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Fueling green connections: Networked policy instrument choices for sustainability regulation

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ABSTRACT

This paper presents a policy network analysis study that examines policy subsystem interconnectedness and cohesion, to explore three constituent regulatory policy instruments that have a combined impact on governing sustainability. The network surrounding the environmental sustainability of biodiesel policy in Indonesia is marked by high interconnectedness and relatively weaker cohesion, properties that impact how policy solutions are formulated through policy actor interactions and define prevailing policy formulation styles. Using primary policy network data on 46 organizations and the review of national regulations, laws, and directives, this paper tests established hypotheses on how instruments that are formulated within the same policy subsystem, share similar characteristics. While overall network interconnectedness and cohesion are important first indicators of policy instrument selection in the literature on policy design, this article recommends also including an examination of network centrality and the characteristics of dominant central actors who are in favorable positions to design policies, to better accommodate for different policy formulation styles.

Keywords: network analysis, policy instruments, policy styles, regulation, sustainability

Introduction

Over the last two decades, ecological and climate change concerns have increasingly occupied the attention of policy makers worldwide. Compounding these issues, volatile prices for fuels have also augmented domestic apprehensions about energy security and the escalating cost of energy imports. This tradeoff has manifested itself in most jurisdictions that strive to find a balance between securing critical supplies of energy to meet development goals, while also regulating environmental and climate impacts, thus giving rise to a veritable web of policy priorities requiring the coordinated action of a wide range of policy actors (Blackstock et al., 2020; Jordan & Moore, 2020).

Modern regulatory responses for reducing environmental degradation in the face of energy-security pressures have taken the form of interdependent policy instruments that are not always deliberately planned to function jointly from the outset. The resulting instrument mixes or policy “toolkits” comprise a variety of state responses such as laws, mandates, certification, and fiscal policy tools, which constantly interact with each other forming a dynamic “network” of evolving policy responses for problems such as deforestation, haze, and loss of biodiversity, alongside matters of energy security. That is, policy instruments seldom work alone. And yet, empirical explorations of the network properties of regulatory policy instruments within the context of a dynamic network of policy actors, remain scant.

That policy instruments bestride both policy creation and implementation is now well established in the literature on policy design (Howlett & Lejano, 2013; Howlett & Mukherjee, 2018; Peters et al., 2018). Formulation and implementation of relevant regulations, in sectors such as forestry, agriculture, and energy, also foster their own institutionalized policy *styles* that guide how policy

actors work together (Howlett & Tosun, 2018). While the original policy styles concept indicated national differences in policy making, such overarching policy formulation styles at the level of sectors additionally entrench overall policy preferences for, for instance, the use of “market, government or non-profit forms of organization” (Howlett, 2009, p. 74), and can dictate a more specific tendency to choose one policy instrument (such as regulation) over others (such as public information campaigns) given previous successes. This means that the effective design of regulatory policy instruments is restricted by significant policy legacies and strong implementation preferences, which determine how well policies can work together toward a united goal (Maor et al., 2017). Contemporary notions of policy instruments indicate that the design of a policy instrument is not static, as previously assumed. Rather, it is the transient manifestation of networked political priorities that guide how policy actors articulate policy aims and allocate means to achieve them (Capano & Howlett, 2020).

The constellation of such policy actors has seldom been operationalized as an independent variable explaining policy design. Policy actors interact in networks while each functioning within their own set of interests and endowments, engaging in interactions that are historically grounded, restricted by prevailing norms and institutions, and subject to uncertainty and knowledge limitations (Howlett, 2019). The resulting networks of these policy actors, their relationships, and reactions affect the choices that are made during policy formulation, often streamlining the characteristics of different policy instruments (Bressers & O'Toole, 1998, 2005; Skodvin et al., 2010).

While hypotheses about the link between policy network structure and the patterns observed in their resulting outputs have been notable, especially in the policy instruments literature (most prominently associated with the joint works of Bressers & O'Toole, 1998, 2005), the empirical testing of these hypotheses has remained scarce. And yet, finding explanations about instrument choice, especially those made with environmental sustainability repercussions, remains an increasingly critical area of research on regulation and governance. To this end, this paper marries an empirical focus on regulatory instruments governing an environmentally sensitive energy product—biofuels—with an investigation of the policy network within which these instruments are formulated. The main research question thus motivated by this article asks: *to what extent do regulatory instruments that are formulated within the same policy subsystem, share similar characteristics?* The study uses the Indonesian case of biofuel governance to test hypotheses originally proposed by Bressers and O'Toole (1998, 2005) about the instrument choices that result from policy scenarios marked by varying degrees of network interconnectedness and cohesion (Bressers & O'Toole, 1998, 2005). In doing so, the paper makes both an empirical contribution to the realm of sustainability governance, and tests known generalizable assumptions about the instrument choice styles that can prevail within policy network contexts.

