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Research article

Food Policy Coherence and Integration: a review of adopted methodologies

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Abstract. Multiple scholars in the last two decades have called for a coherent and integrated approach to food policy to address the challenges of the current food systems. Food Policy Coherence and Integration (PCI) are both challenging, as food matters are addressed at more than one level of governance and across several policy domains. Moreover, the analysis of food PCI has been carried out with different methodologies, but no reviews of such methodologies exist in the literature. Thus, the objective of the present study is to fill this gap, by reviewing which research methods were used to assess food PCI. The research adopts a bibliometric methodological approach to develop a quantitative network analysis of the identified studies and content analysis. Data collection was performed on Web of Science and Scopus including exclusively scientific articles from peer-reviewed journals. A total of 35 articles published since 2006 were included in the analysis. The main topics addressed were health and nutrition policies, followed by food security and agriculture. A variety of methods were used to assess Coherence and Integration. The first methodological phase often aimed at creating a policy inventory, followed by a second methodological phase to assess PCI. Some studies used interviews to identify the relevant policies and to comment on them. Other studies carried out PCI assessment relying on researchers' expertise. To conclude, food PCI studies choose from a variety of methodologies the one that better fits their aims.

Keywords: food policy, policy coherence, policy integration, governance, literature review.
JEL codes: Q18.

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HIGHLIGHTS

- Several methods exist to carry out the assessment of food Policy Coherence and Integration.
- Both bibliometric and content analysis reviewed which research methods were used to assess food PCI.
- The most common research method was a combination of a first phase where a policy inventory is put together from online databases, followed by a second phase to assess PCI through interviews or researchers' expertise.

1. INTRODUCTION

In the past decades, the concepts of Policy Coherence and Integration (PCI) have been of growing interest in political sciences and policymaking (Candel and Biesbroek, 2016; Nilsson *et al.*, 2018). Both practitioners and academics highlighted policy fragmentation and silo-thinking as negative practices that can undermine full policy implementation, creating unintended negative consequences. PCI is therefore considered crucial as it ensures that different governmental policies work together in a complementary and effective way, rather than working against each other (Parsons and Barling, 2022). PCI is appropriate when addressing complex phenomena as many of the issues addressed by governments are interconnected, requiring the implementation of multiple policies across different sectors. PCI helps to ensure that these policies work together effectively to achieve the desired outcomes.

The food sector is the perfect example of PCI importance. Food is a multi-faceted policy matter that encompasses a series of issues, ranging from food security and nutrition to sustainability and animal welfare. Food policymaking requires careful consideration of these various policy domains and collaboration among various stakeholders, making it challenging to reach a good degree of PCI. However, coordinating and harmonising different food policies allows to better achieve sustainable and holistic outcomes in the agrofood sector. For these reasons, multiple scholars have called for a coherent and integrated food policy to address the challenges of the current food systems (Barling *et al.*, 2002; De Schutter *et al.*, 2020; Lang *et al.*, 2009; Matthews, 2008; Parsons and Barling, 2022; Sibbing *et al.*, 2021).

However, despite its importance, PCI assessment and analysis are carried out using different methodologies, but no reviews of such methodologies exist in the literature. The present study aims to fill this gap, by reviewing which research methods were used to assess food PCI. The study includes three research questions. First, finding main authors (and their networks), sources (peer-reviewed journals) and geographic areas of the studies to contribute to a better understanding of the scientific leadership on PCI in the food sector. Second, identifying the most researched policy domains when analysing food PCI to find out what topics scientific research is mainly focusing on. Third, analysing the research methods used to assess food PCI to help the scientific community to improve its methodologies and research approaches to the matter.

2. POLICY COHERENCE AND POLICY INTEGRATION DEFINITIONS

Policy Coherence (PC) and Policy Integration (PI) are not synonyms, yet the two terms are often used interchangeably (Tosun and Lang, 2017). To overcome such confusion, several definitions have been written, allowing to reach some consensus on their distinction.

The first to provide a PI definition was Underdal (1980), who described policies as integrated if "the constituent elements are brought together and made subjects to a single unifying conception". PC, instead, gathered momentum in the 1990s, when policy coherence for (sustainable) development fostered the debate on the topic (Meijers and Stead, 2004). One of its earliest definitions is from OECD (2003), that describes PC as the "systematic promotion of mutually reinforcing policy actions across government departments and agencies creating synergies towards achieving the agreed objectives".

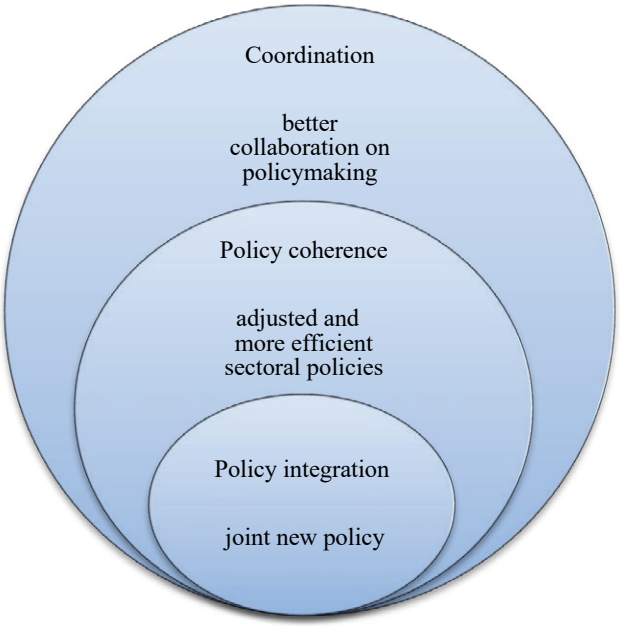
However, the differences between PC and PI remain blurred. Therefore, some scholars reviewed the literature to define PC and PI based on the analysis of how they were used.

