Brokers, prestige and information exchange in the European Union's functional food sector – A policy network analysis

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A B S T R A C T

This paper focuses on policy networks and implications surrounding the complex legal requirements on functional foods in the European Union (EU). Using social network analysis, we empirically identify relevant network actors, both private and public, and quantitatively analyse network structures in terms of reputation, information exchange, and communication. Although private network actors outnumber public network actors, their importance is incontrovertible higher. The study identifies the European Commissions' Directorate-General for Health and Food Safety (DG SANTE), FoodDrinkEurope, and the European Consumer Organisation (BEUC) as the three most powerful network actors; among Council members, Great Britain vested an outstanding position before Brexit. Overall, the findings paint a precise picture of the functional food policy domain network in the EU by linking formal legislative decision-making and informal interest intermediation in policy formulation. Thus, our research shows the importance of information for network actors' strategic positive positioning.

1. Introduction

The European Union's (EU) food policy is going through a process of continuous changes. One of these happened in 2007, when Regulation (EC) No. 1924/2006 on nutrition and health claims (NHCR) (European Parliament and Council, 2006) came into force and aroused the entire food sector. From that time on, it was forbidden (except for some transitional arrangements) to claim health-promoting advertisements on food packaging or on websites, or to use these advertisements for other commercial communication purposes. The companies were forced to scientifically prove that their advertising claims were true.

Companies wishing to advertise certain health benefits (health claims) on their products have to submit their scientific facts to an EU country's national authority, which transmits the information to the European Food Safety Authority (EFSA), where the companies' claims are scientifically evaluated. If the claim is scientifically correct, it is up to the European Commission (EC) to decide whether the health claim should be authorised or not. Finally, the European Parliament (EP) and the Council of the EU (COUNCIL) have a right of scrutiny, otherwise the health claim is going to be authorised (European Commission, 2022c).

In the meantime, there is an established list of health and nutrition claims (European Commission, 2022b) against which companies can check whether their products fulfil the requirements; however, for health claims that have not been verified yet, it is still a burdensome administrative task to obtain approval (Brandenburger & Birringer, 2014). When the NHCR came into force, the packaging of thousands of products had to be changed and the food industry had to adjust their advertising and food development habits immensely.

Crucial for all these developments was the implementation of Regulation (EC) No. 178/2002 on general food law and the associated establishment of EFSA as an independent European agency (European Parliament and Council, 2002). This step was one of the farthest reaching consequences that the EU realized due to several food and feed safety crises in the 1990 s (such as BSE or dioxin) (Bergeaud-Blackler & Paola Ferretti, 2006; European Commission, 2019). The developments led to a more central role of consumer protection and public health issues in every new food policy (Chatzopoulou, 2019).

In the early 2000s, food policy regulation shifted from a merely national to a multilevel governance approach at the EU level as well as among member states (including their regions and local authorities). This new common approach fostered a single common market for food products and integration at the European level. On this basis, a first

version of a European food policy network with various public as well as private actors started to form itself (Chatzopoulou, 2019).

This process overlapped with the early developments regarding claims for functional foods as they were called before the term 'health claim' was established for EU-regulating purposes. In 2001, the EC started an early public consultation process and published a discussion paper on nutrition claims and functional claims (European Commission, 2001) which was commented by over 90 stakeholders (European Commission, 2016a, 2016b, 2016c). After the NHCR, other relevant legislation emerged, leading to an entire field of functional food policy (for our definition of a functional food see appendix A, based on Koch et al., 2014). As a result, public and private actors interested in these particular food policies nowadays form an issue network what we call the EU Functional Food Policy Domain Network (FFPD Network).

This paper aims to describe the EU FFPD Network using the features of social network analysis (SNA). Our two research questions are:

- Who takes part in the EU FFDP Network?
- What is the importance of the different network actors in terms of reputation and communication?

To our knowledge, the existing literature on policy networks has not yet addressed the key actors of the (functional) food policy domain in the European Union. With our study, we aim to close this research gap. By investigating the research questions, we empirically identify relevant network actors, both private and public, and clarify their network structures.

Our findings contribute to interest intermediation theories (Atkinson & Coleman, 1989) and theories of power, exchange, and resource dependencies (Knoke, 1990) applied to policy network analysis (Schneider, 2009), as well as to literature on legislators' and interest group behaviour in EU policymaking (Eising, 2007; Henning, 2009; Wonka & Haunss, 2020).

2. Theoretical background

Interest intermediation in representative democracies reaches its goal in two different ways: first, citizens elect a representative of a political party; second, citizens participate politically in a non-electoral way. Although the second option would be possible for all EU citizens as individuals (via initiatives, petitions, dialogues) (European Commission, 2017), the main part takes place through lobbying activities of private actors organised as interest groups (Lelieveldt & Princen, 2015). Those interest groups tend to target public actors (governmental representatives or politicians) with their activities mainly because of their impact on policy decisions. They would also like to gain effective access to powerful public actors, which could lead to future influence regarding important decisions (Franz Urban Pappi et al., 1995; Rasmussen & Lindeboom, 2013; Warntjen & Wonka, 2004). Especially when a new regulation is discussed, interest groups as well as companies tend to intensify their contacts to EU representatives (Eising, 2007).

However, it is not only private actors who seek information exchange, as EU governance encourages relations among both sides (Wonka & Haunss, 2020). EU representatives search for technical expertise and information on issues important for either European or national interests (European Council and Council of the European Union, 2013). Within the EU multi-level system, there are several opportunities to get in touch with each other, e.g. during meetings, conferences, or evening events (Eising, 2007). As mentioned, the communication intensifies during the development process of a new regulation. Thus, there is a chance that a new policy domain and a corresponding policy network will evolve.

Creating "detailed regulation of specialized policy areas" (European Council and Council of the European Union, 2013) is one of the fundamental pillars of EU integration. Consistently, the functional food policy domain evolved with path dependency to the developments of the

NHCR and other relevant legal provisions as well as the formation of the EFSA.

2.1. Policy networks

Policy networks "refer to actors and relationships in the policy process", which at the same time indicates the presence of "many communities and different types of networks" (Atkinson & Coleman, 1992). They occur as a response to the limitation of policy markets, where different political parties and political agents offer their opinions and views in form of legislative interventions. Another factor facilitating networks is the policy hierarchy, with its electoral hierarchy (voters and parliamentarians) and its bureaucratic hierarchy (parliamentarians, executives, and administrative officials) (Atkinson & Coleman, 1992; Kenis & Schneider, 1991). Policy networks exist as amorphous forms with a core – usually the EU organs and powerful, big interest groups or companies – and no clear boundaries (Atkinson & Coleman, 1992). That makes it possible for us to investigate the FFPD Network as one example of the food policy network. With the exception of a few highly specialized private actors, the powerful players in our FFPD network will also play an important role in the food policy network. We use a structured process to filter out who is important to the FFDP network and which organizations set the tone in communications. In this way, we set boundaries to our study's purpose.

Policy networks can be defined as informal institutions in which political agendas are discussed. Each individual actor (node) enhances the network with her or his own resources, such as political know-how or technical expertise, as well as the relationships to other actors (ties or edges). The resources are responsible for her or his positioning and importance within the network (centrality), which contributes to the actor's reputation (Heaney, 2014; Henning, 2009; Ingold & Leifeld, 2016; Laumann & Knoke, 1988; Pappi, F. U., & Henning, C. H. , 1998; Pappi, F. U., & Henning, C. H. , 1999). Although there exist no clear network boundaries, new actors have to accept certain modes of governance, rules and norms that were set (informally) by the core actors (Kenis & Schneider, 1991; Lang, Barling, & Caraher, 2009).

2.2. Information

To influence policy, information is a crucial factor (Atkinson & Coleman, 1992; Chalmers, 2019; Leifeld & Schneider, 2012; Warntjen & Wonka, 2004). Political actors continuously search for specialised information to evaluate and improve existing regulation or to find gaps within the legal system. The more specialised information a private actor (expert) has, the more relevant and influential he or she is for public actors (European Council and Council of the European Union, 2013; Huwyler, 2020; Kurzer & Cooper, 2013). Considered as highly relevant is expert information on "market conditions, probable policy results, problems of implementation, and the support a specific policy will receive, which politicians need to assess the political feasibility of a policy proposal" (Dür,2008).

At the same time, monitoring information on policies from political actors can be crucial for interest groups and companies. Interest groups might consolidate their position within the network with regard to their members; companies might even have an advantage over competitors. Monitoring information is not a mere collection of information that is freely available through careful observation of publications or events, but it is obtained from long-term sources of information. Confidential information must be acquired from social beings who are free to decide what information to share and with whom (Kirkland, 2011; Pappi et al., 1993).

