed by experts, are needed to guarantee peace among nations. This

is because the national political elites are too interested in re-election to make efficient and good decisions that benefit their people.

It is said that David Mitrany is the founding father of functionalism. In his work published in 1947, entitled "Nationalism and Planning", Mitrany considers that the mix of socialism and nationalism creates a new situation for those who want to build a new pacifist international society.

According to Popoviciu (2010, pp 162-172), the functional approach that Mitrany developed in order to achieve social peace and prosperity is known as functionalism, even if in his writings he does not use this term.

According to Saurugger (2014, p 17) functionalism led to a new and influential understanding of why states agreed to establish international organisations. Functionalism had been central to study of international relations and was part of the liberal-idealist movement and became the precursor to neo-functionalism. This movement developed ideas on how to guarantee peace among nations.

The conceptual framework of functionalism emerged as one of the first to directly question state-centred approaches. Its arguments allowed for the inclusion of other actors in international relations, such as experts, civil servants or international organisations. The functionalist theory suggests a direct and irreversible development toward ever stronger integration (Loth, 2008, p 20).

Some authors see that the emergence and growth of international organization as a consequence of the autonomy of industrial societies. This growth is characterised by the progress of the forces of production, and the internationalisation of socio-economic problem complexes. These problems can only be resolved by means of inter-state or supra-state cooperation. Thus, international organisations can be compared to administrative/executive unions active in primarily technical non-political issue-areas. The organisations simultaneously relieve states of some of their tasks and deprive them of some of their power without incorporating

them in a superior political entity. The internationalisation of problem complexes is governed by the logic of functional necessity. The functional necessities thus produce mechanisms of collective problem resolution at international level.

Saurugger (2014, p 18) notes that at the heart of functionalist approach, there is the belief that political game *per se*, i.e. politics, stands in the way of the creation of favourable social conditions for all:

> "Through their political elite, governments create situations in which the acquisition and exercise of power overshadow the pursuit of the common good. Politics also prevents the state from acting creatively when faced with public policy challenges. Their inflexibility, due to their ideological nature, creates a need for institutions and international or transnational agencies."[21]

One of the acclaimed authors on this subject is Ernst B. Haas, belonging to those who challenged the dominant paradigm of the realist theory focusing on the nation-state as a central political actor and a main analytical unit in the international system. He regarded the treatment of integration in studies made by political scientists and economists as insufficient for they did not answer the question of how and why the process of integration would be started.

> "It is time that the significance of the regionalism in the pattern of international relations be examined, that vital but frequent obscure factual points be thrown into relief, that judgements be made."[22]

In the framework of his theory, integration is seen as a process rather than as the final stage. The integrative process starts off in an apolitical field. Haas (1958, pp 297-299) talked about the need for cooperation among the member states in international economic institutions such as

[21] Saurugger (2014), 'Theoretical Approaches to European Integration', p 18
[22] Haas (1958), 'The Uniting of Europe: Political and Economic Forces 1950-57', p 614

the GATT and the OEEC. He identified spillover pressures stemming from the customs union or other international institutions.

Supranational institutions are created which inherently contain the capacity for expansion; for example, the European Coal and Steel Community was established to realise the benefits expected from a common market restricted to coal and steel. This was carried out even though it was obvious that acting effectively was impossible unless related areas such as foreign trade, taxes, wages and monetary policy were put under the authority of supranational institutions.

2.4 NEO-FUNCTIONALISM

Neo-functionalism was developed in the mid-1950s by scholars (Ernst B. Haas) based in the United States. They highlighted the importance of supranational institution for international relations.

> "The fundamental argument of the theory is that states are not the only important actors on the international scene. As a consequence, neo-functionalists focus their attention on the role of supranational institutions and non-state actors, such as interest groups and political parties, who, they argue, are the real driving force behind integration."[23]

In the early and mid-sixties, students of Haas tried to apply his neo-functionalist theory to integration processes in Latin America and Africa. They learned that the functional theorem was only partly applicable to integration processes outside Europe. Haas himself never made studies or investigations outside Europe, but tried to incorporate the results of the scholars working with his theory in order to amend and refine his theory.

Neo-functionalism explains the reason and process of state cooperation aimed at solving conflicts between each other and gradually giving up on national sovereignty. This theory is based on the assumption that the role

[23] Carsten Strøby Jensen (2015), in European Union Politics, p 53

of nation states would decrease, and did not see the state as single unified actor on the international stage.

> "Neofunctionalism was devised as an attempt to account for the political regional integration process that emerged in its unique form in Western Europe in the 1950s and simultaneously to challenge the dominant international relations (IR) and realist accounts of inter-state co-operation."[24]

According to the neofunctional theory, the next expansion of the scope of integration is described as the result of pressures by interest groups, political parties and other national political elite for strengthening and expansion of the functions for supranational institutions enabling them to realise their interests through the new institutions.

If these functions are carried out, the neofunctionalists anticipate that the support among both the mass public and the elite will ensure further steps towards closer and closer integration. Haas called this mechanism the "spillover" effect. The preamble of the Treaty of Rome, for example, can be interpreted in neofunctionalist logic. Sections of it, especially the technical (apolitical) parts, were defined in detail whereas the political parts were left rather vague.

Xu and Shen state that there were four key parts to the neo-functionalist argument:[25]

> "1) The concept of the "state" is more complex than realists suggested.
>
> 2) The activities of interest groups and bureaucratic actors are not confined to the domestic political arena.
>
> 3) Non-state actors are important in international politics.
>
> 4) European integration is advance through "spill-over" pressures."

[24] Lee (2007), 'Theorising European Integration: revisiting neo-functionalism and testing its suitability for explaining the development of EC competition policy?', p 5
[25] Xu and Shen (2014), 'IR Theories Debate of European Integration', p 217

In the preface to the 1968 edition of his book "The Uniting of Europe", Haas states that a revision of his theory was necessary as he had underestimated certain variables which were crucial for the validity of integration theory. Neo-functionalism tried to clarify the dependent variable "'regional integration" and to distinguish it from related terms such as regional cooperation, regional organisation, regional system, etc. It also contributed to the understanding of spillover.

Sabine Saurugger presents the following core neofunctionalist assumptions:[26]

> "1) Relevant actors are economically rational beings. While their capacity to learn exists, their attitudes are based on interest. Therefore, when transferring loyalty to a new power centre or transforming beliefs and values, these actors choose their options rationally.
>
> 2) Once taken, decisions have unintentional consequences, more often than not leading to new decisions in other policy fields. This conceptualisation of unintentional spill-over shows that neounctionalists did not believe in any preconceived grand design for European integration. Once launched, it seemed rather difficult to see where the progress was heading.
>
> 3) Institutions created under this logic take on a life of their own. They are not only secretaries in the service of member-state preferences, but become independent actors pursuing their own agenda. The High Authority, later the Commission, influences the interests and beliefs of both public and private actors participating in the integration process."

[26] Saurugger (2014), 'Theoretical Approaches to European Integration', p 37

2.4.1 CORE ACTORS: INTEREST GROUPS AND ADMINISTRATORS

Economic interest groups are considered central actors of this approach. They drive the process of integration by lobbying national governments and administrations. They can also be considered as transfer of actor loyalties from national to supranational levels. Thus, according to neo-functionalists' perception of competence transfer, a shift of loyalties occurs to such an extent that interest groups cease to represent their interests to national governments and turn instead to the new supranational authority – more preciously the High Authority, the predecessor of the European Commission (Saurugger, 2014, p 37).

> "Finally, the Commission acts as a political entrepreneur, mobilizing and organizing private-sector groups to support its policy objectives. The Commission regularly creates – and sometimes funds – roundtables, working groups, and committees composed of firms and other non-state actors."[27]

Neo-functionalists argued that spillovers are triggered more likely by non-state actors than sovereign states. Non-state actors would communicate their pro-European interests to their national governments which, in turn, would influence national technocratic actors. This influence would result in a heightened awareness of national political actors, who recognise the benefits of cooperating and networking at the European level.

The importance of non-state-actors in international politics is a key feature of neo-functionalism, referring to multinational corporations and the European Commission, which has a particular role in EU integration that according to the neo-functionalist theory gets advanced through the process of spillover.

[27] Sweet (2012), 'Neo-functionalism and Supranational Governance', p 14

2.4.2 SPILLOVER

The concept of "spillover" is perhaps the most important part of the theory of neo-functionalism. Spillover refers to the mechanism by which integration in one area creates the conditions and incentives for integration in another related policy area.

In the context of early European integration, it was argued that cooperation in core sectors such as coal and steel (while beneficial) could not be fully achieved without also integrating in other sectors, such as transport for example, that were central to the integration of coal and steel (Rosamond, 2000, p 60).

The spillover-process described in the neo-functionalism is a strong point, which describes how regional integration evolved: In order to fulfil and satisfy one goal of integration it is necessary to take actions in another area, which then set other actions in motion. The spillover occurs because if one sector is integrated, the interest groups usually lobbying on national level then switch to the new integrated supranational agency, which then encourages other interest groups to pressure their national access points to integrate as well. Spillover can describe the European Commission's unique position to manipulate domestic and international pressures on national governments through cultivating agreements with national interest groups.

The notion of spillover is the best known of neo-functionalist concepts. It is the driving force behind all integration processes. Spillover is defined as "a situation in which a given action, related to a specific goal, creates a situation in which the original goal can be assured only by taking further action, which in turn create a further condition and need for more action and so forth" (Lindberg, 1963, quoted in Saurugger, 2014, p 39).

The spillover, analysed empirically by Haas in the context of the ECSC, means that member states' economies need to be relatively interdependent prior to the integration process. According to Haas, the

acceptance of ECSC is best explained by the convergence of demands within and among the nations concerned.

However, a transnational authority is needed to implement this process. At transnational level, it was the High Authority and later, the Commission, which was responsible for accelerating the degree of economic integration by technocratic means and, in particular, through more rational, optimized public management. (Saurugger, 2014, p 39)

This spillover-process can be driven by non-state-actors, like interest groups, as described in neo-functionalism. Those interest groups have the power to put pressure on the national governments, influence government decisions, which outcome is reflected in the state's international activities and thereby strengthen the integration process caused by spillover.

2.5 INTERGOVERNMENTALISM

Intergovernmentalism is not only associated with EU politics but also refers to a type of decision-making that occurs within all international organisations. At a general level, intergovernmentalists apply this kind of framework to their understanding of the EU, albeit with some modification (Cini, 2015, p 66).

The intergovernamentalism holds that the creation of supranational institutions is possible only with the agreement of the EU's Member States, and that both institutional and substantive progress in European integration depend essentially on these Member States' decisions and actions.[28]

The intergovernmentalists hypothesise that the European integration is determined by Member States' interests. Integration only takes place if there is a permanent excess of gains and losses for Member States. Intergovernmentalism is thus viewed as strengthening the nation-state

[28] Morgan Roger (2000), 'A European 'society of states' – but only states of mind? ' in International Affairs, Vol. 76, Nr 3, pp 559-574

since it takes place according to its "rules" (Milward, 1994)[29]. Van der Harst[30], reviewing Milward, states that national states did not necessarily "lose" what they delegated to the supranational level. Because of their involvement in the European Community, the governments were in a position to perform beneficial tasks for their citizens, for example in the area of economic and social welfare. They would probably not have been able to achieve this in the absence of integration. This has led to an increased legitimacy of governmental elites whose motivation for integration was the preservation of executive capacity at the national level, not its erosion. In other words, according to Milward, the integrated Europe helped to "rescue" the nation-state.

Intergovernmentalists see governments as the paramount actors and the role of supranational institutions is downplayed. It is argued that governments only transfer sovereignty to institutions if potential joint gains are large. Intergovernmentalists are of the opinion that supranational institutions lack any significant independent entrepreneurship and are subject to amendment by member governments.

In terms of European foreign policy, "classic" intergovernmentalists have been very sceptical concerning the prospect of integration because this policy area was considered "high politics", i.e. close to the heart of national sovereignty (Hoffmann, 1966, p 882; cited in Bergmann and Niemann, 2013, p 8). Therefore, effective cooperation depends on the convergence of national interests. However, in the area of foreign policy such convergence is seen as rather unlikely, as states tend to have very different interests.

[29] Milward (1994), The European Rescue of the Nation-State
[30] Van der Harst (2008), Journal of European History, p 6

2.5.1 REALIST INTERGOVERNMENTALISM

Intergovernmentalism is drawn from classical theories of international relations and, most notably, from realist or neo-realist accounts of inter-state bargaining, albeit at only a very general level (Pollack, 2012, citied in Cini, 2015, p 66). Realists view international politics as the interaction of self-interested states in an anarchic environment in which no global authority is capable securing order.

The counter position to the regional integration theory is based on realism. According to the realist school, the main actor in the international system is the nation-state, which acts rationally and desires to maintain and enhance its power relative to the other nation-states.[31] The state acts in the international environment assuming its own interest to be supreme both as a justification of and predictor of action.

Realist (also called classic) intergovernmentalism sees that national interests arising in the context of the state's perception of its relative position in the states system.[32]

In the framework of this theory the European Community is seen as a gathering of nation-states in an international rather than a supranational organisation. Supranational institutions, even if they have the authority to impose decisions on the Member State, are seen as instruments of the nation states. The protagonist of the intergovernmental position regarded the nation-state as the ultimate authority in decision making and policy shaping. Realists explain the expanding integration in the European Community in terms of the higher level of cooperation and interdependence which would not be realised if it did not best serve national interests.

[31] Waltz (2001), 'Man, the State, and War: a Theoretical Analysis'
[32] Bergmann and Niemann (2013), p 7

2.5.2 LIBERAL INTERGOVERNMENTALISM

Since the early 1990s, liberal intergovernmentalism has become one of the most important theories of European integration (Moravcsik, 1998, cited in Cini 2015, p 73). It has been a touchstone against which all integration theory has been judged, even for those who do not agree with its assumptions, its methods, or its conclusions (Moravcsik and Schimmelfennig, 2009, cited in Cini, 2015, p 73).

> "Drawing on and developing earlier intergovernmentalist insights, it offers an approach that is much more rigorous than those of its antecedents, incorporating within it both realist and neoliberal element, and dealing explicitly with the interface between domestic and intranational politics."[33]

Liberal intergovernmentalism suggests that sector-specific welfare interests of dominant interest groups determine member governments' utility function in terms of cooperation/integration. In terms of foreign policy, this utility function is difficult to ascertain given the lesser involvement of influential (economic) interest groups (Moravcsik 1998, p 28-30, cited in Bergmann and Niemann, 2013, p 8)

Saurugger (2014, p 55) states that Liberal intergovernmentalism is a three-stage bargaining process:

1) The formation of national preferences driven by issue-specific, mostly economic, interests.
2) Inter-state negotiations based in asymmetrical interdependence between member states.
3) The choice of supranational institutions which reflects an interest in securing credible member-state commitments.

[33] Cini Michelle (2015), in European Union Politics, p 73

2.6 OTHER VIEWS ON INTEGRATION

In the literature, there are several other schools of thought offering an explanation for European integration. Dedman classifies three of them.[34]

The first explanation, which Dedman says is an orthodox one, is institutional based. He states that the increased complexity of both the post 1945 international order and the range and functions of the modern nation-state mean that countries are inevitably entwined in a network of functioning international bodies (NATO, the UN or GATT). The (voluntary) membership to an international organisation means the scope for autonomous action by individual states is curtailed due to communal decision taking.

It is argued that once the organisations for the purpose of integration are put in place, there is an inevitable tendency for further integration to occur so that the ECSC of 1951 led to the European Economic Community (EEC) of 1957 and the Single European Act (SEA) of 1987 led to the objective of Economic and Monetary Union (EMU) in the EU Treaty of 1992. So, once the process of European integration had been set into motion, it became a self-sustaining process, powered by Brussels Eurocrats resulting in the incremental integration of Europe. This will inevitably result in increased scope of an integrated supranational organisation and the eventual departure of the nation state whose functions, responsibilities and sovereignty are transformed to the supranational state.[35]

The second school of thought, according to Dedman, attributes European integration to the ideas, growth and influence of European federalist movements particularly from the Second World War onwards. Professor Walter Lipgens, the main exponent of this view, focuses on the history of European federalist movements as an explanation for what followed. He

[34] See Dedman (1996), 'The Origins and Development of the European Union', pp 8
[35] See George (1992), 'Politics and Policy in the European Community and Milward et al., (1993) 'The Frontier of National Sovereignty: History and Theory 1945-92'

regards Euro-federalism as an inevitable and logical post-war policy based on the ideas and proposals of the resistance movements and the UK's "Federal Union" 1939-1941. In UK, according to John Pinder,[36] there was considerable literature on plans for Federation of Europe, published between 1939-1941.

Dedman's third type of explanation of European integration is entirely historical, based on the work of political, diplomatic and economic historians. Economic historian, Alan Milward[37] has produced a thesis firmly based and derived from empirical evidence (drawn from different national archives) to explain the origins and motivation for European integration. He rebuffs the theory that the process of economic development leads through interdependence progressively to integration as far too simple a conclusion.

Germany under the national-socialist regime and of Russia in 1917 both lasted significantly long enough without interdependence. In essence the "Milward thesis" states that European integration only occurs and only works when it is actually needed by nation-states. That means there being no fundamental antagonism between European integration and the nation-state. This stands in marked contrast to the other two types of explanation, both of which rest on the idea that European integration ultimately results in the demise of the nation-state and the creation of a new supranational state or Federal United States of Europe. The fundamental argument here is that power has remained with the nation-states, whether in the EEC of the 1960s or the European Union of 1990s. The final decisions are taken by the Member States' governments collectively in the Council of Ministers.

Milward further argues that European integration, far from advancing the cause of federation, actually "rescued the nation state". He cites the failure of European nation-states between 1938 and 1940, most of which

[36] Quoted in Dedman (1996), 'The Origins and Development of the European Union', p 19
[37] See Milward (1994), 'The European Rescue of the Nation-State'

were either occupied, annexed or divided, to fulfil their oldest and primary duty – the defence of national territory and the protection of their citizens. According to him the supranational organisations ECSC and EEC were – originally created by France, Germany, Italy, Belgium, Luxembourg and the Netherlands – because of economic requirement and political security and Euro-federalist ideas and movements had nothing at all to do with European integration.

Broadly speaking, the main calculation which Member States make is that, although they may lose individual economic autonomy, they gain in terms of general economic welfare through being part of a larger market. Another general calculation is that, although they may lose the political independence to do just as they please, they make real gains in terms of improved security of their environment and the stability of their neighbours. All the countries that take part in European integration are (and must be) democratic civil societies. European integration, as developed throughout its history, assumes that those taking part are open market economies, governed according to democratic values. The requirements of economic reconstruction and national rebuilding in Western Europe following the Second World War often required international solutions.

Most theoretical explanations of integration deal with the specific process of the surrender of national sovereignty. But, it is very difficult to explain what exactly sovereignty is in the first place – since its manifestation has varied from time to time and place to place.

In the case of the European Union, it is safe to say that certain state powers are *commonly exercised*.[38] This method of integration is different in character from simple cooperation between individual nation states, either on a multilateral or bilateral basis, because it implies some new body or new institution which has real delegated authority, legal

[38] Harrison (1995), 'The Organisation of Europe', p 195

personality and independence of its creators. It is in fact an innovation in the means of organising relations between nations.

In my opinion, the history of the European Union shows that most governments were not behaving according to those core assumptions presented here. However, the basic validity of these theories is expected to be found in one or other EU policy areas, including the R&I.

Eppler and Scheller state that apparently, integration and disintegration are taking place simultaneously in different dimensions of the integration process.[39] The best explanation for the process of European integration is most obvious in long-run economic and social trends. Though there are strong voices against the way the EU functions, and ultimately they were able to take the UK out of the EU, the European integration itself is progressing.

[39] Eppler & Scheller (2014), 'European Disintegration – non-existing Phenomenon or a Blind Spot of European Integration Research?', p 8

CHAPTER 3
THE ECONOMIC RATIONALE OF R&I

> The idea that there is a connection between nations' technological capabilities and their performance in terms of international trade and economic growth dates back to the very beginning of economic theory.
>
> Daniele Archibugi, Italian economic and political theorist

3.1 INTRODUCTION

Two great economists Francis Bacon (1561-1626) and Adam Smith (1723-1790) first proposed that science and technology creates wealth. There seems to be no dispute among contemporary economists in accepting the view that new products and new processes are the main source of dynamism in market oriented economies.

But, there is disagreement on the need or the extent of government intervention and using public money to support scientific research and technological development. The relationship between government activities and technological innovation in the private sector of the economy is extensive and complex.

Disagreements among EU Member States concerning the EU research activities arise regarding budget allocation – sometimes being the only subject of dispute.[40]

Hence, what is the justification for the EU funding R&I?

> "One common theme of many commentaries on the competitiveness of the advanced economies is that this competitiveness depends on innovation, particularly in high technology industries. This has led to calls for government subsidy of research and development (R&D)

[40] The budget presented by the European parliament and the Commissioners responsible for R&I is routinely reduced by the Council of Ministers.

> and, in particular, encouragement for cooperative and collaborative R&D."[41]

However, the importance of innovation is not measured simply in new inventions. Innovation also requires dissemination through market adoption and public acceptance. Further, not all kinds of research can automatically contribute to economic growth. Scientific research is of no use for the society, if the research results are not applied in a useful manner.

Depending on the type of scientific research, the results will have varied implications. While the result of a certain type of research may sooner or later be applicable, other research may only be useful for increasing our knowledge in the subject.

The problem with assessing the investment in R&I is that empirical studies on the R&I outcome is hard to quantify. One of the reasons is how to measure new "knowledge" and its "value".

Some other reasons are that the impact of technological innovation can take several years to attain and the social contribution of scientific research is tricky to quantify.

> "(…) we would like to caution the reader that the "return" to R&D is not an invariant parameter, but the outcome of a complex interaction between firm strategy, competitor strategy, and a stochastic macro-economic environment, much of which is unpredictable at time a firm chooses its R&D program. Therefore, there is no reason to expect estimates of the *expost* returns to be particularly stable over time or across sectors or countries."[42]

In this chapter I present some key insights of economics of R&D / R&I. These insights are meant on one side to explain the EU R&I Policy from

[41] Hughes (1993) Technology, competition and skill, European competitiveness, p 139
[42] Hall, Mairesse, and Mohnen (2010), 'Measuring the Returns to R&D', p 2

economic perspective and on the other side to compliment the issue of European integration, which is one of the two subjects of my study.

3.2 EU'S POSITION ON R&I POLICY

The European Commission says that research and innovation contribute to making the EU a better place in which to live and work. It considers R&I being at the heart of its policies to boost jobs, growth and investment.

> "Research and innovation contribute directly to prosperity in the EU and the well-being of its citizens and society."[43]

Indeed, research and innovation can a leading position to a country in any aspect. The issue can be healthcare for its citizens or alternate energy source for the industry.

According to the EU, R&I lie at the heart of Europe's economic strategy and make a critical contribution to the development of its society and cultures.

> "They are a key source of new jobs, growth and competitiveness and underpin a wide range of policy priorities including digital Europe, energy efficiency and sustainability. (…) Our focus is on research as an investment and hence the economic dimension but we also address returns which materialise as social benefit in health, environment and other grand challenge areas. It is also important to acknowledge the value of research as consumption through its intrinsic value as a cultural good and symbol of human achievement.
>
> (…) While it is undoubtedly true that some of the economically transformative effects of research take a considerable time to achieve their full economic weight."[44]

[43] EC (2016), 'The EU explained: Research and innovation'
[44] EC (2015), 'Value of Research', p 4

The above EU statements on one side underline the importance it gives to the subject of R&I. On the other side, it tells about the economic benefits of R&I.

3.3 IMPORTANCE OF R&I FOR ECONOMIC GROWTH

Economics of R&D is a major discipline within economics and business studies. It is primarily concerned with the benefits, costs and reasons for investing in research and development.[45]

Almost 100 years ago, Joseph Schumpeter (1911) wrote one of the most influential works on the subject of innovation – 'Theory of Economic Development'. It describes the entrepreneur as an innovator who efficiently combines resources, adopting new technical improvements in machinery and organising more efficiently the division of labour. In the literature, there are several inter-related assumptions and theories that deal with the subject of R&D (e.g. Dosi et al. 1988, 'Technical Change and Economic Theory').

Technology is now well recognised to be one of the major determinants of economic performance such as productivity and trade performance (Laursen[46] 1999, p 341). Scientific excellence and technological innovation are, more than ever before, preconditions for economic competitiveness and hence for job creation and economic and social progress.

3.4 THE NEED FOR PUBLIC INTERVENTION AND SUPPORT

Why is the EU spending public money on scientific research and related activities? Is it not better to leave the research and innovation to private industry, which shall make investments according to the market requirement?

[45] The study of economics of R&D is quite vast and may contain answers to such questions as: Who are the drivers of innovation and who invests in R&D? Which market structure is most conducive to R&D? Is market power a prerequisite for innovation? Is the level of R&D activities in firms optimal from the perspective of the society as a whole? What is the effect of R&D on aggregate long run growth? How best to manage R&D in a given economic and political environment?

[46] Laursen Keld (1999), 'The Impact of Technological Opportunity on the Dynamics of Trade Performance', in Structural Change and Economic Dynamics

Renowned economists such as Kenneth Arrow (1962) argue for state intervention in support of research and technological development. The majority of the economists are of the opinion that it is appropriate, in fact very rewarding, for the governments to spend on scientific research. They argue from the point of view that science and technology has benefits for the society as a whole and should be encouraged and supported by the state.

Research, innovation and its diffusion need huge financial outlay investment. Private firms in an open economy invest in scientific research only if the expected return for their investment is higher than the expected risk associated with the research. However, many kinds of research carry non-predictable risks (uncertain outcome). Private firms generally avoid such research unless supported by the government. Since the competitiveness of the advanced economies depends on innovation, particularly in high-tech industries, economists call for government subsidies for research and development (Kirsty Hughes 1993, p 139).

Indeed, governments have an essential role in supporting scientific research and technological innovation.

Firstly, they are the providers of basic public goods – education. They also regulate the economy and safeguard appropriate competition within the economy, so that the society as a whole will have maximum benefits In the USA, a leading industrial nation, the Universities do most of the basic research which is funded largely by the federal and state governments.

> "While the private sector has a key role to play in making innovation happen, government must provide three key public-good inputs that allow innovation to blossom: investments in human capital, infrastructure, and research."[47]

[47] Sean Pool and Jennifer Erickson (2012), 'The High Return on Investment for Publicly Funded Research' at https://cdn.americanprogress.org/wp-content/uploads/2012/12/InnovationResearchInvestments-1.pdf (Centre for American Progress), accessed on 27 May 2017

We live in a free-market society, with its basic rules of supply and demand. Competitive markets are normally viewed as having a number of inherent advantages, such as the efficient allocation of resources, the maintenance of consumer choice, the promotion of technological innovation, and the autonomy of industrial enterprises, which is believed to be important for long-term economic progress. Could we then not leave the production, pricing and distribution of scientific and technological knowledge simply to the market forces? Interestingly, a majority of the eminent prominent economists don't agree with this proposition.

> "To say that economic growth in the modern era has been grounded on the exploitation of scientific knowledge is to express a truism. (...) Most of the industrial nations and many among the Developing countries today acknowledge this, and virtually all societies in which modern science is practised pay at least lip service to the belief that it is important to pursue some form of 'science policy'." (Dasgupta[48] & David 1994, p 487)

The common argument among economists is that governments should fund basic research because industry will not. They claim that industry will not for two reasons: first, the outcome of basic research is unlikely to be commercially applicable directly. Second, the discoveries of basic science invariably become widely known, slipping into the hands of competitors. That means private investors can't reap all the benefits of the basic research for which they pay. Ammon Salter & Ben Martin[49] (2001) assert that benefits from public investment in basic research can take a variety of forms. Hence they reconsider the rationale for government funding of basic research.

[48] Dasgupta and David, (1994), 'Toward a new economics of science', in Research Policy, No. 23, pp 487-521

[49] Salter Ammon & Martin Ben (2001), 'The economic benefits of publicly funded basic research: a critical review', in Research Policy, Vol. 30, pp 509-532

Kenneth Arrow has offered the most powerful argument for the government funding of R&D[50]. He observes that there are three categories of economic problems, which make it inadvisable to leave the allocation of resources for invention to the market mechanism. These are uncertainty, indivisibility, and inappropriability.

The following four paragraphs contain a substantiation of Kenneth Arrow by Peter Stubs [51](1997, pp 139-141).

It is quite obvious that there is the risk of uncertainty in every basic research project: the project might not deliver the required results or fail altogether. Even if there is a success, the time consumed might be a lengthy one and a speedier rival might be the one to benefit. There is also a bigger problem of translating basic research results into a tangible product and to market it. For most private investors, including even large corporations, all these risks and uncertainties involved are disincentives against investing in basic research. However, basic research is the bedrock of technological progress that has the potential to yield immensely important advances such as the microchip or genetic engineering.

In contrast to the private investor, governments are concerned with the betterment of the whole society. Moreover, they can pool the risks, since they are bigger than their national companies and may be able to consider longer-term benefits from the social rather than the private point of view. It does not matter to the government which company exploits the research findings, as long as they are exploited. There is a further benefit from the public funding of basic research. Where a private research body would want to maintain its property rights, the public source can be more open.

A public-health research programme, analogous to a public-health investment such as urban drainage, benefits a whole community.

[50] Kenneth Arrow became a Nobel laureate in economics in 1972
[51] Stubs Peter (1997²), 'Science and Technology Policy'

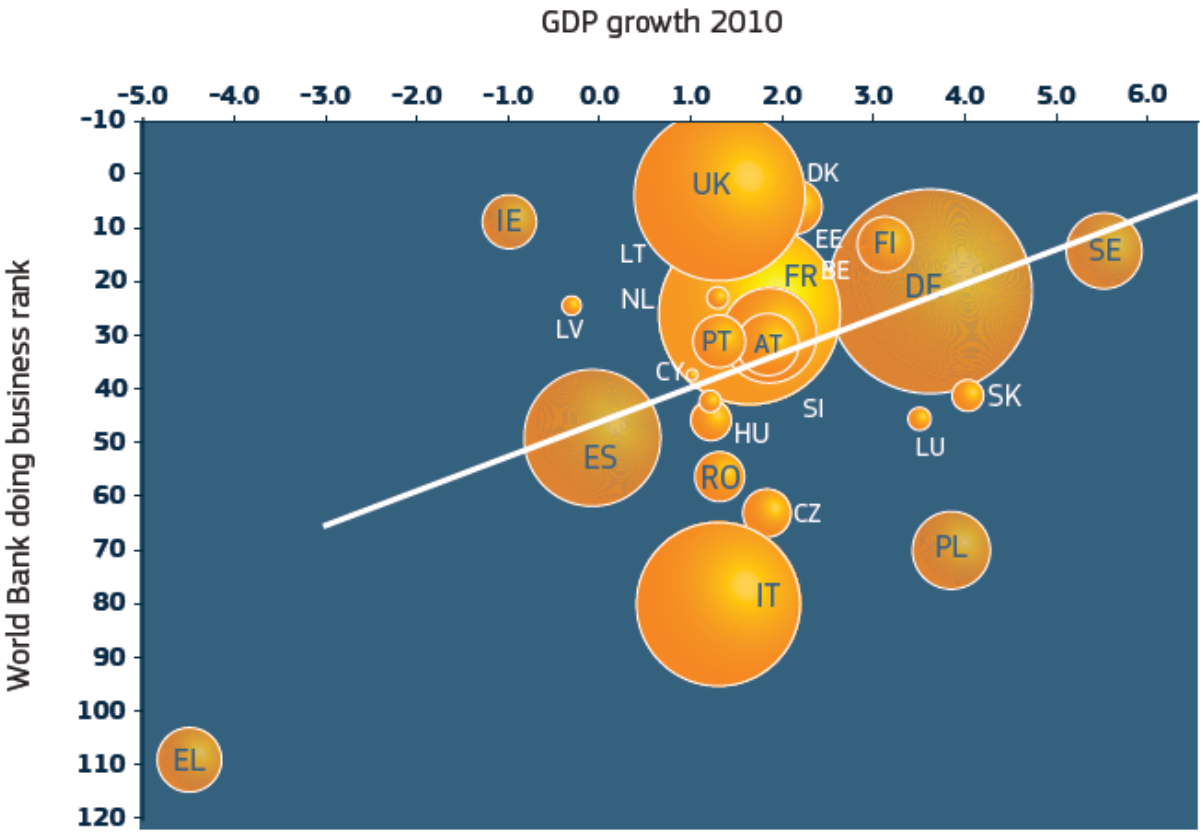
However, given the choice of whether to contribute to its costs, some people could become free riders. They are likely to enjoy the benefits without making any contribution to the costs. In this case, it is better to fund and operate the project at community level. There may also be indivisibilities in the process of research itself. Where an industry is atomistic, with many small producers, no single member may be able to afford a worthwhile R&D facility. In agriculture, a multitude of competing farmers are most unlikely to do systematic R&D; individually they lack the assets, the expertise, and the incentive. Centralised R&D, supported by a levy on users can overcome this problem; this solution can be applied to specific industrial processes or other small-scale industries by establishing research associations.

