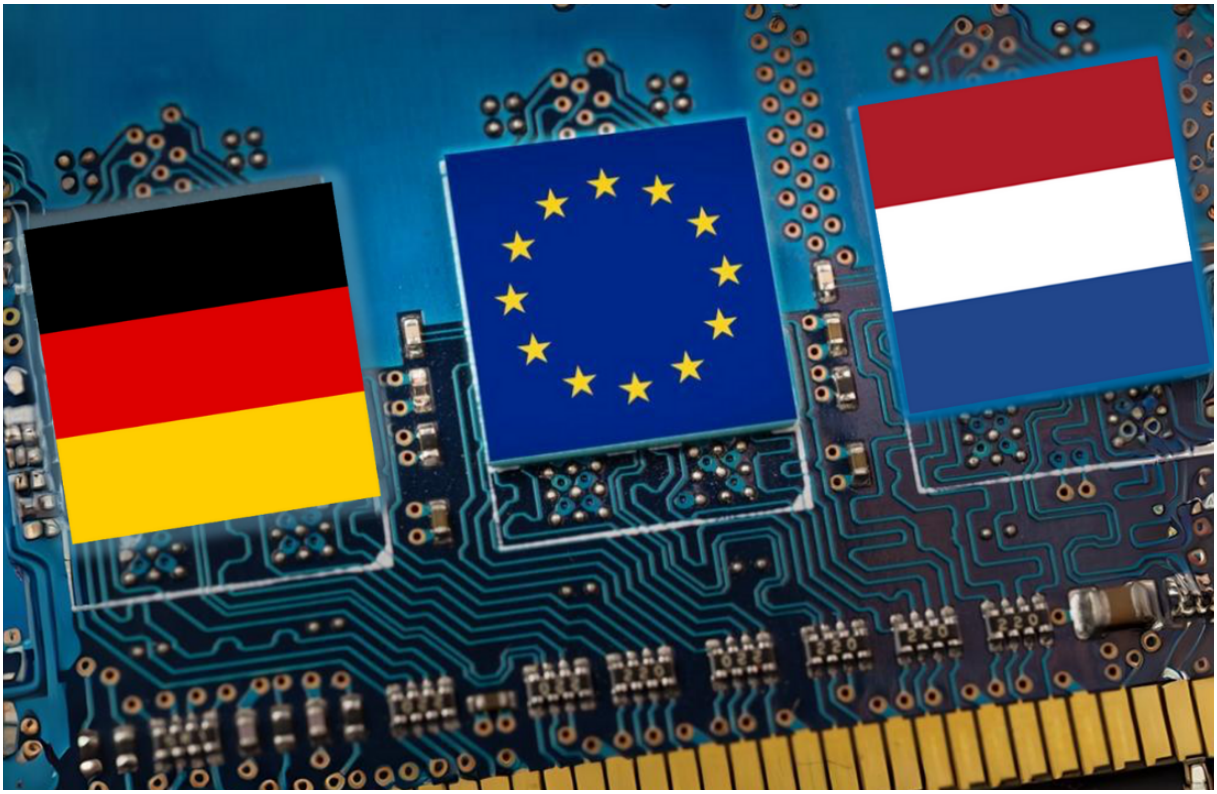

Semiconductor Sovereignty: Navigating the Chip Crisis through the Lens of the European Chips Act – A Comparative Analysis of Germany and the Netherlands

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Summary

This study seeks to discuss how the policy frameworks of Germany and the Netherlands drive their objectives within the European Chips Act. Threats to the vulnerable semiconductor supply chain are touching new heights because of rising tensions worldwide. This research will examine the strategies and motivations behind Germany and the Netherlands' engagement in the ECA. Those theories are framed through the lens of realism, industrial policy, and liberalism The findings are that Germany will mainly base itself on an industrial policy focused on resilience, sovereignty, and national security. The Netherlands had a mixed policy beforehand, but since the announcement of the ECA, it shifted to a more industrial policy approach. In both cases, the study concluded that Germany most suits the defensive realism approach in contrast with the Netherlands, where there is a mix of liberalism and industrial policy motivations.

The study aims to help one understand the making of policies in the semiconductor industry and the dynamics that go into the making of such an ECA.

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Introduction

This research bachelor project addresses the question: "How do liberal and industrial policy frameworks influence Germany's and the Netherlands' goals in enacting collaboration in the European Chips Act?". The reason for this research question is that the global semiconductor industry is currently witnessing a surge in demand for advanced chips, which has become a key driver of modern technologies. However, the EU has a continuing challenge: overdependence on external sources, mainly Taiwan, in terms of sophisticated chips. This dependence poses significant economic vulnerabilities and strategic risks, particularly with increasing tensions between China and Taiwan. If Taiwan's chip production were to disappear completely, it would make a big difference because Taiwan produces more than 60% of the semiconductor chips worldwide and more than 90% of the most advanced. The United States is already trying to bring the gigantic TSMC semiconductor business to Arizona. China has also not been idle and has invested $50 billion in chipmaking, aiming to produce 70% of domestic chips by 2025. China is trying to achieve this by brain-draining Taiwan for all the chip engineers, executives, and trade secrets (The Economist, 2023). Announced by the EU on 9-02-2022, the so-called European Chips Act. The Act will bolster Europe's competitiveness and resilience in semiconductor technologies and applications. From the main research question, the following sub-question have been drawn up:

1. How do Germany's and the Netherlands' semiconductor industry policies align with their stated goals in the European Chips Act?

This question will investigate the existing semiconductor policies in both countries and their alignment with the European Chips Act. It can shed light on their commitment to achieving the Act's objectives and how these policies reflect their national interests.

2. What are the key drivers behind Germany's and the Netherlands' participation in the European Chips Act?

This question aims to identify and compare the fundamental motivations for both countries and why they engage in the ECA. Understanding these drivers will provide insights into the broader goals each nation hopes to achieve.

3. How do the principles of Realism shape Germany's and the Netherlands' strategies and goals within the European Chips Act?

This sub-question examines how the goals of Germany and the Netherlands reflect Realist principles. Principles such as power dynamics, national security interests, and the pursuit of state autonomy within the international system. What also is possible to assess is what kind of Realism both countries act and if there is an interplay between the theories and policies.

The actors to which this research is dedicated are Germany, the Netherlands, and the European Union. Germany, known as the "Engine of Europe", a major European player in chip production. In the last couple of years, Germany's economic policy framework did make a significant shift; it moved from a predominantly liberal approach towards a more industrial-focused strategy. An example of this, especially in the semiconductor industry, is the "Future Fund", whose aim is to expand the Federation's support architecture in qualitative and quantitive terms and especially the financing options for start-ups going through the capital-intensive scale-up phase. An additional €10 billion has been earmarked for investments and future fund costs for this fund. The project provides funding for a time period of 10 years (Future Fund, z.d.).

The Netherlands, often named as the "Gateway to Europe" is home to ASML, a crucial player in chip manufacturing equipment, which is interesting to research the possibilities for the

Netherlands with this company; also, the Netherlands still have a more liberal policy in contrast to Germany; what is interesting is that we can compare this to research what happens if the government decides for a more liberal policy or a more institutionalised way of governing like industrial policy. By comparing industrial policy with liberalism, it is possible to research and identify what are the driving factors behind the decision-making of certain policies and to which paradigm these policies belong (Market Intelligence Report, 2023).
In response to the challenges, the European Union, the third actor in this thesis, launched the European Chips Act. The act seeks to reduce the EU's dependence on external chips from other countries, foster innovation, strengthen the semiconductor supply chain, and ensure technological sovereignty.