2.3. Social resources: prestige, information and power

Policy network analysis is embedded in SNA which is an instrument to identify social capital and social resources (Jansen, 2003). Social
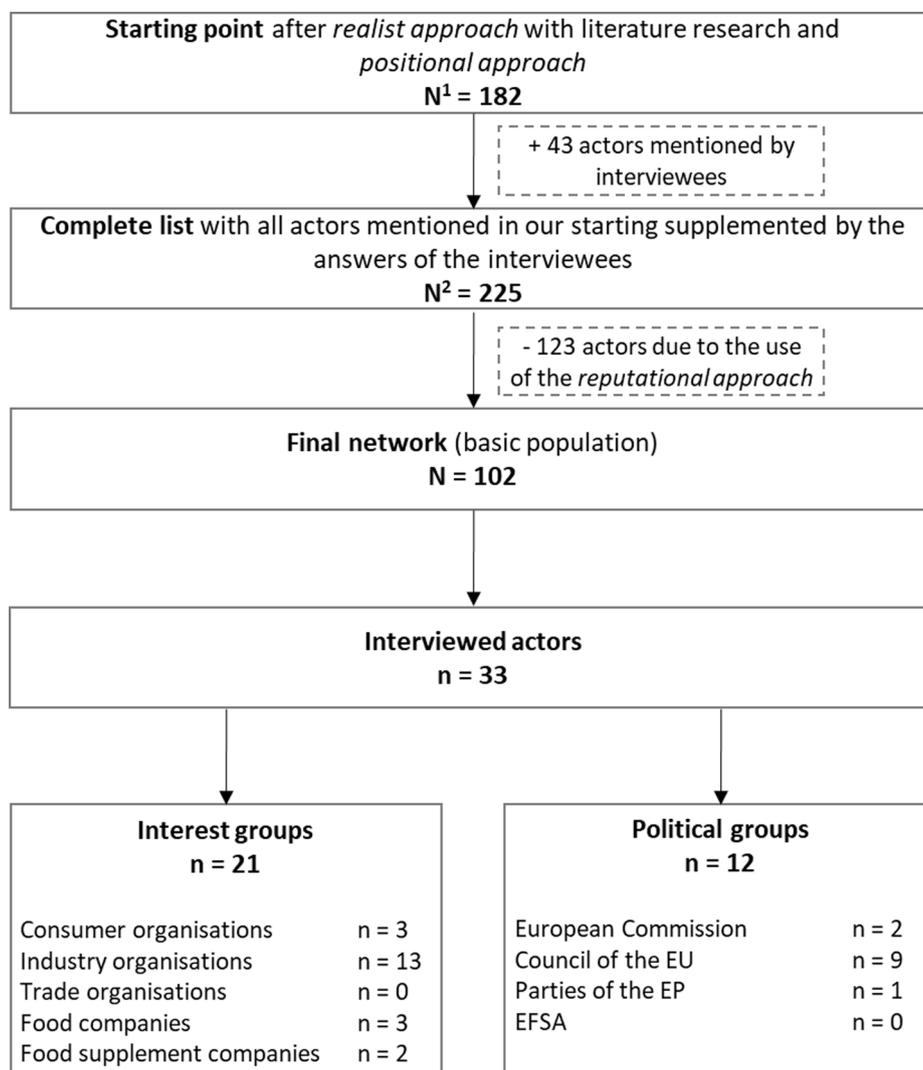
Fig. 1. Scheme of sample development.

capital is defined as "the networks of relationships among people who live and work in a particular society, enabling that society to function effectively" (Oxford University Press, 2022). This social structure makes it possible to transfer material or immaterial resources (Jansen, 2003). In this paper we address the social resources: prestige, information and power due to structural autonomy.

Prestige or importance of an actor depends on the opinion of other actors who perceive someone's high reputation and central position within a network (Jansen, 2003; Knoke & Yang, 2019). According to Granovetter's work on strong and weak ties (1973), this positive positioning makes it possible for actors to quickly acquire *information* from multiple sources. Considering the information flow, another effect of strategically positive positioning is *power,* which can be based on the actor's *structural autonomy* within a network (Jansen, 2003). Such autonomous actors are able to overcome structural holes by connecting otherwise unconnected network actors and are able to use the flow of information to their advantage. They can act as information brokers (Burt, 1982, 1992; Metz & Brandenberger, 2022).

2.4. A practical perspective

A large body of research has been published focusing on complex mathematical modelling of networks and differs in methodology from a purely metaphorical understanding of networks (Schneider, 2009; Scott, 2017). In this paper, we see the value we add in a practical approach

identifying the positioning of actors within the EU FFPD Network and clarifying their modes of information exchange. We interlink food policy regulation with interest intermediation by making use of SNA methods described in section 3.3. data analysis. Our methodology is based on proven procedures, which are explained in the following chapter.

3. Methodology

In this section we provide an overview of our research strategy to evaluate the EU's FFPD Network. We describe our research design, sampling process as well as the quantitative methods used to analyse the network data.

3.1. Data collection and study design

To identify relevant network actors within the EU's food policy domain and their modes of information exchange, we had to take a closer look at the NHCR and other relevant legal provisions, such as the Novel Food Regulation (EU) 2015/2283 (European Parliament and Council, 2015) and the Food for Specific Groups Regulation (EU) No 609/2013 (European Parliament and Council, 2013). We precisely extracted the actors who commented on the relevant discussion papers the EC published.

To produce comparable data, we gathered data via interviews which were conducted with standardized quantitative questionnaires and by

only one interviewer. This proceeding made it possible to minimise the effect of data variation due to different interview styles or respondents' uncertainty about the precise answer wording. The interviews were carried out in 2016 shortly before and after the Brexit referendum and during the time when the Netherlands (until June) and Slovakia (from July on) held the presidency of the COUNCIL. 20 interviews were conducted in person – most of them in Brussels – and 13 interviews were conducted by telephone. The average interview took 68 min. Before we started with the interviews, we defined some basic understandings (appendix A) regarding functional foods and interviewee's expected manner to answer the questions as 'corporate actors' (Coleman, 1990), meaning each interviewee was questioned as representative of its organisation and expert in its respective domain. This approach has been successfully tested and implemented in previous research on EU Common Agricultural Policy (CAP) policy decisions (Henning, 2000; Krause, 2005; Pappi, F. U. & Henning, C. H., 1999).

We used two separate questionnaires: one for political actors and one for private actors. The questionnaire for political actors consisted of 14 questions divided into 4 parts: (I) basic classification of European functional food policy, (II) policy concerns within the European functional food policy, (III) networks, and (IV) relevant functional food policy issues. The questionnaire for private actors had 21 questions divided into 5 parts, adding one part for (V) organisational issues. The questions asked were the same, only the networking questions varied by participant: politician or advocate. Within the policy network survey, we collected quantitative data on seven network questions. Network questions help to gather data on thematically defined relationships of network actors, which can provide information on a thematic network.[1] For the purpose of this paper, we use the reputation network, the expert information network, and the monitoring (information) network; to find the relevant network questions see appendix B. For the expert information network as well as the monitoring network, we included both: the demand and the supply of relevant information. According to Franz U. Pappi et al. (1993) this procedure ensures the reveal of possible asymmetric perceptions of respondents.

The focus of our study lies on actors important for the formulation of policies and having a high reputation within the network. Hence, we first used a *realist approach* to identify who was trying to formulate, advocate, and select the course of action within the NHCR development process (Knoke & Laumann, 1982); we embedded a *positional approach* (Scott, 2017) and further searched for potential participants in specific positions, such as global or EU regulatory affairs managers in companies or governmental members of the health claims working group. With this theoretical information we created a list of actors (list) with relevant political groups, interest groups, and companies, food as well as food supplement producing companies. The development of this roster to frame our FFPD Network was crucial due to the fact that networks are self-organising and not limited by institutional boundaries (Atkinson & Coleman, 1992). Furthermore, we reduced the risk of participants' underreporting while asking our network questions (Henning & Krampe, 2018).

Using this list, we asked participants to tick the organisations that instantly come to their mind in terms of reputation. Self-nominations were excluded. In line with Henning and Krampe (2018, p.186) "the question was framed in a way that instructed interviewees not to exert great effort on a detailed investigation (…)" but to answer quickly on the assumption that only highly important organisations would be mentioned. It was pointed out to participants that missing (but highly important) organisations could be stated and included in the progressing interview. Subsequently, our participants identified who continuously took part in the formulation process of functional food policies and is

perceived as powerful, performing well, and/ or trustworthy by other network actors. We define actors as powerful: who are able to make decisions or influence them due to institutional responsibility, who have influence resources, or who are strong in members (Ingold & Leifeld, 2016; Pappi et al., 1995; Sciarini, 1996). This *reputational approach* ensures the correct limitation of our network (Jansen, 2003; Knoke & Yang, 2019; Sciarini, 1996) because it is not purely set by literature research but from the network actors themselves; it also cross-validates that our network is closed, all actors can theoretically reach each other through short paths (Pappi, F. U., & Henning, C. H., 1998).

Overall, we interviewed 12 public actors (Fig. 1). Among these were two representatives of the Commission's Directorate-General for Health and Food Safety (DG SANTE). Both worked in areas that are considered as especially important for the functional food sector. Within the network analyses, these two interviews were condensed as one node.

We interviewed one representative of the EP. Due to the fact that the decision for the implementation of the NHCR was made before 2006, it was not possible for us to acquire more interview partners of the EP. Firstly, the topic was not on the EP agenda anymore and secondly, persons who were involved in the legislative processes were no longer available. This is a well-known phenomenon in the use of expert interviews in the political system (Warntjen, 2012) and is based on the fast-moving nature and complexity of policy issues addressed in the EP (Greer, 2005; Hausner, 2017).

Furthermore, we interviewed 9 political actors of national ministries responsible for the NHCR. Most often, the representatives were employees from national ministries of health, but representatives from national ministries of agriculture or food were also interviewed, depending on where food policy issues were nationally located. These political actors will be accounted to the COUNCIL (Fig. 1) because they will inevitable be advising their COUNCIL members in functional food matters or are COUNCIL members themselves (European Council and Council of the European Union, 2022).