Ideas are easily stolen. If others threaten much of the originator's benefits through copying and illicit application, there is no immediate social loss – indeed there may seemingly be social gain if the innovation is diffused. A related issue concerns the benefits, which accrue to users, as distinct from the innovator. Governments may give support for innovation on the grounds that there are social benefits from innovation beyond the private benefits, which accrue through the payments to the innovator.

Social returns to innovation are always estimated to be substantially higher than the private returns. However, they are quite asymmetric among trading partners and industries. Further, most the private return to government supported R&D is less than privately supported R&D.[52]

[52] Hall, Mairesse, and Mohnen (2010), 'Measuring the Returns to R&D', p 32

Figure 4: Growth in EU countries versus their investment in R&D
As percentage of their GDP
Source: EC (2013), Innovation Union, p 7



Keith Pavitt (1998) argues that innovation studies in the past 25 years have shown that technologically dynamic firms depend heavily on the close proximity of publicly funded academic research and related training.

3.4.1 ARGUMENTS AGAINST GOVERNMENT INTERVENTION

Not all writers vouch for state intervention in promoting science and research. Especially, the supporters of market capitalism and of political regimes that are ostensibly hostile to centralisation and government planning in economic affairs have other opinions. Their position, in so far as the management of science by the state is concerned, is one of deep suspicion. A good example is Terence Kealy[53] (1996). He asks, "If State-funded research promotes economic, cultural or even scientific growth, why do Japan and Switzerland flourish in its near-absence while Russia and India have stagnated in a sea of government largesse?". Naturally,

[53] Kealey Terence (1996), 'The Economic Laws of Scientific Research'

such a position has added support because of the comparative success of market capitalism and the manifest dysfunction of socialist and communist systems not long ago.

Lal[54] (2000) states that markets are characterized by widespread imperfections, but attempts to remedy them by government intervention usually introduce further distortions due to limited information on the part of planners and incentive compatibility.

[54] Lal Deepak (2002), 'The Poverty of Development Economics'

CHAPTER 4

WHY AND HOW DID THE RESEARCH POLICY ORIGINATE?

> World peace cannot be safeguarded without the making of creative efforts proportionate to the dangers which threaten it.
>
> Robert Schuman (in Schuman Declaration, 9 May 1950)

4.1 INTRODUCTION

The Single European Act (SEA) of 1986 made it a legal and political obligation to conduct scientific research. The Framework Programmes are based on this obligation and today they cover EU research and innovation activities in a comprehensive manner.

But, if one looks at the history of this policy, one realises that it was not the case at the beginning. The Policy got evolved progressively over the years. It started with the sectoral developments – such as the production of steel and coal or atomic energy. This area-wise growth spanned several years before an extensive policy was put in place. By the time, the research policy first became concretised with treaty articles[55] in 1986, there were already significant and institutional based undertakings established.

At each stage of its evolution, the EU scientific research policy was influenced by other political, institutional, social, and economic developments within the Communities. Conversely, the developments within the science and research policy influenced development of the Communities itself.

In this analysis of historical-political aspect, I am going to examine the way the policy got a start, under what circumstances it carried on, and its contribution to the integration of Western Europe.

> "European funding for research activities was envisaged in the first Community Treaties, related to coal and steel and nuclear energy,

[55] Article 130f of Single European Act 1986

and was extended in the early 1980s with the establishment of a European framework programme for research. Research policy was subsequently progressively integrated in the Treaties, to become a shared competence between the European Union (EU) and its Member States."[56]

4.2 TIMELINE OF EU RESEARCH ACTIVITIES – MILESTONES

Figure 5: Timeline and milestones
Source: European Commission 2015, Horizon Special Issue, p 6-7

1951 Treaty establishing the European Coal and Steel Community (ECSC) signed. It provides for the funding of research for the coal and steel industries.

1957 Treaty establishing the European Atomic Energy Community (EURATOM) signed. It provides for research into nuclear energy between countries. The Joint Research Centre (JRC) is launched. It provides independent scientific and technical advice to the European Commission.

1981 Étienne Davignon becomes European Commissioner for Industrial Affairs and Energy and decides to rationalise research funding under a single framework.

1984 First Framework Programme (1984-1987): EUR 3.3 billion

1986 Single European Act signed. It includes, for the first time in an EU Treaty, a chapter on research.

1987 Second Framework Programme (1987-1991): EUR 5.4 billion

1990 Third Framework Programme (1990–1994): EUR 6.6 billion

1994 Fourth Framework Programme (1994-1998): EUR 13.2 billion

1998 Fifth Framework Programme (1998-2002): EUR 14.9 billion

[56] European Parliamentary Research Service 2015, 'Overview of EU Funds for research and innovation', P 1

2000 The Lisbon European Council launches the European Research Area (ERA).

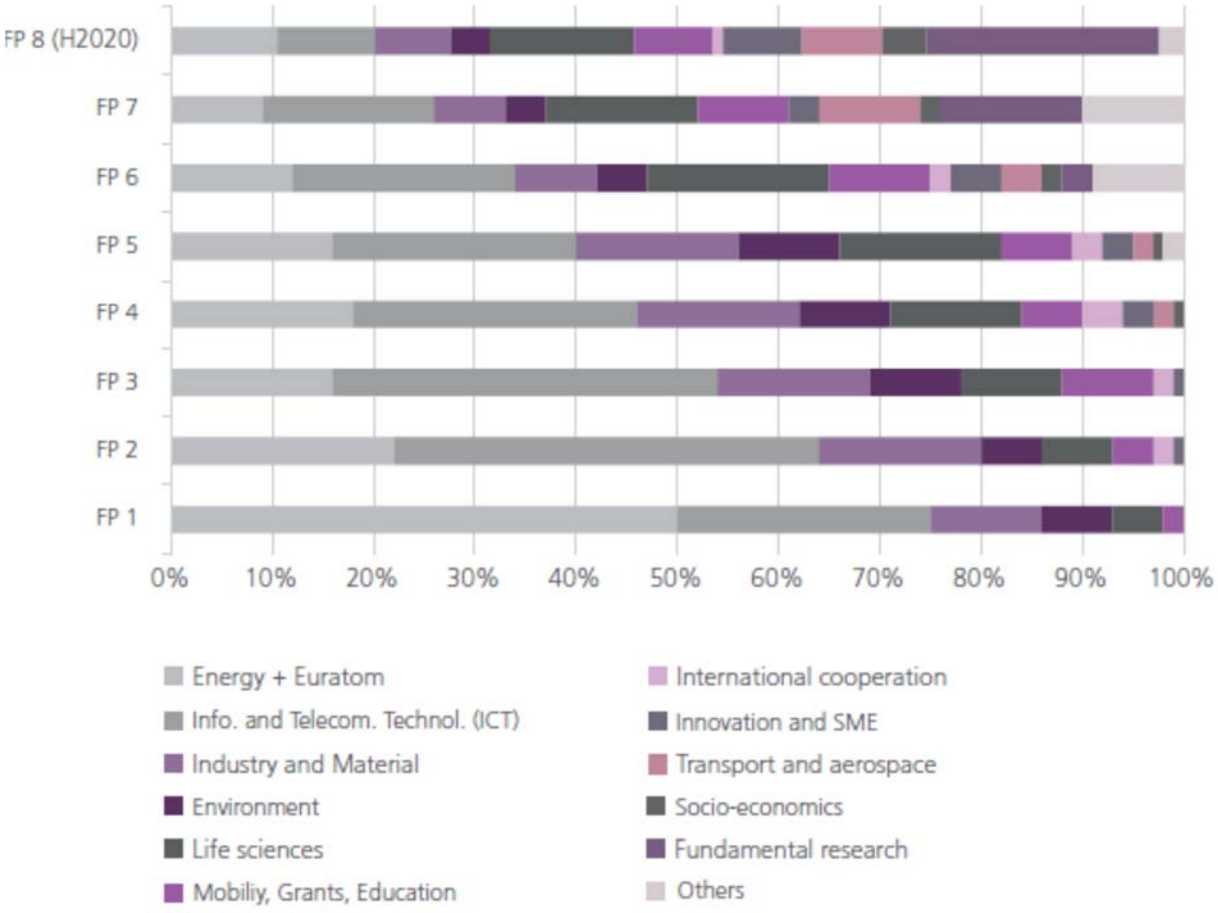
2002 Sixth Framework Programme (2002-2006): EUR 19.3 billion

2007 Seventh Framework Programme (2007-2013): EUR 55.9 billion

2007 Treaty on the European Union (Treaty of Lisbon) signed. The European Research Council (ERC) is launched. It funds frontier research.

2014 Horizon 2020 (2014-2020): EUR 80 billion.

Figure 6: Relative development of the thematic priorities of research
Source: Swiss Federal Department of Economic Affairs, p 14, original source: EU Commission



4.3 THE IDEAS ABOUT EUROPE AT THE BEGINNING

After the ravage and destruction experienced in Second World War, the European nations wanted to start a new chapter in their relations. They wanted to bury their past and to start a future of co-operation. They were also looking for a political construction that would make any future military confrontation impossible. And new ideas how they can do this came up.

> "Among the protagonists of European co-operation and integration in the aftermath of Second World War, two major views were prevailing: One from federalists, who placed primary emphasis on the superseding of the nation state and with a plan for a federal European order based on a written constitution. The other one from functionalists, who saw the need for economic co-operation and thereby interdependence among the states as the prime deterrence of conflicts and wars."[57]

Also, the USA – which was as much involved in the war as the Europeans – wanted to see co-operation among the European nations. With its help, quite a few institutional arrangements were set up in the second half of 1940s, albeit in Western Europe due to the onset of Cold War. These arrangements were either in the economic or in the security fields: In 1947, the Economic Commission for Europe (ECE) was founded. Also in 1947, the European Recovery Programme (ERP), popularly known as the Marshall Plan, put in place. In 1949, North Atlantic Treaty (NATO) was signed.

The first step towards economic integration came at the start of 1948 with the creation of the Benelux customs union, which was to serve as the precursor to the European Economic Community (EEC). Of wider geographical significance was the foundation, in April 1948, of the Organisation for European Economic Co-operation (OEEC), with its key

[57] Bulmer (1997), 'History and Institutions of the EU', p 9

governing body, the Council of Ministers. The OEEC ensured fulfilment of the US condition that reconstruction should be co-ordinated, and that tariff reductions should be implemented.

At this time, there seems to be no significant programme for scientific and research in Europe. An exception was perhaps the UK – thanks to its special relationship with the United States. Among the areas of co-operation and integration, science and technology were still untouched at this stage:

> "In the immediate post-war period, in a Europe which was physically and morally in ruins, science and technology were not major government preoccupations."[58]

However, some eminent political figures in Europe, such as Jean Monnet[59] and scientists were of the opinion that scientific co-operation could make a contribution both to reconstruction and to uniting Europe. The primary objective of the Council of Europe, created in 1949 at the instigation of The Hague Congress, was to encourage the co-operation of Member States in legal, social, administrative and *scientific* affairs (Guzzetti, 1995, p 2). This reference to science was due to the presence in the European Movement (EM) of a number of influential science administrators, including Raoul Dautry.[60]

4.4 ECSC (1951)

The European Community for Steel and Coal (ECSC) is the starting-point of the Community method of supranational integration.[61] This sectoral

[58] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 2
[59] Monnet, a technocrat, was head of the French Commission for Economic Planning in the aftermath of Second World War. He was a *Functionalist* who saw the need for economic co-operation as a starting point for achieving *Federalists'* objective of a united Europe. The Schuman Plan, named after French foreign minister, had in fact been elaborated by Jean Monnet (Stubbs, 1997).
[60] French arms minister before the war and general administrator of the Commission á l'Energie Atomaique (CEA) at that time.
[61] Bulmer (1997), 'History and Institutions of the EU', p *

integration coal and steel created *important path dependencies* concerning some structural characteristics and policy solutions.[62]

It was the first institutional step towards the development of a common market in Western Europe. But what significance did it have on the R&D in Europe? What kind of political and economic land mark did it leave behind?

On 9 May 1950, Robert Schuman, the French Foreign Minister 1948-52, presented the "Schuman Declaration" in which he proposed placing both French and German production of coal and steel under a single authority.

The plan was to create a supra-national body which, unlike the Council of Europe, would have real powers, although in a limited economic field. At this time, steel and coal was considered as the important raw material for war. By supervising and keeping an account of coal production, especially of German production, it was easier to expel a fear that German might be secretly reverting back to its war machinery. Apart from political aims of Franco-German reconciliation and creating a new system of post-war European relations, the idea was concerned with the higher goal of a common market, albeit confined to the coal, steel and related sectors.

> "In two areas, coal and steel, which were crucial for laying to rest the ghosts of war, and nuclear power, which held the promise of a major new industrial development, the political will was strong enough for a few bold people to break new ground."[63]

The ECSC Treaty was signed in Paris in 1951 and comprised the following members: Belgium, the Federal Republic of Germany, France, Italy, Luxembourg, and the Netherlands (EC6). It came into effect from 23 July 1952.

---

[62] Kaiser Wolfram and Leucht Brigitte (2008), 'Informal Politics of Integration: Christian Democratic and Transatlantic Networks in the Creation of ECSC core Europe', in Journal of European Integration History, Vol. 14, p 35

[63] Tindemans (2011), 'Post-war research, education and in novation policy-making in Europe', in European Science and Technology Policy, p 12

Generally, the creation of the ECSC worked out easier than expected.[64] The Treaty of Paris of 1951 was a complex commercial treaty establishing the ECSC as a regulated market sharing arrangement under supranational control.[65] The issue of a common Research and Innovation Policy was not on the cards at this time. Nevertheless, given that these sectors were then regarded as the *backbone* of the industry and economy, the ECSC was concerned with core activities of the then six members of the Community. One of the chief aims of ECSC was the rational expansion and modernisation of coal and steel industries. Article 55 of ECSC Treaty gave the High Authority[66] the task of encouraging *research into technological* and economic aspects of production and growth in the consumption of coal and steel; it was also to foster research into matters affecting safety at work in these industries.[67]

The ECSC was not considered as specifically promoting research and technology development. But, from 1955 onwards through its specialised committees on mining technology, exploitation of coal, and steel technology research, it offered support to studies set up by the industry. It also co-ordinated research projects to avoid duplication and directly financed a number of projects. This work was frequently carried out in collaboration with British public bodies, a fact which verifies the wind of integration in the areas of research at an early stage.

Example of research undertaken in this first phase include the complete mechanisation of galleries, the extraction of coal, the technical development of coking, testing different qualities of coke for use in blast furnaces, the technical processes of rolling and the irradiation of flames (Guzzetti, 1995, p 4).

In operation, the ECSC was regarded initially as successful. Production and interstate trade in coal and steel increased markedly, although how

[64] Harrop (1992), 'The Political Economy of Integration in the European Union'
[65] Dedman (1996), 'The Origins and Development of the European Union' p 61
[66] High Authority is equivalent to the European Commission of today. In fact, with the merger Treaty of 1967, the Higher Authority got absorbed into the Commission of the European Communities.
[67] European Parliamentary Research Service, 2015

much of this could be attributed to the ECSC's existence is open to question (Bulmer, 1997, p 15).

4.5 EURATOM (1957)

The EURATOM assured in a new era for European R&D. If one is able to analyse EURATOM, he is able to understand the complexity of managing the issues of R&D in the European Union of today.

The EEC treaty expanded the joint activity of EC6 considerably. The Treaty had the goal of abolishing customs between the members and adopting a Common External Tariff (CET) on goods entering from other countries. For that reason, matters such as competition policy, freedom of labour and capital, customs unions, state aid, and the harmonisation of national laws were placed within the Treaty's area of competence.

However, there was no provision in the Treaty for science and technology. This state of affairs fell short of an earlier proposal of the plan for "European Technological Community" by Jean Monnet and the Action Committee for a United States of Europe. But, there was some recognition of a technological issue in respect of civilian atomic energy. Monnet by 1955 had become enthusiastic about the collective commercial development of atomic energy by "the Six[68]", given the success of ECSC. Joint European action on the nuclear front was an attractive prospect in the mid-1950s as it would reduce dependence on Middle East oil and American coal.[69]

The 1950s saw an increase in the need for new energy sources. The Arab oil embargo in the wake of the 1956 Suez crisis gave urgency to this matter. The focus was on two sources of energy: coal, the traditional source, and nuclear energy, which was regarded as the energy source of the future.

[68] The six founding members of the ECSC and thereby the European Community.
[69] Dedman (1996), 'The Origins and Development of the European Union', p 98

At that time, atomic energy was an important frontier of science. It was scientifically challenging and exciting. It was expected, in time, to provide very cheap power, and potentially could release Europe from its heavy dependence on deep-mined coal and imported oil. It was an area where there ought to be **economies in conducting R&D collectively**. And Europe did not want to be left behind. The USA and the Soviet Union were fast moving in the research of nuclear energy programmes. However, they were not willing to share their knowledge because of its military implications.

At the same time, France had begun to develop a civilian nuclear programme and saw an opportunity for financial support by its EEC partners for its extension and developing a market for French technology. Against this background, the EURATOM Treaty was also signed in Rome in 1957. Both the EURATOM and the EEC came into effect on 1 January 1958.

> "Although with hindsight it may seem strange given the differing destinies of the two Communities, at the time of their creation the greatest hopes were placed with EURATOM, while the Common Market seemed to be an exercise that would be more awkward to arrange and altogether of lesser importance."[70]

What was the initial influence of EURATOM for the integration of Europe? Like the other two Communities, EURATOM was one more step forward in interdependence. If it were not for the interest in EURATOM, French political circles would not have possibly come to terms with the idea of a Common Market. But, the members of the EC6, led by Germany, were inclined towards a generalised economic integration. As such, the deal was to form both the Communities, which further strengthened the motion towards European integration on the basis of functionalism. EURATOM therefore represented another step in the construction of Europe.

[70] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 7

4.5.1 THE AIMS OF EURATOM

What does the EURATOM reflect in the context? Article 4 of the EURATOM Treaty gave the Commission, the executive arm of the Community, the task of promoting and facilitating the nuclear research of Member States, and integrating them through the implementation of the Community's research and training programme.

In EURATOM's first general report, some of the aims of this research and training programme are listed: to avoid duplication, to co-ordinate national contributions, to cover gaps in national programmes, to standardise measures and equipment, to promote the exchange of ideas and methods, but also its own research and activities aimed at directing research. These basic conceptions are continuing unchanged till today in the management of EU R&I Policy.

The development of nuclear research had a central place in the EURATOM Treaty, and in time it became clear that this was the only task which the Community was able to carry out. The interests of the United States, the main ally of the six Community countries and the foremost supporter of the foundation of EURATOM, did match partly with that of Europe and not at all with that of France. The USA expected the birth of a European Community in the nuclear sector to encourage the political and economic strengthening of Western Europe as an anti-Soviet measure. And it wanted to channel European research exclusively towards peaceful uses of the atom, and eventually to provide a new market for American industries.[71]

The general aims of the Community, in the nuclear field as elsewhere, was the creation of a real common market. The main aims of EURATOM, set out in Article 2 of the Treaty, fell into four main categories: research and the dissemination of knowledge; investment in the development of nuclear industry within the Community; the laying down of regulations, particularly on health matters; and public administration at the

[71] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 9

international level, that is the supervision and management of nuclear fuels and the maintenance of relations with non-members states and international organisations.

What was EURATOM's impact on the scientific community of Europe? At first, EURATOM's activities were concentrated on research and training in the nuclear sector. Accordingly, Joint Nuclear Research Centre (JNRC)[72] was set up to conduct a five-year research and training programme and was established on several sites. Some commentators at this time foresaw a stronger role for EURATOM than the EEC.[73]

But, these expectations were dampened because of several factors: rivalry between the German and French nuclear industries, the bad design of JNRC's reactors and the stable oil prices in the 1960s. As JNRC was left with nuclear scientists but little or no nuclear work to do, gradually it was converted to Joint Research Centre (JRC). Its main base is at Ispra in northern Italy, with others at Karlsruhe in Germany, Petten in the Netherlands, and Geel in Belgium. Generally, EURATOM is considered as a failure and a critical one.

In addition to conducting in-house research through the JRC, EURATOM financed and participated in research through various types of contract: this was what was officially known as "research by indirect means". During the period from 1958 to 1967, such contracts absorbed in total around 350 million Unit Accounts (U.A.),[74] more than half the entire budget for EURATOM for this period.

4.6 TOWARDS THE CRISIS

A state's conduct in international relations can be explained by several theories: realism, neo-realism, liberalism, interdependence-analyses, federalism, functionalism, intergovernmentalism ... In the case of the

[72] The initial name of the Community's laboratories was Joint *Nuclear* Research Centre. This changed with the passing of time for certain obvious reasons to Joint Research Centre.
[73] Stubbs (1997), 'Science and Technology Policy', p 149
[74] Till 1979, the European Communities used a number of units of account (U.A.) for their different policies. All these accounts maintained parity with the dollar.

European Union, the Members behaviour has been intergovernamentalism and neo-functionalism.

In mid-1958, soon after the EEC and EURATOM Treaties came into effect, Charles De Gaulle returned to power in France. His opinions on European integration were very clear and well publicised, and set the tone for the whole decade to come: *the state alone was sovereign, any federalist aims were to be excluded a priori, and Europe could exist only as a meeting place for legitimate national governments*.

> "Although supranational schemes were anathema to General de Gaulle who believed in the sanctity of the nation-state, he nevertheless agreed to honour French commitments to the Treaty of Rome."[75]

It is obvious that Gaullist nationalism intensely effected the Community spirit which was beginning to develop in the new European institutions. When the mandate of the President of EURATOM Commission, Etienne Hirsch, a disciple of Monnet, expired in early 1962, it was not renewed on the instruction of De Gaulle. In his place a Gaullist, Pierre Chátenet, was appointed, who remained in the post until the Community executives were merged in June 1967. This became known as the "Hirsch Case", a policy clash which saw France on one side and the other five countries of the Community on the other, and the settlement of the problem had very important effects on the institution: it sanctioned the principle whereby all the important decisions taken by the Council of EURATOM had to be approved unanimously, thus giving each government the right to a veto.[76]

The need to operate via consensus among the Council helps to explain the stop-go nature of some of the early experiments.[77] The Directorate General responsible for industrial affairs, was not established until 1967,

[75] Dedman (1996), 'The Origins and Development of the European Union', p 112
[76] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 24-25
[77] Sharp (1991), 'The Single Market and European Technology Policies in Technology and the Future of Europe', p 61

and then took some time to choose what its proper part should be. Initially it decided on an active stance, encouraging trans-national mergers, but became caught between West Germany's liberalism and the more interventionist attitude of the French.

In 1964, it was decided to revise the budget of the second five-year programme. The Commission was asking for an additional 50 million U.A. in order to fulfil its research programme. In the Council, the quarrel was general. France accused EURATOM of wasting its resources on too many unimportant research projects and of assigning contracts following the principle of *juste retour* instead of criteria of efficiency and economy. France also expressed annoyance on political grounds: EURATOM had put up a weak defence against American commercial hostility. Germany, on the other hand, attacked France's state control of the industry and insisted on greater liberalisation of the nuclear market, in which the resourcefulness should come above all from the industry itself.

> "The revision of the second five-year programme made it plain that any "community spirit" had vanished from EURATOM, to be replaced only by a "juxtaposition of national egos" which would be difficult to reconcile."[78]

The joint research programmes fell victim to both mistaken assumptions about the future role of nuclear power –which many in the 1960s saw as central to the future economic wealth of the industrialised world – and the nationalistic drives of the individual power plant manufactures, whose traditional linkages were with American not European firms and who had, in any case, licensed American nuclear technology and were anxious to exploit it.[79]

[78] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 29
[79] Sharp (1991), 'The single market and European technology policies in Technology and the Future of Europe', p 62

4.7 FEAR OF AMERICAN DOMINANCE

Apart from the political and economic necessities that were driving a common R&D policy among the Community Members, there was also one important external factor which added leverage to the issue: the dominance of America in technology and science. Although America with its military machine was the closest ally and was instrumental in rebuilding Europe with its Marshall plan, its continuing supremacy in innovative technology products became a worrying factor.

In the mid-1960s a debate emerged in Europe about what came to be known as the "technological gap" with America. Although the post-war years had been a time of exceptional economic growth in Western Europe, it was suddenly realised that simultaneous developments in the United States were quantitatively superior. In America, technology was revolutionising industry and society: the organisation of work was being transformed, new sectors were created from nowhere, and the pace of innovation was at superfast.

This debate was of fundamental importance to the development of science and technology policies at both national and European and Community level, even involving the UK, which was the most technologically advanced European country in many areas, but was still not a member of the European Communities. One of the best-known products of this debate is an imaginative book by French author Jean-Jacques Servan-Schreiber titled *Le défi américain*, meaning the American Challenge. It is all about a technological war waged by American firms such as IBM and General Motors on European soil. If the Common Market was to remain a mere free trade area, unsupported by adequate political and economic institutions, this could only help her rivals.

Faced with the commercial and technological offensive of the United States, individual European governments had proposed and tried out, at national level, three different policies, or a combination of them. The first consisted in encouraging those American companies which had European

subsidiaries to expand in the Common Market; the second was to acquire technological know-how from the USA, abandoning costly research and innovation and retaining only industrial production; the third option was a rigidly protectionist policy which would exclude all American investment in Europe. The obvious inadequacies and possible dangers of these policies suggested a different approach, the Community option: if European states wanted to meet the American challenge they must join forces, creating a whole which would be greater than the sum of their parts.[80]

[80] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 37

CHAPTER 5
HOW DID THE POLICY DEVELOP FURTHER?

> Europe will not be made all at once, or according to a single plan. It will be built through concrete achievements which first create a de facto solidarity.
>
> Robert Schuman (in Schuman Declaration, 9 May 1950)

5.1 INTRODUCTION

In the late 60s, the political situation in the Community started relaxing with the weakening of France's position internationally. One reason was that the May 1968 Students Revolution undermined the power of the government internally; another reason was that the Warsaw Pact invasion of Czechoslovakia in August 1968 spelled the end of de Gaulle's hopes for a "Europe from the Atlantic to the Urals" in which collapse of power blocs would allow France to lead wider European policies in all fields.

In the summer of 1969, President de Gaulle resigned and his successor, Georges Pompidou, although nominally continuing Gaullist guidelines, displayed signs of an increased openness towards his European partners (Guzzetti, 1995, p 41).

In October 1972, a new summit of heads of State and Government took place in Paris, and decided that the Communities should adopt a series of new common policies in the field of the environment, the regions, social policy, industrial and energy policies, technology and education. The final declaration of the Paris Conference defined its objective in the R&D sector as the one of safeguarding the development of *common policies* in the field of science and technology. Once again, the prominence was on joint Community action rather than intergovernmental initiatives.

In 1972, Altiero Spinelli[81] became Commissioner and undertook to define a Community policy. He was convinced that the European Communities

[81] Spinelli was an Italian anti-fascist who drafted his manifesto for a free and united Europe in 1941. The central theme was that conflicts between separate sovereign states would inevitably lead to global war.

should be actively involved in financing research in Europe and in rationalising its organisations, for example, through centre of excellence. He also wanted that this should not be limited to basic science but should also include applied research and that research and industrial policy should go hand in hand.[82]

On 1 January 1973, UK, Ireland and Denmark officially joined the European Communities. Following this enlargement, the Commission too, increased in size, and the various portfolios were redistributed.

A new Commissioner, Dahrendor, inherited the Research. He proposed in his Work Programme research projects in a general context of cultural development, deviating strongly from his predecessor. As regards basic research he proposed to set up a "European Scientific Area" which would result in greater co-operation between Member States. Research and development, in Dahrendorf's view, should be focused on two great objectives: improving the quality of life and regenerating European industry.[83]

14 January 1974 is a historic date for R&D in the European Communities. Following the request made by the Heads of State and Government at the Paris Summit of 1972, the Council adopted four resolutions in the field of science and technology.

These resolutions were fundamentally based on the Commission's suggestions and were not especially ambitious. But they were the first of their kind and a great number of future Community initiatives would be based upon them.

The first resolution was general in character and concerned the co-ordination of national policies and the definition of projects of Community interest in the areas of science and technology.

[82] Peter Tindemans (2011), p 14
[83] This view has continued to reflect, and eventually occupy, a dominate position in the following R&D Policies.

The second resolution concerned the collaboration of the Communities in the establishment of a European Science Foundation (ESF), to be modelled on the American National Science Foundation, to oversee the development of fundamental scientific research.

The third resolution of the Council established the necessity for the Community to have its own science and technology policy which would integrate the research programmes already set up by the Communities.

The fourth and last Resolution set up a specific scheme, which was in a way introductory to the formulation of a Community science and technology policy.

5.2 THE FIRST RESEARCH AND DEVELOPMENT ACTIVITIES (1974-1979)

The Council's decision in 1974 on the progressive development of 'a common policy in the field of science and technology' is a significant milestone in the history of EU's RTD Policy. The scope of this decision, articulated in four resolutions detailed above, is twofold: to coordinate the Member States' policies and to implement Community research programmes and projects.

This sounds simple nevertheless was difficult in practice. The finances available to the EC for implementation was between 1 and 2 percent of public funds spent by the Member States on R&D support. Moreover, the oil crisis, followed by the Arab-Israeli War of October 1973, plunged the economies of all Western countries into a critical situation and prompted European countries to make huge cuts in their budgets, including those of scientific and technological research.

This world crisis also brought to maturity a series of reflections on the model of economic expansion and its limitations. Thus, the themes of the environment and its protection, the demographic explosion, and the relations between North and South were all pushed into the limelight. The interweaving of the economic crisis with reflections on the ultimate aims

of technological development provoked questions about the type of research which had been the subject of investment over the previous twenty years, and whether it would be possible to pass from "big science" to a kind of research that was less expensive and more responsive to the needs of ordinary people.

In this context, the Commission proposed in 1977 a broadening and modification of Community research. It first identified four general objectives for science and technology policy, which correspond to the political aims of the Community:

1) the long-term supply and conservation of resources, such as raw materials, energy, agricultural resources and water supplies;
2) the promotion of economic development through the competitiveness of industry at an international level;
3) the improvement of living and working conditions;
4) the protection of the environment and of natural resources.

In addition to that, there were eleven "specific" selection criteria. These included cases where costs or required R&D capacity would be too high for a single nation to bear them, or where there would be savings through joint efforts. The need for standardisation of measures and information systems was also noted.

All these worthy aims posed a number of problems in implementation. To begin with, the financial means available were not sufficient. In 1977, the Community research budget was 188 million U.A. Further, there was a problem of cooperation among Member States, as each of them was following a distinct research and development policy, depending on the advancement in industry, economy and the skills available. Moreover, how should science and technology relate to other policies?

By the late 1970s, the Commission had begun to address some of the key issues concerning science and technology and establish tentative proposals for action. But these bore the stamp of a hesitant bureaucracy

rather than the confidence which marked the execution of policy by the Ministry of International Trade and Industry (MITI) in Japan.[84]

5.3 ESPRIT – A WATERSHED IN COMMUNITY POLICIES

In the 1970s, the European governments intervened heavily to defend their industries in the area of information technology (IT) against American giants, particularly IBM. The French as well as the British started grand plans to foster their national companies. One idea was to merge companies, on the ground that size was a key factor in competitiveness. In these two countries and in Germany lucrative public-sector contracts in IT were steered towards the respective 'national champions'. For the communication technology, the defence sector in France and in Britain was an important public purchaser.[85]

The end of 1970s saw rapid development in the field of information technology and Europe losing its ground not only to American firms, but also to Japanese and to South East Asian.

In 1975, the EC had a positive balance of payments in information technology, but it was in deficit by 1982.[86] Europe's shares of world production in semiconductors and integrated circuits were declining, foreign penetration of the European market was increasing, and European semiconductor manufacturing was unprofitable. Over four-fifths of the European and computer market was held by US firms. Moreover, USA and Japan were both pursuing ambitious research programmes in search of future IT leadership. In the case of Japan, a programme called VLSI (Very Large Scale Integrated Circuit) project, in which all major Japanese semiconductor manufacturers participated, made the Japanese gain world

[84] Stubbs (1997), 'Science and Technology Policy', in The Economics of the European Union, p 153
[85] Sharp (1991), 'The Single Market and European Technology Policies in Technology and the Future of Europe', p 63
[86] Stubbs (1997), 'Science and Technology Policy', in The Economics of the European Union, p 153

leadership in VLSI.[87] This project was persuaded by the powerful Japanese Ministry of International Trade and Industry (MITI).

In 1979, the Commissioner of DG III, the Director-General of Internal Market and Industrial Affairs, Viscount Davignon, made the first contacts with the main European electronic companies to understand the prospects and needs of the sector. However, these contacts with research directors and other managers at intermediate level were not especially encouraging. Because of that the Commission decided in February 1980 to call a meeting of senior executives from ten top companies to discuss the future of information technology in Europe.