Theory

Realism and Industrial Policy

The theories mainly used in this thesis are Industrial Policy (IP) and liberalism Theory. Industrial Policy is closely aligned with Realism, which emphasises active state intervention to promote national power and interdependence. Realism as a theory of international politics is principally concerned with states as power- and security-maximising actors in a context of international anarchy. States are the fundamental units of organised, hierarchical power, and their relations dominate world politics. Within Realism, there are multiple classes; one of the classes is defensive Realism. Defensive Realism is the most closely aligned theory to Industrial Policy as it focuses more on keeping the state secure, independent and economically stable by protecting and investing in key industries and looking at the other classes; they focus more on gaining power than maintaining security and stability. Defensive realists contend that humans are inherently risk-averse and will only pursue expansionist policies or offensive actions when faced with a clear threat to their security. They are also more optimistic about the prospects for avoiding conflict and want more cautious, cooperative policies (Glaser, 2003, p. 404). Industrial Policy has increased interest as challenges related to demographics, digital transitions, and climate change have risen in the last couple of years. IP use has been motivated by climate mitigation, competitiveness, supply chain resilience, and national security considerations, which fits within the picture of defensive Realism (Industrial Policy Coverage In IMF Surveillance, 2024,p. 4). Industrial policy refers to the strategies and measures governments implement to directly influence the structure, performance, and competitiveness of specific industries or sectors within the domestic economy. Industrial policy is any selective intervention or government policy that attempts to alter the sectoral structure of production toward sectors expected to offer better prospects for economic growth than would occur without such an intervention (Pack & Saggi, 2006, p. 2). Industrial policy has been particularly prominent in East Asian economies like Taiwan, Singapore, South Korea and Japan, and it has been widely cited as a successful example of strategic government intervention in fostering economic development and technological upgrading. The government has substantial centralised control over social and economic affairs. The government's strategic cultivation of the semiconductor industries through targeted interventions, combined with the promotion of R&D and close collaboration with private firms, has enabled Taiwan to achieve a dominant position in global technology supply chains; the World Bank even called it the 'East Asian miracle'. However, it is important to know that Taiwan has had great success because of the accumulation of foreign capital and close collaboration with Western countries. Korea, Singapore, Taiwan, China and Malaysia have all entered the high-technology world of chip fabrication within the space of a decade. A semiconductor industry in Taiwan was created in the 1980s, where public sector laboratories played a major role in transferring the technology needed. Due to this high-tech semiconductor industry, Taiwan could leverage with US firms so

that they could set up agreements. These agreements rapidly increased the technological capabilities of the private sector, so enterprises like TSMC and UMC could be created (Matthews & Cho, 2000).

Realism has been the dominant theory of international relations. It aims to explain the fundamental features of international politics across different historical events, especially conflict and war. Realism emerged in the 1930s as a response to the idealistic and reformist optimism of liberal internationalists like Woodrow Wilson. It offered a more pessimistic outlook, which realists argued was necessary for understanding the tragic nature of international politics. The core realist belief is that conflict is inevitable and sometimes necessary in international relations. When disputes cannot be resolved peacefully, force and war become decisive means of settlement. Realists say any order that exists in international relations is an uncertain product of either the balance of power or domination by a great power and allies(Devetak et al., 2017, p.36). This can explain and/or predict state behaviour as the anarchic nature of the international system leads to security dilemmas where the actions taken by a state to increase security can make other states feel less secure, prompting them also to enhance their capabilities. This cycle can cause if some single states become too powerful and threaten a country's sovereignty, states will try to balance rising powers through alliances. This balance of power theory predicts that states will form coalitions to counterbalance the most potent states or coalitions (Jervis, 1978,p.189).

Realism can be separated into three different classes based on their view of the essential causes of conflict between states: Classical realists, Neorealists, and Neoclassical realists, which can be divided into defensive Realism and offensive Realism.

Classical realists argue that power is the primary currency in international relations. They contend that states are motivated by the pursuit of power and security and that the acquisition and preservation of power are fundamental objectives for states (Kirshner, 2014, p. 156). Neorealism, also called structural Realism, is led by Kenneth Waltz. It focuses heavily on the structure of the international system, seeing states as similar entities distinguished mainly by their power. It does not give much importance to factors inside individual countries (Kirshner, 2014, pp. 157-158). The main difference between classical realism and neorealism is that neorealism emphasises the international system's structure more, while classical Realism believes that understanding world politics requires considering both systemic factors and the unique characteristics of individual countries (Kirshner, 2014, pp. 157-158).

The third category of realism is neoclassical Realism. Neoclassical realism is a perspective within international relations theory that seeks to understand the relationship between a country's relative power and foreign policy decisions. It explicitly incorporates external (international systems) and internal (domestic factors) into its foreign policy analysis. It builds upon insights from classical realist thought, emphasising power's importance in international relations. They also argue that compared to other countries, a country's relative material power sets the basic parameters for its foreign policy. (Rose, 1998, pp. 144-154).

Within neoclassicism, there are two subcategories. The first one is offensive realism.

offensive realism reflects the logic that if a state wants to increase its own safety, it would usually do so by decreasing other states' security. So, it is difficult for a state to increase its own chances of survival without threatening the survival of other states; this is also called a security dilemma (Mearsheimer, 2001, p.36). The second subcategory is defensive realism, already discussed in this paragraph.

Liberalism

Liberalism's central principles are freedom, reason, progress, human rights, and tolerance. The norms of constitutionalism and democracy are deeply embedded in Western political culture. Liberals see war as irrational violence and attribute it to monarchs' unrestrained power, vanity, and ambition. There are different sorts of liberalism. Classical liberals believed in the free market and in limiting government powers to the minimum.

Social liberals saw a positive role for the state in preventing the abuse of economic power and promoting basic services like education and public health (Devetak et al., 2017, pp. 49-53). Neoliberalism is primarily concerned with economic policy and advocates for specific principles related to market liberalisation and limited government intervention in the economy. Neoliberalism emphasises individual economic freedom, particularly freedom of choice in markets. They think the economy will become more efficient due to these limited interventions. Critics point out that neoliberalism only benefits multinationals, the financial sector, and particular government agencies and international organisations. When neoliberalism is put into practice, it has produced increasing economic and social inequalities within countries (Carlquist & Phelps, 2014).

So, how can realism, industrial policy, and liberalism be linked to the thesis proposal?

Realism can be linked with my research question by considering the involvement of Germany and the Netherlands in security concerns by analysing if the participation of the ECA has to enhance national technological sovereignty or to balance against interdependencies on external chip suppliers like Taiwan and other semiconductor actors.

Industrial policy can be linked to my research question by assessing the specific government policies and strategies implemented by Germany and the Netherlands to boost their semiconductor sections. This could be done by analysing subsidies, research and development (R&D) investments, and government and private sector partnerships to understand how the policies reflect a strategic approach to building a competitive and resilient semiconductor industry.

Liberalism can be linked to the research question by examining its principles of cooperation and free trade. This could involve examining how the ECA promotes open markets, encourages innovation through competition, and fosters international collaboration within the semiconductor industry.

The institutional framework aims to answer the research question by examining how the institutional framework within the European Union, with a particular focus on Germany and the Netherlands, impacts the effectiveness of policies aimed at enhancing the semiconductor industry's competitiveness. This involves analysing how the "rules of the game" set by the European Union and its member states affect the European Competitive Agenda's development, adoption, and implementation.

The concept of institutionalism revolves around the framework and processes involved in designing, implementing, and evaluating policies across different countries. The framework is crucial for ensuring the effectiveness of policy interventions by defining the rules, norms, and structures that govern the actions and behaviour of economic actors. The institutional framework for policies should include both a "Hardware" component and a "Software" component. The hardware component consists of a set of bodies responsible for elaborating, implementing, monitoring, and evaluating policy at both the local and central levels. The software component determines how and whether those institutions work together towards reaching common objectives, how they interact with target enterprises and their representatives, and how they interact with broader communities of policy stakeholders. States are not only participants within this framework but also actively engage and influence in these settings

through strategic policy initiatives, investments in R&D, and fostering international collaborations. Understanding how state actions and institutional structures relate to policies being made, implemented, and refined for the semiconductor industry is critical("SME Policy Index: ASEAN 2018", 2018, p. 131).