Network characteristics and styles of policy instrument choice

The theoretical contribution of this paper builds on the existing understanding of the relationship between the structural properties of policy networks (interconnectedness and cohesion) and the policies that are selected through them during the process of formulation. Such an exercise becomes, especially pertinent when analyzing multiple regulations that can coexist and interact in policy mixes, combining their impact toward meeting a broad policy goal such as energy sustainability (Flanagan et al., 2011). This harmonization of different policy elements necessitates a joint effort by multiple policy actors within the concerned policy subsystem to align their activities in support of particular policy aims, such as those related to energy, water, or the environment (Bressers et al., 1994). To this end, studies such as those by Metz et al. (2019) have more recently developed analyses of “actor-instrument networks” and what they can reveal about the concerted preferences of actors for certain instruments. To add to this body of knowledge, this paper more closely examines the substantive content of regulatory instruments formulated within a policy network and what this may reveal about the instrument choice implications of existing policy styles.

A network perspective on instrument choice represents a “second-generation” theorization of policy styles that puts greater emphasis on the contextual variables determining how and which instruments get appointed by policy makers (Howlett, 2004). Analytically, an examination of styles of policy formulation entails looking at the ‘observed preference of national governments for certain types of instruments given the nature of state-society relations existing in each nation’ (Howlett, 1991, p. 16). There exists a notable correspondence between how formulators select portfolios of policy instruments, and how these choices are, in turn, affected by enduring policy styles (Linder & Peters, 1989). This notion has significant implications for how the policy sciences can investigate processes of policy formulation, as well as the choices that are made therein. *Instrument styles*, therefore, echo and are embedded within institutionalized sets of interactions between those tasked with formulating policy responses and hence precipitating distinct implementation logics over time (Bekke & Meer, 2000; Howlett, 2004; Knill, 1999; Rhodes, 2006). They represent distinct, national patterns of policy making in terms of substantive *content* (e.g., favoring regulatory enforcement versus mechanisms of moral suasion) as well as formulation *processes* (for example, exhibiting a preference for fueling either incremental or more radical forms of policy change) (Freeman, 1985; Gustafsson & Richardson, 1980). However, this conceptual progress has also revealed the numerous challenges that exist when trying to utilize the policy styles lens for comparative research on policy design as styles of instrument choice can differ within jurisdictions, by problem areas, and even by the types of formulation processes that are predominant in sectors such as health, energy, and financial policy (Freeman, 1985). Environmental policy, for example, has seen major shifts in policy making styles, from the exclusive use of command-and-control regulatory instruments to policy situations that are more conducive to market-based and incentive-oriented mechanisms for controlling pollution (Jordan et al., 2005; Wurzel et al., 2013). At a more jurisdictional level, while some evidence exists in the case of OECD countries suggesting some convergence toward a new market-oriented design style that has departed away from earlier legalist and more corporatist modes of governing (Jordan et al., 2005; Jordana & Levi-Faur, 2004; Majone, 1994; Turner & Hulme, 1997 among others), the situation in other regions has been less clearly investigated. Asia, for example, represents a region characterized by significant policy design diversity in terms of institutional structures, practices, and established preferences for policy making (Mukherjee & Howlett, 2016).

Examining how different instruments are chosen within policy network contexts is one avenue of research that can begin to address this challenge. Hypotheses forwarded on instrument choice preferences, such as those by Bressers and O’Toole (1998, 2005) allow for systematic inquiry of the impact of policy network structures on the characteristics of chosen instruments. The authors suggest that variable degrees of network interconnectedness and cohesion between government actors and policy instrument target groups can fundamentally influence a particular set of instrument characteristics that are selected during policy instrument formulation.

This is especially the case in situations where changing interrelations between authorities and target groups, or political dissonance between policy actors can lead to diversifying the choice of some instrument elements while ossifying others. Kivimaa and Kern (2016), expound for example, “If the preferences of central actors do not mirror the currently implemented policy mix, they might challenge it in the future. By doing so, unsatisfied actors might destabilize current regulation and push to either introduce new instruments or remove old ones from the mix” (p. 74). This phenomenon is especially true in environmental policy studies where evidence exists that more “bottom-up” and participatory approaches to designing policy solutions (such as product certification and eco-labeling) can better account for homogenous preferences for policy design (Newig, 2012).

Interconnectedness and cohesion as independent variables

A policy network approach can highlight different relationships within a policy subsystem, which can influence policy instrument design decisions. Two such relationships are explored in this article to gauge their combined impact on what features are chosen during policy instrument formulation.