At the end of 1981, the first "Round Table" meeting took place, attended by the 12 largest European Information Technology companies. ICL, GEC and Plessey from UK, AEG, Nixdorf and Siemens from Germany; Thomson, Bull and CGE from France; Olivetti and STET from Italy; and Philips from the Netherlands. These firms, represented by their heads, were well aware of the gravity of their industrial and collective circumstances. Sandholtz (1992) has suggested that

> "in general, states will attempt unilateral strategies first and surrender the goal of autonomy only when unilateral means have proved to be impossible or too costly."

The participant national companies knew that unilateralism had failed, and this recognition gave a climate of favourable co-operation.[88] But, it took two years of talks to settle on something. This is because, firstly, there was a strong and deep-rooted mutual distrust between the European companies, considering their continental counterparts as competitors to be beaten. Then, there was uncertainty concerning the ability of Brussels

[87] This project, conducted between 1975 to 1985 with a budget of 130 billion Yen (US $ 591 Million) was financed 22% by the Japanese government. Although it was widely believed that this project catapulted Japanese as the leader in VLSI and other countries followed suit in forming such R&D consortia, Mariko Sakakibra, who analysed a large sample of government-sponsored R&D consortia in Japan, says that he found no clear link between the existence of R&D consortia and industry competitiveness. (See Sakakibara, in Research Policy 26 (1997), p 447-473).
[88] Stubbs (1997), 'Science and Technology Policy', in The Economics of the European Union, p 154

bureaucracy to run efficiently so ambitions a project for industrial innovation in a sector as dynamic as information technology.[89]

In the end, instead of early hopes of establishing joint manufacturing companies along the lines of the Airbus consortium they agreed for collaborative research. This collaborative research was to be "pre-competitive", as against "near market", and as such, escaped potential conflict with the EC competition policy, as the Articles 85 and 86 which deal with the EU Competition Policy allow collaboration for "pre-competitive research".[90]

The establishment of European Strategic Programme for Research and Development in Information Technology (ESPRIT) is said to be the watershed in EU RTD Policy (Sharp, 1991, p 63-64).

The first outline proposal of September 1980 led to a formal proposal, to establish a strategic collaborative IT research programme between the major European companies, together with smaller companies, research institutes, and universities. This was presented in May 1982 and EC approved it with a funding of 11.5 million ECU.[91]

Contracts under the pilot programme were signed with thirty-eight projects, chosen from over 200 proposals involving 600 companies and institutes. Twelve companies from the "round-table" won about 70 percent of the funds. Since its establishment, ESPRIT has served as a model for promoting new technologies.

The ESPRIT I, 1984-88[92], was to concentrate on pre-competitive research in microelectronic, advance information processing, and software technology, as well as applications in computer-integrated manufacturing

[89] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 77
[90] For details on EU Competition Policy, see Young and Metcalfe (1997), 'Competition Policy', in The Economics of the European Union, p 118-138
[91] The ECU (European Currency Unit), which is at the heart of the European Monetary System, was created in 1979, replaced the various units of accounts used in the preceding decades. The value of the ECU is based on a "basket" of currencies of the Member States.
[92] ESPRIT I had a budget of 800 Million ECU. The approval of this phase was delayed until February 1984 because of Germany and UK government's concerns about the costs of the programme.

and office systems. There was an enormous response to the first call for proposals in March 1984, with only about one proposal in four winning acceptance. The 227 projects in Phase I involved about 3,000 researchers from 240 companies. Of these about 55 percent were Small and Medium Scale Enterprises (SME)) and 180 universities and research institutes. The EC funded up to half of the project expenditure, and firms from at least two Member States had to participate.

Collaboration **across national boundaries** was a pre-requisite to take part in ESPRIT Programmes, which meant the narrow horizon of "national champion" was not valid. Although the Commission identified priorities and broad areas of research, actual research projects were nominated by applicants. Thus, within the restriction that they could not be too near-market, projects became more demand driven.[93]

ESPRIT generated a new awareness of Europe's technological strength, and provided a model for initiatives in other areas of technology. It helped establish the climate for the Framework Programmes (FP), and produced a tribe of acronyms – RACE, BRITE, BRIDGE, BAP, ECLAIR, COMETT.

5.4 EUREKA

A further development in the 1980s is the creation of European Research Coordination Agency, or EUREKA. It was initiated by France and founded in 1985 to cooperate at intergovernmental level and as an European response to President Reagan's announcement of the Strategic Defence Initiative (SDI).

The first EUREKA meeting was held in Paris in July 1985, bringing together seventeen European countries. It extended beyond the EC Member States to include the seven countries of the European Free Trade Association (EFTA), Turkey, and latterly, Hungary; but it was managed and

[93] Stubbs (1997), 'Science and Technology Policy', in The Economics of the European Union, p 155

coordinated by the EC Commission. By March 1993, there were 623 EUREKA projects involving 8.8 billion ECU.[94]

EUREKA is designed to give firms incentives to collaborate on R & D which they might otherwise forego **due to the high risks and costs** involved. EUREKA allowed governments to fund product-oriented, "near market" collaborative projects, without the restrictions placed by EC competition law to do generic, "pre-competitive" R&D.

EUREKA is a loose agenda with no overall strategic goal and few strict rules of process. It seeks to generate projects directed at developing products, processes and services having a world-wide market potential. It is "industry-led", with projects designed and proposed by industry itself. The role of governments is limited to simple choices about which projects involving indigenous participants to fund and by how much. With its focus on "near market" R&D projects, EUREKA was created with the idea that it could take the results of pre-competitive projects funded through the FP "closer to the market". But according to Peterson there is no evidence that EUREKA and the FP are sufficiently linked.[95]

In his empirical study, Peterson states that Eureka has made a genuine difference in the overall European R&D effort by motivating more firms to engage in collaborative R&D and creating new links between firms. According to his findings many firms have used Eureka to propose and undertake projects which otherwise would not have been feasible. He reveals that firms participate in Eureka projects because of its ability to encourage new collaborative links than its provision for funding. While governments appear to provide a great deal of funding to Eureka projects, they do not act as link between private funding and Eureka projects. Still, political obstacles exist which make it difficult to exclude all but "near market" projects from Eureka. It operates under an intergovernmental framework and not a supranational one as other EU RTD Programmes do.

---

[94] Ibid, p 156

[95] Peterson (1993), 'Assessing the performance of European collaborative R&D Policy', pp 243-264

5.5 THE FIRST FRAMEWORK PROGRAMME (1984-1987)

At the beginning of the 1980s the Community research matters were not in a good shape. National Governments were not ready to support any extension of Community activities in the area. Every single programme had to be unanimously approved by the Council. In such a situation Commissioner Guido Brunner and Director-General Günter Schuster adopted a pragmatic approach, citing a crisis in some sector or other, or citing public interest in a particular field of research. They tried to persuade the Council in accepting new Community initiatives. Hence, the main body of research originating in EURATOM was gradually joined by research programmes in energy, environment, health, textiles, fishing, raw materials, and many others. These programmes were often on a very lower scale, and there were absolutely no links between them.[96]

On 6 December 1982, the Committee for the European Development of Science and Technology (CODEST) was created. It was composed of 21 independent experts and with a exact mandate to assist the Community in its policy of encouraging the scientific and technical potential through a systematic analysis of the requirements and opportunities of Member States. Although CODEST's objectives were relevant to all area of RTD, its actions are particularly focused on basic research.

Between 1982 and 1983, Commissioner Davignon began an attempt to reorganise the individual research and development activities. He wanted to include them in a more comprehensive plan which might serve as the basis for a real policy for science and technology. The plan was to draw together all the separate research and development programmes in a Framework Programme designed to last over several years. All the single programmes gathered together by the FP would then be planned, prepared and approved at the same time.

The First FP for the years 1984-87 was approved by the Council on 25 July 1983. From the point of view of planning and of financial provision, this

[96] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 83

was by and large a dress rehearsal. Under existing laws, it was not possible to approve the allocation of finance for research in general, so that the 3,750 million ECU allowed for the FP corresponded to the sum of all the separate budgets for programmes already permitted together with the allocations requested. This budget represented little more than a relisting of items, such as the JRC budget and ESPRIT, that had already been approved. At a political level, there was considerable dissent, with some Member States – especially the UK and West Germany – categorically opposed to any concept of Community "management" of R&D activities.

5.6 THE SINGLE EUROPEAN ACT (1987)

Though Community undertakings in the area of science and technology flourished, especially from the 1970s, it is interesting to note that a comprehensive legal base was missing. This had caused obstacles in important matters such as financial and budgetary aspects and was preventing any further consolidation. The three treaties establishing the European Communities allowed for financing of R&D only in the fields of coal and steel, nuclear research and agriculture. Otherwise, the Community actions related to science and technology had to be taken under Article 235 of the Treaty of Rome:

> "If action by the Community should prove necessary to attain … and this Treaty has not provided the necessary powers, the Council shall, acting unanimously on a proposal from the Commission, and after consulting the European Parliament, take appropriate measures."

Predictably, actions proposed under Article 235 often led to protracted negotiations lasting several years. By the time, the first FP was up and running, the RTD Policy can be said to have established firmly as one of the policy area of the Communities with a strong institutional and political base. What was still lacking was a legal identity embodied in Treaty

articles. This was achieved with the Single European Act (SEA), signed in February 1986, and entered into force in July 1987.

The SEA added a Title VI to the EEC Treaty with a view to legally covering research and technological development activities. Article 130f says as follows:

> "The Community shall have the objective of strengthening the science and technological base of Community industry and encouraging it to become more competitive at international level."[97]

This treaty article, along with other Treaty Articles 130g-130p, formed the legal basis of the European Union's Research and Technology Development (EU RTD) Policy.[98]

Apart from the legal basis, these articles clearly reflect the challenges and demands that the EU faces in the area of science and technology. These are twofold:

Firstly, to face the challenge of superiority and competitiveness of front runners in RTD, namely the USA and Japan, as well to a lesser extent the Asiatic and other newly industrialised countries.

Secondly, there was the challenge of social demands at home. This challenge was to create employment, to improve the quality of life, and to have a sustainable development.

The Single Act also introduced a new theme, which appeared officially with the FP2 on the Community R&D scene: ***economic and social cohesion***. This had the profound objectives of economic prosperity for Europe's less developed regions and the achievement of scientific excellence in Europe at the same time. The idea was born out of the refusal of the principle, according to which each Member State should be allocated RTD contracts

[97] Later, the Maastricht Treaty added just two lines to this article, which are but very significant: ... "while promoting all the research activities deemed necessary by virtue of other Chapters of this Treaty".
[98] Appendix 2, Treaty on European Union - Title XV - Research and Technology Development (version valid at that time)

in proportion to its financial contribution. However, to obtain funding for research and development projects only on the basis of scientific excellence was in contradiction to the objective of economic and social cohesion. The less developed regions of Europe lacked the required and modern research facilities to compete. The solution offered to this problem was to use structural funds for modernising the technical and scientific foundations of less developed regions.

According to Guzzetti, the objectives set out by the Single Act for Community research are primarily economic.[99] It was meant to bolster scientific and technological foundations of European industry and thereby boost its competitiveness internationally. Another goal was to promote geographically homogeneous development.

5.7 THE SECOND FRAMEWORK PROGRAMME (1987-1991)

In June 1985, the Council met in Milan and reached an agreement to harmonise EUREKA with the Community's R&D programmes. It also adopted the Commission's memorandum "Towards a Technological Community". At the Milan summit it was announced that science and technology would in future be allocated at least 6% of the Community's total budget. But, when in 1986, Narjes put forward proposals for a 10 billion ECU budget for FP2, the British and West Germans joined forces to oppose such a sharp increase in expenditure. Opposition was especially fierce from the then British PM Margaret Thatcher. This forced to a drastic reduction in the budget. Finally, in 28 September 1987, the Council agreed to allocate 5,400 million ECU for the FP2. This represented less than 3% of the Community budget, as against 70% absorbed by the Agriculture policy at that time, and amounted only to 1.8% of what the Member States spent on the research.

[99] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 113

Figure 7: Budget distribution in FP2
(Source: European Commission 1994)

Objectives / areas		Funding MECU	%
1.	Quality of life	375	6.9
	Health	*80*	
	Radiation protection	*34*	
	Environment	*261*	
2.	Towards a single market and an information and communication society	2275	42.2
	Information technologies	*1600*	
	Telecommunications	*550*	
	New services of common interest (including transport)	*125*	
3.	Modernisation of industrial sectors	845	15.7
	Science and technology for the manufacturing industry	*400*	
	Science and technology of advanced materials	*220*	
	Raw materials and recycling	*45*	
	Technical standards, measurement methods and reference materials	*180*	
4.	Exploitation and optimum use of biological resources	280	5.2
	Biotechnology	*120*	
	Agro-industrial technologies	*105*	
	Competitiveness of agriculture and management of agricultural resources	*55*	
5.	Energy	1173	21.7
	Fission: nuclear safety	*440*	
	Controlled thermonuclear fusion	*611*	
	Non-nuclear energies and rational use of energy	*122*	
6.	Science and technology at the service of development	80	1.5
7.	Exploitation of the sea bed and use of marine resources	80	1.5
	Marine science and technology	*50*	
	Fisheries	*30*	
8.	Improvement of European S&T cooperation	288	5.3
	Stimulation, enhancement and use of human resources	*180*	
	Use of major installations	*30*	
	Forecasting and assessment and other back-up measures (including statistics)	*23*	
	Dissemination and utilisation of S & T research results	*55*	
	Total	5396	100.00

The idea behind Framework Programmes is to identify and encourage synergy and interaction between research and development in sectors considered to be of primary importance at Community level. The Commission defined 10 priority sectors: information technologies, bio-technologies, new materials, lasers and fibre optics, major scientific instruments, new means of transport, broadband telecommunications, space, the conquest of marine environment, and education and training technologies. Some sectors were already covered by community programmes, such as ESPRIT, RACE and BRITE. New initiatives had to be taken, but not at a higher level than necessary. In a paper of September 1985, the Commission reiterated yet again what would become known as the principle of subsidiarity:

> "It must be clear that with the implementation of R&D activities the Community does not intend to confront all the requirements for achieving these objectives. In fact, it considers that where national or multilateral programmes and activities capable of meeting these objectives already exists, it is not necessary to develop new initiatives at Community level."[100]

[100] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 122. Original source: Commission of the EC

CHAPTER 6
WHAT WAS THE PROGRESS AFTER MAASTRICHT?

> The treaty we are about to sign is a decisive step forward in the path towards the European Union, an unparalleled process in contemporary history.
>
> Aníbal Cavaco Silva, President of the European Council at the time of the Maastricht Treaty, in a ceremonial speech.

6.1 INTRODUCTION

The Maastricht Treaty[101] was signed on 7 February 1992 in a small Dutch town of 120,000 people wedged between Germany and France – the ideal symbolic location. It was indeed a major milestone, which set clear rules for the future single currency as well as for foreign and security policy and closer cooperation in justice and home affairs. Under the treaty, the name "European Union" officially replaces "European Community".

The treaty gave life to a composite construction supported on three "pillars" and held together by a single common institution: the European Council consisting of the Heads of State and Government of member countries.

The first pillar, the oldest and probably the most solid, was the European Community (still three communities from legal point of view).

The second was foreign policy and joint security, which were to be the responsibility of the Council of Ministers of Foreign Affairs, to which the Commission could make proposals, while the Parliament was simply informed of decisions.

The third pillar, internal affairs and justice, was very much inter-governmental.

The Treaty brought several new areas of policy within the competence of the Community. Two in particular, already included in the SEA, assumed greater prominence: economic and social cohesion, and social affairs. In

[101] Full title: Treaty of Maastricht on European Union

addition to the existing Structural Funds, a specific fund was set up in support of the cohesion policy, to finance environmental projects and trans-European transport networks. It was also emphasised that cohesion was one of the fundamental objectives in other areas of Community policy, including RTD. Social policy, in which the UK choose not to be involved, was also accorded a Fund of its own, the aim being to improve the living and working conditions of European citizens along the lines set out in the 1989 Social Charter. To settle questions regarding the respective competencies of the Community and the Member States in the various areas of policy, the Treaty introduced the concept of *subsidiarity*. Regarding the RTD Policy, the Treaty re-emphasised, at the highest juridical and institutional level, the idea which originally gave rise to the framework programme: the Community's RTD policy should be, first and foremost, at the service of other Community policies (Guzzetti, 1995, p 153).

The Treaty gave strong impulse to integration in the area of RTD. It laid down that "The Community and the Member States shall co-ordinate their research and technological development activities so as to ensure that national policies and Community policy are mutually consistent." (Article 130h). Over the years, attempts to co-ordinate national polices have proved difficult and largely unfruitful (Guzzeti, 1995, p 153).

> "But it turned out to be extremely difficult for national governments to ratify the Maastricht Treaty in the absence of popular support from its people. This shocked national governments that had become used to "building Europe" without much reference to the concerns of ordinary citizens."[102]

The worst recession in post-war history spurred new populist resistance to closer European integration. Signed in December 1991, the Treaty was first rejected by Danish voters and then approved by the narrowest of

[102] Peterson and Sharp (1998), 'Technology Policy in the European Union', p 113

margins in France in two referenda held in 1992. RTD policy became mingled in the general turbulence of one of the most difficult periods in the Community's history.

6.2 THE THIRD FRAMEWORK PROGRAMME (1990-94)

The framework programmes overlap each other by one or two years. The reason for this to provide suitable financial planning and ensure the continuity of research activities. The review of the FP2 in 1989 pointed out that the Programme with eight major categories of actions and 32 specific programmes was too complex and needed simplification. Accordingly, in the FP3 the "action lines" were reduced to six which in turn were collected under three titles. The specifics programmes amounted only 15.

The approval of budget for the FP3 ran into problem because of disagreements between the Parliament, the Commission and the Council. The Parliament and the Commission had proposed a budget of 8,230 and 7,700 million ECU respectively, but most unfriendly position was that of the Council. Finally, a consensus was reached on 23 April 1990 for an initial budget of ECU 5,700 million. This was nowhere near the aim of reaching the mark of 6% of the Community budget, set to be achieved by 1997. Three years later however, after bickering, the Council approved a supplement of 900 million ECU.

Figure 8: Budget distribution in FP3
(Source: European Commission 1994)

Objectives / areas		Funding MECU	%
ENABLING TECHNOLOGIES			
1.	Information and communications technologies	2491	37.7
	Information technologies	*1517*	
	Communication technologies	*548*	
	Development of telematics system of general interest	*426*	
2.	Industrial and material technologies	997	15.1
	Industrial and material technologies	*840*	
	Measurement and testing	*157*	
MANAGEMENT OF NATURAL RESOURCES			
3.	Environment	581	8.8
	Environment	*464*	
	Marine sciences and technology	*117*	
4.	Life sciences and technologies	832	12.6
	Biotechnology	*184*	
	Agricultural and agro-industrial research (including fisheries)	*373*	
	Biomedical and health research	*149*	
	Life sciences and technologies for developing countries	*125*	
5.	Energy	1052	15.9
	Non-nuclear energies	*259*	
	Nuclear fission safety	*231*	
	Controlled thermonuclear fusion	*562*	
OPTIMISATION OF INTELLECTUAL RESOURCES		581	8.8
6.	Human and capital mobility	581	
	Total	6600	100.00

The events surrounding the financing of FP3 reveal the continuing fundamental tension between the Commission and Parliament, on the one hand, and the Member States on the other, regarding the importance commitment to science and technology:

> "Each government is essentially trying to keep control of technologies which it considers strategic and in which it has a

> competitive advantage over other countries, while at the same time being prepared to develop those technologies at Community level which it feels are less important. The result is that usually the governments in the Council of Ministers simply reach a compromise at the lowest possible level."[103]

Budgetary negotiations on FP4 were more politicised and polarised than those on any previous occasion. Yet, after a second Danish referendum produced a "yes", Maastricht was finally ratified in late 1993. At nearly same time, a breakthrough was made on FP4.

The Commission's proposal for FP4 consolidated virtually all EU-funded research activities, including those not previously not funded through the framework programme, into a single (and thus larger) budget. The Commission pointed to the Treaty's injunction to "set out all the activities of Community" in future versions of the framework programme.

6.3 THE FOURTH FRAMEWORK PROGRAMME (1994-1998)

The scope and form of the Fourth Framework Programme has been largely influenced by the RTD provisions introduced in the Maastricht Treaty (Treaty on the European Union TEU) and by the Commission's White Paper on Growth, Competitiveness and Employment.

The FP4 was implemented through 18 specific thematic programmes. They were grouped in four priority areas set out in the TEU. Fifteen specific programmes are to be carried out under the First Activity. The remaining three activities are considered as specific programmes in their own right. Two additional programmes have been established to cover scientific and technical support activities. These are mainly implemented by the Joint Research Centre (JRC), although some areas are open to public tender within the new "competitive approach" framework.

[103] Guzzetti (1995), 'A Brief History of European Union Research Policy', p 141

Figure 9: Budget distribution in FP4
(Source: European Commission 2000)

Objectives / areas	Funding MECU	%
Activity 1 - RTD and demonstration programmes	10,686	86.9
Information and communication technologies	3,405	27.7
Telematics	*843*	
Communications technologies	*630*	
Information technologies	*1,932*	
Industrial technologies	1,995	16.2
Industrial and material technologies	*1,707*	
Standardisation, measurements and testing	*288*	
Environment	1,080	8.8
Environment and climate	*852*	
Marine sciences and technologies	*228*	
Life sciences and technologies	1,572	12.8
Biotechnology	*552*	
Biomedicine and health	*336*	
Agriculture and Fisheries	*684*	
Energy	2,256	18.3
Non-nuclear energy	*1,002*	
Nuclear fission safety	*414*	
Controlled thermonuclear fusion	*840*	
Transport	240	2.0
Targeted socio-economic research	138	1.1
Activity 2 - Cooperation with third countries and international organisations	**540**	**4.4**
Activity 3 - Dissemination and exploitation of results	**330**	**2.7**
Activity 4 - Stimulation of the training and mobility of researchers	**744**	**6.0**
Total	**12,300**	**100.0**

During the period 1994-1998, all Community RTD activities were carried out under the FP4 and the parallel EURATOM programme covering research and training in the nuclear sector. Initially it had budget of 12.3 billion ECU, which was increased by 800 million ECU to take account of the accession of Austria, Finland and Sweden to the European Union. A further

financial supplement of 115 million ECU was agreed by the European Parliament and the Council on 1 December 1997, bringing the total budget for both EC and EURATOM Framework Programmes to ECU 13,215 million.[104]

According to the Commission, the 18 specific programmes were to help the EU respond to three major challenges:

- developing scientific and technological excellence in Europe, to meet the needs of industry and improve the quality of life in Member States
- furthering cooperation and improving the coordination and exploitation of the Member States' research efforts
- framing and implementing other Community policies (transport, environment, etc.)

Each of the specific programmes established a work schedule, known as a "Work Programme" setting out in detail the various activities to be pursued during its lifetime. On the basis of the "Work Programme", the programmes launch periodic calls for proposals inviting interested companies, research centres and universities to present project proposals.

Most calls for proposals for the FP4 were published at fixed intervals (15 March, 15 June, 15 September and 15 December), although not every programme will launch a call at the same time. Depending on the programme, the calls may cover all or part of the activities in the Work Programme. Detailed "Information Packs", setting out guidelines for the presentation of proposals were produced by the individual programmes.

By this time the importance of SMEs for technology and job creation was well noticed and steps were taken to inspire their participation. This SME amounted to 90% of all enterprises in the EU amounting to 15 million firms at this time. 66% of all those employed were in SME and SMEs made 65% of the business turnover. In the period of economic crisis,

[104] European Commission, DG XII, (1998), 'The 4th Framework Programme'

SMEs tend to create most of the jobs. Between 1988 and 1995, enterprises with fewer than 100 employees accounted for almost all new job creations in the EU.[105]

In order to encourage and facilitate the SMEs, action plans were implemented in most of the specific programmes. They worked out to be effective. According to the Second Report on Science and Technology Indicators, the level of SME participation in FP4 was highest until that time. According to the Commission, more than 12,000 SMEs had taken part in FP4 by the end of 1998. The level of participation of SMEs in 1997 amounted to 24% of total participants as compared to 18% in 1996. The budgetary contribution they received was 16% in 1997 against 13% in 1996.

The implementation of the FP4 was a remarkable success. In 1997, with nearly 24,000 proposals received and evaluated across all the specific programmes, 6000 contracts were signed and ECU 3,000 million of Community funds attributed to research projects, involving 24,000 participants. Cumulatively, more than 15,000 research projects were established the end of 1997, amounting to ECU 8,200 million in signed contracts. A decision was reached during 1997 on the Commission's proposal for supplementary funding of FP4, presented early in 1996. This resulted in an increased funding of ECU 115 million for a number of specific research areas.

6.4 INSTITUTIONS AND POLICY MAKING PROCESS

At the beginning of the 1980s, there existed only one Directorate-General for Science, Research and Development (DG XII). An information technologies task force was then set up. This was to merge with DG XIII in 1986 (until October 1992 named "Telecommunications, Information Industries and Innovation"), which had the task of disseminating and exploiting the results of research further downstream. As tasks and

[105] European Commission (1995), 'Green Paper on Innovation'

programmes multiplied the structure of the two Directorates-General developed in response to immediate needs.

In July 1992, the Commission undertook a major restructuring of Directorates-General XII and XIII and reformed administrative procedures. The administrative machine was to correspond to the range of new programmes and the aims of the Treaty, and especially the unity of the legislative framework and the method of implementation. One set of Commission measures dealt with changes to the organizational plan of DGs XII and XIII, grouping common administrative tasks together and creating specializations in programme management.

The EU can be viewed as a "multi-level governance", in which different types of decisions are taken at different levels, which are dominated by different actors. While the RTD collaborative programmes expanded rapidly in the 1990s after the experiments of the early 1980s, both the framework programmes and EUREKA were characterised by complicated and often hermetic systems of decision-making.[106]

> "We cannot deny that the current framework programme reflects these principles somewhat imperfectly. There are several reasons for this, not least of which is the decision making process with which it is trammelled."[107]

The formulation of each framework programme is influenced by a complex political process with multitude of stakeholders taking part. Sharp and Peterson (1998) observe that the high politics of research policy are often surprisingly dramatic and hard-fought. The decision making for this policy takes place at two levels. The first one is the strategic level whereby the core issues and the budget for the Framework Programmes is decided. The second level is the operational level, where bargaining is done on individual collaborative programmes.

---

[106] Peterson and Sharp (1998), 'Technology Policy in the European Union', p 163

[107] Mrs. Édith Cresson in European Commission (1997), Five Year Assessment of the European Community RTD framework programmes

6.5 THE FIFTH FRAMEWORK PROGRAMME (1998-2002)

The Fifth Framework Programme (FP5) was a main focus for policy developments in second half of 1990s. Starting with the Commission's formal proposal in April 1997, the first reading of the proposal by the European Parliament took place in December 1997. This was followed by a modified proposal from the Commission in January 1998 and the Common Position of Council in March. The ground was thus prepared for a decision on the FP5 and the specific programmes to implement it by the end of 1998. This allowed funding continuity to be maintained beyond the termination of the FP4 in 1998.

The main obstacle for a speedy agreement was, as anticipated, the budgetary issue. The Commission had initially asked for a budget of 16,300 million Euro. This was supported by the Parliament. But, the Council disagreed and offered 14,300 million - till the very last moment. Finally, an overall budget of 14,960 Euro was agreed upon at a meeting of the Council of Ministers on 22 December 1998. Out of this, 13,700 million Euro was agreed for the implementation of the European Community section of FP5. An additional 1,260 million Euro was allocated to the EURATOM programme. This represented a 4.61% increase in absolute terms of compared with FP4.

Figure 10: Budget distribution in FP5
(Source: European Commission 2002)

Objectives / areas	Funding	
	MEuro	%
EC TREATY	**13,700**	**91.57**
First Activity (Four Thematic Programmes)	**10,843***	**72.48**
1. Quality of life and management of living resources	*2,413*	*16.13*
2. User-friendly information society	*3,600*	*24.06*
3. Competitive and sustainable growth	*2,705*	*18.08*
4. Environment and sustainable development	*1,083*	*7.24*
5. Energy	*1042*	*6.96*
Second Activity Confirming the International role of Community Research	**475**	**3.17**
Third Activity Promotion of innovation and encouragement of SME participation	**363**	**2.04**
Fourth Activity Improving human research potential and the socio-economic knowledge base	**1,280**	**8.55**
Direct Actions Joint Research Centre (JRC)	**739**	**4.93**
EURATOM TREATY	**1,260**	**8.42**
Indirect Actions	979	6.54
Direct Actions	281	1.88

*of which 10% on average is for SME's.

The research priorities of FP5 were based on a common set of criteria divided into three categories. These were used to define the research priorities of FP5 itself and the specific programmes implementing it. The common criteria were applied in the selection of research and technological development activities, including demonstration activities. The three categories of criteria were applied simultaneously. However, the extent to which each category applies could be different from case-to-case:

- Criteria related to the Community "value added" and the subsidiarity principle – so as to select only objectives which are more efficiently pursued at the Community level by means of research activities conducted at that level.
- Criteria related to social objectives – in order to further major social objectives of the Community reflecting the expectations and concerns of its citizens.
- Criteria related to economic development and scientific and technological prospects – in order to contribute to the harmonious and sustainable development of the Community as a whole.

6.6 LISBON STRATEGY AND EUROPEAN RESEARCH AREA (ERA)

In March 2000, the Lisbon strategy was launched in which the research policy was considered to be one of the key elements of European policy to promote economic growth and the creation of new jobs. The Lisbon strategy was a development plan whose main scope was to create in the EU "the most competitive and dynamic knowledge-based economy in the world" and to lay down solid basis for the creation of the single market between 2000 and 2010. Its ambitious goals were far from being fully accomplished in its ten-year life cycle. However, its contribution to progress in different areas of EU economic development and social cohesion is considered to be crucial. There is no doubt that Lisbon-type reforms are needed to be continued.

> "The Lisbon Strategy promoted integration of social and economic policy while focusing in particular on strengthening the EU's research capacity, completing the internal market, promoting entrepreneurship, fiscal consolidation and sustainability of public finances, encouraging progress within information society

> technologies, developing an active employment policy and modernizing social protection systems."[108]

The main goal of the Lisbon Strategy was the creation of new jobs and the improvement of labour skills across the EU. The EU launched the European Research Area (ERA) in 2000 as a key element for implementing the Lisbon strategy. In its communication, the European Commission gave the following picture.

> "Even more so than the century that has just finished the XXIst century we are now entering will be the century of science and technology. More than ever, investing in research and technological development offers the most promise for the future.
>
> In Europe, however, the situation concerning research is worrying. Without concerted action to rectify this the current trend could lead to a loss of growth and competitiveness in an increasingly global economy. The leeway to be made up on the other technological powers in the world will grow still further. And Europe might not successfully achieve the transition to a knowledge-based economy."[109]

In reality the EU was concerned that United States and Japan were ahead of the EU. The average research expenditure of the EU (although there were significant differences from one country to the other) was 1.8% of GDP compared with 2.8% in the United States and 2.9% in Japan. The researchers accounted only 2.5 researchers for every thousands of the industrial workforce in Europe whereas they accounted 6.7 in the US and 6 in Japan. Finally, the trade balance in high tech products showed a deficit of EUR 20 billion per year in Europe in the past 10 years. And this deficit seemed to be increasing (Com EC, 2000, p 6).

[108] Samardžija Višnja and Butković Hrvoje (2010), 'From the Lisbon Strategy to Europe 2020', p 5
[109] Commission of the EC (2000), 'Towards a European research area', p 4

> "On the one hand, science and technology experts and economists became convinced that a new productive paradigm was emerging: the surge of information and communication technologies (ICT) was the premise of a 'knowledge-based economy'. On the other hand, Europe as w whole was suffering from an increasing gap with respect to the US and Japan as far as the implementation of this new engine of growth concerned."[110]

ERA is based on the 27 national research systems of the Member States funded from national tax revenues.[111] ERA comprised of three major aspects:

- The creation of an EU internal market for research, where people, ideas and technologies can circulate freely.
- EU-wide coordination of all research activities.
- The implementation of "ERA instruments", such as the Framework Programme to promote cross-country research.