Hypotheses that will be tested in this thesis:
The Netherlands' policy for the semiconductor industry is driven by liberal principles, which aim to enhance innovation and economic growth.

Germany's policy for the semiconductor industry is primarily driven by a strategic aim for technological self-sufficiency to mitigate external threats and ensure national security in the semiconductor sector.

The Netherlands and Germany have different motivations for participating in the European Chips Act. Germany has a more defensive realism view, while the Netherlands are more motivated by their liberal characteristics.

Methodology

Research Design

In order to answer the research question "What are the different goals between Germany and the Netherlands for enacting a collaborative European Chips Act?" a most similar case study design within a qualitative research framework is insightful. Case study methods are useful for qualitative research, especially when the research aims to understand a specific phenomenon or situation in-depth, with limited observations, like in the case of this thesis regarding the European Chips Act. Case studies allow the inclusion of many variables and contextual factors. Limitations of qualitative research include the potential for inaccurate, incomplete, researcher subjectivity, bias, or expectations. This would affect the reliability and validity of the research. To overcome this, a reflexive journal and document will be maintained with the assumptions, experiences, and potential biases throughout my research process. So, the reader will be able to evaluate the findings, and it will be transparent (Braun & Clarke, 2006, p9).

Data Collection

This research will use exclusively secondary data to explore Germany's and the Netherlands' different goals within the ECA. The secondary data will consist of scholarly articles collected via comprehensive literature research, official government and EU documents, industry reports, and news sources, which are sufficient. This design aims to leverage existing resources to comprehensively analyse the strategies and objectives underpinning the country's participation in the European Chips Act.
The scholarly articles are being searched with Google Scholar, especially in finding theories such as Realism, Liberalism, and Industrial Policy. Government and EU documents, including policy briefs, legislative texts, and strategic plans, will give valuable insights into political positions, commitments, and expectations regarding the ECA. To find policy documents necessary, looking for legislative documents will be useful; also, visiting the official websites of the European Union and the governments of the Netherlands and Germany is helpful.
It is important to extract the data you need before analysing it. This research will use Atlas.ti to code the data. This method assumes the information you extract can be categorised into pre-defined columns. These tools assume that the researcher clearly understands the information needed based on the research question. So, a thorough understanding of the theory is extra important.

Data Analysis

The third step is to analyse the data; this empirical analysis, which is being used in this research, is a Back-and-forth process; as documents are being gathered (data collection/extraction), it is possible to see patterns and ideas emerge (analysis). These initial thoughts can influence what documents to look for next, refining data collection. You should look at it like a puzzle; you do not get the full picture until you have all the pieces. After all the documents have been gathered, it is important to ask the big-picture questions like: Are there any documents missing that you expected to find? Are there any trends over time? (i.e. similarities, differences or evolution that stand out when documents are ordered chronologically). Is there something else you have noticed? When analysing the documents, it is crucial to ensure the set of documents is complete and what is missing. Again, the assumption is that research is flexible as it unfolds as you go, as it is not a pre-determined plan. As a researcher, it is also essential to think critically to assess the completeness of your analysis (Dalglish et al., 2020). For this method, it is important to have codes and subcodes in order to divide the policies in which theory they belong. Eventually, the data will be put into different tables for the Netherlands, Germany, and the EU. An example of how such a table could be the columns: first exist as the actor, which could be a ministry; after that, the motivation of the policy: why does the Netherlands or Germany want this policy? Then, the interaction with social actors hypothetically has a partnership with Intel and Volkswagen to get sufficient chips. Then, the goal of the policy will be analysed. Finally, the column on investment strategy contains funding details about the policy both countries have adopted, such as increases in R&D investment or strategic partnerships aimed at expanding semiconductor manufacturing. This table format clearly visualises how different policy measures across Germany and the Netherlands influence the semiconductor industry's competitiveness over time. This table can be connected to certain theories by understanding which data of the content belongs to which type of international relations and political economy theory. This can be based on the type of measure and the difference in competitiveness.

Case Study Analysis

In this chapter, the gathered data will be analysed. Data from official government websites, such as Rijksoverheid.nl, Bundesrat.de, and Commission.Europe.EU, has primarily been gathered. There are some other institutions, like ZVEI, from which information was gathered. ZVEI is an institution that contributes to developing strategic policies for both Germany and the EU. The data have been divided into two separate time spectrums: one time spectrum before the announcement of the ECA (8-02-2022) and one after the announcement. The policy documents included the subjects of semiconductors, R&D, and photonics. These were the subjects most related to the ECA, which is about the production of chips. For the time spectrum after the announcement, it was easier to find documents that specifically talked about the semiconductor industry; this indicates that the three actors have increased their importance in this industry. There were difficulties in finding policy documents that were at least 5 years old. Both Germany and the Netherlands are participating in the Open Government Partnership (OGP), so there is an expectation that data about previous policies will be available to the public. For Germany, it was less difficult than for the Netherlands. Liberalism is associated with open government (Barry et al., 1997), so the possibility is that both countries are not as liberal as they say.

Germany's Approach

A table has been created to visualise the data. This table overview is an easy way to showcase the theories and how much they imply the documents. A more in-depth analysis of this will be mentioned in the table below.

Germany	12 Articles
What is the policy type used before announcement ECA	7 articles
Leaning towards Industrial Policy	71%
Leaning slightly towards Industrial Policy	28,60%
Mix of both IP and Liberalism	0%
Leaning slightly towards Liberalism	0%
Leaning towards Liberalism	0%
What is the policy type used after announcement ECA	5 articles
Leaning towards Industrial Policy	80%
Leaning slightly towards Industrial Policy	20%
Mix of both IP and Liberalism	0%
Leaning slightly towards Liberalism	0%
Leaning towards Liberalism	0%

Table 1 Policy Types Used in Germany Before and After the Announcement of the ECA

The documents' central concepts before the ECA announcement were resilience, sovereignty, and national security. The first document from 30-4-2015 (BMWI, 2015) mentioned in Innovation through Research, the Ministry of Economic Affairs and Energy discussed how they could reduce energy costs and environmental pollution while strengthening the competitiveness of the German economy. The 43 million EUR funding was distributed over 9-industry-led projects. This policy has significant state intervention, and to enhance security and economic resilience, it is leaning towards industrial policy. The liberal characteristic of this policy was the mention of international cooperation.

The second policy document (Bundesregierung, 2018) was the Framework Program Quantum Technologies. The German government motivated it by the idea that Europe's technological sovereignty in satellite infrastructure was essential for avoiding dependencies. The aim is to create the right framework conditions to prepare new economic opportunities and markets, lay the foundation for industrial leadership, and ensure security and autonomy for Germany and Europe in this crucial future field together. Funding for this policy was focused on start-ups and SMEs as they are, in many cases, the drive of quantum technologies for Germany. The policy leans slightly towards industrial policy because of the focus on state intervention to enhance national security and economic resilience; liberal characteristics are also mentioned, such as competitiveness and international cooperation.

The policy document BMBF Federal Report Research and Innovation 2020 (Bundesministerium für Bildung and Forschung, 2020) is industrial policy, as it focuses on strengthening technological sovereignty, enhancing competitiveness, and there is significant state intervention whereby they are trying to get 500 million euros of funds, including 50 million euros is from the federal fund.

The policy document German Recovery and Resilience Plan (Bundesministerium der Finanzen) leans strongly towards Industrial Policy as they are focused on resilience, whereby the state plays a significant role in the competitiveness of the microelectronics industry. The liberal characteristic is the joint German-French initiatives in hydrogen, cloud computing, and

microelectronics, which also mentioned the effectiveness of competition. However, the policy highlights the importance of strengthening Germany's technological industries. This policy is focused on long-term growth potential.