For the purpose of our work, we decided to contact political actors, as part of the 'political group', on the working level. We expected that technical understanding of the regulations we considered and frequent exchanges with private actors would occur primarily at this level and less often directly with policymakers (Eising, 2007). We decided not to include the European Court of Justice (ECJ) although it takes an important part in legislative decision-making, for example throughout the process of health claims' authorisation. Nevertheless, in general we focused our research on policy formulation and legislative lobbying where the ECJ plays a minor role (Eising, 2007; Wonka & Warntjen, 2004).

For the private actors, we decided to interview relevant actors of associations as well as actors from globally relevant companies who engage actively in legislative processes in Brussels. In our prepared list, we included different categories of supranational interest groups: consumer organisations, such as the European Consumer organisation (*Bureau Européen des Unions de Consommateurs*, short: BEUC), industry organisations (including agri-business organisations), such as Food-DrinkEurope (FDE, formally known as CIAA) or the European Farmers and European Agri-cooperatives (Copa-Cogeca), trade organisations, such as the European Association representing the trade in cereals, rice, feedstuff, oilseeds, olive oil, oils and fats, and agrosupply (COCERAL). We have decided to leave national interest groups out of the equation, as our research focus is on EU regulation. National interest groups are mostly part of larger EU associations and are represented by these associations. It is not common for national interest groups to participate in EU decision-making unless the topic is particularly relevant to their national activities. We interviewed one national interest group but decided to exclude it from the data pool afterwards. EU associations have long-term relationships within EU networks, making them more relevant to the elaboration of our FFPD Network (Eising, 2007). We also excluded food retail and food service companies that did not actively participate in the process of developing the NHCR and other relevant

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[1] The term network is used in two ways, first to explain an informal institution including all actors in a specific policy domain, e.g. EU FFPD Network, and second to define their interactions, e.g. communication network.

Table 1

Summary of network characteristics considered. *Sources*: see Jansen, 2003; Knoke & Yang, 2019; Rudnick et al., 2019.

Characteristics	Description
(i) Network size or basic population (N)	Total number of nodes (actors) in a network
(ii) Network sample size (n)	Number of interviewed network actors (in a confirmed network n = N)
(iii) Directed or undirected network	Depending on whether the data contains the information which actor nominates whom (directed), or not (undirected)
(iv) Density	Proportion of ties (connections) present between nodes, relative to all possible ties *Value:* between 0.00 (no connection between actors) and 1.00 (every-one is to every-one connected)
(v) In-degree centrality	Number of ties directed to one node/ received nominations
(vi) Normalised in-degree centrality	In-degree centrality in relation to network size *Value:* between 0.00 (isolated actor) and 1.00 (highly central actor)
(vii) Betweenness centrality/ geodesic distance	Extent of one node's shortest paths (geodesic paths) among connected node pairs (dyads) in the network
(viii) Normalised betweenness centrality/ normalised geodesic distance	Betweenness centrality/ geodesic distance in relation to network size *Value:* between 0.00 (actor has no geodesic path) and 1.00 (actor falls on every geodesic path of all node pairs)

Table 2

Distribution of organisation categories in our final list *[N = 102]*.

Group	Organisation type	Category	Percentage
Political group (PG) [n^PG = 34]	Council of the EU incl. Competent authorities[1]	PG-COUNCIL	18%
	European Commission[2]	PG-EC	7%
	European Parliament[3]	PG-EP	6%
	European Food Safety Authority	PG-EFSA	1%
Total PG			32%
Interest group (IG) [n^IG = 69]	Consumer organisations	IG-CON	5%
	Industry organisations	IG-IND	27%
	Food companies	IG-COMP	22%
	Food supplement companies	IG-COMP-FS	8%
	Trade organisations	IG-TRA	6%
Total IG			68%[4]

[1] Members of the working group on health claims.
[2] Directorate-Generals and the Joint Research Centre.
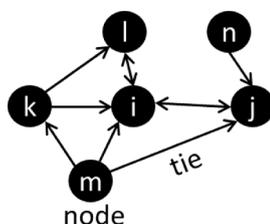[3] Parties.
[4] Numbers rounded.

Fig. 2. Simple network example.

legislation. Furthermore, consulting agencies are not included in this paper because they were not involved in the consultation process. They seem to act as private consultants to interest groups rather than providing specific network access (Huwyler, 2020).

We interviewed private actors of 16 interest groups and 5 companies, including FDE, Copa-Cogeca, Merck, and Unilever. For the purpose of this paper, we will combine both groups and refer only to 'interest groups'.

Fig. 1 summarises the development of our sample, including the distribution of our interviewees. At the end of our literature research on relevant discussion papers published by the EC, we had a list of 78 private actors and 105 political actors relevant to the field of functional food policy. After conducting the reputational approach, in which respondents were asked to tell us who was considered most influential (reputation network), a group of 102 actors (categories and distributions listed in Table 2) emerged for the EU FFPD Network. It was composed of 69 interest groups (IGs) and 33 political groups (PGs). Our sample size (n) comprises 32 actors (the two respondents of the EC were combined as one node), representing 33% of the basic population (N).

3.2. Data analysis

To assess the EU FFPD Network we use SNA to measure the relational data with its complex interactions between political and private actors. Our considered network characteristics are listed in Table 1. We already reflected upon the whole *network size* (i) and deduced our *network sample size* (ii) in Fig. 1.

The standardised questionnaire as well as the formulation of our research questions allow us to include information about which actor (node) nominates whom, which makes it possible for us to calculate both *undirected and directed networks* (iii) for reputation, expert information, and monitoring information. We ascertain binary ties (nominations or connections) which have values of only zero (lack of a tie) and one (presence of a tie) (Knoke & Yang, 2019). The number of binary ties in relation to all possible ties is the *density* (iv) of a network.

The *in-degree centrality* (v) measures the amount of nominations an actor received from other actors in the network. For example, in our sample network in Fig. 2 actor i receives 4 nominations while actor n receives no nomination. The number of ties gives us a value for the actor's *prestige or importance* within the network (Knoke & Yang, 2019). To make the outcome of in-degree centrality comparable, we calculated the *normalised in-degree centrality* (vi) which is measured in relation to the respective network size.

For our communication network (expert information and monitoring information combined) we additionally use *betweenness centrality* (vii) to measure the extent of one node's shortest paths (geodesic paths) among all other connected node pairs (dyad) (Knoke & Yang, 2019). For example, in Fig. 2 actor j is on the geodesic paths of actors n and m as well as actors n and i. More than one geodesic path for a dyad is possible, therefore the proportion of one node's geodesic paths between a dyad is calculated and set into perspective to the whole possible paths for this dyad. The sum of the proportions of all possible dyads gives us the *normalised betweenness centrality* (viii), which is again less sensitive to the network size (Wasserman & Faust, 1994). The closer an actor is to the value one, the more potential *influence* he has on the measured relations in the network (Knoke & Yang, 2019). The actor has the potential to *control* resources (i.e. information or communication) and can be seen as resource broker *(Freeman, 1978; Jansen, 2003)*.

"Social networks are especially sensitive to missing data" (Knoke & Yang, 2019, p. 42); to counter the effect, we took specific care during the participant selection process as well as the preparing of the list (see 3.2 data collection). We double-checked the presence of important network actors with the reputational approach. And not to be forgotten, we interviewed experts in the field of functional food policy (Dorussen et al., 2005). Therefore, we could use the data (Marschall, 2009) for most parts of the analysis and let only one node confirm a tie, which makes it possible not only to show the interviewed actors but all
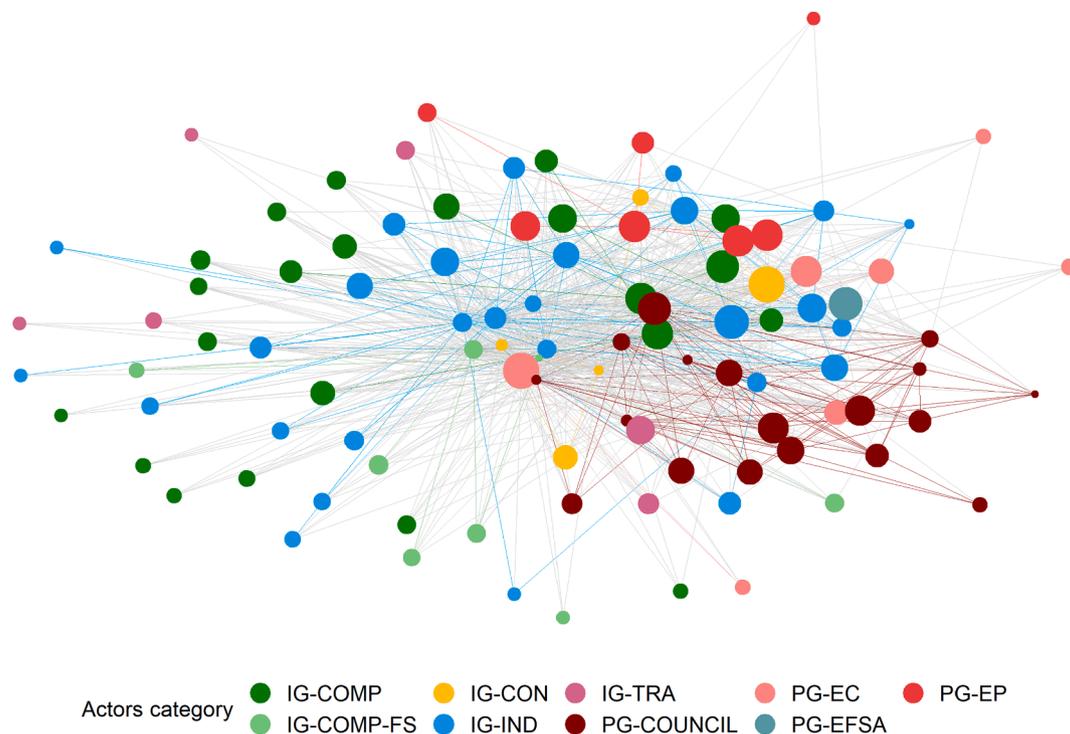
Fig. 3. Reputation network according to normalised in-degree centrality measure *[n = 32]*.