The establishment of the ERA was followed by a pledge to increase R&D national spending to 3% of GDP during the summit of Barcelona in 2002. Subsequently, the Commission proposed an extensive action plan to increase and improve R&D expenditure in Europe and all member states set national R&D investment targets linked to the overall 3% objective (Renda and Granieri, 2012). These policy actions led to major changes to the structure of the programme, which are particularly noticeable from FP6 onward.[112]

The EU was aware that the ERA is will take some years to come into being in its final form. It was to develop gradually with numerous measures, many of which could be implemented from medium to long term. Also, the

[110] Boyer (2011), 'From the Lisbon Agenda to the Lisbon Treaty: national research systems in the context of European integration and globalization' in European Science and Technology Policy, p 101
[111] Commission of the EC (2012), 'A Reinforced European Research Area Partnership for Excellence and Growth', p 3
[112] Ligtvoet Andreas and Van der Veen Geert (2016), 'Evaluation of European FP6/FP7 Energy Research and Demonstration Projects'

role of public and private sector in research had to be clarified along with measures to be taken at regional, national, European and international level. To achieve the objectives, the EU proposed a combination of initiatives, means and instruments at different levels.

In July 2012, the EU decided for a "Reinforced European Research Area Partnership for Excellence and Growth". With this the ERA was adapted to a new economic and political context. Once again it underlined the goal of improving Europe's research performance to promote growth and job creation. It also placed the ERA "at the heart of the Europe 2020 strategy". The Commission has given the following definition to the ERA:

> "A unified research area open to the world based on the Internal Market, in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges."[113]

The ERA evolves around six priorities:

- More effective national research systems;
- Optimal transnational co-operation and competition, including "optimal transnational cooperation and competition" and "Research Infrastructures";
- An open labour market for researchers;
- Gender equality and gender mainstreaming in research;
- Optimal circulation, access to and transfer of scientific knowledge, including "Knowledge circulation" and "Open Access";
- International cooperation.

[113] Commission of the EC (2012), 'A Reinforced European Research Area Partnership for Excellence and Growth', p 3

European Commission has published several reports on ERA, the latest one in 2016. In these reports, it gives detailed findings on the implementation of the 6 main objectives. One of the reports[114] confirms that ERA has made strong progress over the last years. All headline indicators show progress over time according to the EU-28 averages, although large disparities, both in performance levels as in growth rates between countries, exist.

6.7 THE SIXTH FRAMEWORK PROGRAMME (2002-2006)

Beginning with this FP an additional term "Demonstration" was officially added to the title and thus the full title of the programme became "Research, Technological Development and Demonstration". It had two main strategic objectives: a) to strengthen the scientific and technological bases of industry b) encourage EU's international competitiveness while promoting research activities in support of other EU policies.

FP6 did not cover all areas of science and technology. However, there were some areas of focus such as the specific research activities for SMEs, Marie-Curie actions, infrastructure actions, policy coordination and the science and society programme. Based on the above strategic objectives, a limited number of thematic priorities (and selected topics within the overall priorities) have been identified.

FP6 had a budget of 17.5 billion euros and represented about 4 to 5 percent of the overall expenditure on RTD in EU Member States.[115] According to the European Commission, the main objective of FP6 was to contribute to the creation of the European Research Area (ERA) by improving integration and co-ordination of research in Europe.

> "At the same time research will be targeted at strengthening the competitiveness of the European economy, solving major societal questions and supporting the formulation and implementation of

[114] Commission of the EC (2017), ERA Progress Report 2016
[115] European Commission (2002), 'The 6th Framework Programme in Brief'

other EU policies. Activities under FP6 have to be conducted in compliance with ethical principles, including those reflected in the Charter of Fundamental Rights of the European Union. Furthermore, they should strive both to increase the role of women in research and to improve information for, and dialogue with, society."[116]

Figure 11: Budget distribution in FP6
(Source: European Commission 2002)

Area of activity	Spending (in mill. Euro)
EC Framework Programme	**16 270**
1. Focusing and integrating Community research	13 345
1.1 Thematic priorities:	11 285
1.1.1 Life sciences**,** genomics and biotechnology for health	2 255
1.1.1.1 Advanced genomics and its applications for health	1 100
1.1.1.2 Combating major diseases	1 155
1.1.2 Information society technologies	3 625
1.1.3 Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices	1 300
1.1.4 Aeronautics and space	1 075
1.1.5 Food quality and safety	685
1.1.6 Sustainable development, global change and ecosystems	2 120
1.1.6.1 Sustainable energy systems	810
1.1.6.2 Sustainable surface transport	610
1.1.6.3 Global change and ecosystems	700
1.1.7 Citizens and governance in a knowledge-based society	225
1.2 Specific activities covering a wider field of research	1 300
1.2.1 Policy support and anticipating scientific and technological needs	555

[116] Ibid.

1.2.2 Horizontal research activities involving SMEs	430
1.2.3 Specific measures in support of international co-operation	315
1.3 Non-nuclear activities of the Joint Research Centre	760
2. Structuring the European Research Area	2 605
2.1 Research and innovation	290
2.2 Human resources and mobility	1 580
2.3 Research infrastructures	655
2.4 Science and society	80
3. Strengthening the foundations of the European Research Area	320
3.1 Support for the co-ordination of activities	270
3.2 Support for the coherent development of policies	50
Euratom Framework Programme	**1 230**
1. Priority thematic areas of research	890
1.1 Controlled thermonuclear fusion	750
1.2 Management of radioactive waste	90
1.3 Radiation protection	50
2. Other activities in the field of nuclear technology and safety	50
3. Activities of the Joint Research Centre	290
Total	**17 500**

The first and second specific programmes covered a number of selected priority areas. Projects were selected in a competitive way based on Calls for Proposals. These proposals had evaluation from independent and external experts. These two specific programmes had majority of research activities. According to the EU its goal was to strive towards greater integration by promoting research:

- "in 7 key priority areas of exceptional interest and added value for Europe
- responding to the special needs of small and medium-sized enterprises (SME)

- in international co-operation with partners from specific groups of third countries
- to support other Community policies
- to explore new and emerging scientific and technological areas and to anticipate future science and technology needs."[117]

The EU was very ambitious with its "focusing and integrating" European research. It defined seven thematic priority areas of research for that reason. They covered those areas where the EU in the medium term intended to become the most competitive and dynamic, knowledge-based economy in the world. The goal was for the EU to be capable of sustainable economic growth with more and better jobs and greater social cohesion. As one of the measures to implement the international dimension of FP6, this block was opened to participation by organisations from third countries with substantial funding included in the budget.

Specific targeted projects were focused on other community policies, in particular the Agricultural Policy and the Fisheries Policy.

6.7.1 NEW AND EMERGING SCIENCE AND TECHNOLOGIES (NEST)

To help European scientists take a leading position in the latest scientific opportunities, the FP6 introduced a new activity to support research in "New and Emerging Science and Technology" – NEST. Standing slightly apart from the other activities, NEST aimed to support unconventional and visionary research with the potential to open new fields for European science and technology.

A key strength of the NEST "Adventure" projects was their ability to respond to unforeseen new scientific opportunities or to apply innovative and multidisciplinary approaches to address long-standing challenges. NEST "Insight" project was focused on potential risks to society of newly discovered phenomena or new scientific developments. In today's complex world, it is crucial to identify such problems at an early stage. NEST "Pathfinder" initiatives were to support a group of complementary projects

[117] European Commission (2002), 'The 6th Framework Programme in Brief'

focussed on specific, highly challenging objectives, to advance work in emerging scientific and technological fields.

6.7.2 SPECIFIC RESEARCH ACTIVITIES FOR SMES

Another area the FP6 concentrated was the SMEs. In this FP, they were encouraged to participate in the activities implemented under the priority thematic areas within Network of Excellence (NoEs), Integrated Projects (IPs), and specific targeted research projects. At least 15% of the budget relating to the seven thematic priorities was allocated to SMEs. In addition, two specific schemes for SMEs having the ability to innovate without adequate research capacity, were foreseen.

As one of the measures to implement the international dimension of FP6, the SME actions were open to participation by organisations from third countries with funding included in the budget.

According to the FP7 monitoring report[118] from the EC, the SME participation in the Cooperation Programme in 2013 again exceeded the 15% target with 16,8% (representing € 4,6 billion) of the EU contribution going to SMEs 14,6% (€ 6,2 billion) spread over almost 24.000 SME participations. SMEs organisations account 46% of all industry organisations participating in grant agreements for the period 2007-2013. In 2013, 18,6% of all participants in signed grant agreements were SMEs. The average EU contribution to SMEs participating in the FP7 for the period of 2007-2013 is € 259.772. This is about two thirds of the average EU contribution to non-SME participants, which is € 391.772.

Horizon 2020 Programme (2014-2020) has simplified access rules and specific tools encouraging business and SMEs participation. As of July 2015, about 40% of the organisations that have signed grant agreements under Horizon 2020 are newcomers. From these, 80% are from the private commercial sector and the majority of the newcomers are SMEs. Extrapolating current trends, by the end of 2020 around EUR 3 Billion will

[118] EC (2015), Seventh FP7 Monitoring Report, Monitoring Report 2013, p 83

have been invested into thousands of Europe's most innovative SMEs through the SME Instrument. These actions promote industry and academia cooperation and the resolute circulation of knowledge. This is being done as promoted through the European Institute of Innovation and Technology- and between the science community and policy makers.[119]

6.7.3 SPECIFIC MEASURES IN SUPPORT OF INTERNATIONAL COOPERATION

These measures covered specific international co-operation activities (INCO) with selected groups of countries. Researchers from third-countries, especially from Developing Countries, Mediterranean Partner Countries, Western Balkan countries, and Russia participated based on mutual interest and in support of Community external policy. Conditions, thematic areas and budget details applying for the different groups of countries were specified in the work programmes.

6.8 THE SEVENTH FRAMEWORK PROGRAMME (2007-2013)

Since 2002, FPs have become the most important financial and legal tool for the implementation of ERA priorities. Therefore, both FP6 and FP7 have interacted more with national programmes and private investments than any predecessor. As a consequence of the growing interest in EU-wide research, the budget of the FPs has increased steadily since their start and stands at around € 54 billion for FP7, making it the world's largest research programme as well as the largest budget administered directly by the European Commission.[120]

This FP had a big increase compared with its predecessor FP6. It had a budget of over 50 billion Euro, which was increase of 41% at 2004 prices and even 63% at 2007 prices. This reflected once again the high priority the EU gives to research.

---

[119] European Commission (2015), 'State of the Innovation Union 2015' (Brussels), p 7

[120] Ligtvoet Andreas and Van der Veen Geert (2016), 'Evaluation of European FP6/FP7 Energy Research and Demonstration Projects'

> "Indeed, FP7 is a key tool to respond to Europe's needs in terms of jobs and competitiveness, and to maintain leadership in the global knowledge economy."[121]

One term that eminently appears with regard to FP7 is the "European added value". As was case in the previous FPs, this was ensured with the transnationality, i.e., the requirement to build consortia that must include participants from different European countries. Fellowships in FP7 required mobility over national borders. However, the FP7 also added a new possibility for "individual teams". This carried no obligation for transnational cooperation. In this case, the "European added value" was implemented by raising the competition between scientists in fundamental "frontier" research from the national to European level.

As per the EU the FP7 was the natural successor to the previous programme.

> "It is the result of years of consultation with the research community from both the public and private sectors, with economic actors, and with political decision makers in Europe. FP7 is both larger and more comprehensive than its predecessors. It is also more flexible, with simplified procedures."[122]

The FP7 had two main objectives:[123]

- to strengthen the scientific and technological base of European industry;
- to encourage its international competitiveness, while promoting research that supports EU policies.

[121] European Commission (2007), 'How to get involved in the EU 7th Framework Programme for Research'
[122] Ibid
[123] Ibid

6.8.1 THE BUDGET AND STRUCTURE OF FP7

As per the European Parliament and Council, the overriding aim of the Seventh Framework Programme is to contribute to the Union becoming the world's leading research area.[124] For that, the Framework Programme was strongly focused on promoting and investing in world-class state-of-the-art research. The idea was to build upon the achievements of the FP6 towards the realisation of the European Research Area. It was further intended for the development of a knowledge-based economy and society in Europe which will meet the goals of the Lisbon strategy in Community policies.

The FP7 contained five major blocks: Cooperation, Ideas, People, Capacities, and Nuclear Research.

The **Cooperation programme** had two thirds of the overall FP7 budget. It was meant to foster collaborative research across Europe and other partner countries through projects by transnational consortia of industry and academia. Research was carried out in ten key thematic areas:

- Health
- Food, agriculture and fisheries, and biotechnology
- Information and communication technologies
- Nanosciences, nanotechnologies, materials and new production technologies
- Energy
- Environment (including climate change)
- Transport (including aeronautics)
- Socio-economic sciences and the humanities
- Space
- Security

The **Ideas programme** was something new in FP7. Up until now for all programmes a cross-border partnership was a must. But, in Ideas

[124] As per decision No 1982/2006/EC of the European Parliament and of the Council of 18 December 2006 regarding the FP7

programme this requirement was relaxed. This programme was to support "frontier research" solely on the basis of scientific excellence. Research may be carried out in any area of science or technology, including engineering, socio-economic sciences and the humanities. In contrast with the Cooperation programme, there was no obligation for cross-border partnerships. Projects were implemented by "individual teams" around a "principal investigator". The programme was implemented via the new European Research Council (ERC).

The **People programme** provides support for researcher mobility and career development, both for researchers inside the European Union and internationally. It was implemented via a set of Marie Curie actions, providing fellowships and other measures to help researchers build their skills and competences throughout their careers:

- Initial training of researchers – Marie Curie Networks
- Industry-academia partnerships
- Co-funding of regional, national and international mobility
- Programmes
- Intra-European fellowships
- International dimension – outgoing and incoming fellowships
- International cooperation scheme, reintegration grants
- Marie Curie Awards

The **Capacities programme** had the purpose of strengthening the research capacities that Europe needs to become a thriving knowledge-based economy.

It covered the following activities:

- Research infrastructures
- Research for the benefit of SMEs
- Regions of Knowledge
- Research Potential
- Science in Society

- Specific activities of international cooperation

The **Nuclear Research programme** and its training activities comprised research, technological development, international cooperation, dissemination of technical information, and exploitation activities, as well as training. Two specific programmes were put into place:

- the first programme included: fusion energy research (in particular ITER), and nuclear fission and radiation protection;
- the second programme covered the activities of the Joint Research Centre (JRC) in the field of nuclear energy, including nuclear waste management, and environmental impact, nuclear safety, and nuclear security.

Figure 12: Budget distribution FP7, at 2007 prices

Programme area	**Focus**	**Spending (mill. Euro, at 2007 prices)**
Cooperation	projects by transnational consortia of industry and academia. Research was carried out in ten key thematic areas.	3 241
Ideas	"Frontier research". No requirement of cross-border involvement.	751
People	Research mobility and career development for researchers both from within EU and internationally.	475
Capacities	Strengthening the research capacities.	410
Joint Research Centre	Fusion energy, nuclear waste management, nuclear safety, nuclear security, and environmental impact.	175
Euratom		270
Total		**5 322**

Many of the objectives in R&D are long term objectives and are difficult to assess, as Ligtvoet and van der Veen (2016) rightly say. They were

presenting a paper evaluating the FP6 and FP7 for energy projects at the International Energy Policies & Programmes Evaluation Conference in Amsterdam in 2016. They also state that overall, FP6 and FP7 can be considered scientifically and technologically successful in the sense that they have contributed to the (further) construction of the European Research Area in the field of energy. In their opinion the energy research in FP6 and FP7 has therefore certainly contributed to the creation of European Added Value.[125]

6.8.2 GENDER DIMENSION IN FP7 AND IN ERA

In 1999, early in FP5, the Commission adopted a Communication in which it undertook the commitment to develop a coherent approach towards promoting women in research financed by the EU.[126]

According to the Seventh FP7 Monitoring Report,[127] the Commission's stated aim was to achieve at least a 40% representation of women in Marie Curie fellowships, Advisory Groups, Assessment Panels and Monitoring Panels of FP5. This target was subsequently expanded to include all groups, panels, committees and projects involved in the FP. The 40% target remained in place for FP6 and is also valid for FP7. The CORDA database contains data on individuals with assigned contact person roles for each of the organisations participating in FP7 funded projects, for which grant agreements have already been signed. This data includes gender identity. At the moment of data extraction (October 2014) the database contained an estimated total of 433.115 individuals from EU28 participant organisations with assigned contact person roles, whose gender identity has been registered in the database, of which 116.714, or 26,95%, were women. Of all individuals with assigned contact person

[125] Ligtvoet and Van der Veen (2016), 'Evaluation of European FP6/FP7 Energy Research and Demonstration Projects', p 12 (Amsterdam)
[126] European Commission (1999): Communication "Women and Science: Mobilising women to enrich European research", COM (1999) p 76, Brussels
[127] EC (2015, 'Seventh FP7 Monitoring Report Monitoring Report', pp 31-36, see also http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf, accessed 27 May 2017, p 31

roles in coordinator organisations, 31,18% (34.613) are women; in participant (non-coordinating) organisations the corresponding share of women is 25,49% (82.101).

The aim (40%) is not achieved however, at least woman' participation is evident and indicates that further actions are necessary in the field of Gender Policy.

Gender equality has the 4th priority out of 6 priorities set in ERA Roadmap 2015. In its progress report[128] on ERA:

> "Share of women in leading public sector research positions was below the Council's 2005 goal of 25%, while there was limited integration of a gender dimension into the design, evaluation and implementation of research activities. The 2015 ERA Roadmap has renewed the commitment to foster scientific excellence and gender equality by Member States. Moving forward, the top action priority is to translate the various national equality legislations 'into effective action to address gender imbalances in research institutions and decision making bodies'. At the same time, the Roadmap seeks to improve the integration of the gender dimension into research and development (R&D) policies, programmes and projects."

6.9 THE FP8 - HORIZON 2020 (2014-2020)

A financial crisis engulfed major world economies in 2007-2008 and the effect is felt even today in 2017. The crisis started because of unsecured mortgage debt that major banks were holding. As there was a liquidity crunch followed by a loss of trust in financial markets, the banks stopped lending among each other. This led to a domino effect and stock prices dropped steeply, whipping out asset value in billions. The governments of many countries intervened to stabilise the markets but the long-term harm to the economy was done. All European countries suffered because

[128] EC (2017), 'European Research Area Progress Report 2016' p 9

of the financial crisis with job losses and no or negative growth in the years that followed.

The EU was alarmed with this financial crisis and saw that research and innovation can create new jobs and contribute to growth. For that the EC launched a plethora of initiatives on issues related to innovation policy. The year 2009 was named "European Year for Creativity and Innovation". A public consultation on the effectiveness of EU innovation policy led to the development of yet another EU strategy, the flagship initiative "Innovation Union", which was presented in autumn 2010. These are testimony to the importance of the subject and also to the challenges that this domain of EU policy is facing.[129]

A strategy for smart, sustainable, and inclusive growth, the EU 2020, was presented in March 2010. It placed research and innovation at the heart of European policies and introduced the Innovation Union flagship initiative. The 2020 strategy influenced the shape of the 8th FP, Horizon 2020, as well as the objectives for the European Structural and Investment Funds.

The Innovation Union flagship initiative aims at strengthening research and innovation systems in Europe. The goal of the EU Commission is to fully establish the European Research Area, develop strategic research agendas on key challenges, and enhance joint research programming between Member States. It aims to develop innovation in the private sector, with a particular interest in supporting SMEs. The Commission says that it also strives to improve the interactions between education, business, research and innovation. This flagship initiative invites Member States to reform their research and innovation systems to allow for better "interoperability" at European level and to foster EU cooperation. It also

[129] Granieri & Renda (2012), 'Innovation Law and Policy in the European Union, Towards Horizon 2020' p 78

invites them to support education in science, maths and engineering, as well as to prioritise knowledge expenditure.[130]

After 30 years of launching the first FP in 1984, the FP8 was launched to cover 2014-2020. This is yet another ambitious FP going to new heights and containing quite a few new and refined objectives.

First of all, its budget, which is estimated to be 80 billion Euro, is approximately 43% higher compared with the 55.9 billion Euro spent on FP6. Further, it brings all EU support for research and innovation together within a single programme termed Horizon 2020. As per the editorial statements from Carlos Moedas, European Commissioner for Science, Research and Innovation and Robert-Jan Smits, Director-General for Research and Innovation, this FP will play a

> "vital role in European Commission President Jean-Claude Juncker's agenda to strengthen Europe's competitiveness and boost jobs and growth, and will help us find the answers to major societal challenges such as health, climate change and energy security."[131]

6.9.1 BUDGET FOR HORIZON 2020

This Framework has five programme areas: Societal Challenges, Excellent Science, Industrial Leadership, European Institute of Innovation and Technology, Euratom, and "Other".

The initial proposal of the Commission in November 2011 set a budget of € 87.7 billion, whereas the European Parliament had requested a budget of €100 billion in September 2011. Following the ordinary legislative procedure, the final Decision of December 2013 set a budget of € 77 billion for Horizon 2020. In June 2015, the adoption of the European Fund for Strategic Investments lowered this budget to € 74.8 billion.[132]

---

[130] European Parliamentary Research Service (2015), 'Overview of EU Funds for research and innovation'
[131] European Commission (2015), 'Horizon Special Issue'
[132] European Parliamentary Research Service (2015), 'Overview of EU Funds for research and innovation'

Figure 13: Budget distribution in Horizon 2020
Source: European Commission (October 2016), Research and Innovation (Luxembourg: Publications Office of the EU)

Programme area	Focus	Spending (mill. Euro, at 2007 prices)
Societal Challenges	Investment in research and innovation that can have a real impact and benefit the citizen.	29 700
Excellent Science	This programme is intended to bolster the EU's competitiveness, create jobs, and contribute to higher standards of living.	24 400
Industrial Leadership	Invest in promising and strategic technologies, encourage businesses to invest more in research, cooperate with the public sector to boost innovation.	17 000
European Institute of Innovation and Technology	Harnessing the potential of the EU's talent pool, maximising and spreading the benefits of innovation across the Union.	2 700
Other	Science with and for society, spreading excellence and widening participation, non-nuclear direct actions of the Joint Research Council.	3 200
Euratom (2014-2016)	Funding EU research on nuclear fission and fusion, safety and security issues, medical research, radiation protection, waste management, industrial uses of radiation, uses in energy production.	1 600
	Total	**78 600**

6.9.2 MARIE SKŁODOWSKA-CURIE ACTIONS

The Marie Skłodowska-Curie Actions (MSCAs) support international training networks for PhD and early career researchers, international mobility fellowships for experienced researchers, international exchanges of research staff and other programmes related to international and career development. This is a work programme for ensuring excellent and innovative research training.

It helps career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers, and help the researchers better prepare for current and future societal challenges.

The Marie Skłodowska-Curie actions are open to researchers and innovation staff at all stages of their career of all ages. They are open to universities, research institutions, research infrastructures, businesses, and other socio-economic actors, including civil society organisations, from all countries, including third countries under the conditions defined in the Horizon 2020 Rules for Participation. Attention is paid to encouraging the strong participation of industry, in particular SMEs, for the successful implementation and impact of the Marie Skłodowska-Curie actions.[133]

This programme provide Frontier research is essential and is often the foundation for innovation and technological advancement. It plants the seeds from which new industries and market grow. The idea is, Horizon 2020 to provide the means to take technological breakthroughs from frontier research through the next stages of development.

[133] EU (2016), 'Horizon 2020 Work Programme 2016-2017, 3. Marie Skłodowska-Curie Actions'

CHAPTER 7
WHAT IS THE IMPLICATION OF BREXIT?

> Nations have no permanent friends or allies, they only have permanent interests.
>
> Lord Palmerston (English Statesman, 1784-1865)[134]

7.1 INTRODUCTION

United Kingdom, one of the biggest and key Member State of the EU, held a referendum in June 2016 in which the voters were asked for their preference to stay or leave the Union. As a result of this referendum the UK has officially notified the EU on 29 March 2017 that it is leaving the EU, after being a member for 44 years.

As a consequence of this first and unique situation until now, many questions have arisen about the future relationship between the EU and the UK. One of the questions that have to be negotiated and answered is the topic of R&I.

At the beginning of this chapter, I want to give some information on Brexit. However, it is not possible to analyse Brexit in a deeper way, this would go beyond the scope of my studies. In addition, I briefly explain EU-law on Article 50 of the Treaty on EU.

The main object is to analyse the EU's role in funding UK research and to gather evidence on UK's relationship with the EU on R&I. Case studies on EU connected research in Norway and Switzerland, two non-EU member states, will help us to get some ideas on possible scenarios for the future of UK research and the EU. As a third case study, I have chosen Austria, especially to illustrate the dimensions of Horizon 2020 in a small member state. Conclusions on the topic will be done in chapter 9.

[134] See http://thinkexist.com/quotation/nations-have-no-permanent-friends-or-allies-they/771609.html, accessed 8 May 2017

7.2 THE BACKGROUND OF BREXIT

It is necessary to get some basic and background information about the history of Brexit and to investigate the implication of the UK's decision to withdraw from the EU.

To begin with, I wish to clarify the meaning of some terms. What does Brexit mean? What does BREGRET mean?

"BREXIT" is a word that has become used as a shorthand way of saying the UK leaving the EU – merging the words Britain and exit to get Brexit, in a same way as a possible Greek exit from the euro was dubbed Grexit in the past.[135]

It would be interesting to know that right after the Brexit referendum there appeared the term "BREGRET". It is a neologism from "Brexit Regret". This term is still trending.[136] The British Election Study, a long-running panel survey, asked voters in July 2016 whether they regretted their choice. The authors point out that voters for the winning side feel some regret after most elections, but the result suggests that the slim pro-Brexit majority had evaporated within a month of the referendum. Remorse was strongest among Leavers who did not expect their side to win, adding some weight to the idea that many were motivated by frustration with the establishment rather than by Euroscepticism.[137]

7.2.1 WHY IS THE UK LEAVING THE EU?

A referendum – a vote in which everyone (or nearly everyone) of voting age can take part – was held on Thursday 23 June 2016, to decide whether the UK should leave or remain in the EU. The "Leave side" won by 51.9% to 48.1%. The referendum turnout was 71.8%, with more than 30 million people voting.[138]

---

[135] See http://www.bbc.com/news/uk-politics-32810887, accessed 10 April 2017
[136] See https://webgate.ec.europa.eu/fpfis/mwikis/thinktank/index.php/Bregret, accessed 1 May 2017
[137] See http://www.economist.com/news/britain/21708679-minority-leavers-have-changed-their-minds-others-are-bailing-out-after-brexit-bregret, accessed 1 May 2017
[138] See http://www.bbc.com/news/uk-politics-32810887, accessed 10 April 2017

First, I want to give some statistical information on the UK. UK's population[139] is about 65,468,590 people, and equivalent to 0.87% of the total world population. 81.9 % of the population is urban. The population density in the UK is 271 per Km^2. The median age in the UK is 40.1 years.

What was the breakdown of the referendum results? England voted for Brexit, by 53.4% to 46.6%. Wales also voted for Brexit, with "Leave" getting 52.5% of the vote and "Remain" 47.5%. Scotland and Northern Ireland both backed staying in the EU. Scotland backed "Remain" by 62% to 38%, while 55.8% in Northern Ireland voted "Remain" and 44.2% "Leave".[140]

As a consequence of the outcome of this referendum the UK got a new Prime Minister (PM) – Theresa May, who was the former home secretary. She took over from David Cameron, who announced his resignation on the day he lost the referendum. Like Mr Cameron, Mrs May was against Britain leaving the EU but she played only a very low-key role in the campaign. She was never an enthusiast for the EU. She became PM without facing a full Conservative leadership contest after her key rivals from what had been the "Leave side" pulled out.

Opinion polls give the Conservative Party a huge lead over Labour, the largest opposition party. Theresa May became the first PM to gain an opposition seat in a by-election for 35 years. Her message has been that "Brexit means Brexit". She triggered the two years process of leaving the EU on 29 March 2017. She set out her negotiating goals in a letter to the EU council president Donald Tusk.[141]

7.2.2 WHAT WAS THE EFFECT ON ECONOMY, SO FAR?

In the days leading to the vote, there was a wide spread expectation that it will be a "Remain" vote. Therefore, the outcome caught the business

[139] See http://www.worldometers.info/world-population/uk-population/, accessed 23 May 2017
[140] Miller et al (2016) Exiting the EU: UK reform proposals, legal impact and alternatives to membership: House of Commons Library, briefing paper Number 07214, February 2016, p 11
[141] See http://www.bbc.com/news/uk-politics-32810887, seen 10 April 2017

and finance community in surprise. After the referendum, the shares in London and the British Pound lost their value heavily. This disturbance in the finance market and its outlook on the economy were indeed expected in case of a "Leave" vote.

For that reason, David Cameron, his Chancellor George Osborne and several other senior figures vouched for a "Remain" vote. They had predicated negative effects on UK economy in case of a "Leave" vote. Their fear was that there would be a recession with a big rise in unemployment – and an emergency budget would be needed to bring in the large cuts in spending that would be needed.

> "The pound did slump the day after the referendum – and remains around 15% lower against the dollar and 10% down against the euro – but the predictions of immediate doom have not proved accurate with the UK economy estimated to have grown 1.8% in 2016, second only to Germany's 1.9% among the world's G7 leading industrialised nations."[142]

Inflation has risen – to 2.3% in February 2017 – its highest rate for three and a half years, but unemployment has continued to fall, to stand at an 11-year low of 4.8%. Annual house price increases have fallen from 9.4% in June 2016, but were still at an inflation-busting 7.4% in December 2016, according to official ONS figures.[143]

"UK house sales fall to lowest level since EU referendum"[144] was one of the headline in May 2017 in Financial Times. This just shows that the economic effects of the vote are still at the beginning.

7.2.3 FURTHER DEVELOPMENTS

Talks will get under way with EU officials in 2017. The real hard work will not start until July 2017 when negotiations with other EU countries are

[142] Ibid.
[143] See http://www.bbc.com/news/uk-politics-32810887, accessed 11 April 2017
[144] https://www.ft.com/world/uk, accessed 11 May 2017

expected to start. These talks are expected to end in autumn 2018 – and then UK, the European Council, and the European Parliament will each get a vote on any deal that has been agreed.[145]

UK PM Theresa May has announced plans to call a snap general election on 8 June 2017. She says "Britain needs certainty, stability and strong leadership following the EU referendum". On 26 April 2017, the House of Commons approved the election plan – the PM needed two thirds of members of Parliament to vote in favour to bring forward the next scheduled election date of 2020.[146]

One gets an impression how difficult the Article 50 negotiations will be just listening to the news and reading the newspapers.[147] On 28 April 2017, for example, EU leaders expressed mounting alarm that UK PM Theresa May and her team are in a dangerous state of denial about the consequences of leaving the bloc.[148]

On 2 May 2017, PM Theresa May told the BBC she will be a "bloody difficult woman" when dealing with European Commission President Jean-Claude Juncker in the upcoming Brexit negotiations:

> "During the Conservative Party leadership campaign I was described by one of my colleagues as a 'bloody difficult woman.' And I said at

[145] See http://www.bbc.com/news/uk-politics-39143978, accessed 11 April 2017
[146] See http://www.bbc.com/news/uk-politics-39629603, accessed 26 April 2017
[147] For example some headlines/articles from Austrian newspapers:
Die Presse, 21 April 2017: "Brüssel kappt die Kooperation mit Großbritannien"
Die Presse, 28 April 2017: Merkel warnt London vor "Illusionen"; "Der komplizierte Umzug der Arzneimittelargentur"
Die Presse, 25 April 2017, "EU legt Glacèhandschuhe ab"
Die Presse, 2 May 2017, "May erwartet harte Bandagen"
Die Presse, 3 May 2017 "Briten steigen in den Brexit-Ring"
Die Presse, 4 May 2017, "Brexit könnte 100 Mrd. € kosten", "Brexit wird noch teurer"
Kurier, 4 May 2017, " 'Eine Illusion, dass der Brexit schnelll und schmerzlos sein wird' "
Wiener Zeitung, 10 May 2107, "Brexit könnte Top-Forschung teuer zu stehen kommen"
Die Presse, 17 May 2017 "Wetten auf den harten Brexit"
Die Presse, 19 May 2017, "Theresa May verschärft Kurs gegen Einwanderer"
[148] http://www.politico.eu/article/britains-brexit-denial/, accessed 22 May 2017

> the time the next person to find that out will be Jean-Claude Juncker."[149]

The comments follow reports in POLITICO and Frankfurter Allgemeine Sonntagszeitung that May and Juncker clashed after a fraught Brexit discussion over dinner in London, with Juncker saying that he left Downing Street "10 times more sceptical" than he was before.[150]

However, the UK government denied these claims saying that the meeting was "constructive", and came in advance of formal negotiations between the two sides.[151]

The next morning the European Commission president telephoned Angela Merkel on her mobile to complain to the German chancellor that PM May was "living in another galaxy" over Brexit and that PM May was "deluding herself" over her negotiation demands.[152]

The question arises, when UK will actually leave? The time frame allowed in Article 50 of the Treaty on EU is two years – and this can only be extended by unanimous agreement from all EU countries. If no agreement is reached in two years, and no extension is agreed, the UK automatically leaves the EU and all existing agreements – including access to the single market – would cease to apply to the UK. If that happens, Brexit Day would be Friday, 29 March 2019.