The policy in 2021 by ZVEI (Central Association of the Electrical and Electronics Industry) this organisation contributes to developing strategic policies; they advocate for national and European policies. The policy document's theory was more Industrial Policy as the aim of the document: Semiconductor strategy for Germany and Europe (ZVEI, 2021) was to ensure that the technology of Europe and Germany is of a high level and make sure that it will become crisis-proof by making it not able to be manipulated politically or otherwise. They formulated it because it is crucial to ensure technological sovereignty, innovation, resilience, and sustainability of the semiconductor industry in Germany and Europe.

The last document analysed was the Annual Report 2021/22 of the German Council of Economic Experts (Feld, 2021). The motivation was to reduce dependencies and produce the most advanced chips in Europe. The goal of this was to reach technological sovereignty, doubling European production capacity to 20% of the global market by 2030 and reaching the technological frontier of chip manufacturing. The main interesting information of this document is the mentioning of the 20% market share of the global market in the semiconductor industry. This is interesting as this is one of the three pillars of the ECA; this was already known before this document was written. But it is interesting as Germany feels responsible for leading the way for the rest of Europe.

The theories after the EU Chips Act 8-02-2022 announcement are comparable to those before. Industrial Policy is still the dominant theory. The policies and documents described before the announcement are the same topics, the difference is the focus was more on the specific industry of semiconductors. The first document, the Federal decision on the proposal for the EU parliament establishing a framework for measures to strengthen the European semiconductor ecosystem, was on 8-04-2022 (Bundesrat, 2021). The motivation was again to increase resilience and to increase the global market share of the European semiconductor ecosystem by 2030 to at least 20%. The German Bundesrat also criticises this proposal from the EU as the calculation of the proposed Chip Law is not sufficiently comprehensible. They say only a few EU funds are planned, which is insufficient. There are some neoliberalist characteristics in this text as they mention (translated): "The German economy, which has a strong international focus, is dependent on the most unrestricted possible trade regime in the global semiconductor market; Restrictions on free trade may only be considered in well-founded, WTO-compliant exceptional cases." This indicates international focus, cooperation, and free trade.

In 2023, members of the political party Die Linke requested the Bundestag about the current situation and future of the semiconductor industry in Germany and Europe (Hunk et al, 2023). They were worried about the decline in manufacturing and the increase of geopolitical tensions between the USA and China. The shift of manufacturing to Asia has left Europe vulnerable to supply chain disruption. The document is more leaning towards Industrial Policy as they are concerned about supply chain risks.
The Bundesregierung answered this by giving details on how much money is planned to be invested by intel, 30 billion EUR, and how the fund is allocated. Bundesregierung stated this aligned with broader EU goals. With all this information combined, this document leans strongly towards Industrial Policy (Bundesregierung, 2023).

In the Annual Economic Report of 2024, the Federal Government (Bundesregierung, 2024) was worried about the economic challenges and ensuring economic stability and growth in Germany. In the annual report, their goal was to catch up in the micro-electronics industry and communication technologies, especially where Europe is partly dependent. This document also leaned more towards industrial policy, with the main message to ensure economic stability

and try to improve the competitiveness of the semiconductor industry. In 2024, the German government was also worried about their dependence on Chinese raw materials; for example, 89% of rare materials used to make wind turbines came from China. The policy aimed to reduce economic dependencies and enhance technological sovereignty and semiconductor industries. As there is also major funding for technology and the semiconductor industry, this policy also leans towards Industrial Policy (Buschman & German Bundestag, 2024).

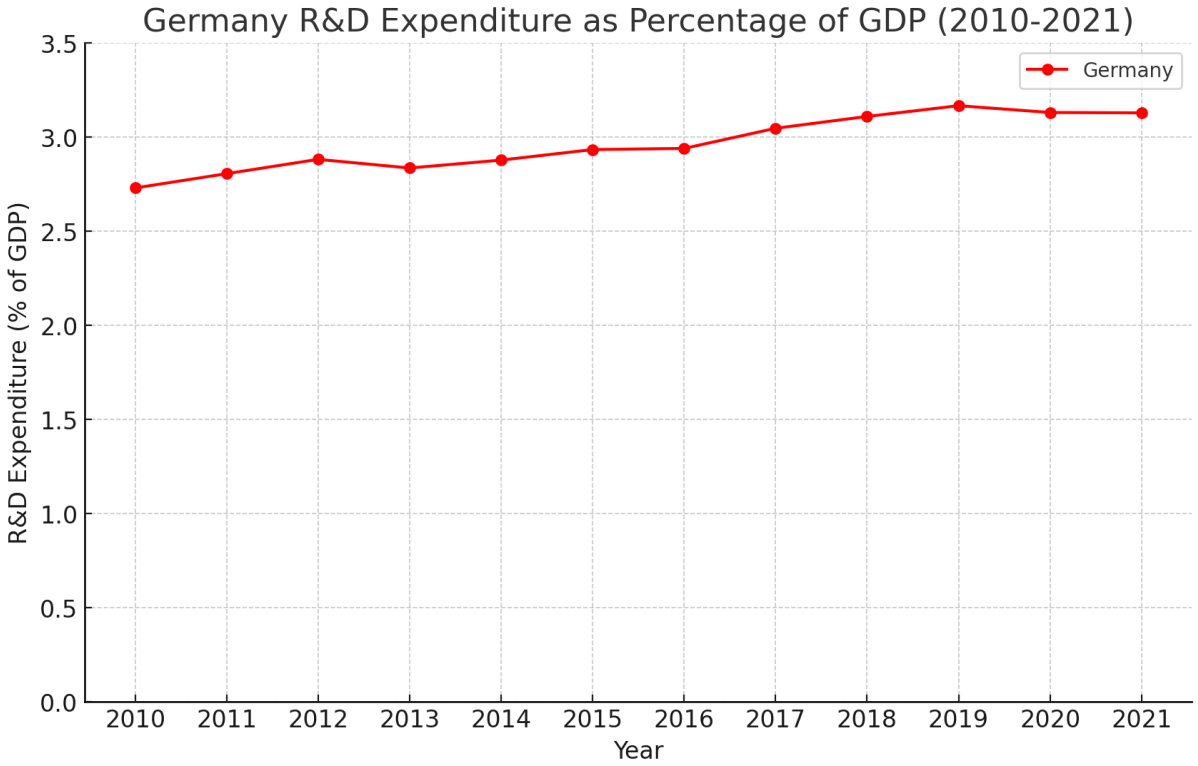

Figure 1
Germany Average EU R&D Expenditure as Percentage of GDP (2010-2021). Source: Gross domestic spending on R&D (indicator.) OECD https://doi.org/10.1787/d8b068b4-en
In general, the table and the content of the documents also reflect Germany's R&D Expenditures as a percentage of GDP; the graph shows a steady increase in GDP percentage.

Also interesting is the importance of the EU in these policies. Seven out of twelve documents significantly focus on the European Union. This indicates that Germany thinks Europe is the way to achieve what they want: technological sovereignty.

The Netherlands' Approach

Analysis of the Netherlands' semiconductor policies and their alignment with the ECA. This table clearly indicates that the Netherlands' policy type is shifting towards a more industrial policy approach.