important network actors (Scott, 2017). We filled missing data with zeros in our matrix to calculate the network data and did not use fully symmetrised data (Marschall, 2009). For our network discussions we do not use the density values. First, they would be extraordinary small due to the relatively small number of realised ties compared to the number of possible ties, which is affected by the large number of network actors and the response rate of 33%. Secondly, the density is not valid for our networks (except for the confirmed network in Fig. 5) (Marschall, 2009); for this reason, we do not want to prematurely draw any conclusions.

All calculations within this paper were conducted in the statistical computing environment R version 4.1.2 (R Core Team, 2021) using i.a. the sna package (Butts, 2020), the network package (Butts, 2015) and the igraph package (Csardi & Nepusz, 2006). Figures were produced using the GGally package (Schloerke et al., 2021). A list of all packages used is given in appendix E of this paper.

4. Results

In this section we present our results regarding key actors within the EU FFPD Network. We identify prestigious actors as well as relevant network brokers by focusing on the communication network.

4.1. Key actors within the functional food policy domain of the EU

During our field work we asked the respondents about the reputation network in the functional food policy domain (the network questions are listed in appendix B). We optimised our original roster of network actors and set the EU FFPD Network limitations. At the beginning we started with a list of 182 categorised actors. During the field work, 43 new actors were mentioned from our participants. In the data analysis we only classified actors as powerful who were nominated at least three times by our respondents (Henning, Aßmann, Hedtrich, Ehrenfels, & Krampe, 2019); following this reputational approach, we included 5 newly mentioned actors. Overall, we identified a reputation network of 102 actors (Table 2 and Fig. 3), which is the system limitation for the analysis.

Fig. 3 shows the reputation network. The actors' categories

correspond to the categories listed in Table 2; we took directed network data and calculated the node sizes proportionally to their normalised in-degree centrality. Highly prestigious (defined as powerful in our reputation network) actors are central (large nodes) in the FFPD Network.[2] Ties (edges) with different sender and receiver categories are coloured in grey; ties with senders and receivers from the same category have the same colour as the nodes.

The network relations are quite heterogeneous except for the two groups: industry organisations (IG-IND coloured in light blue) and PG-COUNCIL (dark red), whose homogenous relations seem to dominate the network. It is well-known that organisations with the same focus or background are likely to exchange information. This so-called 'interest group homophily' is used to coordinate activities and to convince opponents with an increased bargaining power (Leifeld & Schneider, 2012; Metz & Brandenberger, 2022). Homophily is also present in consumer organisations (IG-CON), but due to the small number, it seems under-represented compared to IG-IND. Homophily is relevant for actors with similar political characteristics (Huhe et al., 2018) which explains the inner-group ties between the PG-COUNCIL actors. Here, the effect can be explained through their joint committee or working group memberships, with formal and informal meetings, lunches, dinners, etc., which fosters friendships and close trustworthy relations as well as shared information and a shared understanding regarding the legislative role (McPherson, Smith-Lovin, & Cook, 2001).

The large nodes in the reputation network are actors perceived as influential and powerful from other network actors (Heaney, 2014). The EU FFPD Network has influential actors from almost every category. The exception is the category of food supplement companies (IG-COMP-FS). This supports the assumption, that their interests are advocated through interest groups (Lelieveldt & Princen, 2015), such as FDE or Food Supplement Europe (FSE). In contrast, some food companies (IG-COMP) are

Table 3
The top 10 organisations of the EU FFPD Network regarding reputation *[n=32]*.

Rank	Acronym	Category	Organisation	Nominated by
1	BEUC	IG-CON	The European Consumer Organisation	100%
	DG SANTE	PG-EC	Directorate-General for Health and Food Safety	
2	FDE	IG-IND	FoodDrinkEurope	87%
3	EFSA	PG-EFSA	European Food Safety Agency	85%
4	COUNCIL GB	PG-COUNCIL	United Kingdom	81%
	Danone	IG-COMP	Danone	
5	ALDE	PG-EP	Alliance of Liberals and Democrats for Europe	74%
	EPP	PG-EP	Group of the European People's Party	
	S&D	PG-EP c	Group of the Progressive Alliance of Socialists and Democrats in the European Parliament	
	Unilever	IG-COMP	Unilever	

perceived as influential although they are also members of IGs. Within the IG-IND and IG-CON categories, there is one node that is conspicuously larger (more central) than others in the same category, indicating a hierarchical structure with categorical peak organisations.

Table 3 lists the top 10 organisations in relation to the nominations of our respondents regarding the reputation network. The data identifies BEUC (for IG-CON) and FDE (for IG-IND) as peak organisations on IG-side. Which can be explained by the large number of its members and their financial capabilities (Ingold & Leifeld, 2016). BEUC is one of the oldest EU-lobbying organisations (BEUC, 2022a). With respect to its 46 employees and its 46 member organisations, it is also one of the largest in the FFPD Network (BEUC, 2022b). From our interviewed IGs, only Copa-Cogeca reported to have more employees (50 in 2016). BEUC's income in 2020 was 5.9 million euros of which 60% (3.5 million euros) was spent on employees (BEUC, 2020). Inferentially, FDE is the third largest EU-lobby organisation in the FFPD Network. It has 75 member organisations (FoodDrinkEurope, 2021). With its 23 employees (Food-DrinkEurope, 2022), we calculated 1.8 million euros were spent on employees only. The large number of employees and affiliates, as well as the measured high reputation (Fig. 3 and Table 3), underpin strong
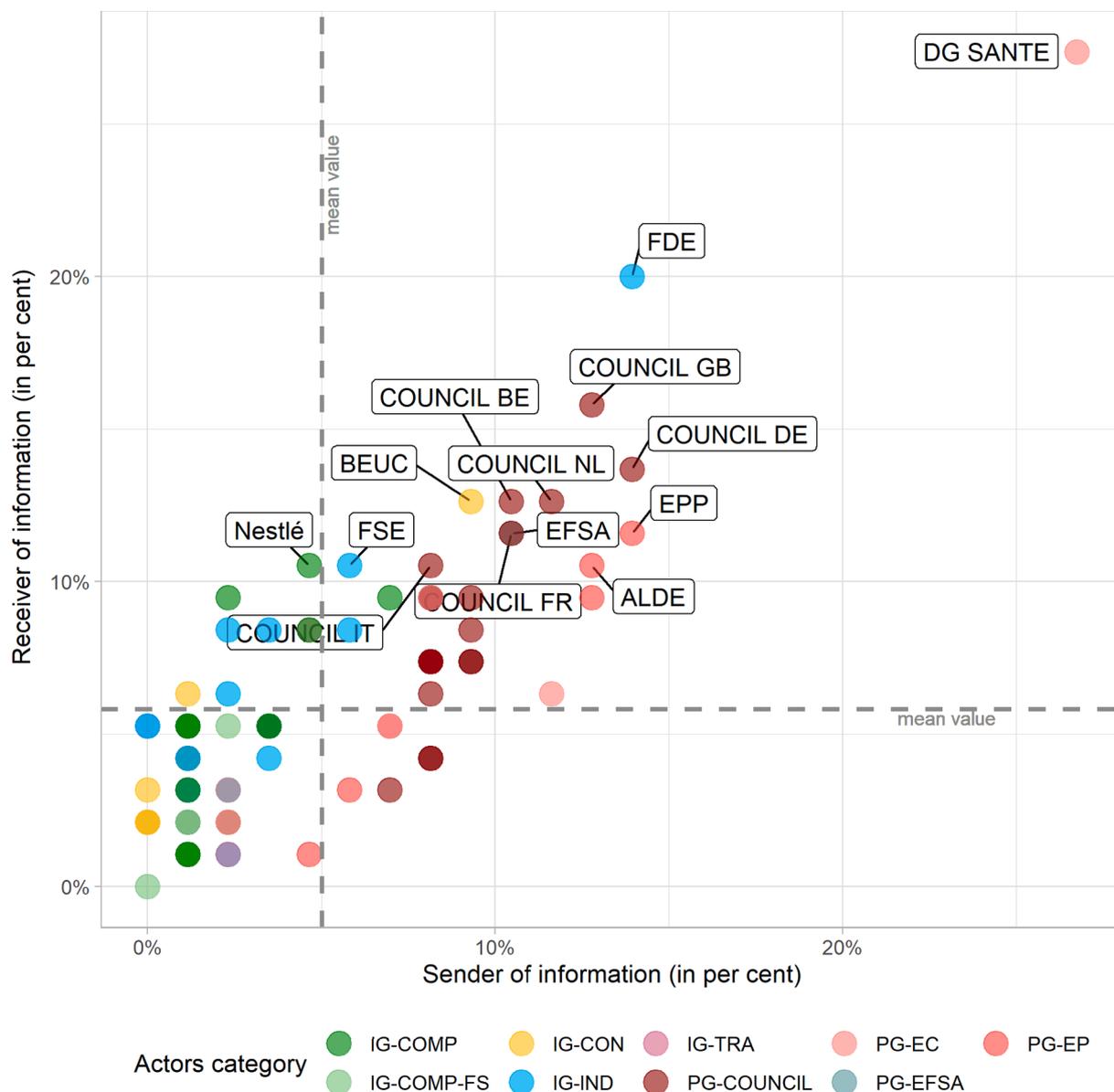