Cejudo and Michel (2017) identified the difference between PC and PI by reviewing academic studies on both concepts. On one hand, they found that assessing PC means checking if existing policies overlap, reinforce each other, and/or share the same goal. On the other hand, PI often entails the creation of a new decision-making body and/or policy that coordinates the design and implementation of joined-up policies to achieve a common goal.

Meijers and Stead (2004) review focused on PI, by comparing it with the other terms used to identify similar concepts (e.g. policy coordination, policy consistency, joined-up policy). They also argue that while PC is more of a processual *modus operandi* aiming to adjust existing policies to make them mutually enforcing, PI's output is different. PI's aim is often to create a new joint policy encompassing the interests of various governmental bodies involved. As shown in Figure 1, both concepts of PI and PC are included in the umbrella term "coordination", which implies a concerted participation in policymaking (Meijers and Stead, 2004).

To sum up, PC is reached when the objectives of different existing policies are aligned among each other, while PI addresses the presence of food in various policy domains by coordinating them through new overarching policies or public bodies. However, while such consensus on the definitions allows the present study to clearly navigate the topics, it would be incorrect to retroactively apply such distinction to all studies on PCI, which may have interpreted the concepts differently.

Figure 1. PC and PI definitions.



2.1. PCI in food studies

Food policy studies only recently addressed PCI. The first to discuss PCI in the context of food policy were Barling *et al.* (2002), who supported a "joined-up" approach to public health policy. They argued the need for a shift from the dominant productivist paradigm having profit as a core, to an ecological public health approach focused on people and the planet. Beyond that seminal article, the food studies literature moved on to identify a set of shared challenges for food PCI (Candel and Pereira, 2017; OECD, 2021). First, PCI can be difficult to reach because policy goals can be a trade-off between two values representing equally valid societal needs, such as environmental concerns and the need for cheap food (OECD, 2021). Second, coordinating various sectors and levels of governance is costly, therefore the coordination process must be efficient (OECD, 2021). Third, also designing a consistent set of policy instruments is complex (Candel and Pereira, 2017; OECD, 2021).

Such challenges make it difficult to reach a good degree of PCI in food policymaking, where several sectors are involved. PC definition by Parsons and Hawkes (2019) reflects such challenge: "food policy coherence can be defined as the alignment of policies that affect the food system with the aim of achieving health, environmental, social and economic goals, to ensure that policies designed to improve one food system outcome do not undermine others". In the definition of PI, a focus on the different types of integration is added: "integrated food policy is the joining up of goals and policies related to food systems – horizontally across governments, vertically between government levels, or between inside and outside government actors –" (Parsons, 2019).

3. MATERIALS AND METHODS

The first step of the present systematic literature review on food PCI was data collection and it consisted of the creation of an inventory of peer-reviewed articles.

The following research string was used in two databases (Scopus and Web of Science): "policy coherence" OR "policy integration" AND Food. No time limit was indicated.

The search on Scopus and Web of Science yielded 163 and 194 results, respectively. After the elimination of duplicates, they were screened based on title, abstract and journal of publication. The resulting 79 papers were read in full and 44 were eliminated as out of scope for this study. Articles were excluded if they lacked focus on the food sector, or if they did not carry out a PCI assessment but only recommended to improve it. The final body of literature consisted of 35 studies.

Regarding data analysis, this paper applies a bibliometric and content analysis approach to PCI (Table 1).

The authors read the 35 selected articles in full and classified them according to the following descriptive and thematic categories. The former includes: Authors (co-authorship networks), Year, Journal title, Policy Integration (PI) or Policy Coherence (PC), Location. The latter consists of: Aim of the paper/Research question, Topic/policy domains (grouped in clusters), Governance level (Urban, National, International), Theoretical framework, Methods (data collection), Methods (data analysis), Stage of policy analysis (content, context, instruments, outcomes, process).

The software VOSviewer (version 1.6.18) allowed for bibliometric analysis, creating and visualising bibliometric networks. The text mining functionality of VOSviewer was used to analyse co-authorships and co-occurrence networks of the articles' keywords. The software NVivo (version 12) allowed for content analysis, generating codes to identify the most common themes.

4. RESULTS

The current section presents the results of the analysis. Answers to the three research questions are provided separately.

Table 1. Research questions, and respective elements and methods of analysis.

	Research Question	Elements of analysis	Method of analysis
RQ1 *WHO*	Which *authors, journals, and geographic areas* lead the literature on food PCI?	Researcher's descriptive classification based on: · Authors (co-authorship networks) · Year · Journal title · Policy Integration (PI) or Policy Coherence (PC) · Location	Bibliometric analysis on co-authorship carried out with VOSviewer.
RQ2 *WHAT*	What are the main *topics* researched in the literature on food PCI?	Researcher's thematic classification based on: · Aim of the paper/Research question · Topic/policy domains (grouped in clusters) · Governance level (Urban, National, International) · Stage of policy analysis (content, context, instruments, outcomes, process)	Bibliometric analysis on keywords co-occurrences and strengths. Content analysis on most frequent themes was carried out with NVivo.
RQ3 *HOW*	What are the main *research methods* used to assess food PCI?	Researcher's thematic classification based on: · Theoretical framework · Methods (data collection) · Methods (data analysis)	Thematic classification

Figure 2. Network visualisation of co-authorships.

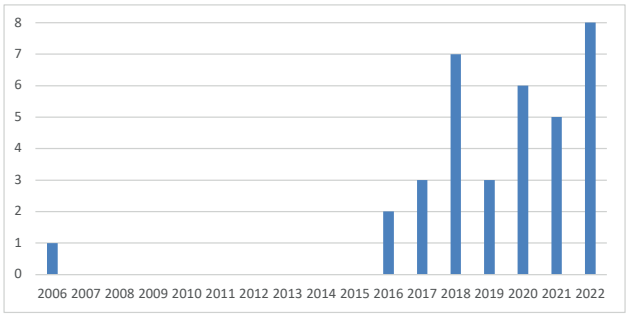
4.1. Which authors, journals, and geographic areas lead the literature on food PCI? (RQ1)

The bibliometric analysis allowed for the identification of two clusters of main co-authors (Figure 2). Two was set as the minimum number of documents of an author, so only 12 of the 105 authors met the threshold and were represented in Figure 2.