7.2.4 THE UK'S EXIT FROM AND NEW PARTNERSHIP WITH THE EU

A day after the Supreme Supreme Court ruled that Parliament – not ministers – must decide whether the government can invoke Article 50 of the of the Treaty on EU, triggering the two-year process of leaving the EU,

---

[149] http://www.politico.eu/article/theresa-may-bloody-difficult-woman-to-jean-claude-juncker/, accessed 22 May 2017
[150] https://www.thetimes.co.uk/article/im-ten-times-more-sceptical-on-brexit-says-juncker-x9w2c5smk, accessed 22 May 2017
[151] http://www.politico.eu/article/theresa-may-bloody-difficult-woman-to-jean-claude-juncker/, accessed 22 May 2017
[152] http://www.faz.net/aktuell/brexit/eu-kommission-skeptisch-vor-brexit-verhandlungen-14993673.html, accessed 22 May 2017; http://www.telegraph.co.uk/news/2017/05/01/jean-claude-juncker-says-theresa-may-deluded-scathing-call-angela/, accessed 22 May 2017

PM Theresa May has announced the government will set out its Brexit plans in a formal policy document. "No deal is better than a bad deal" is one of Theresa May's key slogans. It is to be seen whether this slogan is going to pay or backfire during the negotiations.

7.2.4.1 The White Paper

In February 2017, the UK government published an official policy document setting out its Brexit plans. The White Paper[153] lays out the government's 12 "principles" including migration control and "taking control of our own laws".

The White Paper's publication has come after pressure from MPs across the House of Commons. It sets out the themes of the government's goals for its negotiations with the EU.

In this White paper, PM May stresses in her foreword[154] the following:

> "We do not approach these negotiations expecting failure, but anticipating success.
>
> Because we are a great, global nation with so much to offer Europe and so much to offer the world.
>
> One of the world's largest and strongest economies. (…)
>
> Business isn't calling to reverse the result, but planning to make a success of it. (…)
>
> Not merely forming a new partnership with Europe, but building a stronger, fairer, more Global Britain too. (…)

[153] See https://www.gov.uk/government/publications/the-united-kingdoms-exit-from-and-new-partnership-with-the-european-union-white-paper, Foreword by the Prime Minister from 17 January 2017, p 3, accessed 14 April 2017

[154] The United Kingdom's exit from and new partnership with the European Union Presented to Parliament by the Prime Minister by Command of Her Majesty, February 2017

> So that when future generations look back at this time, they will judge us not only by the decision that we made, but by what we made of that decision. ..." (White Paper, p 3f)

The Secretary of State for Exiting the EU, RT HON David Davis MP concludes, that as

> "things stand, we have the exact same rules, regulations and standards as the rest of the EU. Unlike most negotiations, these talks will not be about bringing together two divergent systems but about managing the continued cooperation of the UK and the EU. The focus will not be about removing existing barriers or questioning certain protections but about ensuring new barriers do not arise." (White Paper, Preface, p 5)

One of the 12 principles (Principle 10) for a "strong new partnership" is ensuring the UK remains the best place for science and innovation.

7.2.4.2 The White Paper and R&I

Not just Principle 10 "Ensuring the United Kingdom remains the best place for science and innovation" is dedicated R&I, in Chapter 1 "Providing certainty and clarity" it is already stated under "Funding commitments" that the UK recognises

> "the importance to business of having certainty about funding arrangements over the coming years. We have already acted quickly to give clarity about farm payments, competitive grants, including science and research funding, and structural and investment funds." (White Paper, chapter 1.13).

Under "Funding Commitments already Made by this Government" it is stated, that regarding the bids made directly to the Commission by UK organisations (including for Horizon 2020, the EU's R&I programme and in funds for health and education), institutions, universities and businesses

should continue to bid for funding. The UK will work with the Commission to ensure payment when funds are awarded. HM Treasury will underwrite the payment of such grants, even when specific projects continue beyond the UK's departure from the EU.

In addition, it is stated clearly that the UK will seek agreement to continue to collaborate with our European partners on major science, research, and technology initiatives. R&I are a fundamental driver of economic growth and long-term UK competitiveness.

Further,[155] it is stressed that the UK is already a leading destination for science and innovation. The breadth and depth of the academic and scientific communities is backed up by some of the world's best universities.[156] The UK ranks on the 6th place regarding university-industry collaboration.[157] The UK was third in the Global innovation Index.[158] Adding to that UK is the country with the most Nobel Laureates[159] (85 winners) behind the United States (259 winners).

For this reasons, this Government's pledge to invest in R&D is sending a clear message that the UK is committed to protecting the UK's strength in science. UK is planning a close engagement with the science and research base to ensure a smooth transition to future arrangements. For this reason,

> "the Government has established a High Level Stakeholder Working Group on EU Exit, Universities, Research and Innovation, which includes a number of senior representatives of UK research and

[155] Chapter 10.2. ibid.
[156] See https://www.timeshighereducation.com/world-university-rankings, accessed 8 May 2017. Three universities of the UK are in the world's top 10.
[157] The Global Competitiveness Report 2016-2017 assesses the competitiveness landscape of 138 economies, providing insight into the drivers of their productivity and prosperity. See http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf, p 355, accessed 8 May 2017
[158] The Global Innovation Index 2016: Winning with Global Innovation is the result of a collaboration between Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO) as co-publishers, and their Knowledge Partners. See https://www.globalinnovationindex.org/gii-2016-report#, p 296, accessed 8 May 2017
[159] See https://www.nobelprize.org/nobel_prizes/lists/countries.html, accessed 8 May 2017

> innovation funders, Higher Education Institutions, national academies and learned societies and business. This group will work with the Government to ensure that the UK builds on its strong global position in research and innovation excellence." (White Paper, p 33).

To respond to concerns of the science and research sectors, providing reassurance and certainty, UK government has also taken quick and decisive action. In chapter 1.13 (see above) as well in chapter 10.9 it is stressed, that HM Treasury will underwrite the payment of such awards, even when specific projects continue beyond the UK's departure from the EU. This has given UK participants and their EU partners the certainty needed to plan ahead for projects that can run over many years.

Finally, it is stated that UK is a global leader in international collaboration.

> "One of the UK's key strengths in research is international collaboration: 47.6 per cent of UK articles in 2012 were internationally co-authored – a share that has been increasing. With just 3.2 per cent of global research and development expenditure, the UK accounts for 6.4 per cent of articles and 15.9 per cent of the world's most highly-cited articles. The UK also exported over £ 11 billion of intellectual property globally in 2015." (Chapter 10.12 White Paper)

The paper closes with the wish, that as UK exit the EU, UK

> "would welcome agreement to continue to collaborate with our European partners on major science, research and technology initiatives." (White Paper, chapter 10.14)

7.2.4.3 What is the Message from the White Paper for R&I?

Analysing the White Paper, it becomes clear that the UK, recognising the deep integration and harmonisation and the advantages in the field of R&I connected with the EU, has vital interest to continue the close cooperation on R&I. HM Treasury promises payment for funds awarded by the EU,

even when specific projects continue beyond the UK's departure from the EU, emphasises this interest.

7.2.5 WORRIES IN THE UK ABOUT R&I

The Russell Group represents 24 leading UK universities, which are committed to maintaining the very best research, an outstanding teaching and learning experience and unrivalled links with business and the public sector.[160]

In several documents,[161] the Russell Group has published its concern about Brexit and the necessity to continue to work with partners across Europe and more widely to boost the UK's international competitiveness.

Russel Group states[162] that there are 61,000 students of other EU nationalities at Russell Group universities, making up 8% of undergraduate students and 15% of postgraduate students. Further, they point out that currently, there are around 24,860 members of staff from other EU countries at their universities: 15% of the overall workforce, 22% of academics and 27% of staff on research-only contracts are EU nationals. Research income from the EU represented 12% of the collective research grant income to Russell Group universities in 2015/2016, up from 8% in 2007/2008 – equivalent to over half a billion pounds.

Therefore, Russel Group is seeking reassurance for students, staff, research funding, collaboration and mobility. It says that the key priorities for the Government in the upcoming negotiations with the EU should be:

---

[160] See http://russellgroup.ac.uk/about/, accessed 9 May 2017

[161] For instance:
Russell Group response to House of Commons Education Committee inquiry: The impact of exiting the EU on Higher Education (November 2016), see http://russellgroup.ac.uk/media/5448/russell-group-response-to-hoc-education-committee-inquiry-the-impact-of-exiting-the-european-union-on-higher-education-november-2016.pdf, accessed 9 May 2017
Article 50 open letter from 29 March 2017, see http://russellgroup.ac.uk/news/article-50-open-letter/, accessed 9 May 2017;
Russell Group universities and Brexit, updated April 2017, see http://russellgroup.ac.uk/media/5486/russell-group-universities-and-brexit-briefing-note-april-2017.pdf, accessed 9 May 2017

[162] See http://russellgroup.ac.uk/media/5486/russell-group-universities-and-brexit-briefing-note-april-2017.pdf, accessed 9 May 2017

"(a) Ensuring UK universities can continue to recruit and retain talented staff and students from across the EU and more widely without bureaucratic visa burdens

(b) Ensuring the UK can continue to have full access to and influence over Horizon 2020 and future EU research and innovation programmes and infrastructures with a focus on excellence

(c) ensuring the UK can continue to participate in the Erasmus+ programme"[163]

Commenting on the latest statistics[164] on Horizon 2020 funding released by the Department for Business, Energy and Industrial Strategy Jessica Cole, Head of Policy at the Russell Group, said:[165]

"These latest figures show once again the importance of EU funding to our world-leading universities. It's really encouraging that the UK is still ranked number one for participation in Horizon 2020. Our universities are key to this success – 26 per cent of the funding allocated to universities across Europe goes to UK institutions."

"We are pleased the Government has committed to underwrite competitive bids for Horizon 2020 funding but ensuring this collaboration continues is vital if we want to remain at the cutting edge of science and research."

"As the Government enters into Brexit negotiations we urge them to prioritise research and innovation to ensure the UK's participation in EU research for the full duration of Horizon 2020 and future programmes with a focus on excellence."

[163] See http://russellgroup.ac.uk/media/5486/russell-group-universities-and-brexit-briefing-note-april-2017.pdf, p 1, accessed 9 May 2017
[164] See https://www.gov.uk/government/statistics/uks-participation-in-horizon-2020-february-2017, accessed 9 May 2017
[165] See http://russellgroup.ac.uk/news/horizon-2020-latest-statistics/, accessed 9 May 2017

However, not only in the UK worries were uttered.[166] Thomas König, a senior researcher at the Vienna Institute for Advanced Studies at the University of Vienna, Austria, who was formerly scientific advisor to the previous ERC president, Helga Nowotny, for instance, warned on 25 January 2017 not to underestimate UK's role in pan-European research endeavours.[167] In response, Roger Michaels pointed out on 2 February 2017:

> "The real loss of influence is also not to be measured in money gained or money lost. Were it that easy. UK is involved in one way or another in more than half of the H 2020 networked projects, which have on average well over 5 partners. (…)
>
> By being in a consortium network then each partner gains access to all the research both in terms of steering it and in terms of outcomes; hopefully positive and useful. THAT is where the UK will miss out, the multiplier effect; the spillovers and the networking. And Europe will miss out too; for the UK influence has been hugely positive."

He continues that a high price to pay for democracy but research is like art, a luxury paid for by society at large, and they have bitten back.[168]

7.3 WHAT ARE THE LEGAL ASPECTS OF BREXIT?[169]

In addition, it is important to look at the legal aspects of UK withdrawing from the European Union. I have given below three important aspects.

---

[166] EuroScientist is the official journal of EuroScience, a grassroots association of scientists and people with an interest in science-related matters in Europe. See http://www.euroscientist.com/about/, accessed 10 May 2017

[167] http://www.euroscientist.com/uk-scientists-lose-influence/, accessed 10 May 2017

[168] http://www.euroscientist.com/uk-scientists-lose-influence/, accessed 10 May 2017

[169] For further information see Jennifer Hillman & Gary Horlick (2017), 'Legal Aspects of Brexit, Implications of the United Kingdom 's Decision to Withdraw from the European Union'. Although this book gives a broad analyse on the legal aspects the implications on FPs are not analysed.

7.3.1 ARTICLE 50 OF THE TREATY ON THE EUROPEAN UNION

"Article 50" is the plan for any country that wishes to exit the EU. It was created as part of the Treaty of Lisbon[170] – an agreement signed up to by all EU states, which became law in 2009. Before that treaty, there was no formal mechanism for a country to leave the EU.

It is pretty short – just five paragraphs with 261 words in length – which spell out that any EU Member State may decide to quit the EU.

Never before interpreted or applied, Article 50 rises a number of legal conundrums but, those are not subject of my study.

According to paragraph 1

> "Any Member State may decide to withdraw from the Union in accordance with its own constitutional requirements."
>
> "A Member State which decides to withdraw shall notify the European Council of its intention. In the light of the guidelines provided by the European Council, the Union shall negotiate and conclude an agreement with that State, setting out the arrangements for its withdrawal, taking account of the framework for its future relationship with the Union. That agreement shall be negotiated in accordance with Article 218 (3) of the Treaty on the Functioning of the European Union. It shall be concluded on behalf of the Union by the Council, acting by a qualified majority, after obtaining the consent of the European Parliament." (paragraph 2)
>
> "The Treaties shall cease to apply to the State in question from the date of entry into force of the withdrawal agreement or, failing that, two years after the notification referred to in paragraph 2, unless the European Council, in

[170] See http://www.lisbon-treaty.org/wcm/the-lisbon-treaty/treaty-on-european-union-and-comments/title-6-final-provisions/137-article-50.html, accessed 11 April 2017

agreement with the Member State concerned, unanimously decides to extend this period." (paragraph 3)

"For the purposes of paragraphs 2 and 3, the member of the European Council or of the Council representing the withdrawing Member State shall not participate in the discussions of the European Council or Council or in decisions concerning it.

A qualified majority shall be defined in accordance with Article 238 (3) (b) of the Treaty on the Functioning of the European Union." (paragraph 4)

"If a State, which has withdrawn from the Union, asks to re-join, its request shall be subject to the procedure referred to in Article 49." (paragraph 5)

After notification to the European Council, UK has to negotiate its withdrawal with the EU. There are two years to reach an agreement – unless everyone agrees to extend it. UK as the exiting state cannot take part in EU internal discussions about its departure.

Any exit deal must be approved by a "qualified majority" (72% of the remaining 27 EU states, representing 65% of the population) but must also get the backing of MEPs.

7.3.2 CAN THE EXIT BE REVERSED?

No country has ever left the EU and Article 50 does not explicitly say whether the process can be halted. The UK government has been unable to make any definitive legal statements on the issue.

However, in her speech to the House of Commons on 29 March 2017, Theresa May said "there can be no turning back" and in the recent UK Supreme Court case on Article 50, both sides assumed it was irrevocable.

However, the European Council President Donald Tusk as said he believes Article 50 can be reversed.

On his side is veteran British diplomat Lord Kerr, who wrote Article 50. He told the BBC in November 2016 "you can change your mind while the process is going on". But he added he did not think any politician in Britain would allow such a U-turn.[171]

7.3.3 THE "GREAT REPEAL BILL"

The great repeal bill is an essential step on the way to leaving the EU, it aims to ensure European law will no longer apply in the UK.

As the name suggests, the Great Repeal Bill will repeal the 1972 European Communities Act, which took Britain into the EU and meant that European law took precedence over laws passed in the British parliament. It will also end the jurisdiction of the European Court of Justice. All existing EU legislation will be copied across into domestic UK law to ensure a smooth transition on the day after Brexit.

The government says it wants to avoid a "black hole in our statute book" and avoid disruption to businesses and individual citizens as the UK leaves the EU. The UK Parliament can then "amend, repeal and improve" the laws as necessary. Ensuring the continuity of EU rules and regulations is also meant to aid trade negotiations with the EU because the UK will already meet all of its product stands.[172]

Is this a good deal for the UK? One thing is clear. Brexit has the potential to be the most significant international economic law event of our lifetimes (Hillman/Horlick 2017, p iii). Despite all benefits, it cannot be ignored that concerns remain, which might be relevant in R&I. A future lack of transparency in use of public funds might be one of them. Further, the UK government loses its right to complain to the EC and to challenge EC's decisions before the CJEU. These rights are strictly linked to the notion of

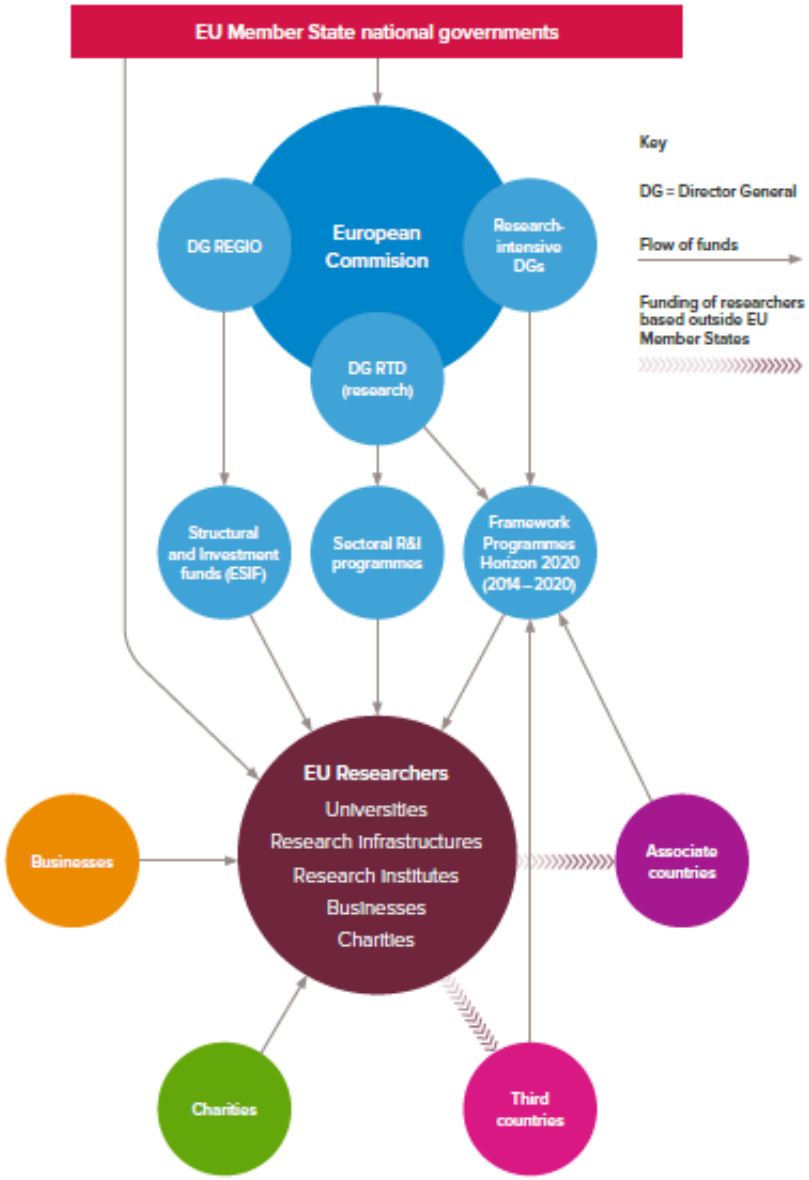
[171] See http://www.bbc.com/news/uk-politics-39143978, accessed 11 April 2017
[172] See http://www.bbc.com/news/uk-politics-39266723, accessed 11 April 2017

Member State, which UK will not any more post Brexit (Weinberger 2017, pp 143).[173]

7.4 THE ROLE OF THE EU IN FUNDING UK RESEARCH

The EU is one of many research funders in Europe. The research landscape is complex. International, national and regional actors interact at multiple levels. Below, the flow of research funding in Europe:

Figure 14: Research funding in Europe
(Source: Royal Society (2015), p 4)



[173] Anna Weinberger, 'State Aid Regulations after Brexit, A Good Deal for the UK?', in Jennifer Hillman /Gary Horlick (2017), Legal Aspects of Brexit, Implications of the United Kingdom 's Decision to Withdraw from the European Union, pp 130-149

Within the research community, the UK has created a world-leading research base.

7.4.1 THE UK RESEARCH AND THE EU

The analysis in the following section is based on the most recent completed EU financial framework that operated during 2007-2013.

The question, how much does the UK contribute to EU research and how much does it receive, has to be answered.

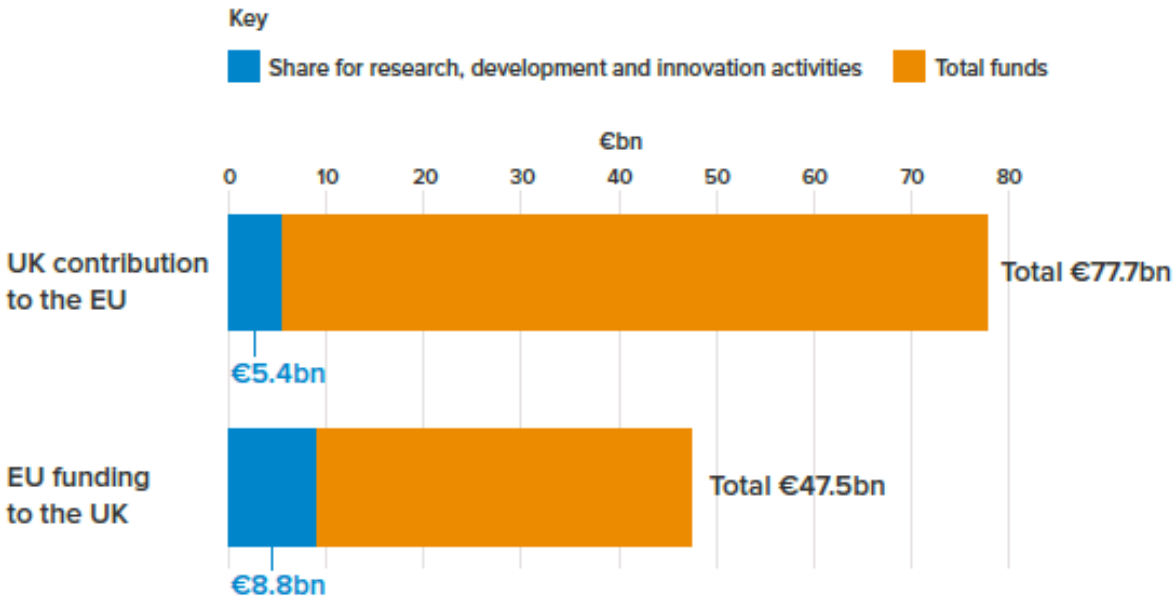
The UK is a net contributor to the EU budget. Over the period 2007-2013, the UK contributed € 77.7 billion to the EU (10.5% of the total EU income from Member States), and received € 47.5 billion in EU funding (6% of the total EU expenditure to Member States.[174]

The UK is one of the largest recipients of research funding in the EU and, although national contributions to the EU budget are not itemised, analyses suggest that the UK receives a greater amount of EU research funding than it contributes. The UK Office of National Statistics (ONS) reports an indicative figure for the UK's contribution to EU research and development of € 5.4 billion over the period 2007-2013.[175]

The UK is one of the largest recipients of research funding in the EU. Over the period 2007-2013, the UK received € 8.8 billion out of a total of € 107 billion expenditure on research, development and innovation activities of the EU. This represents the fourth largest share in the EU.[176]

[174] The Royal Society, (2015) UK research and the European Union / The role of the EU in funding UK research, p 12, with reference to http://ec.europa.eu/budget/figures/2013/2013_en.cfm
[175] The Royal Society, (2015) UK research and the European Union / The role of the EU in funding UK research, p 12, with reference to UK Office national Statistics, UK Government Expenditure on Science, Engineering and Technology
[176] The Royal Society, (2015) UK research and the European Union / The role of the EU in funding UK research, p 14, with reference to http://ec.europa.eu/budget/figures/2013/2013_en.cfm

Figure 15: Flow of funds between the UK and the EU 2007-2013
In billion Euro
(Source: Royal Society (2015), p 12)



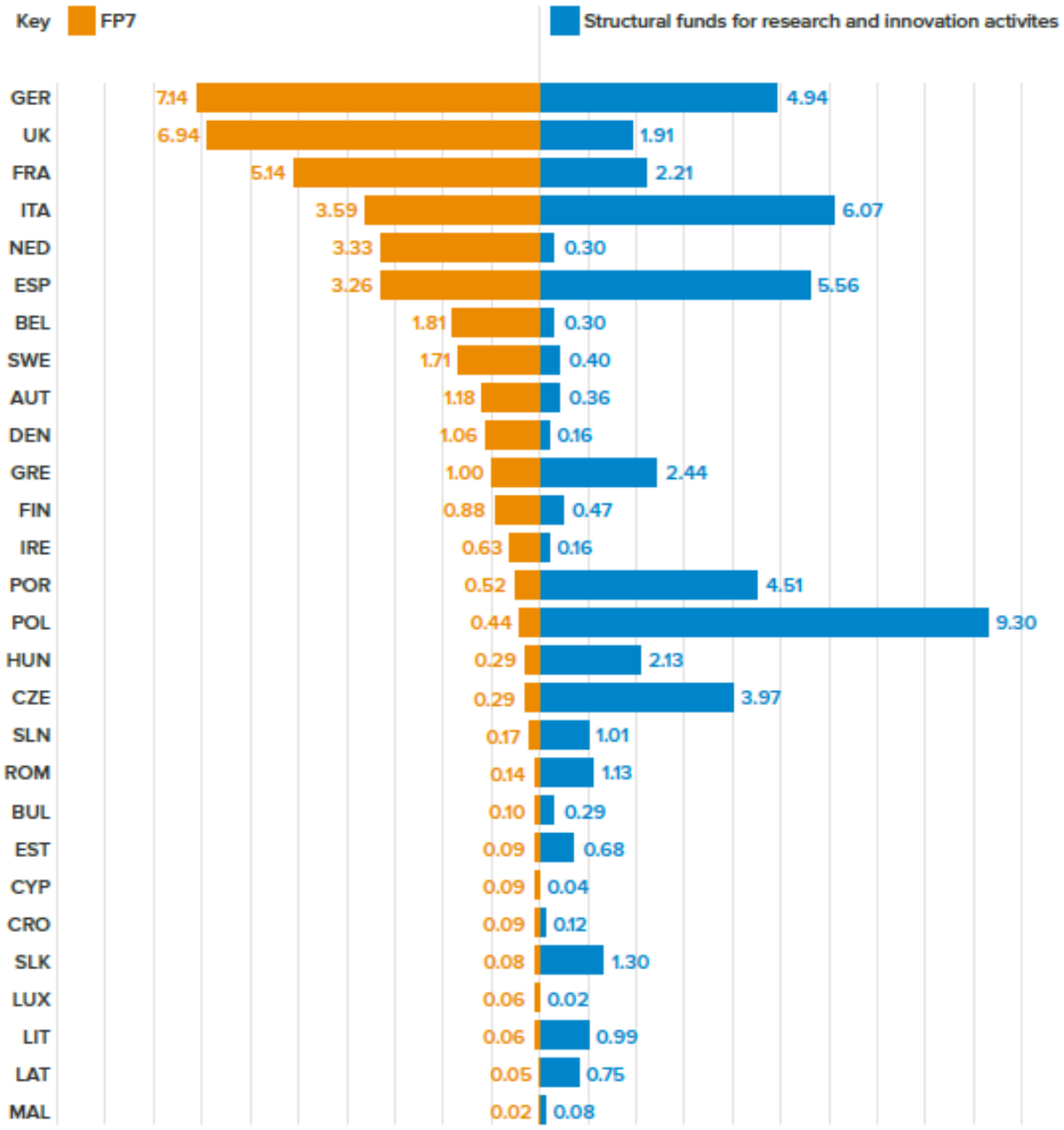
The UK receives most of its EU research funding through Framework Programmes and structural funds. Over the period 2007-2013, the UK received € 6.9 billion of Framework Programme 7 (FP7) funding, of which € 1.7 billion were in European Research Council grants (19%) and € 1.1 billion for Marie Skłodowska-Curie Actions (12%). The UK was allocated € 1.9 billion of structural funds for R&I activities over the same period.[177]

UK was the second largest recipient after Germany, securing € 6.9 billion out of total € 55.4 billion.[178]

Distribution of EU expenditure on research, development and innovation (FP 7 and structural funds) in EU countries. 2007-2013 (€ billion = 10^9)

[177] The Royal Society, (2015) 'UK research and the European Union / The role of the EU in funding UK research', p 13
[178] For more details see Seventh FP7 Monitoring Report MONITORING REPORT 2013, see http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&paagemode=none, accessed 9 May 2017

Figure 16: EU expenditure on R&D FP7
(Source: Royal Society (2015), p 14)



The EU research funding through FP7 represented about 3% of UK expenditure on R&D between 2007-2013.

Total R&D expenditure in the UK in 2013 represented 1.67% of Gross Domestic Product (GDP), an increase from 1.62 % in 2012. International comparisons show that UK R&D expenditure in 2013 was below the EU

(EU-28) provisional estimate of 2.02% of GDP, but the 12th highest of all member countries.[179]

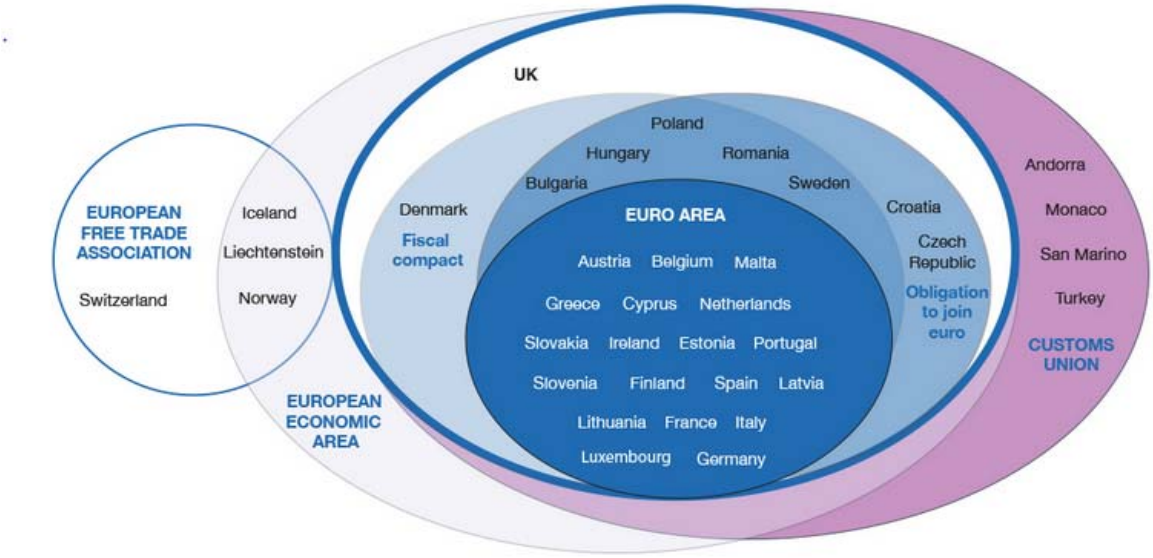
UK universities were among the most successful in securing EU research funding, receiving 71 of total FP7 funding awarded to the UK.[180]

7.5 POSSIBLE FUTURE SCENARIOS FOR A UK-EU RELATIONSHIP

7.5.1 EU AND RELATED MEMBERSHIP GROUPINGS

The diagram below shows, which countries are members of the various groupings associated with the EU. All EU Member States are in the EU Customs Union. A number of additional countries also have a customs union arrangement with the EU, such as Turkey.

Figure 17: Countries – various groupings associated with the EU
Source: White paper[181]



[179] Office for National Statistics, Statistical Bulletin, UK Gross Domestic Expenditure on Research and Development, 20 March 2015, see http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171778_398876.pdf, accessed 10 May 2017

[180] http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&paagemode=none, accessed 9 May 2017

[181] See https://www.gov.uk/government/publications/the-united-kingdoms-exit-from-and-new-partnership-with-the-european-union-white-paper, accessed 14 April 2017

There are several different options for the future UK-EU relationship:[182]

- The European Free Trade Area (EFTA) scenario[183]: UK could set its own tariffs and reach independent free trade agreements.
- The European Economic Area (EEA) or Norwegian option:[184] EEA members are required to incorporate the EU law and regulations relevant to EU's four freedoms but without having a seat at the table when the rules are decided.
- The Swiss option: UK could negotiate bilateral deals with the EU.
- The World Trade Organization (WTO) option: This would give UK more control over its trade deals with non-EU countries, but is has less bargaining power than the EU.
- The Canada option: The Comprehensive Economic and Trade Agreement (CETA) gives Canada preferential access to the EU

[182] Michelle Cini & Nieves Pérez-Solórzano Borragán, 'The UK's EU Referendum, The Background, the Vote, and the Impact', Oxford Univerity Press (2016), p 13
Bowers et al, 'Brexit: Some legal and constitutional issues and alternatives to EU membership': House of Commons Library, Briefing Paper Number 07214, February 2016, p 26 ff

[183] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:European_Free_Trade_Association_(EFTA), accessed 9 May 2017; EFTA is an intergovernmental organisation established in 1960 by seven European countries to promote free trade and economic integration to the benefit of its Member States. All original signatories except Norway and Switzerland withdrew from EFTA upon joining the EU, as did Finland which had become an associate member in 1961 and full member in 1986. As Iceland joined in 1970 and Liechtenstein in 1991 EFTA currently has four Member States. (…) The association is responsible for the management of the free trade between the EFTA countries, EFTA's participation in the European Economic Area (EEA), which includes the EU and three EFTA countries (Iceland, Liechtenstein and Norway, but not Switzerland), EFTA's worldwide network of free trade agreements.