Fig. 4. Scatter plot of prestige within the communication network according to normalised in-degree centrality measure *[n = 32]*.
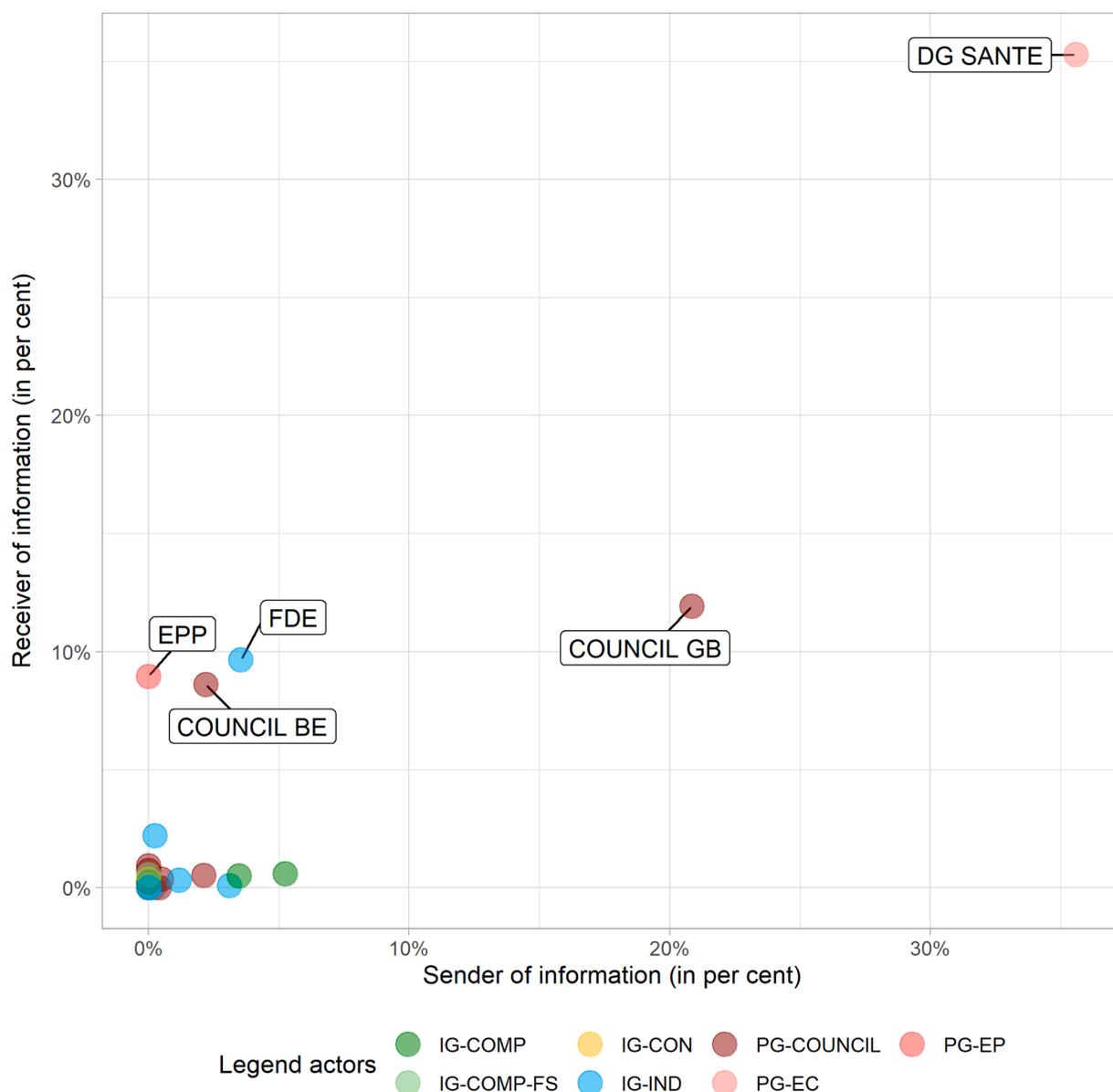
Fig. 5. Scatter plot of information brokers within the communication network according to normalised betweenness centrality measure *[n = 32]*.

bargaining power in interest intermediation.

Companies nominated as powerful are Danone followed by Unilever; Nestlé is on Rank 6 (appendix C: top 12 ranks of organizations in the European functional food reputation network) nominated by 71% interviewees. Those three companies are also in the top five of leading agri-food companies ranked by global agri-food sales in Europe in 2018/19: Unilever with 20.2 billion euros, Danone with 24.6 billion euros, and Nestlé with 79.2 billion euros (Statista, 2020). They all have offices in Brussels (European Union, 2022b) which makes it easier for them to maintain and to strengthen face-to-face relations (Atkinson & Coleman, 1992).

DG SANTE and EFSA are peak organisations on PG-side. Rank 1 for DG SANTE underpins its role as the agenda-setting and policy formulating unit of EC regarding food policy. EFSA's high reputation is surprising, because it is not formally embedded in the legislative decision-making process. Its tasks are defined as "providing scientific advice and communicating on existing and emerging risks associated with the food chain" (European Union, 2022a). Nevertheless, the findings underline EFSA's outstanding importance for the functional food sector, e.g. EFSA evaluates the scientific evidence of a health claim and often decides with

its recommendations whether a claim gets authorised or not.

Great Britain (GB) was the most important COUNCIL member (COUNCIL GB) in the reputation network. GB's population size and diplomatic power (Huhe et al., 2020) presumably influence the perception of other network actors as well as their representatives' language advantages during negotiations (Krizsán & Erkkilä, 2014). Second within the group of COUNCIL members is France (FR) (67%), followed by Germany (DE) (64%), Italy (IT) (52%), and Belgium (BE) (49%) (appendix C). In summary, the data indicate a reputational advantage of larger member states in policy discussions and placement of interests.

Our reputation figures show that small and medium-sized enterprises (SMEs), which account for 91.1% of food and drink manufacturers (FoodDrinkEurope, 2020) and 99% of all companies in the EU (European Commission, 2021b), are underrepresented in the food policy network. Of course, SMEs are members of larger organisations such as FDE, but so are larger companies, which might – in some cases – lead to a conflict of interest. In contrast, the association of crafts and SMEs in Europe (SMEunited, formally known as UEAPME), for example, plays only a minor role in our reputation network (nominations below 10%).

4.2. Prestigious actors and brokers within information exchange

The findings demonstrate the relevance of two resources influencing the EU FFDP Network: expert information and monitoring information, to assess the information exchange between the different network actors. For both, we asked who demands and who supplies information (the corresponding questions are listed in appendix B). In our data analysis we combined those two resources in one communication network.

Highly prestigious actors are central in the communication network and can communicate information quite quickly to other network actors, due to a lot of direct ties. Directed network data were used for the analysis and normalized in-degree centrality was calculated as a value for actor prestige. Fig. 4 shows a scatter plot of the communication network for the EU FFPD. The node colours correspond to the categories listed in Table 2, due to overlapping nodes, we illustrated the nodes in a transparent manner which produces different colours in the figure compared to the legend.

It is eye-catching that PGs are perceived as information receiver as well as information sender while IGs only considerably appear on the receiver-side (except for BEUC and FDE). The groups significantly differentiate in both: sending and receiving of information (appendix D). The findings emphasise the importance of PG information. Expectably, PGs as EU-entity to create and develop legislative change are the main receivers of information. On IG-side, the findings indicate a hierarchical access to information in favour of highly specialised (e.g. SNE) and large IGs (BEUC, FDE).

The high ranks for peak organisations within the communication network (DG SANTE, FDE, COUNCIL GB, BEUC) correlates with the high ranks in the reputation network. This can be explained by the well-known effect that actors who are perceived as powerful or influential by other network actors are more likely to form many information ties (Henning, Aßmann, Hedtrich, Ehrenfels, & Krampe, 2019).

DG SANTE is again the highest ranked actor, with a level of almost 30% of possible ties. This is an amazingly high percentage regarding the fact that we used an incomplete dataset where sometimes only one actor confirmed a tie. The data underpin that DG SANTE is the most important contact partner for both IGs and PGs (Eising, 2007; Schmidt, 2000).