First, *interconnectedness* investigates the level or frequency of interactions between actors of a policy network (e.g., based on routinized meetings, information transfer, or contractual obligations, to name a few). In this study, the interconnectedness of the network is measured using the level of formal collaborations between subsystem actors on matters related to biodiesel policy. Measured thus, interconnectedness alludes to “both to the contacts in the relevant policy formation process (and the habits that have developed in this connection over time) and also the relationships between these actors outside the actual policy process at any particular time” (Bressers & O’Toole, 1998, p. 219). Second, *cohesion* refers to how actors are aligned in terms of their objectives and to some extent, their ideologies. Assuming these characteristics are relatively stable over time in any given policy arena, the theory maintains that *policy instruments that help perpetuate the existing levels of interconnectedness and cohesion are more likely to be chosen than those instruments that may introduce network changes* (Bressers & O’Toole, 1998, p. 220). According to the authors, network interconnectedness and cohesion act as independent variables that determine how *six* instrument characteristics are chosen during the formulation of policy. Namely, these six characteristics are:

1. The provision/withdrawal of resources: What kind of resources are added/taken away by the policy, therefore impacting the range of possible options for the target population? For example, the creation of a new monitoring agency or a reduction in subsidy for a particular fuel.
2. Freedom of choice to apply the instrument: Is there any scope for differentiation in terms of how the target population uses or ‘receives’ the instrument? For example, a tax on gasoline can be applied simply and uniformly across gas stations, but the regulation of environmental management systems can vary by company, land parcel, land-use type, and so forth.
3. Unilateral/bilateral action: Is the instrument implemented solely by and within the government or does the government partner with other multilateral stakeholders to enact it? For example, choices made to pursue public-private partnerships (PPP) vs. direct provision.
4. Normative appeal: How does the instrument appeal to the values or behavior of the policy target? For example, a legal directive or law appeals to the law-abidingness or compliance of the target group by penalizing non-compliance.
5. Proportionality: To what degree is the size and intensity of the instrument flexible and can be adjusted in step with how policy targets respond? For example, are there gradations in terms of how a certification scheme or eco-label is applied to a product, and the price that producers can demand that product?
6. Role of policy makers: Is the instrument *formulated* solely by and within the government, or does it include elements that are designed by other multilateral stakeholders (e.g., international organizations or academics)?

Marked by high/low interconnectedness and high/low cohesion, four types of policy network structures are thus possible and these represent four distinct sets of hypotheses (H1 –H4) about the choice of instrument characteristics as shown in Table 1. Given that the policy network case presented in this article is marked with *high interconnectedness* and *low cohesion* (second column, Table 1), the hypothesis guiding the analysis of the three constituent policy instruments is as follows:

“High interconnectedness and low cohesion in the subsystem, will result in characteristics of all three constituent policy instruments to include: (1) limited withdrawal of resources, (2) uniform implementation across different target groups; (3) many implementation partners; (4) normative appeal (compliance) on the part of targets; (5) proportionality or flexible design that is responsive to how target groups behave; (6) design decisions are taken primarily by the government.”

TABLE 1. Instrument choice hypotheses based on network structure

Instrument characteristics	Given network structure:			
	H1: Interconnection (high) Cohesion (high)	H2: Interconnection (high) Cohesion (low)	H3: Interconnection (low) Cohesion (low)	H4: Interconnection (low) Cohesion (high)
1) Provision or withdrawal of resources	Net provision	Limited withdrawal	Withdrawal	Provision
2) Freedom of choice to apply	Present	Absent	Limited	Present
3) Unilateral or bilateral action on target groups	Bilateral or multilateral arrangements	Many bi- or multilateral arrangements	Unilateral	Unilateral
4) Normative appeal	Absent	Present	Present	Absent
5) Proportionality (Individualized or generally applied)	Present (individualized)	Present (individualized)	Present (generally applied)	Present (not as individualized)
6) Role of policy makers in the implementation	Implementation by a policy maker or by affiliated organizations	Implementation by a policy maker or by affiliated organizations	Implementation by parties other than policy makers	Implementation by a policy maker or by affiliated organizations

Note: Adapted from Bressers and O'Toole (1998)

To elaborate upon the causal argument made by Bressers and O'Toole (1998) regarding why these hypothesized relationships exist between policy network structures (interconnectedness and cohesion) and six specific instrument characteristics:

1. Low cohesion between government and target groups leads to instrument choices that are aimed more at penalizing undesirable behavior, as the government is not already positively inclined to maintain a long-standing relationship. Strong interconnection, however, can limit the extent of this withdrawal of incentives, as it is in the interest of the government to maintain working connections with target groups due to frequent communication and coordination.
2. If there is limited alignment between the objectives of government and those of target groups (i.e., there is weak cohesion within the policy network), there are corresponding limits to how much freedom of choice target groups are afforded in adapting to policy instruments. In this situation, instruments are more likely to be uniformly implemented without any special provisions for application by specific target groups.
3. A weakly cohesive policy network, also necessitates the use of explicit covenants or intensely negotiated bilateral agreements with major target groups (such as industry) and implementation partners such that the enactment of the policy can be more efficiently

achieved by the specific action of such stakeholders. Such instrument choices are also reinforced by high-interconnectedness whereby there are regular channels of communication and existing negotiation processes between government and target groups.