Netherlands	14 Articles
What is the policy type used before announcement ECA	8 Articles
Leaning towards Industrial Policy	50%
Leaning slightly towards Industrial Policy	0%
Mix of both IP and Liberalism	12,50%
Leaning slightly towards Liberalism	0%
Leaning towards Liberalism	37,50%
What is the policy type used after announcement ECA	6 Articles
Leaning towards Industrial Policy	66,60%
Leaning slightly towards Industrial Policy	16,70%
Mix of both IP and Liberalism	16,70%
Leaning slightly towards Liberalism	0%
Leaning towards Liberalism	0%

Table 2 Policy Types Used in the Netherlands Before and After the Announcement of the ECA

The first document, formulated in 2013, discussed the Netherlands' innovation land status. The motivation for this document was the new economic development on the long-term of R&D increases. In this document, they mentioned the importance of especially start-ups but also the collaboration with AMSL. The policy (TNO et al., 2013) aimed to shift from labour-intensive growth to innovation-driven growth and enhance productivity through increased R&D investments. The Dutch government subsidised with interest discounts. This policy is a mix of both Liberalism and Industrial Policy as there are strong liberal characteristics like the interest discount and flexible labour market. However, there is a quote in the document which is interesting: "The Anglo-Saxon growth model… has become elaborated in recent years. A renewed long-term growth model must be based on the use of additional R&D and knowledge". The document recognises the historical reliance on a more liberal model but suggests a shift towards a model with more government intervention in R&D.

The second policy document (Minister Onderwijs, Cultuur en Wetenschap, 2014), the Ministry of Economic Affairs and the Ministry of Education, Culture, and Science reviewed the Dutch participation in the Seventh Framework Programme for Research and Technological Development. The framework was developed by the European Union and aimed to support research in scientific disciplines and technological sectors. The program was designed to enhance Europe's technological base, enhance competitiveness, and help to address major societal challenges. The Dutch government was in favour of this policy as in the Netherlands, there was a decline in natural resources, and so a decline in natural gas revenues. They aimed to strengthen the position of Dutch researchers and innovators within European Research and increase their international competitiveness. This was liberal as they highlighted international cooperation, competitive funding, and focus on knowledge and innovation.

The policy in 2016 Digitisation of Domains: actions New Digital Agenda is written because if barriers to international trade via the Internet were removed, it (Rijksoverheid, 2016) could lead to economic growth of 4% GDP in the EU. The government aimed to offer companies more space to cooperate and use ICT optimistically. This will be done by reducing the regulatory burden. The investment will be made through both the public and private sectors.

The public funding is a total of 146 million EUR over a time period of 10 years. This policy is more liberal because of the presence of deregulation, market efficiency and international cooperation. There is also an emphasis on economic resilience and Industrial Policy attributes; however, it is not as important as the liberal factors in the policy.

In 2018 (Ruud Sies, 2018), the Ministry of Foreign Affairs created a policy to enhance the Netherlands' international earning capacity and ensure sustainable and inclusive growth. The aim was to create a fair international playing field, enhance market access for Dutch companies, and promote sustainable and responsible business practices. This policy is more focused on liberalism as it focuses on the open market and fair competition. However, it is only slightly, as it also mentions investing in sectors such as technology and innovation, which are characteristics of Industrial Policy.

Also in 2018, the Dutch government created a National Agenda Photonics in collaboration with manufacturers and knowledge industries (Rijksoverheid, 2018). The motivation is that they thought the Dutch photonics sector needed to strengthen in order to maintain its leading position. The goal is to accelerate the application of photonics technologies to address societal challenges and create new business opportunities. The funding included investments of 60 million EUR, partly public and partly private. This policy leans towards Industrial Policy, focusing on strengthening the photonics sector, state intervention, and using significant funding. The elements of liberalism, emphasis on free markets, competition and open markets were also present; however, the main focus was still on Industrial Policy.

In 2018, the Ministry of Defense wrote its Defense Industry Strategy. The motivation was to enhance security, strengthen the industrial base, and ensure technological autonomy. They hoped to achieve a strong, independent defence, technological, and industrial base. This policy leans more towards Industrial Policy because it emphasises strongly on protecting and strengthening the national defence industrial base, including measures to prevent foreign takeovers and increase autonomy and national security (Defensie, 2018).

In 2019, the Ministry of Economic Affairs and Climate wrote a letter to the second chamber to inform them about a mission-driven top sectors and innovation document. The motivation was the potential economic changes and the ambition to be a key player in a couple of key technologies. The Ministry saw potential for collaboration between public and private actors. They mentioned investments in both private and public stakeholders. The document leans towards Industrial Policy as there is a main focus on state intervention to enhance national security, economic resilience, and state sovereignty by not being too dependent on the United States and China (Ministerie van Economische Zaken en Klimaat, 2019).

In 2020, the Ministry of Economic Affairs and Climate wrote for the second chamber, the Vision for the Future of Industry in the Netherlands. The motivation is that they want to increase the competitiveness of the Dutch semiconductor industry through innovation and sustainability. The focus is on the high-tech and semiconductor sectors; there are also significant investments through national growth funds and European programs. So, this policy leans towards Industrial Policy (Ministerie Van Economische Zaken en Klimaat, 2020).

The types of policies after the announcement of the EU Chips Act 8-02-2022 are different from the types before. Before the announcement, the types were a mix of Liberalism and Industrial Policy; they shifted towards a more Industrial Policy type after the announcement. The Dutch government's assessment of the EU Chips Act was positive. They liked the idea of enhancing competitiveness and resilience by reducing dependence and increasing production capabilities. This policy was a mix between Liberalism and Industrial Policy because of the reducing independencies, but also Liberalism is reflected as there is a big focus on the encouragement of collaboration with both EU and non-EU states.

The second chamber also had questions about this European Chips Act; the main questions asked were the funding allocations and strategic implications for the Netherlands, Dutch businesses, and the EU. The VVD (liberal party) thinks the 10% to 20% increase is too ambitious. Other questions were about local industries and how the ECA benefits them. Members were worried about regulatory impact, how the businesses could be impacted negatively, and concerns regarding export restrictions. By looking at all these questions, this policy document is leaning more towards Liberalism as the main concern is competitiveness, regulations and economic interests.

In 2023 the Dutch government announced the Upcoming Expert Control Measures for Advanced Semiconductor Production Equipment (Minster van Buitenlandse Zaken, 2023). The Ministry of Foreign Trade & Development Cooperation created this policy to safeguard security by managing the export of strategically important semiconductor production equipment. They safeguarded this by restricting exports to certain countries outside the EU. The goal was to prevent goods which contribute to unwanted end-use, like military applications or weapons of mass destruction. This is more Industrial Policy as it involves significant state intervention.

In 2023, the Ministers of Economic Affairs and Climate & Foreign Trade and Development intervened to enhance the semiconductor ecosystem. The motivation is to foster being a key actor in the semiconductor industry and to streamline communication and policy implementation across the semiconductor industry by involving diverse stakeholders. The goal is to increase the resilience of supply chains, strengthen the European semiconductor ecosystem, and ensure the Netherlands retains a critical role in global production. The government decided to fund this via investments in R&D. With all this taken into mind, this policy is leaning more towards industrial policy.

The trend of the change from the Dutch government to a more Industrial Policy type is also visible in the R&D Expenditure as Percentage of GDP. The R&D increased by 0,5656 percentage points. This does not seem that much, but in terms of percentage, the increase from 1,707% to 2,269% is an increase of 33,15%.