COUNCIL GB is again the highest ranked PG-COUNCIL actor within the network. The effect of the proper use of English as a lingua franca for legislative discussions and for overall communication is perceived as an economic value (Krizsán & Erkkilä, 2014). In addition, GB's strong opinion leadership to strengthen the EU single market might make communication both sending and receiving attractive for network actors (Stubb, 2014).

Fig. 4 makes it possible to show powerful homophily effects between the PGs. COUNCIL GB and the COUNCIL member Germany (COUNCIL DE) are highly prestigious in the communication network; they receive and send a lot of information. For COUNCIL DE the same popularity effects as for COUNCIL GB might exist, due to population size and diplomatic power. The high prestige for both COUNCIL members might be strengthened due to their high level of scientific knowledge shown by their countries' high number of scientific publications (Scimago Lab, 2022; The World Bank Group, 2022) and their strong positions regarding trade and innovation (Möller, 2014).

Our data indicate a high prestige for the COUNCIL member Netherlands (COUNCIL NL). The high rank is affected by its Council presidency (in 2016), which was immediately reported by the interviewees during the interviews. These finding is in line with Schalk et al. (2007, p.245), who stated "independent of country size and economic power" presidencies have an effect on EU decision-making.

We measured high prestige for the COUNCIL member Belgium (COUNCIL BE), consistent with Jacques et al.'s (2021) summary of Belgians high influence within the EU compared to other small powers. Belgium is respected in the EU hierarchy for its extraordinary "capacity to reach compromises" (Jacques et al., 2021). It hosts the lion's share of

the European institutions and the European quarter in Brussels, where European negotiations take place, giving Belgian delegates an on-site advantage.

Within the segment of IGs, most of the communication towards political actors is managed through peak organisations (Pappi and [Franz U.], & Henning, C. H., 1998); regarding the communication network BEUC and FDE are the most central IGs. This is a proof of their good access possibilities to other actors in the FFPD Network. Obviously, they deal with information resources, which identifies them as main brokers of the IGs.

Along with the actors' prestige within the communication network, we measured the actors' normalised betweenness centrality to identify brokerage activities, illustrated in Fig. 5. We used confirmed network data (data of the 32 participants only) to identify relevant network brokers.

DG SANTE is clearly the broker with the most influence having access to almost 40% of all network connections, which makes it impossible to address FFPD issues without its involvement. Its broker position supports its important standing during negotiation processes.

In 2016, COUNCIL GB was another broker who has had a high impact regarding the control of the resource communication. As a broker, COUNCIL GB indirectly connected many actors of the FFPD Network. The Brexit has surely affected the communication structures of the remaining states in the system (Huhe et al., 2018). It can be assumed that the power of COUNCIL DE and other COUNCIL members with a high population size like France or Italy increased since GB left the EU (Huhe et al., 2020).

Additionally, the confirmed communication network data exhibits a comparatively high density of 0.29[3] indicating that almost 30% of all possible connections are realised. The data reveal that the EU FFPD Network actors exchange information quite intensively.

5. Discussion

This is the first paper in functional food research which focuses on policy networks and implications surrounding complex legal requirements in the EU. To understand the dynamics of the EU FFPD, we applied a network analysis by considering the communication of various types of institutions as well as network actors, as suggested by Wonka and Haunss (2020). This approach gives us the opportunity to discuss relevant policy implications. Furthermore, our methodological contribution can be regarded as an example of obtaining reliable results for an entire domain network.

5.1. Groups of network actors

Our first research questions was to identify who participates in the EU FFPD Network. We identified different actors and categories as well as their reputation in the FFDP Network. Secondly, we measured and described their influence on information exchange.

This study underlines the pivotal role of decision-makers in the EU within the functional food sector. Although there exist more IGs than PGs in the EU's FFPD Network, the relevance of PGs' information is exceptionally higher. We argue and show that PGs have opportunities to navigate functional food policies beyond formal statutory provisions supported or even created by their network interactions. For example, the **EC** is responsible for legislative initiatives according to Art.251 II of the EU Treaty (European Union, 2002), making it a gate-keeper for legislative decision-making (Wonka & Warntjen, 2004). Our data identify this role for DG SANTE with high values for reputation, communication (as receiver and sender), and its outstanding capabilities to act as an information broker.

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[3] In contrast, the confirmed expert network of the policy domain of the CAP showed a network density of only 0.11 (Henning and Krampe, 2018).

Although Henning (2009) argued that the intensification of supranational procedures strengthens the positions of the EC and the EP, our findings show that national governments, ministries, and governmental actors play an important role in the policy formulation process. In the EU FFPD Network, the **COUNCIL** can even expand its institutional decision-making power by leveraging its dense intra-group network. COUNCIL GB and COUNCIL DE are its strongest communication members. This exceeds the findings of Huhe et al. (2018), who also measured their popularity, but only within the COUNCIL. Presumably, the Brexit has led to an increased emphasis on Germany as well as on other COUNCIL members such as France and Italy with a large population and high ranks in reputation. An opportunity might also have arisen for COUNCIL BE, which might use its high prestige in the communication network to expand its abilities to influence policy discussions and to place its interests.

The results imply reputational advantages for the **EP** groups: Alliance of Liberals and Democrats for Europe (ALDE), Group of the European People's Party (EPP), and Group of the Progressive Alliance of Socialists and Democrats in the European Parliament (S&D). Unfortunately, functional food policy topics were not on the EP-Agenda at the time we conducted our research, and information from EP-actors is missing for further analyses.

Our findings demonstrate a strong position of **EFSA** in terms of reputation. Although EFSA is not formally embedded in policymaking, its product assessments are highly relevant to both, policymakers and interest groups. High reputation is a variable that indicates EFSA's good scientific judgement, which is relied upon by EU institutions, in particular the EC, and consumer associations. In consequence, the higher the reputation, the more EFSA's product evaluations will be adopted in evidence-based decision making by the EC. This might lead to predictability of results, which is important for industry organisations and companies (Joosen, 2021).

In general, the EC, the EP, and the COUNCIL try to develop and enhance legislation with a bottom-up philosophy. They try to incorporate consumer interests and interests of SMEs (Economic and Social Committee, 2002), however, our data indicate an alarming distortion of interest representation. Both **consumers** and **SMEs** are highly underrepresented in the EU FFPD Network. Consequently, the "consumer protection" and "inclusion of minority views" objectives need serious scrutiny, which should be considered during consultation processes. Probably the new developments to EU's digital targets for 2030 might be a step forward (European Commission, 2021a) and lessen the degree of reality that "Brussels only talks to Brussels" (European Commission, 2002).

In contrast, we measured efficient roles of FDE and BEUC as the **largest IGs** in their respective categories; as expected, they are identified as peak organisations within the EU FFPD Network. Their perceived importance in the reputation network makes them even more relevant as information brokers. In fact, large IGs are more appealing to political actors and are often consulted on important policies (Rasmussen & Lindeboom, 2013). Even the EU institutions themselves stated that they rather discuss important issues with permanently existing, institutionalised organisations operating at European level than with small, highly specialised, national organisations (Economic and Social Committee, 2002; European Commission, 2002). Larger IGs are able to operate in Brussels and to access a wide range of expert knowledge due to their large number of (specialised) members and their large financial capacities. Consequently, it is hard for IGs or companies that do not have the financial resources to gather enough expertise to be relevant for PGs (Atkinson & Coleman, 1992; Casey, 2004).

Although formal interest mediation works through IGs, our findings provide evidence that **big companies** such as Danone, Unilever, and Nestlé are powerful network actors. Our results indicate that they benefit from their presence in Brussels. An advantage is created through regular, on-the-ground exchanges with political actors which can develop privileged relationships from which others are excluded (Atkinson & Coleman, 1992). Therefore, a two-way interaction between political actors and actors of global companies is expected (Rasmussen & Lindeboom, 2013). This is consistent with the findings of Cullerton et al. (2016), who found an advantage of the food industry in influencing nutrition policy decisions in Australia due to a large number of direct contacts to decision-makers. Van Dam et al. (2021) pointed to the existence of comparable effects concerning the European food industry and its potential power to influence public health policies. Nevertheless, we measured the role of food companies in the communication network merely as "listeners" and not as senders of information. Interestingly, food supplement companies seem to play an irrelevant role in terms of information exchange. In our data, no food supplement company was measured on the first reputation ranks.

5.2. Central policy implications

The findings of this study indicate several consequences for engaging in the policy network and thus for influencing functional food policy. For instance, we delimitated the EU FFDP Network with 102 actors, among which we deduced a centralised core with only a few powerful actors. In line with the findings of Eising (2007), we showed that financial capacities on IG-side favour central positioning with regard to reputation as well as information exchange. Additionally, we observed relevant homophilic tendencies within two groups, the COUNCIL and industry organisations, which increase their bargaining leverage relative to other network groups and might produce favourable outcomes for them. Thus, to reduce the network effects, favouring the opinions of homophilic groups as well as resourceful actors, politicians should try to include the opinions of diverse and multiple network actors.

Another obstacle might be the lack of network flexibility; although there are no clear, formal network boundaries (Atkinson & Coleman, 1992; Kenis & Schneider, 1991; Lang, Barling, & Caraher, 2009), the concentrated core provides evidence that the entrance of new network actors is highly unlikely. Especially in view of the increasing importance of sustainability aspects in all policy as well as industry areas (European Commission, 2022a), political actors might use their function as an interface to introduce new network actors in order to generate a balanced and open discourse.