Anne Marie Thow and Jeroen Candel authored the highest number of documents (6 and 5, respectively), but are not linked between each other. In bibliometric analysis, a link is a connection or a relation between two items – in this case co-authorship. They both have the highest Total Link Strength (TLS) in their respective clusters[1]. The left cluster in Figure 2 includes authors researching on the topics of health and trade policies. They are based in various Higher Education Institutions in Australia and they study PCI mainly in their country. The cluster on the right side of Figure 2 is centred around Jeroen Candel, who is based in Europe and aims

[1] TLS indicates the total strength of the co-authorship links of a given researcher with other researchers, i.e. the number of publications two researchers have co-authored.

Figure 3. Time distribution of the selected articles.



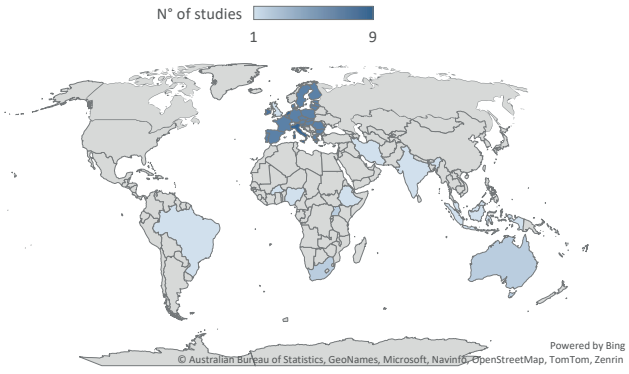
to systematise PCI analysis to provide a comprehensive theoretical approach. Bianca Minotti appears outside of the cluster as their co-authors did not pass the threshold of the two papers.

As shown in Figure 3, the body of literature on PCI has steadily grown in recent years, especially from 2016 onwards. 2022 was the year with the highest number of studies (8), while the lowest was 2006 with 1 article.

Food Policy and *Food Security* were the most recurrent journals, with 3 articles each. The other studies were published either in public policy journals, such as *Journal of European Public Policy* and *Environmental Science and Policy*, or in public health journals, such as *Public Health Nutrition*.

Most studies focus on European countries (16), but also African (6), Asian (4) and Oceanian (4) scholars have addressed PC and PI issues, while the remaining five studies had a global scope (Figure 4). Of the European articles, almost half addressed European-wide policies, while the other focused on single countries national policies. This suggests that PCI is more challenging in the context of a supra-national governance such as the European one. Topics also differ in different geographic areas, as for example African scholars are more focused on food security and nutrition while European ones on environmental issues.

Figure 4. Map of the countries where the selected studies are located.



4.2. What are the main topics researched in the literature on food PCI? (RQ2)

Keyword networks visualisation

The researchers' analysis of article texts showed that most studies (23 out of 35) addressed PI, while only 12 PC. This is because PI analysis has a longer history, and it emerged linked to environmental studies, that are neighbouring food studies.

The national governance level was the most studied (17), followed by the supra-national one (13). Urban policymaking, which is receiving increasing attention in food studies, was less investigated as only 5 articles addressed it. All urban food policies studies focused on European cities, covering Italy, Germany, the Netherlands and Switzerland. Two articles focused on one single case study (Arcuri *et al.*, 2022; Moschitz, 2018), while the other three articles focused on more than one case study. Baldy *et al.* (2022) compared two German cities to determine how practice in policymaking improves PI at the local level. Minotti *et al.* (2022) investigated the governance of three food policy processes in Rome, all aimed to improve sustainability in the city. Sibbing *et al.* (2021) assessed 31 Dutch municipalities to understand how they integrated food-related topics in the city governance.

Both bibliometric analysis with VOSviewer and content analysis with NVivo were carried out to understand which topics are the most studied in the literature.

The bibliometric analysis allowed for the identification of number of Occurrences (OC), links and Total Link Strenght (TLS) of articles keywords. 2 was the minimum number of OC of a keyword to be selected for this list, and 14 of the 98 total keywords met the threshold (Table 2)[2].

Bibliometric analysis confirms the results of the researchers' analysis, as *Policy integration* as a keyword was present 14 times, while *Policy coherence* only 8. *Policy integration* is also stronger than *Policy coherence* in terms of number of links (10 and 8, respectively), but especially in terms of TLS. When analysing keywords co-occurrence, TLS is the number of publications in which two keywords occur together, and for *Policy integration* is 27 while it is 11 for *Policy coherence*.

As shown in Figure 5, the more strongly linked are *Policy integration* and *Food policy*, and *Policy integration*

[2] A VOSviewer thesaurus file was applied to create a vocabulary that merged synonyms.

Table 2. Occurrences (how many times a keyword is present), links (number of relationships with other keywords) and TLS (number of publications where keywords occur together) of documents keywords.

Keyword	OC	Links	TLS
Policy integration	14	10	27
Food policy	8	9	17
Climate and environmental policy	7	9	10
Policy coherence	8	8	11
Governance	7	7	16
Food security	4	7	8
Health and nutrition policy	6	6	13
Food systems	4	6	8
European Union	2	4	4
Sustainability	2	4	4
Urban food policy	2	3	4
SDGs	2	3	3
Trade policy	2	2	3
Common Agricultural Policy	2	2	2

and *Governance* (6 in both cases), showing the centrality of the PI discourse in the literature on food public policy. *Food policy* also has a high TLS as it is the overarching subject underlying the discourse on PCI analysis in the food sector. *Climate and environmental policy* has high numbers in terms of OC, links and TLS (7, 9, 10, respectively), and it is the most common policy domain emerging from the bibliometric analysis. In terms of policy domains, it is followed by *Food security* and *Health and nutrition policy*, showing a strong focus on the consumption side.