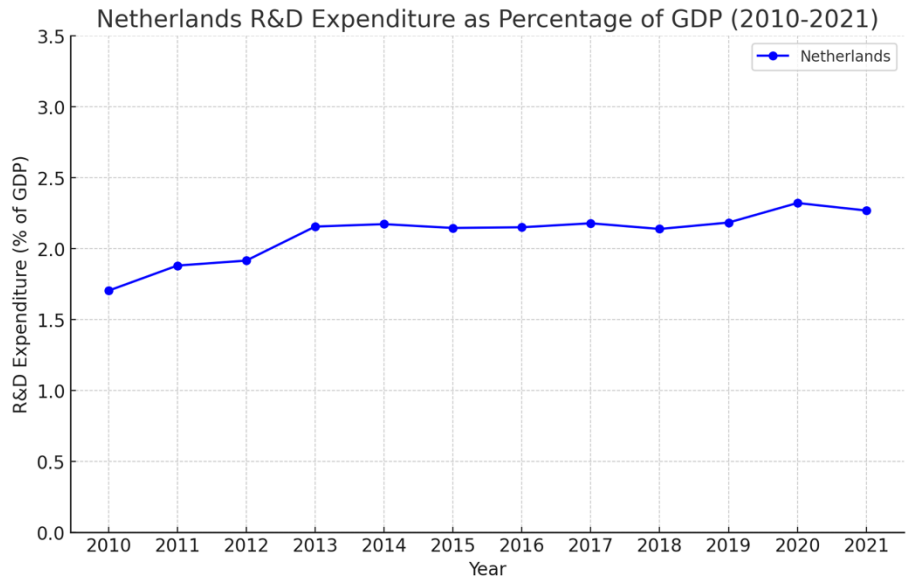

Figure 2
The Netherlands Average EU R&D Expenditure as Percentage of GDP (2010-2021). Source: Gross domestic spending on R&D (indicator.) OECD https://doi.org/10.1787/d8b068b4-en

European Union's approach

Analysis of the European Union's semiconductor policies and their alignment with the ECA. This table clearly indicates that the European Union's policy type is shifting towards a more industrial policy approach.

European Union	10 Articles
What is the policy type used before announcement ECA	5 articles
Leaning towards Industrial Policy	0%
Leaning slightly towards Industrial Policy	20%
Mix of both IP and Liberalism	40%
Leaning slightly towards Liberalism	20%
Leaning towards Liberalism	20%
What is the policy type used after announcement ECA	5 articles
Leaning towards Industrial Policy	80%
Leaning slightly towards Industrial Policy	0%
Mix of both IP and Liberalism	20%
Leaning slightly towards Liberalism	0%
Leaning towards Liberalism	0%

Table 3 Policy Types used in the EU before and After the Announcement of the ECA

The first document from 2006 was the Seventh Framework Programme, which was developed by the European Union and aimed to support research in scientific disciplines and technological sectors (The European Parliament and the Council of the European Union, 2006). The program was designed to enhance Europe's technological base, enhance competitiveness, and help to address major societal challenges. The motivation was that the EU wanted to improve the competitiveness of the European industry and generate knowledge to ensure its transformation from a resource-intensive to a knowledge-intensive industry. Europe must maintain and develop its leading position. The collaboration was focused on interactions with small size enterprises to increase the sharing of expertise to create new methodologies, technologies, processes and standards. This paper is more leaning towards Liberalism as it highlights prosperity and freedom. The quote in the document typically Liberal: "To become competitive and play a leading role at the world level, EU needs a strong coherent international science and technology policy". Both emphasise international cooperation and promote an open market. Also, a smaller set of funding schemes should be used to deal with deregulation.

In 2009, the European Commission formulated a policy that talked about the future of semiconductor intellectual property architectural blocks in Europe (Tuomi & European Commission, 2009). The objective is to describe the current state and potential future developments in semiconductor Industrial Policy and to relate the outcomes of the study to policy-related discussion relevant to the EU and its Member States. The goal was to support the development of open innovation ecosystems, ensure access to design tools and competencies, and facilitate the formation of strategic ecosystem hot spots. There is a mention of both Industrial Policy as well as Liberalism; however, the policy is more liberal, highlighting open market strategies. There is also support for market efficiency and deregulation.

In 2017 (European Council & General Secretariat of the Council, 2017), the European Council met and formulated a policy to build a coherent Digital Europe by fully integrating governments and public sectors into the digital age, establishing a future-orientated regulatory

framework, and creating world-class infrastructure and networks. The motivation was the immense opportunities for innovation growth & jobs that will contribute to the EU's global competitiveness and enhance creative and cultural diversity. The council also wanted the members to have a stronger combination with each other. The document is leaning slightly towards Industrial Policy as there are significant state interventions and the use of subsidies. The Liberal aspect is that the EU want to achieve this policy by integrating a single market (competition), open markets and cooperation between member states, so there is Liberalism in this policy.

The European Commission wanted to have a renewed European Agenda for Research & Innovation (European Commission, 2018). The goal is to deepen Europe's innovation capability, ensure the necessary investments, and accelerate the diffusion of innovation across Europe. The commission created this renewed European Agenda because they want to maintain and improve Europe's global competitiveness by investing in research and innovation. By looking at these facts, it looks like the policy is more leaning towards Industrial Policy; however, the liberal characteristics are more present as they mention the importance of open markets: "The EU is the most open research and innovation area in the world". Another liberal quote: "It needs to provide the open and competitive markets".

The European Commission reviewed the State of Play of the Important Projects of Common European Interest (ICPCE). The EC addressed important market failures and societal challenges. They also want to enhance EU strategic autonomy and align with EU political priorities such as the Green Deal and digital strategy. The EC wanted to achieve this by interacting with Member States and investing in technological development. This policy is a mix of Liberal and Industrial Policy. Liberal because it encourages broad participation, including SMEs and aims to minimise market distortions. However, it also focuses on IP as this policy aims to boost strategic sectors through significant public investment and state aid.

On 8 February 2022, Von der Leyen, president of the European Commission, announced the EU Chips Act. The Act had three pillars:

1. The "Chips for Europe Initiative" will support large-scale technological capacity building and innovation
2. A Framework to incentivise public and private investments in manufacturing facilities will ensure the security of supply and resilience of the Union's semiconductor sector
3. A coordination mechanism through the European Semiconductor Board will be the key platform for coordination between the Commission, Member States and stakeholders

The goal mostly discussed was the increase in global market share in the semiconductor ecosystem from 10% to 20% by 2030. Other goals were the security of supply, monitoring, and crisis response. The motivation was that semiconductors are the drivers of digital transition. Their production relies on complex and vulnerable global supply chains. There was also a global ship shortage and the global 'subsidy race' presence. The Act is more leaning towards Industrial Policy as there is significant state intervention, subsidies, and enhancing security. There are also elements of liberalism as the EU would improve access to financing for start-ups and SMEs, reflecting a market-driven innovation(Ragonnaud et al., 2022).

Also, in 2022, the European Commission looked at the position of the EU in the semiconductor value chain. The motivation was to provide evidence-based scientific support to the European policymaking process in the semiconductor sector, emphasising trade, foreign acquisitions, and ownership. This is important as more traditional sectors increasingly rely on

semiconductors, and no country is independent or autonomous over the entire chain, which indicates collaboration is crucial. More importantly, the aim is to highlight the strengths and weaknesses of the EU in different segments of the value chain. The objective of the document was to provide preliminary evidence on Europe's position to map companies within this ecosystem. Several research areas have been highlighted, like supply chain and demand needs, subsidiary data, and future research. The document is that although it has a significant focus on international trade and attracting foreign investments, it leans more towards industrial policy as the main focus is on increasing the EU's semiconductor production capacity, public and private investments, and strategic autonomy(European Commission, 2022).

The Council of the European Union established in 2023 a framework of measures for strengthening Europe's semiconductor ecosystem and amending regulation. They made this regulation because they want to address the strategic dependencies in the semiconductor industry and enhance digital sovereignty because the current disruptions have exposed long-lasting vulnerabilities, in particular, a strong third-country dependency in the manufacturing and design of chips. The First objective of the regulation is to ensure the conditions necessary for the competitiveness and innovation capacity of the European Union, to keep up with the industry changes due to fast innovation cycles, and to strengthen the Union-wide semiconductor ecosystem with pooled knowledge, expertise, resources and common strengths. They also wanted to improve the functioning of the internal market. This regulation is a mix of Liberalism and Industrial Policy as the EU tries to promote innovation through market mechanisms and enhance competition. Elements of IP are a public investment in infrastructure, research and development, also to increase resilience and to try to be more autonomous (European Union, 2023).