4. A network situation of low cohesion between the government and target groups (and other relevant stakeholders) signals the heightened use of coercion-based or normative instruments (such as regulations) that make use of the governments' legitimacy to control the behavior or elicit the compliance of target groups.
5. A high degree of interconnectedness between the government and target groups indicates that the government has regular avenues of information about individual differences within the target group, which can lead to design choices that make instrument implementation more flexible or proportional to the distinct behaviors within target groups.

RESEARCH DESIGN

This study contains two research components and is based on a mixed-methods approach. First, the instrument analysis component of this research scrutinizes three policy instruments that govern sustainability in the biodiesel policy mix of Indonesia, to ascertain the type of instrument characteristics they each entail. Second, the network analysis component allows for interconnectedness and cohesion to be evaluated within this policy context.

The unit of analysis here is the Indonesian biodiesel policy subsystem. It represents a “typical” case of low cohesion and high interconnectedness, allowing for a deeper investigation of variance that lies within the case itself. Given the research question guiding this study, an analytic-heuristic case study design (Yin, 2012) was chosen as appropriate wherein a causal investigation is used to enhance existing theory by generating new hypotheses through the case. Consistent with scholars of the case study research design (King et al., 1994; Seawright & Gerring, 2008; Yin, 2012), the unit of analysis was a system of action, rather than an individual or a group of individuals.

Instrument analysis

In the last decade, global production of alternate fuels—particularly those derived from plant sugars and oil crops—has flourished with the help of government investment, national mandates, and lucrative global trading opportunities. Biofuels also encompass a quintessential “wicked problem” of public policy, posing a web of interlocked dilemmas ranging from energy security concerns to finding fuel alternatives for reducing imports and improving balances of payment, to mitigating global climate change impacts from energy use (Koizumi & Ohga, 2007; Sorda et al., 2010; Zhang, 2008; Zhou & Thomson, 2009). In addition, mainstream biofuels today are also held responsible for large-scale ecological changes caused by intensive agricultural production of feedstock, that apart from having local, regional, and global environmental repercussions also have meant international censure for producer countries, especially from trade partners.

Indonesia, as the largest producer of biofuels derived from palm oil, is one from the handful of cases around the world where these myriad policy issues pertaining to sustainability are contained and addressed in the same jurisdiction with the use of a variety of policy instruments. Three major regulatory policy tools formulated by the Government of Indonesia (GOI) elicit and govern environmental sustainability repercussions along the commodity's supply chain, and these instruments either have *direct* effects on sustainability as part of feedstock production upstream, *indirectly* impact the environment by involving the final commodity downstream or have sustainability “*spillovers*” across sectors. Respectively, these instruments are the Indonesian Sustainable Palm Oil (ISPO) certification standard that is a re-establishment of existing multi-ministerial regulations into a dedicated package that streamlines national sustainability certification efforts (Ministry of Agriculture Regulation No. 19/2011), the national mandates on biodiesel use (Ministry of Energy Regulation No. 32/2008) that requires a progressive blend of biodiesel and diesel to be supplied across the nation, and

the Basic Forestry Law (Law No. 41/1999) that has established a classification system for national forests which is used to site oil palm plantations for biodiesel production.

Instrument analysis methods

To review the substantive characteristics of each of the three selected instruments both secondary data from published reports and regulatory documents as part of a larger research project. Data sought for the 2006–2012 period included biodiesel production, consumption, projection data available through the GOI Ministry of Energy, land use/land cover (LULC) data publicly available from the GOI Ministry of Forestry and the World Bank, and plantation cover data from the Ministry of Agriculture as well as the Food and Agriculture Organization (FAO). Carbon emissions data from academic publications, research institute reports, private sector approximations as well as government projections were juxtaposed to represent the existing range of estimates. In addition, content analysis was conducted of English and Bahasa Indonesia versions of official government publications, peer-reviewed literature, NGO reports, public and private sector presentations, and relevant newspaper articles spanning the period of study.