Figure 6 shows that *Policy coherence*, *Trade policy* and *Common Agricultural Policy* were linked and more common in the literature about five years ago (2018), when the discourse on policy coherence for development was still happening and trade agreements were a crucial aspect of it. *Food systems* thinking, *Sustainability* and *SDGs* are more recent keywords (2022 and beyond) as a holistic approach to food systems only developed recently, often linked to ecological concerns.

To sum up, PI at national level is the most studied topic and the two main clusters that link environmental and agricultural policy as well as trade and health policy emerged.

Keyword grouping in clusters

The bibliometric analysis also allowed for the grouping of keywords in four clusters (Table 3). In VOSviewer, clusters are a non-overlapping set of items grouped in a map.

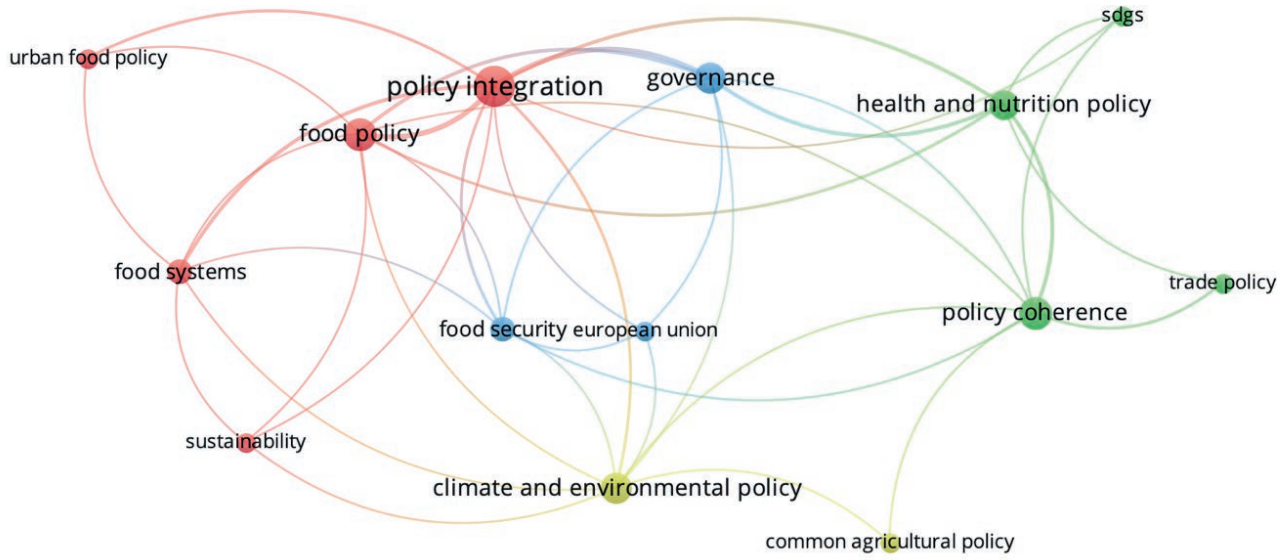
The first one includes *Food policy*, *Food systems*, *Policy integration*, *Sustainability*, *Urban food policy*, interconnected concepts that play a significant role in shaping the way we produce, distribute, and consume food. Given that two of these keywords were part of the selection string, this cluster encompasses all of the articles selected in the present study.

Health and nutrition policy and *Trade policy* are in the second cluster, as the impacts of trade agreements on nutritional behaviour have been widely studied in the literature (Baker *et al.*, 2019; Battams and Townsend, 2018; Friel *et al.*, 2019; Garton *et al.*, 2022; Ruckert *et al.*, 2017; Thow *et al.*, 2016, 2018). The need to study PCI between trade and nutrition policies emerged from the urgence to analyse the effects of Western countries policies on developing countries populations' health. Unfair Trading Practices can have repercussions on both a country's economy and the spread of Non-Communicable Diseases (NCDs). In the selected literature, PCI between trade and nutrition policies has been addressed in different contexts. Baker *et al.* (2019) addressed it on a theoretical basis, as they analysed how nutrition is interpreted by stakeholders and how such framing influences PC between trade and nutrition policies. Ruckert *et al.* (2017) carried out a Health Impact Assessment (HIA) to define how regional trade agreements at global level can hinder the implementation of health and nutrition-related SDGs. Similarly, the other studies focused on the interplay between trade and nutrition policies in specific case studies, often finding inconsistencies (Battams and Townsend, 2018; Friel *et al.*, 2019; Garton *et al.*, 2022; Ruckert *et al.*, 2017; Thow *et al.*, 2016, 2018).

The third cluster includes *European Union*, *Food security* and *Governance*. The EU plays a crucial role in ensuring food security within its member states, coordinating efforts to address food safety, quality, and affordability. Several studies focused on EU governance as the supra-national level that is crucial for vertical integration (Alons, 2017; Candel and Biesbroek, 2018; De Roeck *et al.*, 2018; De Schutter *et al.*, 2020; Matthews, 2008; Muscat *et al.*, 2021; Ugland and Veggeland, 2006).

Climate and environmental policy and *Common Agricultural Policy* create the fourth cluster. These topics are closely related because agriculture is a significant contributor to climate change. The Common Agricultural Policy (CAP) has often been criticised for its negative impacts on the environment, but the 2023 CAP reform provides financial incentives for farmers to adopt practices that reduce greenhouse gas emissions, promotes biodiversity, and protects natural resources. The relationship between environmental and agricultural policies – not necessarily the CAP – was addressed by

Figure 5. Co-keyword network visualisation based on occurrences.



a good amount of studies in different contexts (Alons, 2017; Biesbroek and Candel, 2020; De Roeck *et al.*, 2018; Harahap *et al.*, 2017; Medina Hidalgo *et al.*, 2021; Mosnier *et al.*, 2023; Schmidt, 2020; Šumrada *et al.*, 2020; Zembe *et al.*, 2022). Šumrada *et al.* (2020), for example, used the policy cycle framework to assess what level of priority is given to biodiversity conservation compared to other agricultural policy objectives in Slovenia. Medina Hidalgo *et al.* (2022) assessed national policies in the Pacific Island of Fiji and Vanuatu to determine how they support integrative approaches to climate change adaptation, agriculture, and health.