[184] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:European_Economic_Area_(EEA)accessed, 9 May 2017; The EEA consists of the 28 Member States of the EU and three countries of the EFTA (all except Switzerland, namely: Iceland, Liechtenstein and Norway). The Agreement seeks to strengthen trade and economic relations between the contracting parties and is principally concerned with the four fundamental pillars of the internal market, namely: the free movement of goods, people, services and capital. The availability of comparable statistical data is considered as relevant to the four freedoms and is therefore included in the agreement.

single market without the obligations that Norway and Switzerland face.[185]

- The Anglosphere option: UK could join a group of fast growing economies linked to Asia regardless to EU regulation and protectionism.

For the topic R&I, just the Switzerland and Norway options might bring a solution.

7.5.2 WHICH COUNTRIES CAN ACCESS EU RESEARCH FUNDING?

Before we can discuss the future of EU R&I Policy, we still have to know more about EU research funding, especially which countries can access EU research funding.

It is evident, that all EU Member States can access EU research funding. In addition, the EU has developed a strategy for international scientific cooperation as well with following intentions:

> "Scientific cooperation with third countries aims to strengthen the European Union's attractiveness and competitiveness, tackle global societal challenges and support EU external policies. Science diplomacy is also an increasingly important tool to ease cooperation with third countries."[186]

This EU strategy focuses on two dimensions:[187]

---

[185] See http://ec.europa.eu/trade/policy/in-focus/ceta/ceta-explained/, accesses 9 May 2017; CETA will remove customs duties, help make European firms more competitive in Canada, make it easier for EU firms to bid for Canadian public contracts, open up the Canadian services market to EU companies, open up markets for European food and drink exports, protect traditional European food and drink products (known as Geographical Indications) from being copied, cut EU exporters' costs without cutting standards, benefit small and medium-sized EU firms, benefit EU consumers, make it easier for European professionals to work in Canada, allow for the mutual recognition of some qualifications, create predictable conditions for both EU and Canadian investors, make it easier for European firms to invest in Canada, help Europe's creative industries, innovators and artists, support people's rights at work and the environment.

[186] European Parliament Briefing (July 2015), EU scientific cooperation with third countries, see https://era.gv.at/object/document/1957/attach/EPRS_BRI_July2015_564393_EN_pd.pdf, accessed 7 May 2017

[187] Ibid.

First, the research programmes carried out by the EU are open to participation by research institutions and researchers worldwide.

Second, the EU is developing targeted strategies – multiannual roadmaps – with selected countries in order to achieve specific objectives.

A number of mechanisms exist to enable scientific institutions and researchers in non-EU countries to participate in, and receive funding from, EU Framework Programmes.

7.5.3 ASSOCIATED AND NON-ASSOCIATED THIRD COUNTRIES[188]

Association to Horizon 2020 is governed by Article 7 of the Horizon 2020 Regulation. Legal entities from Associated Countries can participate under the same conditions as legal entities from the EU Member States.

Seventeen counties[189] (including Norway and Switzerland) have "Associated Country" status and contribute to Framework Programme budgets proportionally to their GDP.

Associated Country status is open to countries that are members of the European Free Trade Association (EFTA) and current EU candidate nations. The terms of their association differ slightly by country. They do not have a role in the negotiations that shape EU research funding.

Under the 'openness' strategy, institutions and researchers from other countries can also apply and participate in EU Framework Programmes. In some circumstances, they receive direct funding. Depending on the exact scheme, third countries might have to provide matching funds.

7.5.4 SCIENTIFIC AND TECHNOLOGICAL COOPERATION

To support scientific cooperation, the EU has signed international agreements with 20 countries. These create a framework for bilateral

[188] See http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf, accessed 7 May 2017

[189] As of 1 January 2017, the following countries are associated to Horizon 2020: Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland, Faroe Islands, Ukraine, Tunisia, Georgia and Armenia. Ibid.

cooperation and enables participation in joint projects, sharing of facilities, staff exchanges or the organisation of specific events.

The EU has also sent science counsellors to third countries to strengthen dialogue and cooperation.[190]

7.5.5 CASE STUDY SWITZERLAND

Although Switzerland is at the heart of Europe, the country is a tiny island as a not EU-member on the political map of Europe, surrounded by the twenty-eight member states of the EU. Nonetheless, various solutions have been found that allow Switzerland to deal with the challenges imposed by European integration.

The historical outline of Switzerland's relationship with the European Community, and later with the EU, can be structured in four, consecutive stages: initial multilateral failures, stagnation, further multilateral failure and enhanced unilateral and bilateral integration.[191]

> Hanspeter Kriesi and Alexander Trechsel argue that
>
> "Switzerland's current and probable future relationship with the EU can best be characterized as a 'customized quasi-membership'."[192]

Participation in the EU's research Framework Programmes is one of the priorities of Swiss science policy. Switzerland's participation in the Framework Programmes takes a variety of forms:

[190] European Parliament Briefing (July 2015), 'EU scientific cooperation with third countries', see https://era.gv.at/object/document/1957/attach/EPRS_BRI_July2015_564393_EN_pd.pdf, accessed 7 May 2017

[191] See https://www.cambridge.org/core/books/the-politics-of-switzerland/foreign-policy-switzerland-and-the-eu/F8841A8E447503E688EC9F789744D9A6, accessed 15 April 2017

[192] Kriesi, H., & Trechsel, A. (2008), 'Foreign policy: Switzerland and the EU', in The Politics of Switzerland: Continuity and Change in a Consensus Democracy (pp 172-190). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511790676.012

Figure 18: Swiss participation in FPs
Source: State Secretariat for Education, Research and Innovation (SERI) (2015), Swiss Participation in European Research FPs, Facts and figures 2015), p 5

1987-2003 (FP1-FP6)	Third country
2004-2013 (FP6 and FP7)	Full association
2014-2016 (Horizon 2020)	Partial association

The participation in FP7 was very successful for Swiss. The Swiss Confederation transferred a total of CHF 2,263,1 million to the EU for Switzerland's participation in FP7. In return, funding totalling CHF 2,482,1 million was committed to Swiss institutions. This means that, subject to final settlement of the EU accounts, Switzerland benefits from a net return flow of CHF 219 million.[193]

No wonder that Swiss wanted to extend the participation. As a result, Switzerland was – as a not an EU member state – partially associated to the EU Framework Programme until the end of 2016.

During the period from 15 September 2014 to 31 December 2016, researchers based in Switzerland could access some parts of Horizon 2020 funding on the same basis as those in an EU Member State.

The association of Switzerland to Horizon 2020 covered the following parts of the Programme:

> "the 'Excellent Science' pillar, containing the European Research Council, Future and Emerging Technologies, Research Infrastructures and the Marie Skłodowska Curie actions; the actions under the specific objective "Spreading excellence and widening participation."
>
> "During that period, Switzerland was also associated to the entire Euratom Programme and the activities carried out by the European

[193] Federal Department of Economic Affairs, Education and Research (EAER), State Secretariat for Education, Research and Innovation (SERI), (Swiss Participation in European Research Framework Programmes Facts and figures 2015, Swiss confederation, p 6

> Joint Undertaking for ITER and the Development of Fusion for Energy for 2014-2020. In other Horizon 2020 priorities that are not listed directly above, for all actions where the grant agreements were signed before 1 January 2017 Swiss legal entities continue to participate with a status of non-associated third country entities."[194]

Extension of this access through to 2020 was dependent on Switzerland's ratification of an agreement on free movement of people related to Croatia joining the EU.

On 17 June 2016, the Federal Assembly authorised the Federal Council to ratify Protocol III extending the Agreement on the Free Movement of Persons (AFMP) to Croatia, subject to a specific condition. After Parliament passed the act implementing Article 121a of the Federal Constitution, the Federal Council concluded that this condition had been fulfilled. At its meeting on 16 December 2016, it therefore authorised the Federal Department of Foreign Affairs (FDFA), in cooperation with the Federal Department of Justice and Police (FDJP), to confirm the ratification of Protocol III to the EU. This also means the precondition has been met for Switzerland to participate fully in the Horizon 2020 research programme.[195]

> "The ratification of Protocol III is key to the Federal Council's plans to consolidate and further develop the bilateral approach. It will also mean that from 1 January 2017 Switzerland can participate fully in the Horizon 2020 research programme as a fully associated member. This is vitally important for the quality of the research conducted in Switzerland, for the country's reputation as a research centre and for its competitiveness. Swiss researchers will therefore be able to participate fully in the European research projects funded by the

[194] See http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf, accessed 7 May 2017
[195] See https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-64991.html, accessed 14 April 2017

programme. The international partnerships entered into by Swiss higher education institutions are just as important as the financial aspects."[196]

The ratification of the Protocol on the extension to Croatia of the Free Movement of Persons Agreement between the EU and Switzerland means that in accordance with Article 13 paragraph 6 of the Agreement associating Switzerland to Horizon 2020, as of 1 January 2017 the Association Agreement with Switzerland continues to apply and is expanded to cover the whole of Horizon 2020, EURATOM Programme 2014-2018 and activities carried out by Fusion for Energy.[197]

The above figure is going to continue as follows:

Figure 19: Swiss participation in Horizon 2020

2017-2020 (Horizon 2020)	Full association

7.5.6 CASE STUDY NORWAY

Norway and the EU – A historical overview

As Switzerland, Norway is not a member state of the EU. Following a brief overview of the history of the relations between Norway and the EU:

1972: A majority of Norwegians (53.5%) vote against European Community (EC) accession in a referendum.

1992: The EEA Agreement is signed between the EFTA states and the EC. Switzerland rejects participation in the EEA by referendum, but remains a member of EFTA. Norway, Sweden, Finland and Austria apply for membership of the EU.

[196] See https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-64991.html, accessed 14 April 2017

[197] European Commission, Swiss participation in Horizon 2020 (version January 2017), see http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-hi-swiss-part_en.pdf, accessed 7 May 2017

1994: The EEA Agreement enters into force on 1 January 1994. A majority of Norwegians (52.2%) reject EU membership in a referendum.

2001: The Schengen Convention enters into force for Norway and the other Nordic countries. All passport controls between Norway and the fourteen Schengen countries are abolished.

2004: The EU is enlarged to include 10 new member states. The EEA Enlargement Agreement establishes a European Economic Area consisting of 25 EU member states and the EEA EFTA states Norway, Iceland and Liechtenstein.

2010: The EU establishes its own foreign service, the European External Action Service (EEAS). In accordance with the Treaty of Lisbon, responsibility in the EU for coordinating EEA matters is moved from the European Commission to EEAS.

2014: The EEA is expanded to include Croatia, and now consists of 31 European countries.[198]

Norway is not an EU-member state but is an official "Associated Country" meaning it participates in Framework Programmes under the same conditions as EU Member States. The nature of the agreement signed between Norway and the EU means that terms do not need to be renegotiated with each new Framework Programme.

As an "Associated Country" Norway is not represented on the European Council or in the European Parliament so has limited ability to influence the direction of European research funding. However, it does engage extensively in EU-funded research, contributing to, and receiving funding from, EU Framework Programmes.[199]

[198] See https://www.norway.no/en/missions/eu/areas-of-cooperation/historical-overview/, accessed 15 April 2017

[199] The Royal Society, (2015) UK research and the European Union / The role of the EU in funding UK research, p 10

Through the EEA Agreement and bilateral agreements with the EU, Norway currently participates in 12 EU programmes and 21 EU agencies. In addition, Norway participates in the work of five agencies that manage EU programmes. The EEA EFTA states participate on an equal footing with EU member states and areas covered include anything from research cooperation and statistics to health and traffic safety.[200]

Norway also has a bilateral arrangement for participation in interregional programmes under the EU's Regional Policy.

7.5.7 DIFFERENCES BETWEEN SWITZERLAND AND NORWAY

The differences between a Third country and an Associated country respectively Switzerland and Norway concerning Horizon 2020 shall be summarised in the following two tables:

Figure 20: Comparison: Third / associated country participation

	Third-country	**Associated country**
Contribution to the research budget.	No	Yes. Annual mandatory contributions to the overall budget of the FPs
Funding of own research participants	Self-funding. EU funding is only if the research participation by the third-country is required and helpful to the research agenda.	Paid from the budget of FPs.
Participation in management and steering committees.	No	Yes
Direct access to information	No	Yes
Possibility to contribute to the design of future programmes.	No	Yes

[200] See https://www.norway.no/en/missions/eu/areas-of-cooperation/participation-in-programmes-and-agencies/, accessed 15 April 2017

Figure 21: Comparison of Swiss and Norwegian participation

Switzerland	Norway
Third-country participant until the end of 2003. Limited possibility to take part in FPs.	Full participation of Norway since FP4 in 1994 because of membership in and contribution to European Economic Area. EURATOM is not covered by the EEA agreement and Norway is considered as "third country". Norwegian researchers participate on a project to project basis in EURATOM and Norwegian institutions are not eligible for funding from the EU.
Became an associated country in January 2004. Participation in FP6 with all rights and obligations because of the association. Associated status also meant that official Swiss delegates could sit on the management committees of the specific programmes, as well as on various steering committees. This gave Switzerland direct access to information and enabled it to participate in the implementation of current EU framework programmes and to contribute to the design of future programmes.	The quantitative ambition is to reach a participation level where Norwegian participants retrieve a minimum of 2 per cent average of the grants announced in Horizon 2020.[201]
In 2007, the agreement was renewed for the whole of FP7. As a result, Switzerland paid annual mandatory contributions to the overall budget of the FPs. Successful candidates from Switzerland were funded directly from this budget.	

[201] Norwegian ERA Roadmap 2016-2020 (Norwegian Ministry of Education and Research)

7.5.8 EXCURSUS: WHAT ABOUT AUSTRIA?

As I am a student of Vienna University, I think it is important to add some information about Austria as an EU member state and the Austrian R&I policy.

The Republic of Austria has always scored well in international quality of life, environment and culture rankings. Since the beginning of this century, Austria has sustainably invested in R&I, putting it at the cutting-edge of EU research in many fields.[202]

On 1 September 2004, The Austrian Research Promotion Agency (FFG) was founded.[203] The aim was to bundle the resources and instruments by creating a single one national funding agency for industrial research and development in Austria.[204]

As a "one-stop shop" offering a diversified and targeted programme portfolio, the FFG gives Austrian businesses and research institutions quick and uncomplicated access to research funding.[205]

The tasks of the FFG are stipulated follows in the Mission statement:

> "To manage and finance research projects in the business and science sectors, impulse programmes for the economy and research facilities, and networks fostering cooperation between science and industry.
>
> To manage cooperative programmes and projects with the EU and other European and international partners.
>
> To represent Austria's interests at relevant European and international institutions on behalf of the Austrian government.
>
> To provide consultation and support to intensify Austria's involvement in European programmes, especially in the EU

[202] See https://www.ffg.at/en/content/rd-austria, accessed 14 April 2017
[203] FFG Act on establishing a research promotion agency, Federal Law Gazette I 2004/73
[204] Guidance notes to government bill 510 of annexes XXII legislative period (= RV 510 BlgNR 22. GP)
[205] See https://www.ffg.at/en/content/about-ffg, accessed 14 April 2017

Framework Programme for Research, Technology and Innovation and the Framework Programme for Competitiveness and Innovation.

To provide support and strategy development services for decision-makers in the Austrian innovation system.

To improve public awareness of the importance of research and development."[206]

The FFG is wholly owned by the Republic of Austria, represented by the Federal Ministry for Transport, Innovation and Technology (bmvit) and the Federal Ministry of Science, Research and Economy (BMWFW). As a provider of funding services, however, the FFG also works for other national and international institutions.[207]

The FFG helps Austria in developing as a centre for R&I. It distributes annually over 400 million Euro in federal funding to around 3,000 applied R&I projects involving around 5,500 partners.

The FFG also offers a comprehensive range of information and services. It is the national contact point for Horizon 2020, which provides Austrian organisations with 150 to 200 million Euros in funding each year. It provides professional expertise on tax incentives for R&I and coordinates Austrian activities in space research and technology. It has also been commissioned to manage the programme to extend Austria's broadband infrastructure.[208]

National and international evaluations prove the achievement of these activities. Without FFG funds around 80% of the projects could not have been undertaken at all, or only to a lesser degree.

[206] See https://www.ffg.at/en/content/mission-statement, accessed 14 April 2017
[207] See https://www.ffg.at/en/content/about-ffg, accessed 14 April 2017.
[208] See https://www.ffg.at/en/content/results-impacts, accessed 15 April 2017

Austria is also very successful in FP Horizon 2020. As a member of TAFTIE (European association of leading national innovation agencies), the FFG was charged with organising the TAFTIE Academy.[209]

These goals reflect the statutory purpose of the FFG:

> "The purpose of the FFG is to promote research, technology, development and innovation for the benefit of Austria." (Paragraph 3 (1) of the FFG Act)

The mission statement of the FFG is derived from this definition of its aims and objectives.

> "Our aim is to make a lasting contribution to the strength of the Austrian economy. As part of the Austrian innovation system, we help Austria's business and science sectors to remain competitive both nationally and internationally. The skills and expertise of our employees enable us to provide high-quality research promotion services and achieve the highest degree of customer satisfaction."[210]

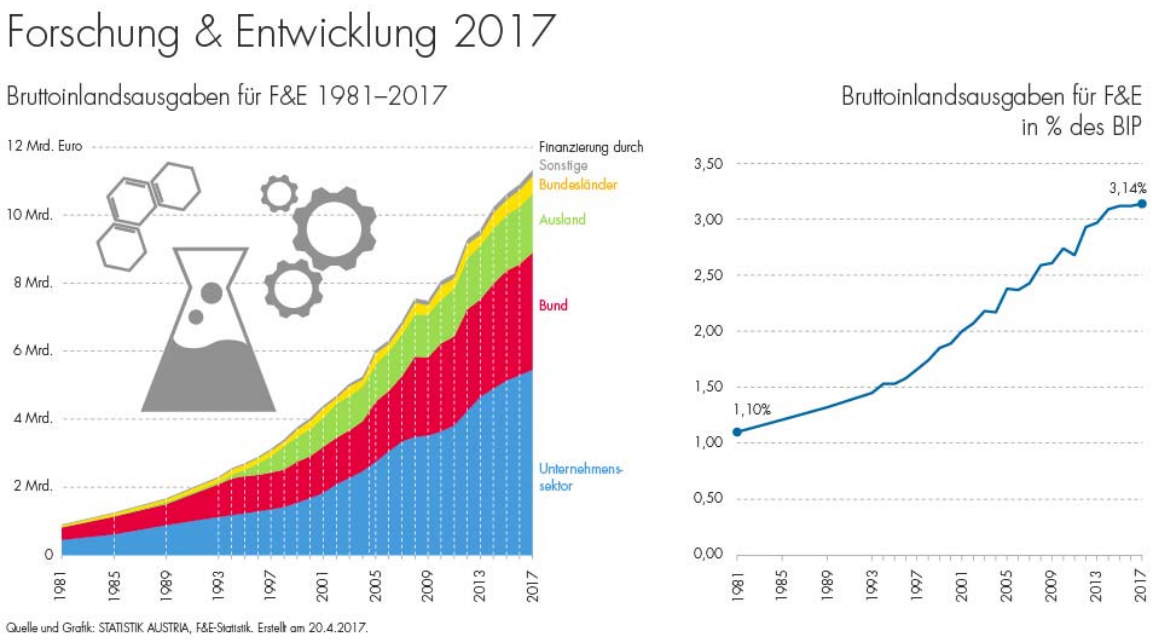
The Austrian Republic has signed a treaty with the FFG in 2013 for implementing and participating in the FPs with a maximum budget of € 30,398,000.[211]

In 2014, Austria ranked fourth among the 28 EU countries in terms of R&I spending, at 2.99% of GDP. The number of enterprises involved in R&I rose from around 2,000 in 2002 to over 3,300 in 2011. During the same period, the number of researchers in Austria increased from around 39,000 to over 61,000 (measured in full-time equivalents). Today more

[209] See https://www.ffg.at/en/content/results-impacts, accessed 14 April 2017
[210] See https://www.ffg.at/en/content/mission-statement, accessed 14 April 2017
[211] 'Vertrag zur Beauftragung der FFG/EIP mit der Unterstützung österreichischer FTI-Akteure im Europäischen Forschungs- und Innovationsraum 2014 – 2020, abgeschlossen zwischen der Republik Österreich, vertreten durch das Bundesministerium für Wirtschaft, Familie und Jugend; das Bundesministerium für Verkehr, Innovation und Technologie; das Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft; das Bundesministerium für Gesundheit sowie das Bundesministerium für Wissenschaft und Forschung als federführendes Ressort und der Wirtschaftskammer Österreich, im Folgenden kurz Auftraggeber genannt, einerseits und der Österreichischen Forschungsförderungsgesellschaft mbH (FFG), im Folgenden kurz Auftraggeber genannt, andererseits', GZ: BMWF-360.025/0009-II/5/2013.

than 400 Austrian enterprises are global market or technology leaders in their particular industries.[212] In 2017, Austria is going to spend probably € 11,3 billion on R&I. The private sector finances 48%, the public sector 36%. 15,4% are financed from foreign countries, including the repatriation from EU R&I-programmes.[213]

Figure 22: Forschung und Entwicklung 2017
Source: FFG (2017)



Reinhold Mitterlehner, at that time Vice Chancellor and Federal Minister for Science, Research and Economy and Jörg Leichtfried, Minister for Traffic, Innovation and Technology state that Austria is now (2014) in the EU-wide comparison on the third in the place behind Finland and Sweden concerning the research-quota. They state further the aim,

[212] See https://www.ffg.at/en/content/results-impacts, accessed 15 April 2017
[213] See http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/globalschaetzung_forschungsquote_jaehrlich/index.html, accessed 23 April 2017

> "dass es weiterer Anstrengungen der öffentlichen Hand bedarf, um den Weg zum Innovation Leader tatsächlich gehen zu können."[214]
>
> "that it further needs more public efforts to be able to continue the way to become innovation leader."

To achieve this, Austria has to put all efforts.

7.6 WHAT IS THE IMPLICATION OF BREXIT?

No one knows for sure, what will happen in future. There are many scenarios, what might be the final outcome of Brexit.

Swati Dhingra and Thomas Sampson from the LSE analyse the "Life after Brexit: What are the UK's options outside the European Union?"[215] They state, that it

> "is highly uncertain what the UK's future would look like outside the European Union (EU), which makes 'Brexit' a leap into the unknown."

At the time of being, the advantages and drawbacks of the most likely options can be analysed. Swati Dhingra and Thomas Sampson are the opinion, that after Brexit, the EU would continue to be the world's largest market and the UK's biggest trading partner.

> "There are economic benefits from European integration, but obtaining these benefits comes at the political cost of giving up some sovereignty. Inside or outside the EU, this trade-off is inescapable.
>
> One option is 'doing a Norway' and joining the European Economic Area. This would minimise the trade costs of Brexit, but it would mean paying about 83% as much into the EU budget as the UK

[214] Bundesministerium für Wissenschaft, Forschung und Wirtschaft / Bundesministerium für Verkehr, Innovation und Technologie, Österreichischer Forschungs- und Technologiebericht 2016, 'Lagebericht gem. § 8 (1) FOG über die aus Bundesmitteln geförderte Forschung, Technologie und Innovation in Österreich', Wien 2016, p 4, see https://wissenschaft.bmwfw.gv.at/uploads/tx_contentbox/FTB_2016_de_WEB.pdf, accessed 23 April 2017

[215] Swati Dhingra and Thomas Sampson (2016), 'Life after BREXIT: What are the UK's options outside the European Union?' The London School of Economics and Political Science, PAPERBREXIT 01, p 1

currently does. It would also require keeping current EU regulations (without having a seat at the table when the rules are decided).

Another option is 'doing a Switzerland' and negotiating bilateral deals with the EU. Switzerland still faces regulation without representation and pays about 40% as much as the UK to be part of the single market in goods. But the Swiss have no agreement with the EU on free trade in services, an area where the UK is a major exporter.

A further option is going it alone as a member of the World Trade Organization. This would give the UK more sovereignty at the price of less trade and a bigger fall in income, even if the UK were to abolish tariffs completely."

Concerning RI Policy, Brexit would allow the UK to negotiate its own agreements with the EU. As an individual country and relatively smaller one compared with the EU, the UK would not have much bargaining leverage.

After leaving the EU, the UK government would regain responsibility for issues such as R&I-Policy. Following Brexit, the government would need to decide whether to replace the EU-funding and all the R&I-programs, which are currently handled at the European level. There would be a high cost of developing the competencies necessary to manage these areas, since the required skills do not currently exist within the UK civil service.

Tim Oliver from London School of Economics states as follows:

"We also need to keep in mind the role of ideas in European integration and relationships; supranational, intergovernmental, multilateral and bilateral links that connect Europe; global and European political and economic pressures such as the Eurozone or

> emerging powers; and the outlook of the political elites across the EU that will define how Europe responds to a Brexit."[216]

There are still a lot of different visions of the UK's future place in the world. The Brexit will have significant implications not only for the UK, but also for the EU, the ideas and structures of European integration, and European geopolitics. The UK-EU relationship will have to be renegotiated weighing up the pros and cons. With regard to the R&I-Policy, the EU has the better cards how far going in negotiating, refusing or appeasing. An EU without UK in R&I-Policy would be a big loss and is rather unimaginable. This because of the net, which has been woven within the R&I-community and the economy and the big economically loss and costs on the UK economy created by such a scenario. The question is not if there will be arrangements, but which one.

[216] Oliver Tim (2016), 'A European Union without the United Kingdom', p 3

CHAPTER 8
ASSESSMENT OF THE POLICY

8.1 INTRODUCTION

The EU R&I Policy as it stands today is the outcome of six decades of continuous progress. During these six decades, the policy has reoriented itself and has undergone sometimes sweeping changes. Analysing its development, I see that the EU R&I Policy is not an end in itself but programmed to grow with the change of times.

Currently, in 2017, the EU seems to have two critical issues:

1) The EU is (again) lagging behind the US, Japan, and even South Korea in Research and Innovation. This is a fact based on global registration of patents. In addition, China, India, and Brazil are catching up rapidly.
2) The EU is very strong in Basic Research. But it is not successful in transforming the results of basic research into marketable products which will have a financial and economic value addition.

Despite the above two critical issues, or perhaps because of them, everyone connected with the EU R&I agree that the Policy is extremely important for the EU and should continue to grow and strengthen.

Right now, I wish to have a look at the objectives of the Policy since its origin.

8.2 CHANGING OBJECTIVES

In the 1950s the scientific research activities were based more on the political objectives of that time. Today, the economic, industrial, and environmental objective guide equally, perhaps even more, this policy. The reason for this, in EU's own statement, is simple:

"Research, technology and innovation are at the core of Europe's economy and are vital for a successful society."[217]

As all EU Members have their own national research and technology policies, which are well established and often successful. Therefore, European programmes and projects need special justification.

One of the justifications is that European cooperation is obviously to the advantage of all Member States and solitary national action is impractical. Even in the cases where European cooperation is neither directly nor symmetrically advantageous, solitary national action may no longer be feasible because of lack of all kind of resources. This is true in cases such as nuclear technology involving fusion reactors or placing satellites in orbits.

Finally, it must be considered that even if the benefits of European cooperation are not immediate or direct and even if national solutions are feasible, there can still be good tactical reasons for European cooperation. A concentration of R&I in any particular region or Member State may create negative effects on the efficiency of European markets in the long run. It may also have an adverse effect on the integration of Europe.

To obtain maximum benefits of cooperative R&I in the EU, a multitude of objectives are embodied in the policy. The formulation of these objectives and the implementation of the same through FPs is a complex political process in which a multitude of stakeholders take part. Since the start of collaborative FPs, the EU has constantly set new objectives. Each new FP differs considerably from its predecessor.

Figure 23: Some key objectives in each FP
Source: European Commission (2015), A new role for EU Research and Innovation in the benefit of citizens: Towards an open and transformative R&I policy

FP (years)	**Key objectives**
FP 1	To promote competition in agriculture and in industry, to improve the management of raw materials and energy resources, to better living and

[217] European Commission 2015, 'Horizon Special Issue', p 2

(1984-1987)	working conditions, and to improve the effectiveness of Community's scientific and technological potential.
FP 2 (1987-1991)	Quality of life, towards a single market and an information and communication society, modernisation of industrial sectors, exploitation and optimum use of biological resources, Energy, Science and technology at the service of development, Exploitation of the sea bed and use of marine resources, Improvement of European S&T cooperation.
FP 3 (1990-1994)	Information and communication technologies, Industrial and material technologies, Environment, Life sciences and technologies, Energy, human and capital mobilization.
FP 4 (1994-1998)	Four activities: 1) RTD and demonstration programmes. This included all the thematic areas from FP3 and in addition Transport and Targeted socio-economic research. 2) Cooperation with 3rd countries and international organisations 3) Dissemination and exploitation of results 4) Stimulation of the training and mobility of researchers.
FP 5 (1998-2002)	Four activities: 1) Quality of life and management of living resources, user-friendly information society, Competitive and sustainable growth, Environment and sustainable development of energy 2) International role of Community research 3) Promotion of innovation and encouragement of SME participation 4) Improving human research potential and the socio-economic knowledge base. In addition, EUATOM and Joint Research Centre for nuclear energy.
FP 6 (2002-2006)	Four blocks of activities: 1) Life sciences, genomics and biotechnologies for health, Information society technologies, Nanotechnologies, Aeronautics and space, Food quality and safety, Sustainable development, global change and ecosystems, Citizens and governance in a knowledge based society. 2) Research and innovation, Human resources and mobility, Research infrastructures, Sciences and society. 3) Support for the co-ordination of activities, Support for the coherent development activities 4) Euratom Framework including Joint Research Centre for nuclear energy.
FP 7 (2007-2013)	Five blocks of activities: 1) Cooperation: This contains Health, Food, agriculture and fisheries, and biotechnology, Information and communication technologies, Nanosciences, Energy, Environment, Transport, Socio-economic sciences and the humanities, Space, and Security. 2) Ideas: "Frontier Research" solely on the basis of scientific excellence in any area of science and technology. No obligation for cross-border partnerships. 3) People: Support for researcher mobility 4) Capacities: Strengthening the research capacities. 5) Nuclear Research: Joint Research Centre in the field of nuclear energy
FP 8 (2014-2020)	Three Pillars: Excellent Science, Industrial Leadership, and Tackling Societal Challenges. In addition, private and public national investment in research activities is foreseen.

The above table gives a good overview of the priorities set and their development in each FP. The development priorities over the time can be roughly assessed like this: Agriculture and industry – Modernisation of industrial sector – Information technology – Nano technologies – Biotechnologies – "Frontier research".

This means the Research Policy has adjusted itself to the developments in the research surroundings. The method of participation itself seems to be becoming flexible. This is evident because the "Frontier Research" can be done in area chosen by the participant if its importance can be proved. In addition, there is no obligation to build a consortium to participate in projects sanctioned under "Frontier Research".

8.3 INDEPENDENT ANALYSIS OF R&I POLICIES AND OUTCOMES

The R&I Policy can be assessed on the basis of various objectives the EU has set, by investigating and verifying the result of the cooperative programmes. The Commission took its first initiative in assessing the impact of RTD programmes as early as 1978 by organising a seminar in Copenhagen on the "Evaluation of R&D". The Commission publishes several reports every year on R&I outcomes including statistical reports. For example, the FP7 monitoring report published in 2013, or several ERA Progress Reports published in 2016. The reports are prepared mostly with outside consultants.

The Commission also relies on independent external expert panels for the evaluation.[218] Member countries and associated countries have also commissioned their own studies through specialised institutes such as Technopolis Group, Amsterdam. Such studies are generally focused on a particular project that has been implemented within the FP.

Apart from the studies commissioned by the authorities or countries involved with the R&I Policy, there have been also studies, which were

[218] Article 130P of the EC Treaty and the Framework Programme Decisions (EC and EURATOM) require the Commission to send a report each year to the European Parliament and Council.

carried out by academic researchers on their own initiative from different disciplinary points of view. (Sharp 1991 & 1998, Peterson 1993, Archibugi 2000, 2004, Luukkonen 1998, Pavitt 1998, Granieri and Renda 2012, Delanghe, Muldur and Soete 2011, Rodríguez et al 2013, ...).