Network analysis

The SNA methodology for this case study has been derived from, first, fundamental SNA methods texts (including Prell, 2012; Wasserman & Faust, 1994) as well as, second, key policy network studies (Henry, 2011; Ingold, 2011; Weible & Sabatier, 2005) to operationalize the conceptual premise that actors join coalitions based on shared ideologies and that those who share the same belief systems have the tendency to coordinate action in a non-trivial manner. The social network analysis (SNA) software UCINET and its constituent NetDraw function were used for analysis and visualization.

As proposed by Milward and Provan (1995), as well as Weible et al. (2011) in their comments on managing a networked notion of governance, one of the main reasons why policy actors may form a network through repeated interactions is to formally coordinate their activities (implying interconnectedness), as well as in the interest of shared goals (implying cohesion). Therefore, in addition to network data on formal collaborations on tasks and projects and agreements based on similar organizational objectives, data on affiliations from association memberships were sought to shed light on the history of coordination between the different actors of the biodiesel policy subsystem. Intuitively, the higher the number of ties connecting the actors of a network, the more consistent or “tight” the network is—an observation captured by measuring the overall density of existing formal working relationships within the network. Subgroups or “clusters” can work to undermine the “tightness” of the network—especially so given the various history of a close knit working relationships among some actors of the network.

In short, interconnectedness is being operationalized here based on data on affiliations (i.e., how subsystem actors are co-members of different multi-party associations), and cohesion, is being observed here first through the collaboration network (i.e., how subsystem actors formally work together on biodiesel policy matters), and secondly, through network correspondence analysis of affiliations to show how actors have stayed clustered together and moved together (measured by joint variation) over time indicating the history of how they have co-prioritized sustainability along the supply chain of biodiesel. This latter point captures elements of shared ideologies and shared objectives among policy actors, which should not be conflated to only mean collaboration.

Network analysis methods

The network component of this study relied on network data collected over the period of one year, on organizations that make up the biodiesel policy subsystem in Indonesia. These data were collected sequentially using an electronic network survey to collate a roster of those organizations that constitute the policy network surrounding Indonesian biodiesel. Data collection through this roster proceeded first via email and telephone interviews, followed by fieldwork for additional and follow-up interviews. One of the challenges of this kind of network study spanning a long-term frame

concerns the issue of boundary definition as network membership can change during the study. To this end, the “realist” approach to SNA boundary approximation (Wasserman & Faust, 1994) was employed so that data collection allowed actors and key informants to identify and name other members who remain active in biodiesel policy over one year despite any internal or professional changes. A total of 46 organizations were identified as making up the network, through data elicited from interviews and surveys with at least one senior representative from each organization. These organizations are listed in Table 2.

TABLE 2. Actors of the biodiesel policy network (2006–2013)^a

Organization name	Abbreviation	Organization type
Ministry of Energy and Mineral Resources	ESDM	Government
State Ministry of Research and Technology	RISTEK	Government
Ministry of Forestry (DEPHUT)	DEPHUT	Government
Ministry of Agriculture (DEPTAN)	DEPTAN	Government
Ministry of Trade (DEPDAG)	DEPDAG	Government
State Ministry of Environment (MENLH)	MENLH	Government
National Biofuel Development Team (TimnasBBN)	TimnasBBN	Government
Indonesian Palm Oil Commission (IPOC)	IPOC	Government
World Bank Group (IBRD-IDA, IFC, MIGA)	WBG	International
Asian Development Bank (ADB)	ADB	International
Ford Foundation	FF	International
Indonesian Palm Oil Producers Association (GAPKI)	GAPKI	Producer/Private
Association of Indonesian Biofuel Producers (APROBI)	APROBI	Producer/Private
Roundtable for Sustainable Palm Oil (RSPO)	RSPO	Producer/Private
PT Eterindo group	–	Producer/Private
PT. Indo Biofuels Energy	–	Producer/Private
PT Wilmar	–	Producer/Private
PT Sumi Asih	–	Producer/Private
PT Musim Mas	–	Producer/Private
PT Sinar Mas	–	Producer/Private
PT Salim/Indofood	–	Producer/Private
Indonesian Institute of Sciences (LIPI)	LIPI	Academic
Bogor Agricultural University (IPB)	IPB	Academic
CGIAR (Including CIFOR and ICRAF)	CGIAR	Academic