Content analysis of full article texts

Content analysis of the full articles texts supported the bibliometric analysis results. NVivo coding allowed to identify the most common themes in the 35 selected articles. Two main codes emerged: *Food* and *Policy*, terms that were part of the research string. Such codes were both present in all of the studies, but *Policy* had a much higher number of references (563) than *Food* (379). *Food policy*, *Food safety* and *Food security* were the three main sub-codes of the code *Food*, confirming the trend showed in the keywords analysis. For the code *Policy*, the highest number of references was reached by sub-goals linked to policy development and analysis, such as *Policy goals*, *Policy instruments* and *Policy process*.

The researcher analysis also identified which stage of policy analysis (content, context, instruments, outcomes, process) the study was focusing on. The three most common were: Content, Context and Process. Content refers to the document analysis, while Context and Process to the frame of reference where policymaking happens. Fewer studies focused on policy Instruments and Outcomes, as assessing them is quite complex, as it requires scope and resources for monitoring.

4.3. What are the main research methods used to assess food PCI? (RQ3)

The adopted research methods are closely linked to the articles' aims. The most common objective was to assess PCI in different domains (horizontal) or at dif-

Figure 6. Co-keyword overlay visualisation based on the occurrences and average publication per year scores. Source: authors.

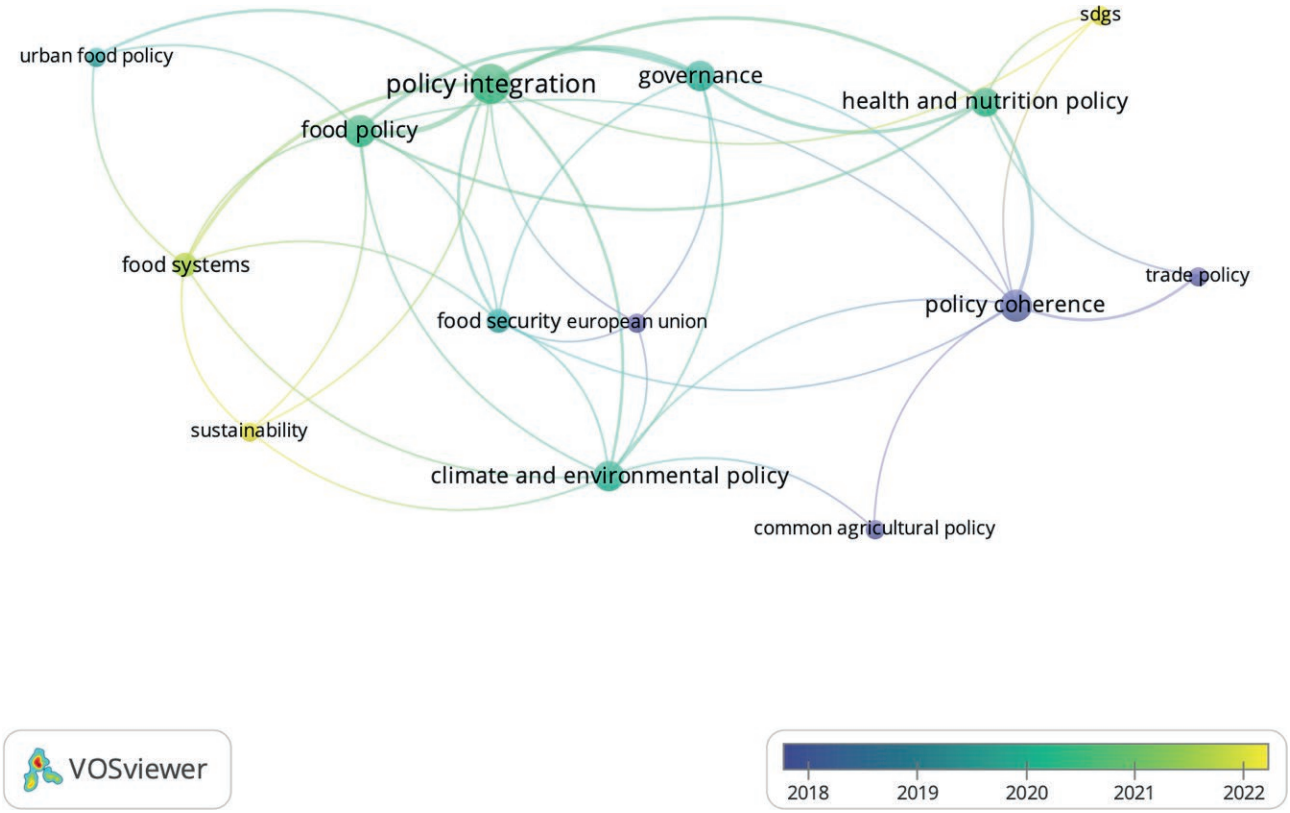


Table 3. Clusters of articles keywords.

Cluster 1	Food policy, Food systems, Policy integration, Sustainability, Urban Food Policy
Cluster 2	Health and nutrition policy, Policy coherence, SDGs, Trade policy
Cluster 3	European Union, Food security, Governance
Cluster 4	Climate and environmental policy, Common Agricultural Policy

ferent levels of governance (vertical). It was mainly the external PCI to be addressed, which is the analysis of a certain policy coherence/integration with another one or with a framework, e.g. the Sustainable Development Goals. The internal PCI, i.e. the coherence/integration of policy goals with their own implementation plans, has not been addressed in the selected articles. The identification of enabling factors and obstacles to PCI often was a related research question. Determining stakeholders' interpretation of PCI was a focus in some articles.