In 2024, the EC created a White Paper: How to Master Europe's Digital Infrastructure Needs. The goal is to create an equally strong dynamic partnership between businesses in Europe due to EU businesses increasingly partnering with non-EU players. To safeguard EU global leadership in technological equipment. The EU has an ambitious funding programme which already mobilised 100 billion EUR of public and private funding. The goal is to foster a vibrant community of European innovators, an ecosystem that spans semiconductors, computational capacity in all kinds of edge and cloud environments, radio technologies, connectivity infrastructure, data management, and applications. This paper leans more towards Industrial Policy as it details public funding mechanisms and strongly focuses on autonomy (European Commission, 2024).

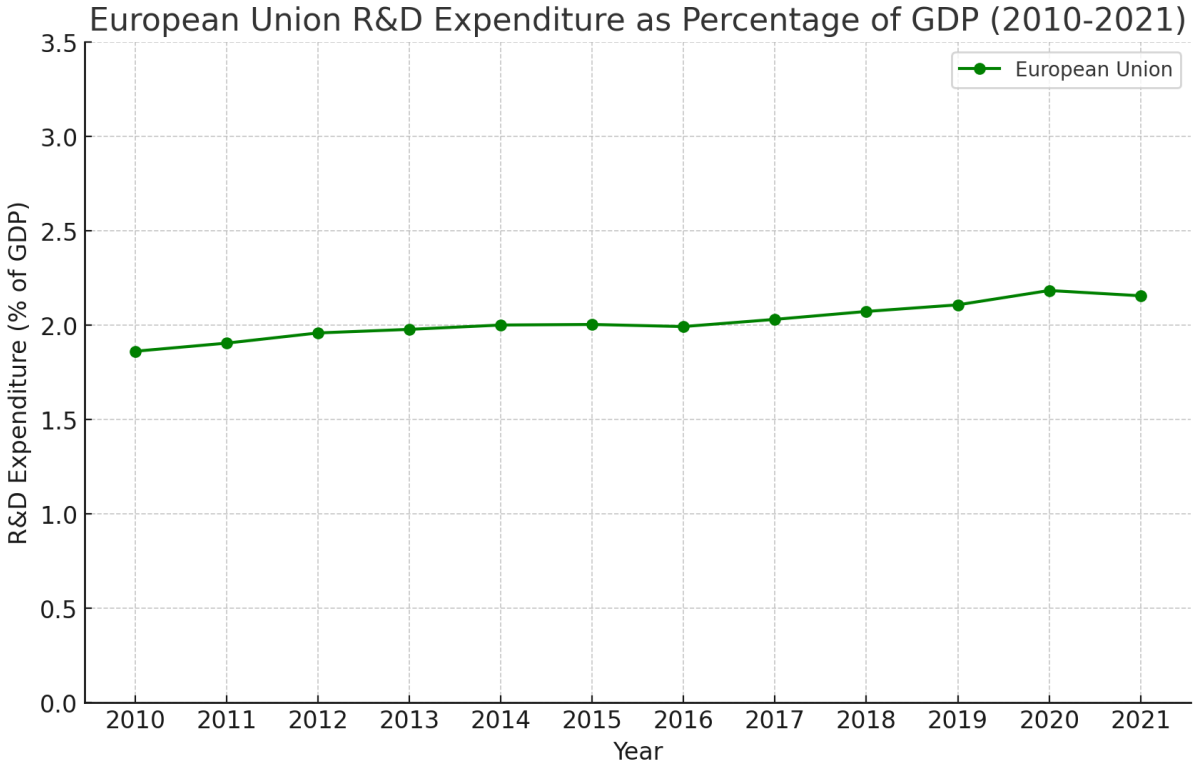

Figure 3
Average EU R&D Expenditure as Percentage of GDP (2010-2021). Source: Gross domestic spending on R&D (indicator.) OECD https://doi.org/10.1787/d8b068b4-en

The trend of this moving policy type to a more Industrial Policy is expecting the R&D Expenditure as a Percentage of GDP to increase. The data is the average of the 27 Member States from 1-02-2020. It indeed increased from 1,862% to 2,156%; this is really that significant compared to the major move of the policy type.

Comparative Analysis

The Netherlands and Germany have different motivations for participating in the European Chips Act. Germany has a more defensive realism view, while the Netherlands are more motivated by its liberal characteristics. The difference is clearly visible in the table; Germany has a significant dominant Industrial Policy type before and after the announcement. The Netherlands is more comparable with the EU as before the ECA, they had a mix of theories used in their policies, and after the ECA, it changed to a more Industrial Policy type.

Comparison	Germany	The Netherlands	European Union
What is the policy type used before announcement ECA	7 articles	8 Articles	5 articles
Leaning towards Industrial Policy	71%	50%	0%
Leaning slightly towards Industrial Policy	28,60%	0%	20%
Mix of both IP and Liberalism	0%	12,50%	40%
Leaning slightly towards Liberalism	0%	0%	20%
Leaning towards Liberalism	0%	37,50%	20%
What is the policy type used after announcement ECA	5 Articles	6 Articles	5 articles
Leaning towards Industrial Policy	80%	66,70%	80%
Leaning slightly towards Industrial Policy	20%	16,70%	0%
Mix of both IP and Liberalism	0%	16,70%	20%
Leaning slightly towards Liberalism	0%	0%	0%
Leaning towards Liberalism	0%	0%	0%

Table 4 Comparison of Policy Types Used Before and After the Announcement of the ECA

The difference can also be seen in the line chart of R&D as a percentage of GDP. The Netherlands has almost an identical line chart to the EU, whilst Germany's percentage is higher. It also looks like Germany feels more responsible for the status of the semiconductor industry in Europe. This is possible because Germany had a bigger influence and guidance on the European Union (Yu, 2023), so they felt more responsible for guiding Europe towards common goals. As they mentioned, the Netherlands do not seem responsible for being the leader: "This is almost one and a half times as much as the Netherlands via the EU budget contributes" (Minister Onderwijs, Cultuur en Wetenschap, 2014). The document's tone seems like they are proud of receiving more money they contribute, so they do not feel the responsibility like Germany of leading the way for Europe. Germany also feels the necessity of having control over the supply chain, as over 90 per cent of all raw materials that are being used in Germany are imported. This means raw material security of supply is crucial for Germany (Menkhoff & Zeevaert p318, 2022). The automobile market is one of the most important industries for the German economy (Zeng, 2018). This automobile sector also needs a significant amount of chips. During COVID-19, a "chip shortage" occurred in the automobile industry, which caused disruptions in the supply chain. Germany realised the problem of this crisis, so the German Automobile Industry Federation called on the Bundesrat to take measures to solve this chip supply crisis (Wu et al., 2021). The Dutch economy was not that reliant on these chips. The Netherlands is home to ASML; this company is at the beginning of the supply chain as it creates the machines necessary to produce chips. This means the Dutch economy is not heavily reliant

on importing chips, so they do not see the necessity of investing a lot of money in R&D to increase their chips import.