Organization name	Abbreviation	Organization type
Indonesian Bioenergy Experts Partnership	IKABI	Academic
Renewable Energy Forum of Indonesia	METI	Academic
Indonesian Forum for Environment (WALHI)	WALHI	NGO
Sawitwatch	–	NGO
World Wildlife Fund (WWF)	WWF	NGO
Conservation International (CI)	CI	NGO
Non-Timber Forest Products/SETARA	NTFP	NGO
University of Papua—Tanjung Pura	–	Academic
Indonesian Palm Oil Research Institute (PPKS/IOPRI)	IOPRI	Academic
Institute of Technology Bandung (ITB)	ITB	Academic
PT Gaikindo (automobile association)	–	Producer/Private
PT Mutuagung Lestari (certification)	–	Certification Agency
Pertamina (Persero)	–	State Owned Entrp.
PT Bayer	–	Producer/Private
LINKS	LINKS	NGO
PT Sai Global	–	Certification Agency
PT TUV Nord	–	Certification Agency
PT Sucofindo	–	Certification Agency
APKASINDO (Palm Oil Smallholder Association)	APKASINDO	Producer/Private
GPPI (association of plantations)	GPPI	Producer/Private
Indonesian Palm Oil Society	MAKSI	Academic
Ministry of Transport	MENTRAN	Government
National Development Planning Agency	Bappenas	Government

^a The six types of organizations (i.e., government, international/multilateral, private sector producers, academic, non-government organizations, and independent certification agencies) were determined based on the primary appointment specified by the organizations themselves, through their mission statements, reports and other identifying documents, and verified websites. Government organizations were defined by their position within government ministries and agencies, private sector producers in Indonesia all have a ‘PT’ (Perseoran Terbatas) designation which indicates they are limited liability companies. Universities and academic institutions (whether

state-funded or autonomous) were labeled as ‘academic’ as their primary role in the network concerned scientific research. According to International and national non-government organization designations are self-explanatory.

The investigation proceeded by presenting this roster to representatives of the organizations in the network and asking them to identify those on the list (or any other) with whom their organization formally collaborate on matters related to biodiesel and whose organizational objectives are similar to their own. Second, in order to gauge affiliations, these participants were also asked to indicate the relevant multi-stakeholder associations of which their respective organizations are members. Affiliation data were further triangulated using publicly available information on multistakeholder associations. Eight such associations were identified as being relevant to biodiesel policy and these are listed in Table 3. Standard SNA procedures were thereafter employed on the resulting networks to gauge interconnectedness and cohesion. Specifically, the interconnectedness was assessed using the affiliations data and a core-periphery analysis of that data to pinpoint those organizations and associates that most frequently co-habited the biodiesel policy network. And cohesion was examined through density examination of the collaborations data, and using correspondence analysis of affiliations data, to show the degree to which actors of the network have historically and formally cooperated on biodiesel policy by “clustering” or creating sub-groups within the network. Further details on this correspondence analysis, relevant descriptive statistics, limitations, and validity considerations are elaborated upon in Appendix A.

TABLE 3. Associations within the Indonesian biodiesel policy subsystem (2006–2013)

Name	Abbreviation	Majority membership	Year established
Palm Oil Producers Association of Indonesia (*GA)	GAPKI	Industry	1981
Renewable Energy Forum of Indonesia (*ME)	METI	Multi	1999
Indonesian Palm Oil Society (*MK)	MAKSI	Academic	1998
Forum Biodiesel Indonesia (*FBI)	–	Academic	2002
Roundtable on Sustainable Palm Oil (*RS)	RSPO	Industry	2003
National Team on Biofuel Development (*TN)	Timnas BBN	Government	2006
Biofuel Producers Association of Indonesia (*AB)	APROBI	Industry	2007
Indonesian Sustainable Palm Oil program (*IP)	ISPO	Government	2011

Qualitative data from interviews with network members as well as the analysis of relevant policy documents, enriched and triangulated findings of interconnectedness and cohesion in the network.

Network boundaries

As a first step, 23 biodiesel policy experts were identified as key informants through purposive sampling and a review of authorship of the major literature covered as part of the document analysis for this research. Snowball sampling proceeded with these key informants who were asked to name

those organizations which they thought were the most actively involved with Indonesian biodiesel policy making. (See Appendix A for more information on respondents).

In order to reach actors of the entire policy network, the responses of the key informants were verified against the subsystem database that was constructed initially to distinguish those actors who have been present for multiple meetings over the course of the last 6 years, based on affiliations data. Through this exercise, an initial roster of actors estimated to make up the policy network was collated and used to create the network survey. After short-listing organizations into the policy network roster, the key informants were then asked to suggest names of representatives from those organizations who can be contacted with the survey. In the event that candidates were unable or unwilling to take the survey, they were asked to name other, alternate representatives from their organization who were then approached. Following Knoke et al. (1996), policy “actors” in this study were defined as key representatives of organizations that take part in the biodiesel policy process and specifically, are part of the biodiesel policy network unearthed through the subsystem mapping activity and key informant interviews.