Theoretical frameworks

In terms of theoretical frameworks, the most widely used was Candel and Biesbroek's (2016) multi-dimensional framework that theorises four dimensions to guide PI analysis: policy frame, subsystem (i.e. subdomain) involvement, policy goals, and policy instruments (Arcuri *et al.*, 2022; Milani-Bonab *et al.*, 2022; Minotti *et al.*, 2022; Namugumya *et al.*, 2020b). Such four dimensions were applied in different contexts. Arcuri *et al.* (2022) studied the process leading to the first Intermunicipal Food Policy in Italy, including five municipalities within the same Tuscan province. The multidimensional framework allowed to analyse qualitative data to outline the enabling factors and obstacles to PI. Similarly, Minotti *et al.* (2022) interpreted qualitative data from nine interviews and participatory observation through Candel and Biesbroek's framework, to describe three food policy processes in Rome. On the contrary,

Milani-Bonab *et al.* (2022) and Namugumya *et al.* (2020) focused on the national governance level, in Iran and Uganda, respectively. They both used Candel and Biesbroek's framework to guide the qualitative content analysis they carried out through coding with the software Atlas.ti and MaxQDA (Milani-Bonab *et al.*, 2022; Namugumya *et al.*, 2020b).

A study on Ugandan nutrition policy combined process-tracing methodology with policy mechanisms approach (Namugumya *et al.*, 2020a). Researchers analysed 34 interviews with experts engaged in nutrition policy in various ministries (Health, Agriculture, community development) and a workshop with 15 participants from academia, government and international agencies to identify mechanisms that support or hinder PI. They found that supporting mechanisms were: international policy promotion, issue promotion by international actors, issue promotion by domestic policy entrepreneurs, and instrumental policy learning. On the contrary, leadership contestation and "turf wars" were identified as counteracting mechanisms. Similarly, Biesbroek and Candel (2020) adopted one application of the policy mechanisms approach, the CMO (Context-Mechanism-Outcome) model. Such model claims that, within the Context of the policy process, observed patterns of Outcomes may be interpreted by identifying a set of Mechanisms that caused them (Pawson and Tilley, 1997). In the case of food and climate adaptation policies in the Netherlands, a common mechanism hindering PI are "turf wars" between ministries, competing for legislative powers. This is counteracted by the scientific community highlighting the cross-cutting nature of these issues, and therefore the importance of PI (Biesbroek and Candel, 2020).

Sabatier's Advocacy Coalition Framework (Sabatier and Jenkins-Smith, 1999) was borrowed from political sciences and applied to food studies in two articles in this review: Battams and Townsend, 2018 and Thow *et al.*, 2018. The former assessed PC of nutrition and trade policies in Australia and Malaysia, and the latter analysed how PC could be improved in relation to food security and nutrition in South Africa. Data collected with semi-structured interviews were coded for actors, ideas and power relationships, drawing from Sabatier's framework. Both studies found that the prevalence of the "Economic Growth" coalition in the public policy discourse is framing nutrition issues in a way that does not prioritises people's health.

Another multidimensional framework used in the literature encompasses the three indicators used in the measurement of Environmental Policy Integration (EPI): policy process, output and outcome. Alons (2017) applied them to the assessment of environmental sustainability integration in the CAP.

Two frameworks borrowed from political sciences also allowed for a process-focused analysis of PCI: the Policy Pathways approach and Policy Space analysis (Friel *et al.*, 2019; Garton *et al.*, 2022; Thow *et al.*, 2016). The Policy Pathways approach applied by Friel *et al.* (2019) identified the pathways from trade to diet-related disease risks, leading to various degrees of policy (in) coherence. Plus, the theoretical framework was the basis for codes development to analyse the 19 semi-structured interviews with key experts. They found that formal and informal mechanisms exist in the governance of trade for nutrition goals, but that in both cases the key element is the issue of power imbalance that leads to the prioritisation of trade goals over nutrition ones (Friel *et al.*, 2019). Garton *et al.* (2022) focused on the nutrition Policy Space (i.e. scope), examining how Trade and Investment Agreements (TIAs) could hinder the implementation of better nutrition policies. Thow *et al.* (2016) explored the Indian food supply policy space to identify strategies strengthening public health nutrition policy against the double burden of malnutrition. Threats to higher PC are policy inertia and competing priorities between nutrition and the economic sector.

To sum up, several thereotical frameworks were borrowed from political sciences and adapted to food studies to allow a comprehensive analysis of complex phenomema.

Data collection methods

Several data collection methods were adopted in the literature.

Four articles adopted a case study approach to collect data (Arcuri *et al.*, 2022; Kelleher *et al.*, 2019; Moschitz, 2018; Ugland and Veggeland, 2006). Case studies were at different governance level, as Ugland and Veggeland (2006) focused on EU level polices, Kelleher *et al.* (2019) on Irish national policies, Moschitz (2018) on urban policies of the city of Basel and Arcuri *et al.* (2022) on inter municipal governance. The case study approach allows researchers to delve into one place's specific features, and gain more insights about it.

In most studies, the first step of data collection was creating an inventory of relevant policy documents (Alons, 2017; Biesbroek and Candel, 2020; Candel and Biesbroek, 2018; De Roeck *et al.*, 2018b; Farmery *et al.*, 2020; Garton *et al.*, 2022; Harahap *et al.*, 2017; Kelleher *et al.*, 2019; Medina Hidalgo *et al.*, 2022b; Milani-Bonab *et al.*, 2022; Moschitz, 2018; Muscat *et al.*, 2021; Namugumya *et al.*, 2020b; Parsons *et al.*, 2018; Schmidt,

2020; Sibbing *et al.*, 2021b; Thow *et al.*, 2016, 2018; Werlang Girardi, 2018; Zembe *et al.*, 2022). Sources used to collect policy documents were a variety of databases, including government websites and Google search engine. Kelleher *et al.* (2019) created a policy inventory from the Irish state's Department of Agriculture, Food and the Marine, while Moschitz (2018) retrieved them from the Swiss online archive of laws, directives, and regulations. Non-institutional databases were also used: Schmidt (2020) retrieved policy documents from the Climate Change Laws of the World database and Namugumya *et al.* (2020b) from the global database on the Implementation of Nutrition Action (GINA).