Turning to the information aspects, in line with the existing literature (Heaney, 2014; Henning, Aßmann, Hedtrich, Ehrenfels, & Krampe, 2019; Ingold & Leifeld, 2016; Laumann & Knoke, 1988), we measured the powerful network actors to be the central actors with regard to the EU FFPD communication network; thus, they are able to control the flow of information. Furthermore, information can be communicated quickly within a dense communication network. Especially the outnumbering industry organisations can use the short communication streams to react on policy decisions or new developments of the market to interfere in their favour; this risks neglecting the interests of consumers and SMEs, which has happened in the NHCR development process (Brandenburger & Birringer, 2015). For both groups it is nearly impossible to address their issues themselves, they need policymakers who want to reach a fully-informed policy decision. It has to be crucial to gather information outside the usual channels; this means leaving their "comfort zones" and gathering information directly from relevant sources.

Additionally, the overarching impacts on public health as well as discussions on sustainability should be taken into account (Lang et al., 2009; van Dam et al., 2021). On these topics, active information gathering from trusted sources is absolutely relevant. For example, the inclusion of perspectives from scientific organisations such as universities or research institutes might be a possibility to restrain the risk of misinformation or bias emanating from a strongly industry-led, hierarchical interest representation in the EU FFPD Network.

Concluding the discussion on policy implications, our results imply that information from public network actors is generally perceived significantly more important compared to their private counterparts; this gives politicians the opportunity to use their central position to

disseminate reliable information and data to achieve a substantial policy outcome.

5.3. Methodological input

The complexity of our network calculations is an example of how some effort is needed to start untangling the dependencies between different individual actors and groups. Especially setting the network boundaries is challenging as well as crucial for receiving reliable data (Prell et al., 2021). Our detailed description of the process to set the network limitation for the EU FFPD Network might help to reproduce the procedure for other network analyses.

Usually, policy calculations are based on confirmed network data, using only interviewed actors as system limitation for the analysis (Henning & Krampe, 2018; Leifeld & Schneider, 2012; Moschitz & Stolze, 2009, 2010). In contrast, we used the network limitation given by our expert respondents; for our calculations we included all actors nominated as important for the EU FFPD Network by at least three different experts. Of course, the calculations and numbers of a network with partially missing responses are smaller and less stable compared to calculations with confirmed network data. However, this study confirms that it is worth trading exact but limited calculations for a closer look at all relevant network actors in order to draw representative conclusions about the entire respective field.

5.4. Limitations

Our study can only be seen as a beginning for the analysis of networks in the field of food policy of the European Union. Although we have a useful sample thanks to a considerable number of prestigious respondents, we did not succeed in interviewing all powerful actors. For example, we underestimated the role of EFSA, assuming that it plays a passive role in policy-making. Another limitation stems from the timing at which the interviews were conducted, just before Brexit. We can only make assumptions about the effects that may have occurred since the loss of UK as a central actor. Finally, although we contacted potential interviewees by stating that we were coming from a university with an exclusively academic interest in the data, respondents may still have had some presumptions that their answers might have consequence in their domain. For this reason, there is a risk that respondents may under- or overreport. Usually, powerful actors tend to underreport and less powerful actors tend to over report their relationships.

6. Conclusion

The purpose of this study was to describe the EU FFPD Network by identifying network actors and clarifying their information exchange. Based on theories of interest mediation (Atkinson & Coleman, 1989) as well as of power, exchange, and resource dependencies (Knoke, 1990), we developed a practical approach to analyse the reputation network and the communication network of the functional food sector.

The policy regulating the European functional food market has been legally and hierarchically restructured over the last 20 years. Consequently, new important and prestigious network actors started to influence the policymaking process. For the first time the network structures have been empirically assessed, resulting in a precise picture of important network actors. Additionally, this paper provides insights to understand the resource dependencies (information, financial capacities, language know-how, etc.) in the functional food policy domain which affected the policy adopted.

By stating the relations between powerful network actors and their agile communication capabilities in the functional food policy area, we were able to practically contribute to the existing literature on legislators' and interest group behaviour in EU policymaking (Eising, 2007; Henning, 2009; Wonka & Haunss, 2020). More precisely, we measured network characteristics such as the normalised in-degree centrality and the normalised betweenness centrality, which allowed us to derive a clearly centralized and hierarchical structure of the EU FFPD Network. The network core can be defined as the EU organs as well as big interest groups and companies. Peripheral actors in the reputation network, revealing remote prestige or remote importance of actors, are irrelevant for information exchange. Conversely, our findings indicate that peripheral actors in the communication network may nevertheless be of relevance to other network actors in terms of power, performance, and/ or trust.

In a next consequential step, the findings might be put into context with a more detailed understanding of information exchange, for instance, in relation to the network actors' policy concerns. This could lead to an understanding of different coalition types in the EU FFPD Network or of how information exchange might influence policymakers' decisions.

Our research can only be considered a limited case study and a starting point for trying to understand the complex information exchange and communication structures within EU's diverse food policy domains. Further research on food policy networks is needed to give a more precise picture. For instance, it would be interesting to compare the food policy network with other policy networks such as the CAP network. Especially since considerations are being made arguing that an imminent change due to the environmental threats will merge the CAP and the food policy into a common European Common Food Policy including all actors from-farm-to-fork (International Panel of Experts on Sustainable Food Systems, 2019).

In addition, our approach regarding EU's functional food policy can serve as an example for identifying key actors and information exchange in other countries with a strong market for health foods such as Japan or the United States (U.S.) (Brandenburger & Birringer, 2015) This seems reasonable given the sheer size of the global health food market, worth over 500 billion U.S. dollars (IFT, 2020); indicating the relevance of analyses of the health food sector and its political environment.

CRediT authorship contribution statement

Sonja Jost: Conceptualization, Software, Validation, Formal analysis, Methodology, Investigation, Data curation, Writing – original draft, Visualization, Project administration. **Marc Birringer:** Writing – review & editing, Supervision, Funding acquisition. **Christian Herzig:** Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Appendix A. Basic understandings as part of the questionnaire

Before we begin, I would like **to point out** that we have designed the questionnaire that allows you to answer the questions as an expert of your organization. That is, we are interested in the **position represented by your organization**, which may not **necessarily correspond** to your own personal opinion.

Since you are the expert, we would like to learn as much as possible from you. With this in mind, there are no wrong answers, as your views are crucial to furthering our knowledge and understanding around functional foods.

For the outcome of this questionnaire, it is absolutely critical that we refer to the same definition of functional foods, as no legal definition for functional foods exists. Therefore, below you will find our project's definition for functional food:

Functional food is a food (or drink) or food component that beneficially affects one or more target functions in the body. It may have health benefits beyond basic nutrition.

Throughout this questionnaire, I will discuss the European Union's Functional Food Policy. It comprises all political issues influencing functional or health foods.

The project members are aware that there is no official 'Functional Food Policy' within Europe; nevertheless, this term most suits the purpose of the Functional Food Europe Project.

Appendix B. Network questions on reputation, expert information and monitoring information

1 Reputation:

Please check those organizations from our list that stand out as especially influential regarding European Functional Food Policy and other Food Policies.

2a. Supply of expert information (question for interest groups):

On the other hand, interest groups can frequently provide political organizations with expert knowledge, especially when consequences of complex policies must be evaluated. Such expert information is e.g. the knowledge of the effects of different policy issues on the welfare of different social groups, as well as the knowledge of the attitude of different social groups towards different policy issues. Therefore such expert information can be of interest for political organizations and other interest groups of the sector.

Using our list, please check all organizations to which your organization provided expert information during the negotiation process.

2b. Demand of expert information (question for political groups):

On the other hand, interest groups can frequently provide political organizations with expert knowledge, especially when consequences of complex policies must be evaluated. Such expert information is e.g. the knowledge of the effects of different policy issues on the welfare of different social groups, as well as the knowledge of the attitude of different social groups towards different policy issues. Therefore such expert information can be of interest for political organizations and other interest groups of the sector.

Using our list, please check all organizations from which your organization received expert information during the negotiation process.

3a. Supply of monitoring information (question for political groups):

Interest groups need information about new policies in an early stage of the policy cycle in order to keep their members well-informed. For example, the information about a new reform can be placed on the agenda. Normally, interest groups receive such monitoring information from political organizations.

Using our list, please check all the organizations to which your organization gave regularly monitoring information during the negotiation processes.

3b. Demand of monitoring information (question for interest groups):

Interest groups need information about new policies in an early stage of the policy cycle in order to keep their members well-informed. For example, the information about a new reform can be placed on the agenda. Normally, interest groups receive such monitoring information from political organizations.

Using our list, please check all the organizations from which your organization received regularly monitoring information during the negotiation processes.

Appendix C

See Table C1

Table C1

Top 12 ranking for reputation within the European functional food network [*n*=32].