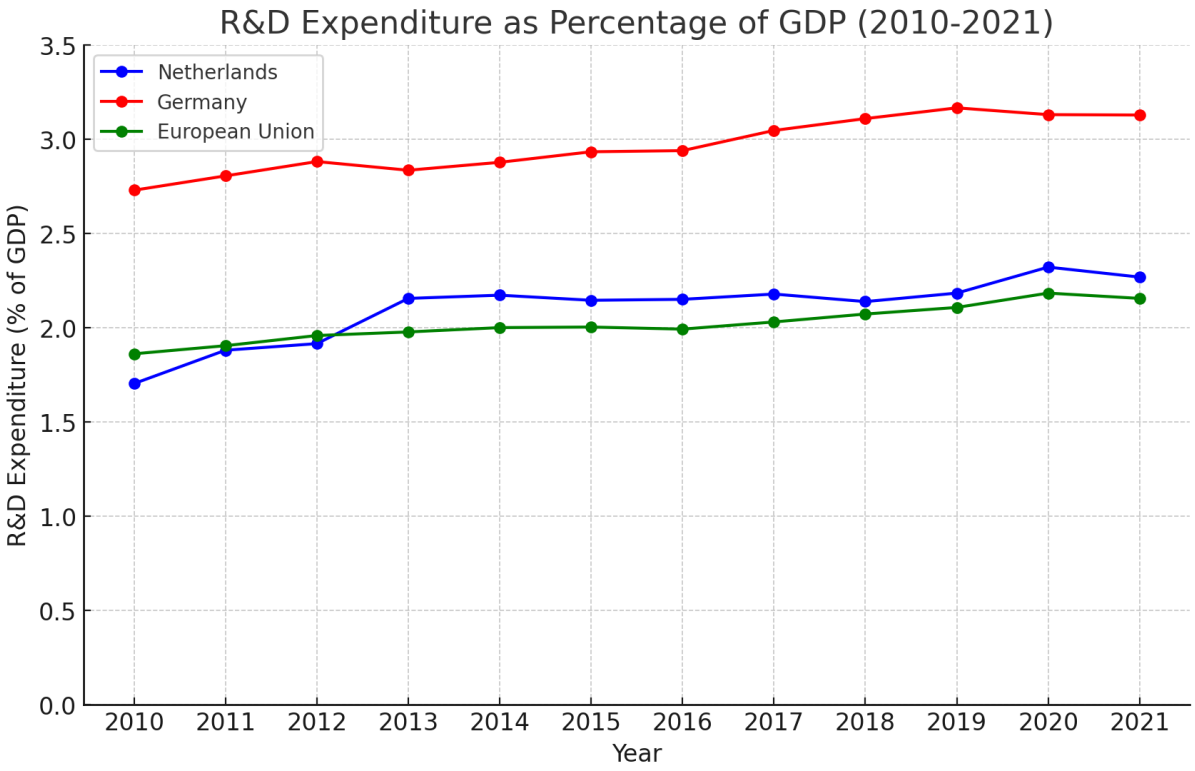

Figure 4
R&D Expenditure as Percentage of GDP (2010-2021). Source: Gross domestic spending on R&D (indicator.) OECD https://doi.org/10.1787/d8b068b4-en

This graph also shows the similarities between the Netherlands and the EU, as in the table. Germany's clear policy type is also visible, which is significantly more than the average of Europe and the Netherlands.

Germany’s increase in R&D expenditure as percentage of GDP (2010-2021) was 0,399%.
The Netherlands increase in R&D expenditure as percentage of GDP (2010-2021) was 0,562%.
The EU’s increase in R&D expenditure as percentage of GDP (2010-2021) was 0,294%.

Conclusion

Key findings

To answer the question "How do liberal and industrial policy frameworks influence Germany's and the Netherlands' goals in enacting collaboration in the European Chips Act?", multiple policy documents from Germany, the Netherlands, and the European Union have been analysed to determine whether the policies were more aligned towards Liberalism, Industrial Policy or a mix of both policies. The German policies were strongly focused on resilience, national security, and autonomy, so the German Industrial Policy strongly influenced how they enacted the European Chips Act. The Germans were also focused on Europe, as they discussed Europe in seven of twelve documents. For the Netherlands, the liberal framework also had an influence on how they enacted the European Chips Act; there is a clear distinction between the policy type before the announcement of the ECA and after it moved towards a more Industrial Policy. This could mean that Europe greatly influenced Dutch governance, so the Netherlands tried to

align more towards Europe. The European Union also had a mixed approach before the ECA, which changed after the ECA towards industrial policy. Reasons for this could be the pressure of Germany as for them the import of advanced chips is crucial for the automotive industry and Germany has significant influence in the EU.

For the hypothesis: Germany's policy for the semiconductor industry is primarily driven by a strategic aim for technological self-sufficiency to mitigate external threats and ensure national security in the semiconductor sector.

This hypothesis is confirmed. The documents analysed for Germany had a significant focus on national security, autonomy, and resilience. This indicates that Germany wants to depend less on actors outside the EU.

The hypothesis: The Netherlands' policy for the semiconductor industry is driven by liberal principles, which aim to enhance innovation and economic growth.

This hypothesis has not been fully rejected but has not been fully confirmed. The Netherlands did have, before the ECA, a mixed policy approach. Some policies mentioned that GDP growth can be achieved by reducing the regulatory burden for some industries (Rijksoverheid, 2016). However, in other documents, the government focused, like the Germans, on state intervention, economic resilience, and state sovereignty to achieve autonomy(Ministerie van Economische Zaken en Klimaat, 2019).

The Netherlands and Germany have different motivations for participating in the European Chips Act. Germany has a more defensive realism view, while the Netherlands are more motivated by their liberal characteristics.

This hypothesis is also confirmed, as before the ECA, the Germans were already talking about autonomy and securing the supply chain. The Netherlands had a more mixed view, as they were more concerned about cooperation between non-EU members and EU members to enhance competitiveness and the economy.

Policy implications

It is important for the European Union not to get too obsessed with the semiconductor industry. Because of the ‘subsidy race, ’ governments fund extreme amounts of money. Companies like Intel are getting paid billions of euros to build a fabric in Germany, and if these companies are allocating as much money as possible, it does they may exploit these funds. The European Union must also promote collaboration between the Member States to achieve economies of scale and technological advancements. For Germany and the Netherlands, they both should focus on what their speciality is. For the Netherlands, it is ASML, and for Germany, it is their strong import. For both countries, it is important to have a close connection with businesses to ensure the alignment of business strategies with policies; a close collaboration can also increase productivity and more efficient use of resources (Jing & Besharov, 2014).

Future Research Directions

For the future, it would be interesting to investigate why the European Union formulated this policy and if they wanted to follow in the footsteps of the US and China, as Die Linke also asked the Bundesrat that the EU must ensure they must not join the ‘subsidy race’. Some people also argue that the ECA is already too late. This can also be seen in the analysis of the documents for Germany. In the older documents, they mentioned they wanted to maintain their

leadership position, and in the newer documents, they mentioned a few times they needed to catch up with technology, indicating Europe is already falling behind on other regions of the world.

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Data Appendix

Coding Scheme

Example of a coding table:

15-11-2021 Annual Report 2021/22 of the German Council of Economic Experts

Document Title	Annual Report 2021/22 of the German Council of Economic Experts
Actor	German Federal Government and several ministries
Motivation	To reduce dependencies and produce the most advanced chips in Europe
Interaction with Societal Actors	Emphasizes international cooperation and the involvement of multiple European and international stakeholders in the semiconductor chain
Policy Goal	Technological sovereignty, doubling European production capacity to 20% of the global market by 2030, and reaching the technological frontier of chip manufacturing.
Funding Details	Extensive state funding and subsidies, with plans for significant support in multiple countries, including the EU's Important Project of Common European Interest (IPCEI) for microelectronics.

The conclusion is that this article leans more towards industrial policy, as there is significant state intervention to support the semiconductor industry, aiming to boost local production. They also emphasise technological sovereignty. Where Germany has a strategy to enhance national and regional capabilities. This annual report also describes coordinated efforts and regulatory measures to support the semiconductor industry. The only category typically neoliberalism is the interaction with societal actors as Germany emphasises international cooperation. Also interesting in this article is the goal of reaching 20% of the global market of semiconductors by Europe, as this annual report was written on 15-11-2021, and they announced the ECA on 25-03-2022; maybe this means that Germany has a significant vote in the policies being developed in Europe.