All these experts give a deep insight into a wide range of topics related to the EU R&I and enable us to a better understanding of this policy and its implication to the EU politics. For example, Daniele Archibugi states the following about the EU R&I policy in the introduction of one of his paper:

> "The process of European integration is not based on a customs union, a common agricultural policy and a single currency only: it is also based on circulation of knowledge among individual member countries. This is not associated to cultural and social values only, but also to the belief that economic growth and welfare in the old continent is strictly associated to its capability to generate and diffuse new technologies. It is therefore not surprisingly that there is a major policy concern within governments, business and trade unions on the ways to promote scientific and technological activities and to foster innovation in firms."[219]

In this study, I am going to make a general assessment, without concentrating on any particular objectives of Framework Programmes. Basically, my study has the aim of understanding the Policy's relevance to European integration and the economy as well as the aspect of Brexit on this Policy.

To what extent has the R&I Policy had the effect of cementing the EU together politically? In which way does this Policy contribute to the economic progress of the European Union? Is the technological gap as serious as it has been claimed by the Commission? Is the Policy helping

[219] Archibugi (2000), The Globalisation of Technology and the European Innovation System, p 2

Europe's competitiveness? Is the UK going to remain in the Policy as an Associated Member?

8.4 IMPACT ON INTEGRATION

In 2013 the EU-27 spent a total of 256,587 million[220] Euro on R&I. This included 152,478 million by business enterprise sector and 32,528 by government sector of all Member States. Whereas the funds provided under FP7 by the EU were a meagre 8.370 million.[221] This is only 3.26% compared with the total spending by the EU-27.

The big question is, why is it EU R&I Policy important for Europe, although its share of financing the R&I is meagre?

> "It is evident that EU RTD Policy has concentrated on sponsoring different forms of collaboration between Member States. Such forms of collaboration are not generally those which the participants would choose spontaneously, otherwise the EU initiative would have been redundant, having been implemented already by the market. Part of the motive for the policy is political, to accelerate European integration."[222]

The Community undertakings in the area of R&I have been based on various objectives: sharing of resources and costs, being competitive, economic growth ... All these objectives are inclusive of political and economic goals of individual Member States and are European based. The objectives have in the end initiated a multitude of actions across the Member States. The implication is that, in all these objectives there is the goal of European integration.

One fundamental requirement to participate in a EU R&I programme is to build a consortium with members from two or more EU countries. Finally,

[220] Statistical Office of the European Communities (2013), 'Science, technology and innovation in Europe 2013', p 35
[221] European Commission (2014), EU Budget 2013 Financial Report, p 120
[222] Stubbs (1997), 'Science and Technology Policy' in The Economics of the European Union', p 166

the outcome of the research outcome will belong collectively to the members of the consortium. This inevitably encourages, rather forces integration.

> "Cooperation in research is first reflected in co-inventorship: cooperation between inventors residing in different EU member countries resulting in an invention. This is very strong form of integration: it is more than just exchanging information of sharing research programmes; it really means working together and sharing efforts and rewards."[223]

This seed of integration is explicitly visible in ECSC and EURATOM, the two Communities through which the first cooperative research activities at European level were undertaken. Although the ECSC was formed to share the production and use of Steel and Coal in the Member countries, it had a higher objective of market integration, even if it was confined to the coal steel and related sectors. The ECSC sought to restrict Member States' use of discriminatory state subsidies and it provided a common external commercial policy relating to the two sectors. In technology research (mining, steel) the work was carried out not only within the Member States but also frequently in collaboration with British public bodies, a non-Member then. These collaborations involving scientists, engineers and pooling of resources laid the seeds for future collaborative activities on a wider scale.

The EURATOM delivered, first and foremost, a European identity to a very important branch of science and research which was then considered as the future of mankind, specially, in energy sector. With it, it was ushered in a "European awareness" among the general public. It produced a basis for development and integration on a functionalistic model. It also helped to avoid any potential nuclear race among Europeans, which could have been damaging to the spirit of integration. Instead, it laid the foundation

[223] Guellec and Dernis (2011), 'The levelling off of the integration of European technology' in European Science and Technology Policy, p 293

for the positive use of nuclear energy for all the citizens of Member States. It also ushered in an era of human co-operation and integration in the area of science and technology. The four branches of Joint Research Centres, set up in four different countries have served the nuclear scientists of the Community as a platform for cooperation, exchange of knowledge and interaction among the scientists across the borders.

Unfortunately, EURATOM never became what its founders had hoped. The nuclear energy sector did not succeed the heavy industries of coal and steel as the natural economic integrator of Europe. The later separate development of civil nuclear energy programmes in the various Member States, especially, in France and Germany, illustrated that at least in this sensitive sector the national framework would remain predominant.

Apart from such political considerations, continuing economic doubts about nuclear energy have prevented it from being at the forefront of European economy. Even so, EURATOM did much to initiate the trend and promote transnational contacts. Although the initial main objective of EURATOM to encourage the creation and growth of a European atomic industry hasn't materialised, it's contribution to European integration can't be ignored. Its significance is evident in FP5, in which 1,260 million Euro has been allocated to EURATOM programmes. In all probability, the scientific and technical knowledge attained in the nuclear branch has only a limited "spillover" effect on other branches. But its identification with harmonising European R&I has endured.

8.4.1 INTEGRATION THROUGH COLLABORATION

> "In political terms, technology policy was mostly uncontroversial, technocratic and marked by problems of competitiveness that were both severe and collective. It seemed a perfect candidate-area for

> integration, which would beget further integration, as predicted by neofunctionalist theory."[224]

The major collaborative programmes which started to roll out in the mid-1980s can be viewed as a positive development for European integration. By this time technology policy was seen as a sector ripe for an amalgamation of national policy efforts. Through the Big 12 Round Table meeting, Europe's most powerful industrialists rallied behind new collaborative programmes.[225] By this time the Members' efforts to promote their own national champions – the leading big firms – had resulted in failure. This was also the time when internal markets were radically liberalised.

For the EU, the collaborative cross-border R&D has helped compensate for reduced national aid to industry. The best solution was to pool efforts and resources, which in turn means integrating European R&I. This is actually what the Communities were intending to do with the introduction of collaborative programmes. The result will be economies of scale and critical mass necessary to compete with the Americans and Japanese.

The socio-political and economic situation in Europe has changed to a great extent since the time of ECSC and EURATOM, possibly far beyond the expectations of the founding fathers of the Community way of integration. With these changes, there have been also relative changes with all the issues concerned with European integration. Integration is not seen any more from the point of view of avoiding wars between Member States or as an elaborate trade agreement. It is rather seen in the context of higher goals of cooperative mingling of people and institutions in order to be competitive on the world stage.

One of the pre-conditions to participate in a Community programme is to have at least one partner in another member state. The purpose of this co-operation is on one side to accelerate and to intensify integration. On

[224] Peterson and Sharp (1998), 'Technology Policy in the European Union', p 56
[225] Ibid. p 45

the other side, this encourages a kind of R&I consortia among EU companies.

There is substantial evidence to accept my first set of hypothesis that the science and technology policy of the European Communities has contributed to the integration of the EU. For example, transnational collaboration has become a fact of daily life for researchers in Europe, thanks in large part to Community programmes.

The links established through cooperative research is certainly massive. A statistic from FP 7 gives as an insight:

> "During seven years of FP7, 487 concluded calls received nearly 136.000 proposals, involving more than 601.000 applicant organisations and individuals of which more than 25.000 proposals involving more than 130.000 participants – were finally retained for negotiations. Proposals and applicants had an average success rate of 19% and 22% respectively."[226]

Even the EUREKA programme, which is not a EU programme but an intergovernmental programme involving all of the EU Members, plays a key role. Many of the participants in EUREKA viewed the consequent exchange of ideas between organisation and across borders as a key benefit of participation.

> "Overall, researchers are more mobile than the rest of the population. Roughly speaking, their level of mobility is around 5% of the active population whereas 2% is the average for other professional groups. That said, they are still not as mobile as they could be in proportion to requirements."[227]

[226] European Commission (2015), 'FP7 Monitoring Report 2013', p 7
[227] Commission of the EC (2000), 'Towards a European research area', p 16

8.4.2 FUNCTIONALISM OR INTERGOVERNMENTALISM?

Functionalism with its related theories of neo-functionalism and structural functionalism has been one of the most influential of all social science theories in political science as well in sociology and anthropology.[228]

In the post War political development in Europe, functionalism is identified with integration. In a broader sense, it meant certain important policy areas of Member States must be co-ordinated and made to "function" properly in order to cope with their environment and achieve common goals.

Neo-functionalism's central assumption is that integration proceeds exponentially as successful common policies in relatively depoliticised area create "spillover" pressures for further integration.

Some spillover effects of R&I are functional or neo-functional in that the integration of one area of an economy produces technical pressures that generate demands for further integration. For example, the development of new generations of microchips in the computer industry will invariably create a demand for the same in communication industry.

Collaborative R&I programmes lead firms to develop new technical processes all together, thus creating pressures for pan-European standards. Collaboration that brings together centres of excellence across Europe serves good purposes. It promotes the cross-fertilisation of ideas and the transfer of knowledge and skills between research institutes and, of prime importance for innovation, between the academic and industrial research sectors.

The area which fails to be explained by neo-functionalism or functionalism seems to be the area of budgetary politics of Framework Programmes. Here, a realistic intergovernmentalist explanation is more appropriate. In budgetary politics self-interest of Member States is more likely to prevail

[228] Robertson David (1993), 'Dictionary of Politics', p 200

and intergovernmental dealing is a decisive factor for reaching agreements.

The case can be further explained with the position taken by net contributors to the EU budget, such as Germany or France. National governments are motivated by their own narrow, national interest. They rationally calculate the relative gains or losses that might occur to them from different potential EU policy arrangements or outcomes.

It is the outcome of continuing globalisation of the economy, trade and industry where going it alone can have fatal consequences for a state as well as for industry. It has been correctly pointed out that even highly developed states no longer have the resources to master technologies which might be regarded as fundamental to their survival as separate entities.

Certain areas of industrial production of the kind which European nations have previously thought in their own advantage to foster in order to remain at the forefront of technological advance, the manufacturing of large long-distance passenger aircraft for example, or equipment for exploring space, appear now to require technological cooperation between all but the largest economies before they can be achieved at a politically acceptable cost.

The cooperative research benefits, which, on the face of it are not easily recognised:

> "Inventions resulting from cooperation between research teams located far from each other gather more diverse knowledge and are therefore in general of higher quality."[229]

The European Commission, in its memorandum "Towards a Technological Community", issued in 1985, identified the common interests and objectives of a technological community – "to strengthen the technological bases of European industry and to develop its international

[229] Guellech and Dernis (2011), in 'European Science and Technology Policy', p 309

competitiveness." Although the document regarded the legal and political basis of the EEC as being adequate, it considered that a political commitment by the Member States was needed to give the necessary resources and powers to the creation of such a technological community.

"Towards a Technological Community" viewed national and Community technology programmes as co-existing, with effective co-ordination ensuring that there would be no wasteful duplication of resources and identifying possible synergies between national and Community level initiatives. The memorandum proposed flexible forms of cooperation between industrial firms, universities and government, envisaging a network of research initiatives that would incorporate European and non-European partners in a gradual outcome that was to be realised through the Framework Programmes.

> "... On the other hand, most governments of the EU member states are united in their suspicion that both the Commission and Parliament try to grab too much power to make decisions on nationally vital, strategic technologies."[230]

8.5 ECONOMIC BENEFITS

One of the main characteristics of the EU R&I Policy is its alignment with the major social and economic objectives of the Union. Apart from the question of integration, the other issue that I would like to address the way in which and to what extent the policy might be influential to the economy. Needless to stress here is that this issue is of great importance, more so because of the tradition of market economy in all of the Member States. The long-term success of R&I Programmes is greatly depending on their viability as social investment and their contribution to the economic progress.

[230] Väyrynen Raimo (1998), 'Global interdependence or the European fortress? Technology policies' in perspective', Research Policy, 27: p 630

But, how are we going to calculate the viability of these investments or measure their role in economic progress? This task, as I see it, is a very problematic one. In the absence of any widely recognised analytical procedures, the task is accomplished by experts mostly with the help of theoretical enquiries.

First of all, the assessment of the economic impact of R&I policies has an inherent difficulty due to the time lag required to put research results into practical use. Additionally, often economic goals in R&I programmes cannot be explicitly described. Luukkonen's[231] points out that there are also conceptual and methodological problems in evaluation studies arising from the fact that they are part of the political processes for formulating the programmes. In the absence of any possibility to quantify the output, substitutive means for appreciating its performance have been developed. These are to a large extent based on considerations related to the input into the research system, since this input, at least, can be measured or expressed in volume or other quantitative terms.

> "The output of basic research serves as input into the production part of the economic system which uses it in the innovation process in order to turn out new products and services. The corresponding transfer mechanisms are very complex and the delays between the production of new knowledge and its use, leading to an economic activity, which can be quantified, are a priori undetermined and may be long."[232]

Regardless of these difficulties, the need to assess the R&I Programmes is crucial for everyone involved including the European Commission. The assessment of economic impact by the Commission goes back to the formulation of a broader European R&D policy beginning from 1974. Its continued expansion to new scientific and technological fields created the

[231] Luukkonen, Terttu (1998), 'The difficulties in assessing the impact of EU framework programmes', Research Policy 27 (1998), p 599-610
[232] Schmied (1995), 'R&D – Management in Europe', p 12

need to systematically evaluate the results of Community sponsored R&I programmes. Amelinckx notes that

> "this need in turn originated from the fact that the motivation for sponsoring research and development has predominately become economic and social."[233]

Since 1978, the Commission has developed its own evaluation approach in order to continuously rearrange R&D priorities on the basis of observed social and economic changes.[234]

From 1985 onwards it has been conducting studies to evaluate the overall impact of Community research and development policy on Member States. These studies had to reflect a wide range of direct and indirect effects not only on national research and development policies but also on a nation's internal cohesion, and on Community cohesion.

Although the economic impact of R&D is very crucial to the decisions regarding the continuation of programmes, the calculation of this impact is a most complex and delicate problem. Clearly not all results are measurable in economic terms. There are so called "spin-offs effects" (secondary economic effects) of R&I which benefit other areas. Also, certain results of research might come to use only several years after its invention, making it difficult for proper empirical assessment.

While a concrete, empirical proof for economic outcome of R&I is hard to establish. I have mentioned initially, there are ample theoretical arguments that help in making a proper decision. One of the most fundamental economic question to be asked in considering EU R&I Policy is why nation states or a union of nation states should fund and promote science and technology policy at all?

We live in a free-market society, with its basic rules of demand and supply. Competitive markets are normally viewed as having a number of

[233] See introduction by S. Amelinckx in Commission of the EC (1984), 'Evaluation of Research and Development'
[234] Commission of the EC (1983), 'Evaluation of Research and Development'

inherent advantages, such as the efficient allocation of resources, the maintenance of consumer choice, the promotion of technological innovation, and the autonomy of industrial enterprises, which – it is believed – is important for long-run economic progress.

An essential element in the concept of a common market of the EU is the unfettered mobility of goods, services, and factors of production so as to ensure the greatest efficiency in resource allocation. This was an essential theme throughout the development of the European Community. Could we then not leave the production, pricing and distribution of scientific and technological knowledge simply to the market forces? Interestingly, a majority of the eminent economists don't agree with this proposition. Let me quote Dasgupta and David:

> "To say that economic growth in the modern era has been grounded on the exploitation of scientific knowledge is to express a truism. (...) Most of the industrial nations and many among the developing countries today acknowledge this, and virtually all societies in which modern science is practised pay at least lip service to the belief that it is important to pursue some form of 'science policy.'"[235]

One of the strong features of EU R&I Policy is that it encourages cooperation among firms, research organisations and universities. Apart from direct impact on the economy as a result of technological change, cooperation in R&I itself has financial and other incentives.

One of the incentives is risk sharing and cost saving. Often pursuing a particular type of research is too risky or costly for a single institution. By sharing and pooling the resources of two or more institutions will help overcome this problem. And ultimately the research results will benefit the whole European society.

One other incentive of cooperation is to share information. This will help firms and universities to cooperate and monitor new developments in

[235] Dasgupta and David (1992), 'Towards a new economics of science', p 487

science and technology. Eventually the information gathered can be used to develop new products, enter into new promising areas of activities or exit from declining one.

A third economic benefit of R&I cooperation could be training and placement. Cooperation may encourage the mobility of researchers and personnel from one institution to another. Mobility of researchers among university and research organisations during a scientific project provides exchanges of knowledge and dissemination of useful information.

Like many others, Wendy Hansen (2011) states that human capital has a strong and critical role in the knowledge-based economy. He rightly tells that highly skilled scientists, engineers and researchers drive job creation through innovation and support economic change through the flexibility of skill sets and inter-occupation, sector and country mobility. Today, multinational companies have the possibility to choose R&D skills from all over the world. And they do this, especially by setting up their R&D centres in India or in China where highly skilled scientists are not only available but also cost lesser than in industrialised countries.[236] In this sense the interference by the EU to encourage mobility of researchers have strong added value.

The economic logic of collaboration is clear for European companies: as innovation is becoming increasingly expensive and European producers are losing market share, a European research and development would be advantageous to the participating firms. The EU, through its Framework Programmes encourages cooperation in such way so as not to distort market forces. It funds projects which concentrate on pre-competitive research. There are also strict selection criteria for the participating firms and institutions with proper time limits to wind up the research. Funding research that is going to get diffused into useful products and services for the whole society is quite acceptable. This should be done despite the fact

[236] Hansen Wendy (2011), 'The European Research Area and human resources in science and technology' in European Science and Technology Policy, pp 237-255

that there is no clear way of measuring the outcome of usefulness of any particular research. Economists agree that it is not possible to make an accurate decision depending on the economic impact of the collaborative research or to measure the R&I outcome empirically.

In the meantime, everyone agrees that there are various economic benefits for the state in encouraging the development of technology. I would suggest that we consider the EU as a private entrepreneur concerning its R&I Policy. Any entrepreneur runs the risk of losing. But without the spirit of entrepreneurship, mankind would not have been able to achieve all those technological innovations it has achieved today.

CHAPTER 9
CONCLUSIONS

> I simply wish to share my views as a politician, who believes in science and innovation as the true drivers of growth and prosperity, and as unique tools for diplomacy.
>
> Sir Martyn Poliakoff, Fellow, Royal Society, speaking at a Royal Society Lecture on 25 March 2015

9.1 EUROPEAN INTEGRATION AND COOPERATION

Scientific research and innovation leads to newer and efficient products, services, and jobs, thus adding value to the economy. Therefore, leading industrial nations facilitate and support scientific research with tax money. However, this government support is usually limited to that particular country and the gains from this support happen within this single country.

In the case of EU research programmes, the value addition happens in a number of European countries. This is because the process of EU supported research has been defined in such a way that the research work and thereby resulting the knowledge is shared, right from the very beginning, by several countries. Hence the EU R&I Policy is as much as contributor to integration as contributor to wider European economy. This is the simple but crucial understanding I gained from my study with regard to the question whether the research policy is contributing to the European integration.

The integration based on shared scientific knowledge and the resulting economic value addition in multiple member countries is the main outcome and core benefit of the EU research policy from the point of European integration. In addition, several peripheral benefits can also be seen with regard to the integration. The social integration especially because of movement of scientists from one country to the other and the networks that get established among research institutions in different member countries are other two peripheral benefits.

The EU plays a significant role in the organisation of scientific research activities and the improvement of the competitiveness of the industries in its Member States. This is much different than national technology policies. Further, the networks among scientists, research institutions, and firms that have come to operate with the help of the EU work on the "European Basis" with "European Interests", rather than the national interest of their base country. In this context, the government of a particular Member State is not anymore as influential as it would wish in defining a particular path or cornering any particular sector of technology.

Wolf-Michael Catenhusen and Werner Fricke (1995) go one step further and declare that "the age of techno-nationalism in Europe is over and the EU plays a significant role in the central fields of technology policy".

> "The age of techno-nationalism in Europe is over. Even those making German technology policy must accept the fact that, on the verge of the 21st century, urgent social problems such as the improvement of industrial competitiveness, the elimination and prevention of ecological damage, structural long-term unemployment and the economic exclusion of entire groups of people or the dramatic underdevelopment of large parts of our world cannot be solved solely on a national level. (...) The European Union, which plays a significant role in the central fields of technology policy, is of special importance in this context. Thus, there has been a fundamental change in the economic and institutional framework of technology policy-making and the constellations of social interests involved."[237]

The above was a bold statement in 1995, which, looking back in 2017 is still very much true. In the 2010s, new impulse has come into the policy, namely "innovation", which has added impulse to the integration.

[237] Catenhusen & Fricke (1995), 'The End of Techno-Nationalism as a Challenge for German and European Technology Policy'

It is highly likely that this policy will continue to grow for at least another two decades in its current form. After that the research cooperation within the EU countries will become a natural phenomenon, just like it would be in a single country. Eventually it is likely that the share of EU funding in some areas will get smaller. Because private enterprises might find it easier and cheaper to cooperate directly with research entities in another EU country. The cooperation will be then based on individual choice, which would be direct and easier to establish.

The EU R&I Policy, with its collaborative programmes, is today a very elaborate instrument to promote research. With only about 6% of the EU budget[238] devoted to its programmes, the contribution of this policy for the contemporary European R&I scenario is remarkable. It has financed tens of thousands of projects and set priorities and objectives that are beneficial to the industry and citizens of all its Member States. It tackles societal challenges by investing in R&I that can have a real impact and benefit the citizens. It strives to achieve industrial leadership by setting thematic focus on "promising and strategic technologies" which are vital to the industrial future of the EU.

The EU and its officials are quite convinced about the achievements of R&I Policy. Dr. Walter Mönig, Chairman of the Board of Governors, the EU's Joint Research Centre, has this to say:

> "The impact of the Framework Programmes is clearly visible in 30 years of cross-border collaborations between Europe's scientists, in the rise in research activity across Europe –particularly in the newer Member States – and in the emergence of an increased reflex for cooperation among researchers and heads of research organisations in Europe."[239]

[238] 9,007 million Euro was spent in 2015 on FP. This makes about 6.36% of a total EU budget of 14,586 million Euro.
[239] EC (2015), 'HORIZON Special Issue', p 4

9.1.1 THEORIES THAT EXPLAIN THE R&I INTEGRATION BEST

Christopher J. Bickerton (2012)[240] defines the EU as a "union of member states" that is the result of the transformation of the state in Europe. The member states are at the centre of the Union and the decisions are made by national representatives, not European agents, as we might think.

A theoretical explanation and clarification of the European integration resulting from EU supported R&I activities is limited. It is because there is a wide range of interpretation of the related theories. Besides there is also no uniform agreement what the EU is.

> "European integration theory, however, does not comprise one homogenous research agenda, but encompasses a wide range of theoretical approaches that differ with regard to their epistemological underpinnings, ontological assumptions and their analytical focuses."[241]

While there is no doubt that the EU R&I policy has loosened the nationalistic character that dominated innovation and technology in Europe, my study shows that the R&I activities did not follow any particular method of integration.

However, neo-functionalism and intergovernmentalism are the two theories which more visible than any other theories (federalism or realist).

In addition, functionalism is visible at a broader level, in the making and the evolution of R&I Policy: what initially began as research in the steel, coal and atomic sectors has now grown to cover research in almost all branches of science and technology. Meantime, the policy has spread over to other aspects such as education and human development. Intergovernmentalism with realistic traits is visible at the secondary level, i.e., the level where the focus is on implementation of the policy. Here,

[240] Bickerton (2012), European Integration from Nation-States to Member States
[241] Bergmann and Niemann (2013), p 1

the Member States tend to use its bilateral ties with other Members and their own financial strength to carve out the best deal.

The study also shows that the policy had several overlapping stages of evolution. Initially the objective of this policy was political (1950-1975). In the later years (1975-1992) the objective was mostly economic and today it is directed towards socio-economic issues such as job creation, health, and environment.

In the initial stage, the focus of this policy was on sectoral development, the first being nuclear technology. The concentration on sectors made a broad consensus among Member States often difficult to achieve. Policy issues were altered or put on hold because of conflicting national interests and any undertaking faced resistance from various sources. As the degree of economic integration intensified, a comprehensive research policy came into being (beginning from 1974) placing individual projects in wider frame of reference.

The intermittent and weak evolution of EU R&I Policy can be explained by several factors. One of them is inexperience in cooperation among countries in the areas of science and technology. First of all, the international dimension of co-operation between research organisations was still a new phenomenon up until 1990s.[242] In the absence of an encouraging precedence, new political undertakings could be suspicious and fail to draw support from all sections of society and government. Member States' relations concerning R&I have oscillated between cooperation and competition. Other issues such as budgetary constraints, political situation at home, urgency of the need etc. have all contributed to the poor cooperation and haggling over policy issues among Member States. This tends to change, as the socio-economic significance of a Community Policy is becoming more and more evident.

[242] Muldur and Petrella (1994), 'Science and Technology Policy: The European Community and the globalisation of technology and the economy'

The substantially long period of R&I co-operation between EU members has produced very positive results. The planned and coordinated nature of EU R&I can help firms to be efficient and avoid duplication. This saves costs and a certain kind of R&I that would have high social value will have direct benefit. The economy of the EU, rather than the politics of the individual countries is the key influencing factor in policy orientation. Moreover, many aspects of the policy can be justified using economic theories. The main criticism of this policy arose because of its incompatibility to a certain extent with the market economy and the EU's own competition policy. Margaret Sharp observes that there has always been a degree of schizophrenia in notable advocacy for the advancement of science and technology in Europe. She attributes this to the

> "tension between the free marketeers, whose emphasis throughout has been on competition and the diminution of internal barriers to free competition within the Community, and the mercantilists, who have constantly warned against Europe's increasing dependence on American (and latterly Japanese) technology, and whose vision centred on a more positive and interventionist approach."[243]

As Prof. Ruberti says, today the fabric of European policy is complex and flexible.[244] It is the focus of many players, pursuing different objectives. On the one side the policy is the means of intergovernmental cooperation and on the other it brings together and the Community mechanisms. Its activities are directed towards industrial ends as well as basic research. The policy is entrusted with the duty of achieving European excellence, meantime it should also strive for European cohesion. In order to obtain the best and optimal result of intended objectives, the Policy has to get feed backs on its various programmes. These studies would help the EU in keeping a corrective watch on the R&I Policy.

---

[243] Sharp (1991), 'The Single Market and European Technology Policies', in Technology and the Future of Europe, p 60

[244] Prof. Ruberti, Antonio in the Preface to Guzzetti (1995)

However, measuring R&I performance is an intrinsically difficult task and the result may not be always entirely reliable.

> "... technical change will typically display extremely complex and unstable patterns far beyond the competence of individual agents to design optimal strategies for when and how to adopt new technologies over time."[245]

For example, there is no clear picture available with reference to the economic output of the Policy as there is no clear and consistent methodology to quantify the output of an R&I effort in monetary terms.

First of all, the effect is a long term one and sometimes never ending as in the case of electric bulbs. Secondly the effect is universal, beyond the boundaries of a country where the R&I takes place. Under these circumstances, an optimal policy decision in R&I is a difficult task for the EU.

The significance of the EU's Technology Policy is not limited to research funding. Apart from participation in research programmes and beyond the financial indicators, human involvement is important. In Ireland, amongst academic spin-off companies, EU research programmes were the instrument used by virtually all academic entrepreneurs to demonstrate the quality of their research and provide it with international credibility. Dasgupta and David state that national science policies have tended to become more strongly inventionist and more explicitly commuted to "planning and management".

This seems to be true in the case of the EU, at least in its commitment to planning and management. The EU research funding through its R&I Policy is a necessity even though all the Member States have a market oriented capitalist economy. The plausible and convincing reason for state funding is, that in the end science and technology becomes a public good

[245] Heiner in Dosi et al (1988), 'Technical Change and Economic Theory'

to benefit whole of the society. The other reason is that even in a market economy there are irregularities which are impossible to avoid.

Nelson and Soete[246] observe that there is general agreement that market failure is indeed one of the intrinsic characteristics in R&D area and that under-investment in R&D will be the logical outcome of market allocation.

The policy exhibits considerable deficiencies when assessed by the extent its activities contribute toward achieving its contractual goals, especially with regard to the improvement of the competitiveness of European industry. European R&I Policy has not succeeded overwhelmingly in making EU Firms and institutes leaders in the development and application of all new technologies. Not only do the majority of evaluations on the EU's research and technological development come to this conclusion, but so does the European Commission itself in its review of its R&I Policy.

Again, and again the policy's distance from the market and the protracted decision-making processes and administrative procedures are criticised. The policy has certain strategic and institutional deficiencies. As the Commission itself says

> "the main problem of the European firms is not primarily the amount of their R&D expenditures, but rather their inadequate ability to turn their research and technology developments into inventions and to turn their inventions into market shares and profits."

Strategically, the policy should improve by focusing more on transforming the results of research into value added products. This is can be achieved by investment in enhancing the qualification of employees, new forms of work organisation, new production concepts and new forms of management. Considerable attention should be given to programme management. Besides the efforts towards progressive improvement of management performance and quality, significant advances should be made in the evolution and further development of management systems

[246] Nelson, et al (1988), 'Technical Change and Economic Theory' (London: Pinter Publishers)

to reflect fully the new principles of focus, coordination and flexibility in the implementation of the FPs. At the institutional level, the EU should cut down bureaucracy and protracted decision making processes in order to react with speed to the changes in technologies. The institutions should also have greater coordination at various levels of the research and technological development activities, programmes and strategies in Europe.

The policy has succeeded in encouraging collaboration between firms and research institutions across the EU. It also has opened up opportunities for upgrading European knowledge and skills, widening horizons and improving understanding and information flows. In this way, the EU R&I Framework Programmes have done commendable work in helping the firms to come out of their national seclusion. and play a European role. The European Union does play a necessary and indispensable role in technology policy. However, it can be asserted as Keith Pavitt did, that it is unrealistic to expect EU-funded R&I programmes by themselves to make a substantial difference to the rate and direction of technical change in Europe.

However, EU policies for competition and other forms of regulation, trade and investment can have a major influence on corporate decisions about technical change. The financial dimension, and the wide range of actions in all the Framework Programmes so far proves that EU R&I Policy is moving forward, consolidating, and widening the Community's involvement. The financial budget for FPs has continuously grown (see figure 1 and 3), which is a clear indication proving the importance of this policy.

Not long ago there were a great variety in the nature of national systems of innovation within Europe.[247] But now the collaborative programmes have created a vast, complex and impressive array of links between

[247] Archibugi & Pianta (1993), 'Patterns of technological specialisation and growth of innovative activities in advanced countries', in Hughes, Kirsty (ed.), European competitiveness

governments and industry, between institutions and individuals. In 2000 the creation European Research Area is a further indication of European Integration. What started initially with 6 countries in the 1950's has grown to a Union of 28 countries in 2013. All newcomers in the last two decades, with the exception of Poland, were relatively smaller countries. They now participate fully alongside with existing Member States in the R&I activities. They certainly make significant contribution to the EU R&I, along with contribution to other common European goals. It can be declared with fair certainty that that these newcomers have profited from the participation in EU R&I.

9.2 ECONOMIC JUSTIFICATION

It is evident that research and innovation are important for the EU: It is indeed essential to possess up-to-date technology in the fast-changing world in order to keep-up and continue with social progress and economic growth. Technical change is a fundamental force in determining the pattern of transforming the economy. It is said that the 50 leading countries in science and technology have enjoyed long-term economic growth much higher than that of other 130 countries of the rest of the world. Since the beginning of 20th century, the governments of all advanced countries have funded R&I to various extents.

The public benefit of this policy is shown to be far greater than private one. By sponsoring and funding selected research, the EU is not involved in direct and tangible value addition. But it is doing something for the greater society. Most of the basic research the EU has funded since the 1960s would not have been funded by private enterprises. In the last two decades, the EU R&I policy is also supporting programmes that transform research results into products and services that create wealth.

Based on the detailed analysis made in the previous chapter, it is clearly evident that the policy has tangible as well as intangible economic benefits. The tangible economic benefits are well proved in several EU and

independent reports. But he intangible economic value addition might be much higher than the tangible one.

9.2.1 SPILLOVERS AND SOCIAL BENEFITS

In enquiring about the economic benefits of this cooperation one fundamental question asked in regard to scientific cooperation is why should two or more entities cooperate? The obvious answer for that is: by cooperating we share knowledge and thus avoid duplication, which by implication reduces costs. From time immemorial, and by its very nature, science has always been universal, and there is a tradition amongst scientists the world over to report on their work and to share their newly acquired knowledge through scientific publications. Science has always been international and researchers by nature wish to co-operate with the most interesting experts or institutes in their fields, independently of where they are located. Thus, the vast majority of scientific co-operation is through bilateral co-operation between individual research institutes and bottom-up co-operation arranged by individual laboratories, universities or scientists.