While the inventory aimed to create a picture of policy characteristics on paper, it was often combined with interviews, focus groups and/or participant observation to provide a more real-life practice view to the research. Semi-structured interviews with a number of stakeholders ranging from a minimum of 6 to a maximum of 177 (Arcuri *et al.*, 2022 and Jiren *et al.*, 2021, respectively) were carried out. Around 20/30 was the most common number of interviews per article. The semi-structured format was generally preferred as it allows the researcher a certain degree of freedom, while still following a set list of questions. Interviewees were mostly key stakeholders, being either policy experts or civil servants at various levels of governance.

In some cases, focus groups were the research tool adopted (Jiren *et al.*, 2021; Muscat *et al.*, 2021), always in combination with interviews. Muscat *et al.* (2021), assessing the PC between bioeconomy and agro-food policies in the EU, collected expert opinions through an online survey, and later proceeded to delve into the single policy domain with focus groups, allowing for an exchange among stakeholders. Jiren *et al.* (2021) used focus groups to integrate expert opinions with people's experiences. After completing almost 200 semi-structured interviews, they carried out 24 focus group discussions with local people to collect lived experiences on the challenges to achieve food security while conserving biodiversity in Ethiopia.

Similarly, participant observation allowed to gather data on the field (Arcuri *et al.*, 2022; Baldy *et al.*, 2022; Battams and Townsend, 2018). Baldy *et al.* (2022) applied a practice-theoretical perspective to analyse how the three dimensions of practice that they identified (doings, sayings and things) can influence PI. They found that practice dimensions play an important role in policymaking dynamics that increase or decrease the level of PI.

To sum up, interviews, focus groups and participant observation were crucial complements to the inventories, as they provide a practical-theoretical perspective on PCI.

Table 4. Summary of data collection research methods used in the literature.

Methods	Sources
Inventory of policy documents	Alons, 2017 Biesbroek and Candel, 2020 Billings *et al.*, 2021 Candel and Biesbroek, 2018 De Roeck *et al.*, 2018 Farmery *et al.*, 2020 Garton *et al.*, 2022 Harahap *et al.*, 2017 Kelleher *et al.*, 2019 Medina Hidalgo *et al.*, 2022 Milani-Bonab *et al.*, 2022 Moschitz, 2018 Muscat *et al.*, 2021 Namugumya *et al.*, 2020b Parsons *et al.*, 2018 Schmidt, 2020 Sibbing *et al.*, 2021 Thow *et al.*, 2016, 2018 Werlang Girardi, 2018 Zembe *et al.*, 2022
Semi-structured interviews	Alons, 2017 Arcuri *et al.*, 2022 Baker *et al.*, 2019 Baldy *et al.*, 2022 Battams and Townsend, 2018 Biesbroek and Candel, 2020 Candel and Biesbroek, 2018 Farmery *et al.*, 2020 Friel *et al.*, 2019 Garton *et al.*, 2022 Minotti *et al.*, 2022 Namugumya *et al.*, 2020b, 2020a Parsons *et al.*, 2018 Jiren *et al.*, 2021 Schmidt, 2020 Thow *et al.*, 2016a, 2018 Zembe *et al.*, 2022
Focus groups / workshops	Jiren *et al.*, 2021 Muscat *et al.*, 2021 Namugumya *et al.*, 2020a Šumrada *et al.*, 2020
Participant observation	Arcuri *et al.*, 2022 Baldy *et al.*, 2022 Battams and Townsend, 2018
Survey with close-ended questions	Muscat *et al.*, 2021

Data analysis methods

Several data analysis methods were adopted in the selected literature.

Qualitative and quantitative content analysis assessed both policy documents gathered in the data collection

phase and interviews, focus groups and participant observations transcripts. The most used software for such analysis were NVivo, MaxQDA and Atlas.it, that support codes and subcodes creation. Most studies drew coding structures from the theoretical frameworks presented above. Some studies combined qualitative and quantitative content and thematic analysis. For example, Candel and Biesbroek (2018) studied whether better integrated food security policies were created in the EU after the 2008 food prices crisis. In doing so, they complemented a quantitative content analysis of policy documents with a qualitative analysis of interviews. In one study, interviews were interpreted through the lenses of the Social Network Analysis (SNA) methodology (Farmery *et al.*, 2020). They examined PI of fisheries policy within the food sector, finding a good degree of integration of food security into fisheries policies, but a lack of integration of fish matters into food policies. SNA showed how a good level of collaboration between sectors can increase PI (Farmery *et al.*, 2020).

Another mixed methods approach was used by Muscat *et al.* (2021) in their assessment of PC between bioeconomy and EU agro-food policies. They adopted a Policy Coherence Matrix (PCM), which is a table where the horizontal axis consists of policies that the study aims to compare and the vertical axis the reference policies with which they are to be compared. The resulting table cells contain the coherence score of each intersection. To populate the PCM, they distributed an online survey to experts, who scored the effect of one policy domain of their expertise (waste, bio-based industry, environment, renewable energy) on agro-food policy goals. Other than the coherence score, they also filled a confidence score, according to their level of confidence in assessing coherence. Following the survey, focus groups were also carried out, where 3 or 4 experts commented on the results of the survey.

The FABLE approach was the only fully quantitative method used in the literature. Mosnier *et al.* (2023) presented a collaborative approach developed together with the Food, Agriculture, Biodiversity, Land, and Energy (FABLE) Consortium. Such approach consists of an Excel-based tool that aims to better integrate food policies with environmental sustainability standards. Using country-specific data, it constructs a baseline model that can be tweaked to increase PI.

To sum up, the most common and complete methodology involved making an inventory of relevant policies at one or more governance level and coding them following the themes emerging from a theoretical framework. After such detailed analysis of contents, interviews or focus groups then allowed to build a more comprehensive picture of the real-life experience of PCI.