Rank	Acronym	Category	Organisation	Nominated by
1	BEUC	IG-CON	The European Consumer Organisation	100%
	DG SANTE	PG-EC	Directorate-General for Health and Food Safety	
2	FDE	IG-IND	FoodDrinkEurope	87%
3	EFSA	PG-EFSA	European Food Safety Agency	85%
4	COUNCIL GB	PG-COUNCIL	United Kingdom	81%
	Danone	IG-COMP	Danone	
5	ALDE	PG-EP	Alliance of Liberals and Democrats for Europe	74%
	EPP	PG-EP	Group of the European People's Party	
	S&D	PG-EP c	Group of the Progressive Alliance of Socialists and Democrats in the European Parliament	
	Unilever	IG-COMP	Unilever	
6	COUNCIL FR	PG-COUNCIL	France	71%
	DG AGRI	PG-EC	Directorate-General for Agriculture and Rural Development	
	Nestlé	IG-COMP	Nestlé	
7	COUNCIL DE	PG-COUNCIL	Germany	68%
8	Verts/ALE	PG-EP	Group of the Greens/ European Free Alliance	65%
9	FSE	IG-IND	Food Supplements Europe	61%
10	Coca-Cola	IG-COMP	The Coca-Cola Company	58%
	EuroCommerce	IG-TRA	Euro Commerce	
	Mondelēz	IG-COMP	Mondelēz International	
	UNESDA	IG-IND	Soft Drinks Europe	
11	COUNCIL IT	PG-COUNCIL	Italy	55%
	SNE	IG-IND	Specialised Nutrition Europe	
12	CAOBISCO	IG-IND	Chocolate, Biscuits & Confectionary of Europe	52%
	COUNCIL BE	PG-COUNCIL	Belgium	

Appendix D

See Fig. D1
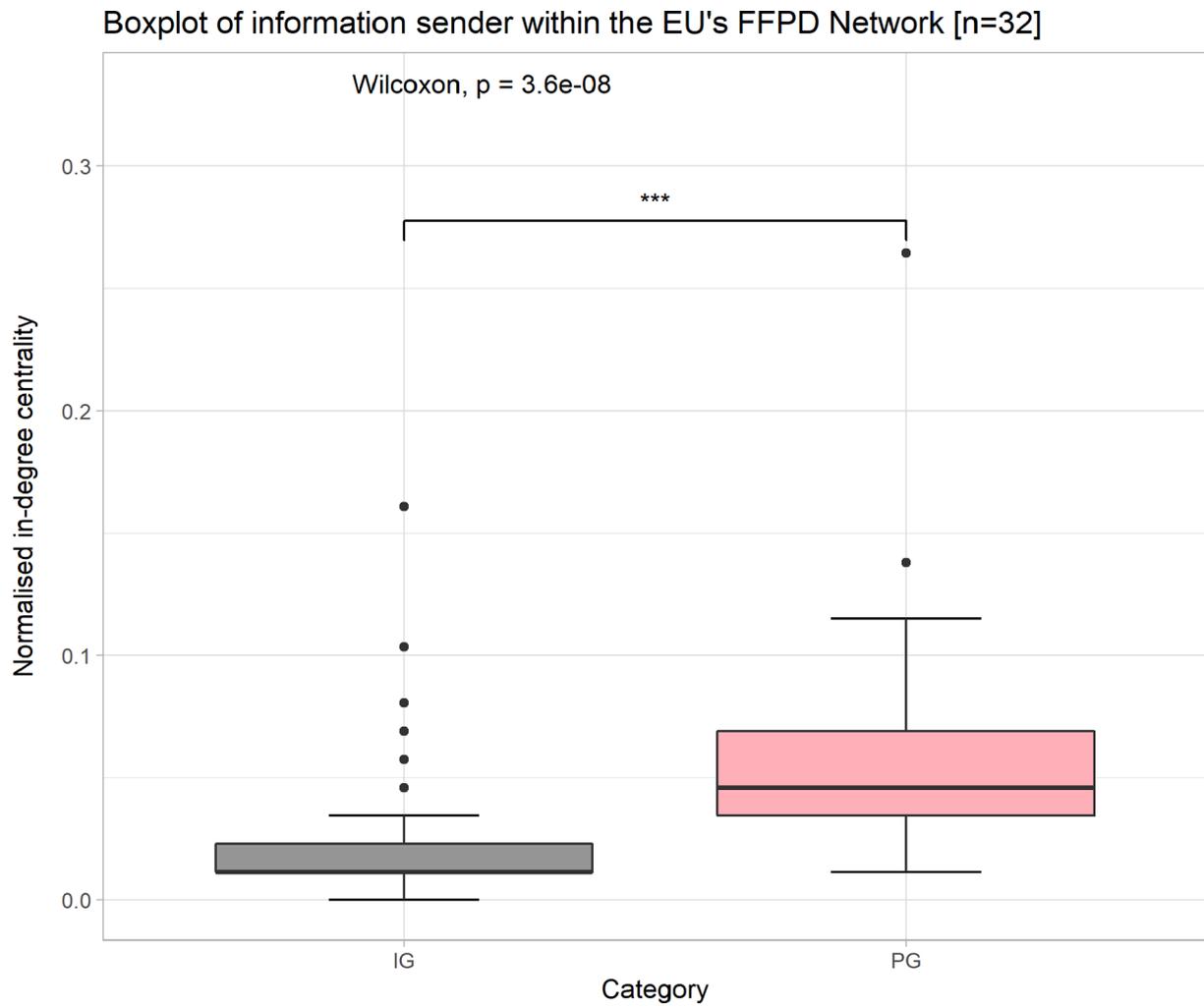
Fig. D1. Boxplots regarding the communication network within the EU's functional food policy domain.

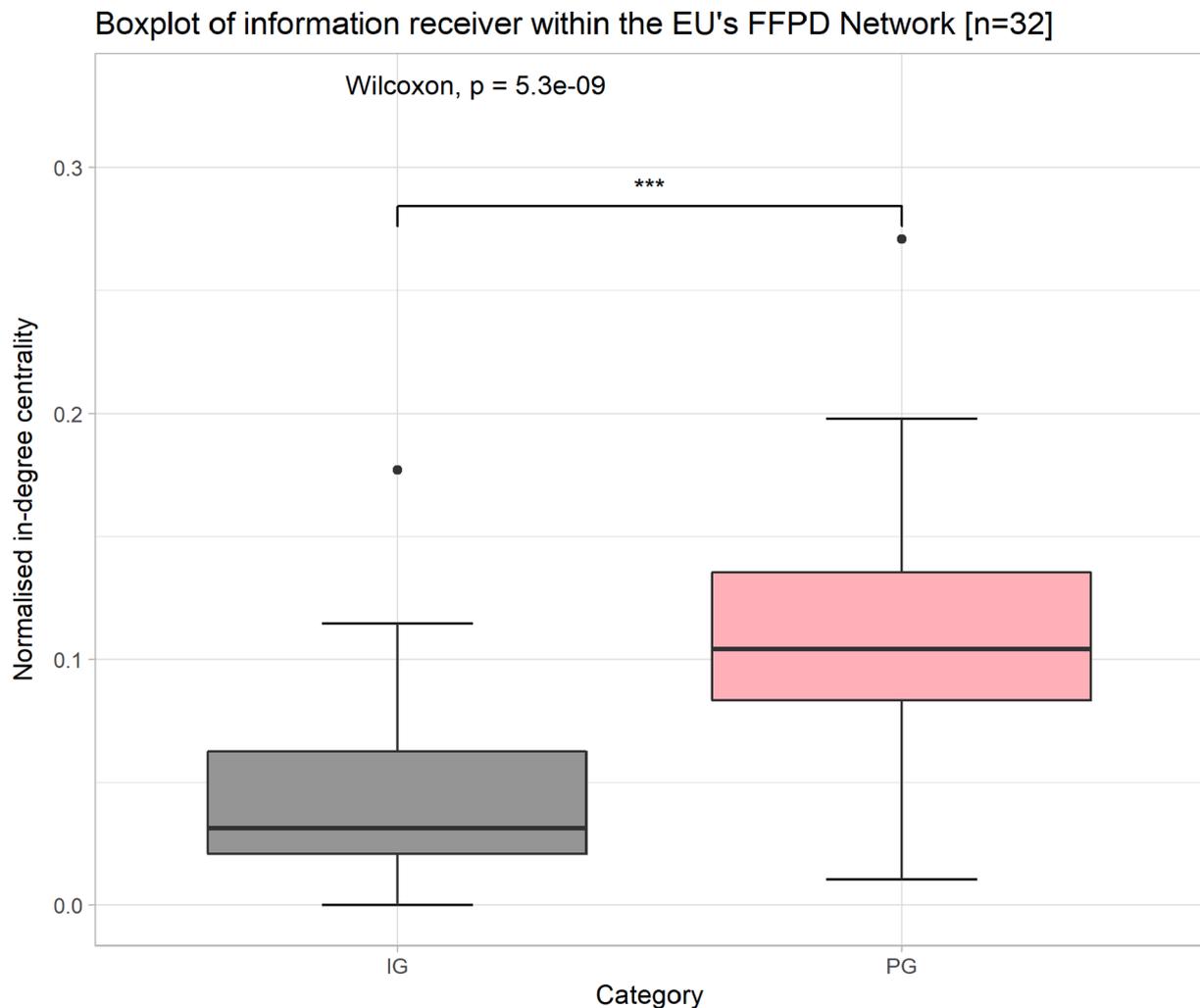## Boxplot of information receiver within the EU's FFPD Network [n=32]

Fig. D1. (*continued*).

Appendix E. Further packages used in R

EnvStats (Millard, 2013), ggpubr (Kassambara, 2020), ggrepel (Slowikowski, 2021), openxlsx (Schauberger & Walker, 2021), psych (Revelle, 2021), reshape2 (Wickham, 2007).

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