Because of the cooperation, the scientists from the Developing countries are able to establish and further their contacts with scientists from European countries. One precondition for participation in the cooperation is to build a consortium first that must have equal number of scientists from the EU as well from the Developing countries. Hence the cooperation becomes a platform for networking for the scientists. The Commission’s impact assessment (CEC 2003, p 5) asserts, "The exchange of scientists, and the meetings, conferences and similar events that took place resulted in the transfer of experience, technology, and data in both directions". Further, the cooperation is a stimulus to the governments of the Developing countries to encourage scientific research that is relevant to them.

9.3 UK'S PARTICIPATION AFTER BREXIT

Many journalists and editors relay on the old wisdom "only bad news are good news". People do not complain about what is working well. They just complain about what is not is functioning.

The EU R&I Policy seems to be one of the EU policy areas, where there is no obvious controversy or complaints. Because of this, it seems there is a lack of news coverage in the media that is read or accessed by general public. As a result, people in general are not much aware of the existence of such a policy, more important of its benefits. Only the scientific community in the UK is very much involved with the EU R&I activities and concerned with the negative consequences of Brexit.

In Brexit referendum, the issue of EU R&I Policy was hardly touched for open discussion by any political party. However, as I have described, the scientific community tried to make the general public aware of the negative impact Brexit might have on R&I at UK universities and other research institutions. The prominent issues in Brexit referendum were the immigration of EU citizens or some critical EU policies such as Agricultural Policy.

In the meantime, many people in the UK regret already the decision; the short, medium and long-term effects cannot be foreseen, especially for R&I.

The importance of EU R&I policy and the impact of Brexit on the future of this policy have to be analysed to understand the consequences for integration process.

In short, excellent R&I as well as good education are the most important factors driving economic growth, competitiveness and prosperity. It helps us to improve our lives, to live healthier, to protect environment, and to succeed in economy. R&I is not a luxury. Metaphorically speaking, it is the vehicle that helps to preserve the world for our children.

Innovative business succeeds in competition, grows more quickly, and creates more employment than their less innovative competitors. Highly developed business locations, modern infrastructure, and especially first-class public funding for R&I are the key for a better life, for health and for prosperity.

Researchers from all over the world come to collaborate with researchers based in Europe using European scientific infrastructure. The European research landscape is complex. Both the EU and individual European countries fund research. Researchers collaborate with each other within Europe and internationally.

As I have described bevor in chapter 7, the UK is a net contributor to the EU budget. However, the UK is one of the largest recipients of research funding in the EU and, although national contributions to the EU budget are not itemised, analyses suggest that the UK receives a greater amount of EU research funding than it contributes. UK is one of the largest recipients of Framework Programme funding.

Nevertheless, the financial aspects of funding research should therefore not be considered in isolation, because the monetary value of scientific research is not the only one. Researcher's mobility and the encouragement for collaboration can have a bigger impact than the monetary values might suggest. The quantification of these aspects is not easy and not the purpose of my research.

In addition, one has to consider further spillover effects of R&I Policy, such as the transfer of loyalty. Cooperation in research leads functionally to cooperation in other fields, such as the necessity of common laws for common standards in quality especially in health and safety, common quality management, and maximum permissible values. At least, there

will be a common European level – even though this had not been the original objective of the FP.[248]

Further, the fields of EU R&I are crucial ones. UK is a world leading research base keeping UK research at the cutting edge. And UK cannot risk destroying the net which combines the UK researchers with researchers all over Europe and other countries in the world. UK cannot risk throwing out all the high potential students and researchers and isolate UK-researchers. It would take far too much time and resources to establish a similar net with other countries regardless to the EU activities. The disadvantages would be immense, and rather countless.

On 31 March 2016, the League of European research Universities (LERU) even put forward the question: Brexit: The collapse of a world-class research system for the UK?[249]

The impact that the EU has had on the UK is substantial and vice versa. In the recent years, there have been many challenges to European integration, in particular terrorist attacks, migration and refugees, unemployment, low rate of economic growth. One of the consequences was even the Schengen suspension. But, Brexit is one of the biggest challenges, if not the biggest one for the EU.

One of the challenges Brexit poses is if other Member States take UK as an example and block efforts in an attempt to gain advantages. Or Member States might even decide to leave the EU. A domino effect following in the UK's footsteps would indeed seriously threaten the European integration.

Despite of all these problems, the process of integration within the EU is still going on in many different areas and actually in most policies, such as free movement of goods, services, capital and people, further environment, health, social affairs, and – for the context most important –

[248] Jensen, C.S. (2000), 'Neofunctionalist theories and the development of European social and labour market policy', Journal of Common Market Studies, 38/1, p 71-92
[249] See http://www.leru.org/index.php/public/news/brexit-the-collapse-of-a-world-class-research-system-for-the-uk/, accessed 9 May 2017

R&I. This ongoing process of integration is primarily driven by the European law, especially the Court of Justice for the EU (CJEU). But, in case of R&I, the motor for integration is primarily the Framework Programme Policy.

At the time being, the dimensions of Brexit have to be analysed and clarified in the negotiations, including the chapter R&I.

However, considering the above-mentioned facts, it is highly probable, that UK – regardless to the outcome of the negotiations for the further relationship – will try with all efforts to continue participation in EU Framework Programme funding. This is underlined by the fact that – as I have described before – HM Treasury has already declared to underwrite the payment of such awards, even when specific projects continue beyond the UK's departure from the EU. The structural funds, where UK received relatively little, will not be in the centre of discussions.

Analysing the UK's position on EU R&I Policy, all the evidence suggests that the UK will remain in EU R&I Framework.

The Brexit negotiations will certainly be difficult ones. As time passes by, the tone of the political conversation tends to become rougher. The first impressions ("bloody difficult woman") were already given.

Nevertheless, concerning Horizon 2020 and the future Framework Programmes, I am convinced that UK will not risk losing the cutting edge of its research. The price of breaking the link to the Framework Programmes is much too high.

That means that R&I Policy is one factor of integration in spite of UK's decision to leave the EU. Despite of European citizens' Euroscepticism, R&I Policy will be an unneglectable factor in that keeps integration going on. UK will try to be an associated country and has to pay for its participation.

This result is somehow contradicting, somehow paradox. UK wants to leave EU, wants to regain sovereignty. But, concerning R&I it has to pay for its participation and will not be able to take part in decision making

concerning the FPs. UK certainly will not get other options than Switzerland or Norway. "Raisins picking" will not be possible. The integration process in the field of R&I will continue despite of the disintegration or separation in many other fields. UK just has to pay for it, without possibility to take part in decision making.

One of the purposes of my studies is to try to understand ongoing European integration process especially in the field of R&I and the consequences of Brexit in this field.

9.3.1 CONCLUSIONS ON UK UNDER NEO-FUNCTIONALISTIC FOCUS

Can neo-functionalism as a "middle-range theory in studies of process of European integration"[250] (Jensen, 2016, p 53) explain the process and dynamic of further European integration in R&I Policy despite Brexit? There are some indicators that R&I Policy drives further integration and will be a "package deal" (Jensen, 2016, p 58) but, neo-functionalism cannot explain it in all aspects:

First, I want to analyse if neo-functionalism's core concept, the "**spillover hypotheses**" (Jensen, 2016, p 54), is applicable on R&I. Cooperation in the area of R&I creates pressures in neighbouring political areas, such as free movement and the need of common (supra)national regulations. These neighbouring political areas will be on the agenda of the Brexit negotiations ("placing it to on the political agenda" (Haas, 1958). UK participation and cooperation in the future FPs will ultimately lead to further integration (Haas, 1958). But, this will not be a dynamic further integration, this spillover effect might slow down, reduce or even minimalize the effects of a (hard) Brexit concerning R&I. As we have seen, there is a huge political interest in UK's further participation in the FPs. However, the process of further cooperation in the field of R&I and connected areas will not be an automatic one, it will hardly be guided from

[250] Jensen, Carsten Strøby (2016), 'Neo-functionalism', in Cini Michelle, Nieves Péres-Solérzano Borragán, 'European Union Politics', p 53

the researchers and the research institutions themselves, as Haas stipulates (Haas, 1958). It is in the political leaders' hand to minimalize the consequences of Brexit concerning R&I and to be open for a future common bases, especially concerning R&I connected regulations (functional spillover). This could be seen as "scientific spillover". A "spillback", the disintegrative equivalent, (Jensen, 2016, p 60) will probably not take place concerning R&I-Policy.

Secondly, I want to examine the role of societal groups, the researchers and research institutions, in the process of Brexit. Is there a further integration or disintegration? Researchers and research institutions as well as politicians are the key actors in driving the integration forward by demanding, pushing for and enabling participation in the FPs. Researchers and research institutions will see integration as a way of resolving the problems in doing research that they face (Jensen, 2016, p 54). This process is primarily driven by the self-interest of the named group, "*rather than by any ideological vision of a united Europe or shared sense of identity*" (Jensen, 2016, p 54). The UK politicians share the interest in the FPs Policy. Their interest is not integration. They rather fear that UK's role in research might become weaker. To achieve this, they will try that UK will be an Associated Member in FPs.

In the field of R&I, there is a kind of "**elite socialization**". The fact that researchers and research institutions have common interests and goals, and work together across borders at European level – and UK's researchers will still continue to work together with their European colleagues despite Brexit – makes it difficult for them to focus solely on national research interests. Although researchers' loyalty tends to be oriented toward the European research level, the main result of this natural ally is a form of integration by working together and common goals. Researchers use the European infrastructure as well as that one in national level for realizing their research project. This "scientific" integration due to the "tacit support" of the European peoples and the

"permissive consensus" (Jensen, 2016, p 54) in this Policy hardly lead to a political one. But, the spillover effect of R&I is quite huge, especially functional spillover concerning (supra)national regulations e.g. for health and safety. Nevertheless, the result of the UK referendum, UK's population did not follow the research elites.

This analyse that indicates that UK will be an Associated Member of the FP Policy.

Figure 24: **Neo-functionalism - An analysis**

Theoretical key points of neo-functionalism	**Factors that drive integration**	**Results concerning Brexit in the field of R&I**
Spillover hypothesis	Cooperation in R&I creates pressure in neighbouring policy areas; functional, political, and cultivated spillover.	For the time being, generally no further integration due to Brexit; reduction of the negative effects of Brexit by active political decision for further participation in FPs; primarily functional spillover especially in trying to keep common (supra)national regulations concerning R&I; hardly any political or cultivated spillover but, "scientific spillover". Package deal.
Supranational interest group hypothesis	Role of the researchers and research institutions as supranational interest groups / non-state actors at national and international level.	Researchers and research institutions are the driving force for minimalizing the negative consequence of Brexit and seek for further integration; although politicians share the interest in further participation in FPs, they do not aim further political integration.
Elite socialization hypothesis	Integration tends to be driven by functional and technocratic needs; loyalty transfer.	UK: "Scientific" integration as an Associated Member State; researchers shift their loyalty towards European institutions.

9.3.2 CONCLUSIONS ON UK UNDER INTERGOVERNMENTALISTIC FOCUS

Looking at the key points of intergovernmentalism, I see the theoretically approach in the fact that UK referendum was focused on the topic gaining sovereignty, sovereignty shall rest with UK. But concerning R&I, it is UKs interest to cooperate further on European-level institution. As a "low politic" and a "less controversial area" (Hoffmann, 1995, cited in European Politics, p *) functional integration might be possible despite Brexit. The "interlocking politics" ("Politikverflechtung") (Risse-Kappen, 1996) might be a factor for R&I.

9.3.3 SUMMARY

I share Saurugger's opinion[251] that integration theories[252] are not obsolete by any means and that new theoretical frameworks should put forward to be used to understand the ongoing process of European integration. The existing integration theories can just in a limited way help us to understand and to explain this process of integration and disintegration, respectively separation especially in context with Brexit.

Neo-functionalism and intergovernmentalism lack in explanatory power to understand European integration, disintegration, and the consequences of Brexit in all dimensions. And, no single theoretical framework can explain the process of European integration help us to understand the challenge of Brexit especially concerning R&I.

From my point of view, the spillover dynamic of R&I is powerful but, it is interrupted and limited by intergovernmental cooperation. The explanatory power of the existing theories lacks, because the result we face is somehow paradoxically. They can only explain parts of the process.

[251] Professor Sabine Saurugger, speaking at John Hopkins School of Advanced International Studies, Bologna Institute for Policy Research, 16 February 2017.
[252] Ibid. The four major existing theories are neo-functionalism, (liberal) intergovernmentalism, constructivism, and federalism. But, neo-functionalism and intergovernmentalism continue to resonate within the mainstream academic discourse on European integration.

For the time being, Brexit itself does not threaten EU and the ongoing process of integration. Regarding R&I-Policy, I am convinced that in this special field UK integration will continue despite Brexit and that there will be further cooperation which might slow down or prevent disintegration in certain areas. UK just has to pay the price without being able to take part in the decision-making process. I would even state the paradox: UK is gaining sovereignty and losing sovereignty in R&I Policy at the same time, or generally speaking: UK's gain of sovereignty through Brexit is a limited one because of existing interests in R&I. The further cooperation in the field of R&I has spillovers, which are interrupted and limited. In R&I Policy, there will not be a spillback. Disintegration in other fields is not necessarily linked with disintegration in R&I area.

The negotiations will not be an easy job. There are two poles. For general preventative reasons, the EU has to be rigid, to be sure that Brexit was a one-off event and not any other member state sees just its individual advantages in leaving the EU. But, for single policies such as R&I, it should give UK the same position like Norway or Switzerland.

The price, which UK has to pay for democracy, is quite high, especially concerning R&I.

In answering thoughts on the article "UK scientists' loss of influence to be felt at home and across Europe, Roger Michaels[253] writes:

> "And if the European Commission, the Council of Ministers, The European Parliament do not think they have a MAJOR perception problem on their hands ALL over Europe, then we can all look forward to very dark days; and maybe not even very many of those. Wake up Brussels. Sell Science for what it is – the source of all progress and wealth creation."

I want to add these words:

[253] Roger Michaels, see http://www.euroscientist.com/uk-scientists-lose-influence/, accessed 10 May 2017

"Brussels, remember the European idea. R&I Policy is a link that guarantees further cooperation between EU and UK despite Brexit. The positive effects of R&I Policy for the EU as well as for the Post Brexit UK oblige you to make a good price for the UK as an associated member. But, just for R&I Policy."

Bibliography: Secondary literature

Acemoglu Daron (2002), 'Directed Technical Change', in Review of Economic Studies, Vol. 69, pp 781–809
Archibugi Daniele & Bizzarri Kim (2004), 'Committing to Vaccine R&D: A Global Science Policy Priority' SPRU Electronic Working Paper Series, Paper No. 112 (Brighton: The Freeman Centre, University of Sussex)
Archibugi Daniele & Coco Alberto (2004), 'A New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo)', in World Development, Vol. 32, No. 4
Archibugi Daniele & Coco Alberto (2005), 'Measuring technological capabilities at the country level: A survey and a menu for choice', in Research Policy, Nr. 34, pp 175-194
Archibugi Daniele & Mario Pianta (1992), 'The Technological Specialization of Advanced Countries' (Dordrecht: Kluwer Academic Publishers, and The Commission of the European Communities)
Archibugi Daniele (2000), 'The Globalisation of Technology and the European Innovation System' (Rome: Italian National Research Council)
Archick Kristin (2017), 'European Union: Questions and Answers' (Washington, DC: Congressional Research Service)
Arrow Kenneth (1962), 'Economic Welfare and the Allocation of Resources to Invention', in The Rate and Direction of Inventive Activity (Princeton: Princeton University Press)
Artis Mike and Lee Norman (eds.) (1997), *The Economics of the European Union, Policy and Analysis* (New York: Oxford University Press)
Aspinwall Mark & Schneider Gerald (2000), 'Same menu, separate tables: The institutionalist turn in political science and study of European integration: A survey and a menu for choice', in European Journal of Political Research, Nr. 38, pp 1-36
Bergmann Julian & Niemann Arne (2013), 'Theories of European Integration and their Contribution to the Study of European Foreign Policy' (Mainz: Johannes Gutenberg University)
Bickerton Christopher (2012), 'European Integration from Nation-States to Member States' (Oxford: Oxford University Press)

Boekholt Patries, Arnold Erik, Carlberg Malin, Collins Isabelle, and Fikkers Derek-Jan (2012), 'Norway's affiliation with European Research Programmes' (Amsterdam: Technopolis)

Bulmer Simon (1997), 'History and Institutions of the European Union', in Artis, Mike and Lee, Norman (eds.), in The Economics of the European Union, Policy and Analysis (New York: Oxford University Press)

Catenhusen Wolf-Michael & Fricke Werner (1995), 'The End of Techno-Nationalism as a Challenge for German and European Technology Policy' (Bonn: Friedrich Ebert Stiftung)

Cini Michelle & Borragán Nieves Pérez-Solórzano (2016[5]), 'The UK's EU Referendum, The Background, the Vote, and the Impact' (Oxford University Press)

Cini Michelle & Borragán Nieves Pérez-Solórzano (eds) (2016), 'European Union Politics' (Oxford University Press)

Dasgupta Partha & David P. (1994), 'Toward a new economics of science', in Research Policy, No. 23: pp 487-521

Dedman Martin (1996), 'The Origins and Development of the European Union' (London: Routledge)

Delanghe Henri, Muldur Ugur, and Soete Luc (eds) (2011), 'European Science and Technology Policy' (Cheltenham: Edward Elgar Publishing Limited)

Dhingra Swati and Sampson Thomas (2016), 'Life after BREXIT: What are the UK's options outside the European Union?' (The London School of Economics and Political Science)

Dhingra Swati, Ottaviano Gianmarco, Sampson Thomas, and Van Reenen John (2016), 'The consequences of Brexit for UK trade and living standards' (The London School of Economics and Political Science)

Dosi Giovanni, Freeman Christopher, Nelson Richard, Silverberg G., and Soete L. (eds) (1988), 'Technical Change and Economic Theory' (London: Pinter Publishers)

Eppler Annegret & Scheller Henrik (2014), 'European Disintegration – non-existing Phenomenon or a Blind Spot of European Integration Research?' (Vienna: Institute für europäische Integrationsforschung)

Freeman Christopher, Sharp Margaret, and Walker William (eds.)

(1991), 'Technology & the Future of Europe, Global Competition and the Environment in the 1990s' (London: Pinter)

Frenken Koen, Hoekman Jarno, Oort Frankvan (2007), 'Toward a European Research Area' (Rotterdam: NAI Publishers)

Frontier Economics (2014), 'Rates pf return to investment in science and innovation' (London)

Funk Mark (2002), 'Basic Research and International Spillovers', in International Review of Applied Economics, Volume 16, No. 2, pp 217-226

Georghiou Luke, Rigby John, Cameron Hugh (eds) (2002), 'Assessing the Socio-economic Impacts of the Framework Programme (ASIF)' (England: University of Manchester)

Granieri Masssimilliano & Renda Andrea (2012), 'Innovation Law and Policy in the European Union, Towards Horizon 2020' (Milano: Springer)

Guzzetti Luca (1995), 'A Brief History of European Union Research Policy' (Brussels: European Commission)

Haas Ernst B. (1958), 'The Uniting of Europe: Political, Social and Economic Forces, 1950-1957' (Stanford: Stanford University Press)

Hall Bronwyn, Mairesse Jacques, and Mohnen Pierre (2010), 'Measuring the Return to R&D' (Montréal: CIRANO)

Harrison, David Mark (1995), 'The Organisation of Europe' (Routledge)

Harrop Jeffrey (1992²), 'The Political Economy of Integration in the European Union' (Hampshire: Edward Elgar)

Hillman Jennifer & Horlick Gary (eds) (2017), 'Legal Aspects of Brexit' (Washington, DC: Georgetown Law)

Holzinger Katharin, Knill Christoph, Peters Dirk, Rittberger Berthold, Schimmelfenning Frank, Wagner Wolfgang (2005), (Paderborn: Schöningh)

Hughes Kirsty (ed) (1993), 'Technology, competition and skill', in European Competitiveness (Cambridge: Cambridge University Press)

Ilievski Nikola (2015), 'The Concept of Political Integration: The Perspectives of Neofunctionalist Theory' in Journal of Liberty

and International Affairs, Vol. 1, Nr. 1

James Andrew & Edler Jakob (2015), 'Understanding the emergence of new science and technology policies: Policy entrepreneurship, agenda setting and the development of the European Framework Programme', in Research Policy, Nr. 44, pp 1252-1265

Kealey Terence (1996), 'The Economic Laws of Scientific Research' (London: Macmillan Press)

Kohler-Koch Beate & Woyke Wichard (1996), 'Die Europäische Union' (München: C.H. Beck)

Lal Deepak (2000[2]), 'The Poverty of Development Economics' (Cambridge: The MIT Press)

Laursen Keld (1999), 'The Impact of Technological Opportunity on the Dynamics of Trade Performance', in Structural Change and Economic Dynamics, Vol. 10, pp 341-357

Lee McGowan (2007), 'Theorising European Integration: revisiting neo-functionalism and testing its suitability for explaining the development of EC competition policy? ' (European Integration Online Papers)

Ligtvoet Andreas and Van der Veen Geert (2016), 'Evaluation of European FP6/FP7 Energy Research and Demonstration Projects' (Amsterdam: Technopolis Group)

Luukkonen Terttu (1998), 'The difficulties in assessing the impact of EU framework programmes', in Research Policy, Nr. 27, pp 599-610

Milward Alan (1994), The European Rescue of the Nation-State (London: Routledge)

Milward Alan, Lynch Frances, Romero Frederico, Raniere Ruggero, and Sorensen Vibeke (1993), 'The Frontier of National Sovereignty: History and Theory 1945-92' (London: Routledge)

Møller J. Ørstrøm (1995), 'The Future European Model – Economic Internationalization and Cultural Decentralization' (London: Masell Publishing)

Moravcsik Andrew (1993), 'Preferences and Power in the European Community: A Liberal Intergovernmentalist Approach', in Journal of Common Market Studies

Morgan Roger (2000), 'A European 'society of states' – but only states of mind? ' in International Affairs, Vol. 76, Nr 3, pp 559-574

Nedeva Maria (2012), 'Between the global and the national: Organising European science', in Research Policy, Vol. 42, pp 220-230

Oliver Tim (2016), 'A European Union without the United Kingdom: The Geopolitics of a British exit from the EU' (London: London School of Economics)

Owen Richard, Macnaghten Phil, and Stilgoe Jack (2012), 'Responsible research and innovation: From science in society to science for society, with society', in Science and Public Policy, Vol. 39, pp 751-760

Pavitt Keith (1998), 'The inevitable limits of EU R&D funding', in Research Policy, Vol. 27, pp 559-568

Pavitt Keith (1998), 'The social shaping of the national science base', in Research Policy, Nr. 27, pp 793-805

Peterson John & Sharp Margaret (1998), 'Technology Policy in the European Union' (London: Macmillan Press LTD)

Peterson John (1993), 'Assessing the performance of European collaborative R & D policy: The case of Eureka', in Research Policy, Vol. 22, pp 243-264

Peterson John (2001), 'The choice for EU theorists: Establishing a common framework', in European Journal of Political Research, Vol. 39, pp 289-318

Popoviciu Adrian-Claudiu (2010), 'David Mitrany and Functionalism. The beginnings of functionalism', in Revista Româna de Geografie Politica, article 198

Roberts Geoffrey & Patricia Hogwood (1997), 'European politics today' (Manchester: Manchester University Press)

Rodríguez Hannot, Fisher Erik, and Schuurbiers Daan (2013), 'Integrating science and society in European Framework Programmes: Trends in project-level solicitations', in Research Policy, Vol. 42, pp 1126-1137

Rosamond Ben (2000), 'Theories of European Integration' (Basingstoke: Palgrave)

Russell Group (2017), 'Russell Group universities and Brexit'

(www.russellgroup.ac.uk)

Saille Stevienna (2015), 'Innovating Innovation Policy: The emergence of 'Responsible Research and Innovation', in the Journal of Responsible Innovation (Online: Taylor & Francis)

Salter Ammon & Martin Ben (2001), 'The economic benefits of publicly funded basic research: a critical review', in Research Policy Vol. 30, pp 509-532

Samardžija Višnja & Butković Hrvoje (2010), 'From the Lisbon Strategy to Europe 2020' (Zagreb: Sanja Tišma)

Sandholtz Wayne. (1992), 'ESPRIT and the Politics of International Collective Action', Journal of Common Market Studies, Vol. 30, pp 1-24

Saurugger Sabine (2014), 'Theoretical Approaches to European Integration' (Houndmills UK: Palgrave Macmillan)

Saurugger Sabine (2017), 'Politicization and Integration Through Law' (Bologna: John Hopkins School of Advanced International Studies)

Schimmelfenning Frank, Leuffen Dirk, and Rittberger Berthold (2014), 'The European Union as a System of Differentiated Integration: Interdependence, Politicization and Differentiation' (Vienna: Institute for Advanced Studies)

Schmied Helwig (1995), 'R & D – Management in Europe' (Wiesbaden: Gabler Verlag)

Shaw Jo (2000)[3], 'Law of the European Union' (Houndmills UK: Palgrave)

Stubbs Peter (1997[2]), 'Science and Technology Policy', in Artis, Mike and Lee, Norman (eds.), The Economics of the European Union, Policy and Analysis (New York: Oxford University Press)

Sweet Alec Stone (2012), 'Neofunctionalism and Supranational Governance' (Yale Law School)

The Royal Society (2015), 'UK research and the European Union / The role of the EU in funding UK research' (London: The Royal Society)

Ugur Muldur and Richardo Petrella (1994), 'Science and Technology Policy: The European Community and the globalization of technology and the economy' (Brussels: Commission of the EC)

Ulnicane Inga (2016), 'Research and innovation as sources of renewed growth? EU policy response to the crisis', in Journal of European Integration, Vol. 38, No. 3, pp 327-341 (Routledge)

Van der Harst Jan, Gillingham John, Kaiser Wolfram, Knudsen Ann-Christina, Leucht Brigitte, Loth Wilfried, Pine Melissa, Rasmussen Morten, and Warlouzet Laurent (2008) 'Journal of European History' (Baden-Baden: NOMOS)

Väyrynen Raimo (1998), 'Global interdependence or the European fortress? Technology policies in perspective', in Research Policy, Vol. 27, pp 627-637

Waltz Kenneth (1979), 'Man, the State, and War: a Theoretical Analysis' (Columbia University Press)

Weber Matthias, Andrée Dan, and Llerena Patrick (2015), 'A new role for Research and Innovation in the benefit of citizens: Towards an open and transformative R&I policy' (Luxembourg: Publications Office of the EU)

Wedlin Linda & Nedeva Maria (2015), 'Towards European science: an introduction' (Elgar Online: Downloaded at 29/03/2017)

Xu Jing & Shen Shiyoung (2014), 'IR Theories Debate of European Integration', in Open Journal of Political Science, p 217

Bibliography: Primary Literature and Reports

Austrian Federal Ministry of Science, Research and Economy (2015), 'Investing in Europe's Future' (Vienna: BMWFW)
Commission of the European Communities (1994), 'Science and Technology Policy – The European Community and the globalization of technology and the economy' (Luxembourg: Office for Official Publications of the European Communities)
EU (2016), 'Horizon 2020 Work Programme 2016-2017, 3. Marie Skłodowska-Curie Actions' (Brussels)
European Commission (2002), 'The 6th Framework Programme in Brief' (Brussels)
European Commission (2007), 'FP7 in Brief – How to get involved in the EU 7th Framework Programme for Research' (Luxembourg: Office for Official Publications of the European Communities)
European Commission (2013), 'Innovation Union: A pocket guide on a Europe 2020 initiative' (Luxembourg: Publications Office of the EU)
European Commission (2013), 'The European Union explained: The founding fathers of the EU' (Luxembourg: Publications Office of the EU)
European Commission (2014), 'EU budget 2013: Financial Report' (Luxembourg: Publications Office of the EU)
European Commission (2015), 'A new role for EU Research and Innovation in the benefit of citizens: Towards an open and transformative R&I policy' (Brussels)
European Commission (2015), 'Horizon Special Issue' (Luxembourg: Publications Office of the EU)
European Commission (2015), 'Seventh FP7 Monitoring Report 2013' (Luxembourg: Publications Office of the EU)
European Commission (2015), 'State of the Innovation Union 2015' (Brussels)
European Commission (2015), 'Value of Research: Policy Paper by the Research, Innovation, and Science Policy Experts' (Brussels)
European Commission (2016), 'EU budget 2015, Financial report' (Luxembourg: Publications Office of the EU)

European Commission (2016), 'European Innovation Scoreboard 2016' (Brussels)

European Commission (2016), 'Open Innovation, Open Science, Open to the World: a vision for Europe' (Luxembourg: Publications Office of the EU)

European Commission (2016), 'Research and Innovation' (Luxembourg: Publications Office of the EU)'

European Commission (2016), 'The EU explained: Research and innovation' (Luxembourg: Publications Office of the EU)

European Commission (2017), 'European Research Area Progress Report 2016' (Luxembourg: Publications Office of the EU)

European Commission (2017), 'Science & Policy Making: Towards a new dialogue' (Luxembourg: Publications Office of the EU)

European Commission (COM 2000) 6 (2000), 'Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions – Towards a European research area' (Brussels)

European Movement International (2016), 'The consequences of a British exit from the European Union' (Brussels)

European Parliamentary Research Service (2015), 'Overview of EU Funds for research and innovation' (Brussels)

Eurostat (2013), 'Science, technology and innovation in Europe' (Luxembourg: Publications Office of the EU)

HM Government (2017), The United Kingdom's exit from and new partnership with the European Union' (www.gov.uk/government/publications)

House of Commons Library (2016), 'The European Union: a guide to terminology, procedures and sources' (London)

House of Lords (2016), 'EU membership and UK science' (London)

Norwegian Ministry of Education and Research (2016), 'Norwegian ERA Roadmap 2016-2020'

OECD (2015), Frascati Manual 2015: 'The Measurement of Scientific, Technological and Innovation Activities'

Official Journal of the European Union (2012), 'Consolidated Version of

the Treaty on the Functioning of the European Union'
Swiss Federal Department of Economic Affairs (2015), 'Swiss Participation in European Research Framework Programmes' (Bern: State Secretariat for Education, Research and Innovation)
The European Communities (2011), 'National report on joint and open programmes NORWAY'

Internet Sites

CORDIS Community Research and Development Information Service: http://cordis.europa.eu/home_en.html
Director General for Research and Innovation: http://ec.europa.eu/research/index.cfm?pg=dg
Homepage of Professor Andrew Moravcsik, Princeton University: https://www.princeton.edu/~amoravcs/
HORIZON 2020: https://ec.europa.eu/programmes/horizon2020/
Norwegian Ministry of Education and Research
The EU Official Website: https://europa.eu/european-union/about-eu/eu-in-brief_en
The Royal Society: https://royalsociety.org/
The Russel Group: http://russellgroup.ac.uk/

List of Abbreviations

BlgNR	Beilagen-Nummer
BRITE	Basic Research in Industrial Technologies for Europe
CERN	European Organisation for Nuclear Research (French Abbreviation)
CJEU	Court of Justice for the EU
CODEST	Committee for European Development of Science and Technology
CORDIS	Community Research and Development Information Service
COST	European Research in the field of Scientific and Technical Research
CREST	Scientific and Technical Research Committee
EAEC	European Atomic Energy Agency
EC	European Community
ECE	Economic Commission for Europe
ECE	Economic Commission for Europe
ECSC	European Coal and Steel Community
ECU	European Currency Unit
EEC	European Economic Community
EFTA	European Free Trade Association
EMU	Economic and Monetary Union
ERP	European Recovery Programme
ESA	European Space Agency
ESF	European Science Foundation
ESPRIT	European Strategic Programme for R&D in Information Technologies

EU	European Union
EURATOM	European Atomic Energy Community
EUREKA	European Research Coordination Agency
Eurostat	Statistical Office of the European Communities
FP	Framework Programme
FP1 ...	1st F, 2nd Framework Programme
FPs	Framework Programmes
GATT	General Agreement on Tariffs and Trade
GP	Gesetzgebungsperiode
JRC	Joint Research Centre
MEP	Member of European Parliament
MITI	(Japanese) Ministry of International Trade and Industry
NATO	North Atlantic Treaty Organisation
Nr.	Number
OECD	Organisation for Economic Cooperation and Development
OEEC	Organisation for European Economic Cooperation
P	Page
pp	pages
R&D	Research and Development
R&I	Research and Innovation
RACE	R&D in Advanced Communications Technologies for Europe
RTD	Research and Technology Development
RV	Regierungsvorlage
S&T	Science and Technology
SEA	Single European Act

SME	Small and Medium Scale Enterprise
TEU	Treaty on European Union (Maastricht Treaty)
U.A.	Unit Accounts
UK	United Kingdom
UN	United Nations
USA	United States of America
VLSI	Very Large Scale Integrated Circuit
Vol.	Volume