Table 5. Summary of data analysis research methods used in the literature. Source: authors.

Methods	Sources
Content analysis	Alons, 2017 Baker *et al.*, 2019 Baldy *et al.*, 2022 Battams and Townsend, 2018 Billings *et al.*, 2021 Candel and Biesbroek, 2018 Farmery *et al.*, 2020 Friel *et al.*, 2019 Kelleher *et al.*, 2019 Medina Hidalgo *et al.*, 2022 Milani-Bonab *et al.*, 2022 Moschitz, 2018 Namugumya *et al.*, 2020a, 2020b Ruckert *et al.*, 2017 Schmidt, 2020 Sibbing *et al.*, 2021 Thow *et al.*, 2016, 2018 Werlang Girardi, 2018 Zembe *et al.*, 2022
Social Network Analysis (SNA)	Farmery *et al.*, 2020
Policy Coherence Matrix (PCM)	Muscat *et al.*, 2021
FABLE approach	Mosnier *et al.*, 2022

5. DISCUSSION AND CONCLUSIONS

The aim of this study was to assess the research methods used to analyse food PCI. To achieve this objective, a comprehensive literature review was conducted, which included articles published in peer-reviewed journals, as well as book chapters. Three main points emerge from the results.

First, the study results suggest that there are several methods used to analyse food PCI, including both quantitative and qualitative methods, as well as mixed methods. Quantitative methods such as scoring matrices and quantitative content analysis are commonly used to assess the relationship between different policy domains and to determine the degree of PCI. However, these methods may present limitations as they may not capture the complexity of policy processes and the context-specific nature of policy outcomes. Qualitative methods, such as qualitative content analysis of stakeholder interviews, can provide a more nuanced understanding of the policy context and the factors that influence PCI. These methods, allowing a deeper understanding of policy contexts and processes, can help to identify gaps and inconsistencies in policy goals and instruments, as well as to develop recommendations for improving

policy outcomes. The combination of content analysis of policy documents and stakeholder interviews is the most common research method used to analyse PCI in food studies. Such mixed methods allow the identification of factors that facilitate or hinder PCI. Interviews can also provide a real-life practice view and practitioners insights into the power dynamics and relationships among different policy actors, which can help to identify potential areas for collaboration and cooperation to improve PCI in the long term. Case studies are also commonly used to analyse food PCI, as they involve in-depth analysis of a specific policy context and can provide place-specific insights. Case studies can also be used to identify best practices and lessons learned, which can inform policy development and outcomes in similar contexts. Mixed-methods are therefore the preferred combination, albeit an effective systematisation of methodological approaches is not necessarily an auspicable outcome. The choice of methods should be guided by the research question and the specific objectives of the study, rather than a one-size-fits-all fixed approach. Therefore, the variety of methods can be considered a richness rather than a limitation, albeit fragmentation could hinder the development of the research field.

Second, the results of RQ1, assessing which authors, journals, and geographic areas lead the literature on PCI in the food sector, identified a strong geographic prevalence of Europe in studies on PCI. Such results show a consistent bias towards the Western world, which is commonly found in the academic literature on public policy studies. In this case, such bias is exacerbated by a strong tradition of analysis of PC for development, that opened the stream of research on these matters. PC for development was particularly focused on the implications of Western policymaking on developing countries and therefore introduced the bias. For Western world scholars it was easier to follow such stream of research, albeit adapting it to the food policy domain. Moreover, the results of RQ2 also showed a prominent role of the supranational and national level, which reflects the layered governance of those levels, where many stakeholders and their interests are involved. However, the local level would benefit from a better PCI, especially as far as food policies are concerned. Future studies could address PCI at urban or regional level, which could prove easier as less stakeholders are involved but more difficult as more personal relationships are in place (Monticone *et al.*, 2023).

Third, the present study confirmed that the most researched policy domains when analysing PCI in the food sector were the following two dyads: nutrition policies and trade agreements; agricultural policies and environmental ones. This reflects the reports of some governmental bodies researching on these topics, showing a rare parallel between the academic and practitioner world (Alliance Environnement, 2018; Hawkes, 2016). Environmental and agricultural polices are increasingly important as the number of policies issued on these topics is growing in recent years, because of the negative environmental impact of the agrifood sector. However, such growing attention for sustainability in the agrifood sector has boomed in recent years, therefore not allowing enough time for adjustments. The two sectors seem to move at a different pace: while environmental policies set high sustainability standards, the agricultural sector is not being thoughtfully guided in the transition, making the two sectors progress uneven and therefore PCI difficult to reach. Similarly, trade and nutrition policies have different paces, as well as different interests behind. Both policy dyads confirm the relevance of PCI in the food sector, as the complexity of domains involved makes PCI more relevant.

Finally, given the urgency of PCI in food policymaking, through the analysis of PCI research methodologies, the present study developed three main suggestions. First, to give PCI priority from the first stages of policymaking. Second, to assess PCI adopting mixed methods, which allow for better evaluation and more complete impact assessment. Mixed methods, being both quantitative and qualitative, are more suitable to better coordinate and harmonise different food policies with the aim of achieving sustainable and holistic outcomes. Third, to systematise the methods adopted for PCI evaluation, as methods fragmentation can enrich academic studies but has to be limited among practitioners. Also, systematisation leads to an improved methods adaptation to the real context of policymaking, which is often carachterised by difficult coordination and missing communications among various departments. To conclude, a combination of analytical methods is needed to provide a comprehensive understanding of the policy content, instruments, tools and processes affecting PCI, and therefore improve it.

The present study has two main limitations. First, as it is typical of literature reviews, the language searched was only English. This excludes articles published in other languages, limiting the scope of the research and the geographical areas covered. Second, only two databases, namely Scopus and Web of Science were adopted as sources.

To conclude, the results of this study suggest that a combination of methods is necessary to provide a comprehensive understanding of the policy contents, contexts, instruments, outcomes and processes influencing

PCI. Moreover, the choice of method should be guided by the research question and the specific objectives of the study.

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