As the data collection proceeded, if further actors were mentioned by those taking the survey, these new names were included in the roster only if they were also mentioned by one other respondent. This manner of snowball sampling is preferred to simple random sampling for collecting network analysis data, and it is also consistent with the realist approach to network boundary approximation mentioned earlier in this section (Frank, 1979; Wasserman & Faust, 1994).

RESULTS

Instrument analysis

Each of the three instruments included in this study is aimed at regulating the behavior of relevant policy targets—both industry and society—and they all exhibit distinct instrument choices that formulators made with respect to the provision of resources, freedom of implementation, bilateral action of target groups, normative appeal, proportionality, and the role of policy makers in implementation.

Instrument 1: Biodiesel use mandates—GOI Ministry of Energy Regulation 32/2008

Indonesia issued use mandates for biofuels (ethanol and biodiesel) in 2008 as a part of an invigorated national interest in securing domestic energy supplies in the face of volatile world fuel prices. A strong interest in maintaining energy sovereignty and reducing the dependence on imported fuels has driven the policy push for biodiesel mandates in Indonesia since 2006. Although research and development activities surrounding biodiesel officially began more than a decade ago in Indonesia during the mid-1990s, the commodity then was not a government priority and its development was confined to a few laboratories as oil remained inexpensive and relatively abundant (Wirawan & Tambunan, 2006).

The choice characteristics defining the mandates as a policy instrument are as follows:

- *Provision of Resources:* Since their formulation, the design of the mandates has built-in fiscal resources as incentives for compliance by target groups. These resources have been used to deliver government adjustments to index and export prices of biofuels, along with subsidies for producers.
- *Freedom of Choice:* As a formal regulation applied to all target groups, the mandates do not afford any freedom of choice to apply. However, its phased implementation has been shown to be flexible based on relative prices of feedstock and fossil fuel, as well as distributor concerns.
- *Some bilateral action on target groups:* There are two target groups for these mandates (biodiesel producers as well as distributors). The government has been responsive to the

behaviors of both these groups in making gradual adjustments to the required values contained in the mandates since 2006.

- *Normative Appeal Present with Incentives:* The regulation of mandatory compliance to consumption targets presents mostly a normative appeal to the target group. However, other regulations and price incentives for producers have also been present as incentives to encourage production.
- *Individualized Proportionality:* With different targets for households, industry, and the transport sector, this instrument shows a level of proportionality that is individualized to different target groups.
- *Role of Policy makers in Implementation:* The Ministry of Energy, through its Directorate General of Renewable Energy and Energy Conservation (EBTKE), is the singular implementer of these mandates.

Instrument 2: Indonesian Sustainable Palm Oil (ISPO) standard: GOI Ministry of Agriculture Regulation 19/2011

As of March 2011, the GOI put in place the Indonesian Sustainable Palm Oil (ISPO) standard to govern palm oil production. Rivaling the more widely known Roundtable on Sustainable Palm Oil (RSPO)—an international consortium of industry, government, and research actors that has established voluntary sustainability certification standards—the ISPO is designed to be a mandatory certification standard for all palm oil producers functioning in Indonesia (GOI, 2011). However, its international acceptability as a sound standard ensuring environmental sustainability when compared to the RSPO is in question given Indonesia's inherent challenges related to oversight capacity (Caroko et al., 2011). There are in total seven principles that companies must abide by according to the standard are general and these include:

- Operationalizing licensing and management tools.
- Articulating technical guidance for oil palm cultivation management.
- Enforcing environmental management and monitoring.
- Responsibility toward employees.
- Social responsibility toward the community.
- Economic activity that enhances community empowerment
- Business improvement in a sustainable manner.

Forty criteria and 128 indicators follow from these principles and make up the ISPO certification standard, all of which are based on existing regulations and laws furnished by the President, the Ministries of Environment, Forestry, Labor, Agriculture, and the National Land Agency (Suharto, 2012). The adherence to this multitude of regulations is the main difference between the ISPO and the voluntary Roundtable for Sustainable Palm Oil (RSPO), which has arisen as a significant non-state, a market-driven form of certification because the former is a legally enforceable standard, subject to penalties in the case of non-compliance.

The attributes chosen for the ISPO as a policy instrument, are as follows:

- *Withdrawal of Resources:* The ISPO is marked with a strong withdrawal of resources as it is a mandatory system and significant sanctions are in place for non-compliance.
- *No Freedom of Choice to Apply:* The ISPO standard applies to *all* palm oil producers in Indonesia irrespective of whether they are Indonesian or foreign-owned. As a result, there is no freedom of choice to apply for the target group.

- *Unilateral action on target groups*: Through the ISPO, the government unilaterally acts on the target groups. The standard, as an affirmation of existing regulations, is characterized more by “vertical rule-setting or order giving” than “horizontal mutual adjustment” (Bressers and O’Toole 224)
- *Normative Appeal*: The ISPO is more of a legal rather than an economic instrument. Therefore, a strong normative appeal is made to the target group’s compliance.
- *General Proportionality*: The ISPO applies a single legal framework that is to be applied generally to all producers.
- *Role of Policy makers in Implementation*: The government has directly assigned itself as the main implementer, while the actual certification will be carried out by third-party auditors trained by the Ministry of Agriculture.

Instrument 3: Basic Forestry Law: GOI Ministry of Forestry Law (UU 41/1999)

The GOI Ministry of Forestry forest classification system as defined by the Basic Forestry Law of 1999 is a major instrument for national forest management that has a significant, extended impact on related sectors such as agriculture and land management. As a result, the definitions of different forest use types provided by the classification system have determined how and where biodiesel feedstock plantations have expanded, thus affecting the sustainability of the final product.

According to the Law, all Indonesian forests can be classified as either public state forests (*Kawasan Hutan Negara*) where no private rights are attached or private forests (*Hutan Hak*) which count as forest areas in national accounts even if they entail private ownership (Contreras-Hermosilla et al., 2005). The state forest zone is further divided according to three major land use categories: production forests (*Hutan Produksi*), protection forests (*Hutan Lindung*), and conservation forests (*Hutan Konservasi*). Further sub-divisions exist for these forest types which are summarized in Table 4.

TABLE 4. GOI Forest classification scheme. New basic forestry law (41/1999)

Forest classification Purpose (Kawasan Hutan)		Characteristics	Use management
<i>Production forests (Hutan Produksi)</i>	Source of forest products (e.g., Timber)		Forest concessions
Permanent production forest (<i>Hutan Tetap</i>)	Revenue from forest products	Regular logging	<ul style="list-style-type: none"> • Granted to private organizations, individuals, cooperatives, communities, or state enterprises connected with the forest sector • Tenure of 20–55 years over natural forests • Tenure upto 60 years over HTI
Limited production forest (<i>Hutan Terbatas</i>)	Limited revenue from forest products	Low intensity, selective logging limited clear cutting	
Convertible production forest (<i>Hutan Produksi yang dapat dikonversi</i>)	Available for clear cutting for non-forestry purposes (agriculture, mining, settlements)	Permanent or temporary deforestation, clear cutting	Subject to ministerial approval <ul style="list-style-type: none"> • Proposals from the industry scrutinized before HPK land is released • Allocation over 5–25 years

Forest classification Purpose (Kawasan Hutan)		Characteristics	Use management
			<ul style="list-style-type: none"> New use of HPK land has to comply with local government regulations and contribute to economic development
<i>Protection Forests (Hutan Lindung)</i>	Protection of ecosystem buffer areas, water management, prevention of flood and erosion, buffer against brine water, and maintaining land fertility	Protected area. Logging/clear cutting not permitted	Subject to local government approval <ul style="list-style-type: none"> Limited human activity allowed including the collection of secondary forest products. Not for commercial use
<i>Conservation forests (Hutan Konservasi)</i>	Preservation of floral and faunal biodiversity, ecosystem services, natural buffer zones	Protected area. Logging/clear cutting not permitted	Managed directly by the authority of the central government (MoF) <ul style="list-style-type: none"> Entry fees Recreation facilities Forest use permits
Nature reserve			
Nature recreation park (<i>Taman Wisata Alam</i>)			MoF may issue particular types of lease use permits for non-forestry activities (e.g., mining)
Hunting resort (<i>Taman Buru</i>)			
Grand forest (<i>Taman Hutan Raya</i>)			Managed by provincial governments
National park			Managed by dedicated NP staff. Own budget allocation

The Basic Forestry Law exhibits the following instrument design characteristics:

- Limited Withdrawal of Resources:* By legally limiting the area of forest lands that can be converted for activities, this instrument is marked more by withdrawal rather than the provision of resources. However, the capacity to enforce and implement the classifications has been called into question since the creation of the law, and since the designation of the HPK has facilitated additional forest clearing by industry, “withdrawal” per se has been limited.
- No Freedom of Choice to Apply:* As a law, there is no freedom of choice to apply for the target group. However, internal inconsistencies with forest definitions have meant that the law has been differently applied across provinces.

- *Unilateral action on target groups*: As the UU 41/1999 is a national law, the government unilaterally acts on the target groups. The responsibility for enforcement and oversight falls under the purview of provincial governments.
- *Normative Appeal*: The UU 41/1999 is purely a legal instrument, and is therefore characterized by a normative appeal that is forwarded to the targeted group. However, the ensuing regulations have facilitated the transformation of additional forest areas that can be cleared due to new designations (such as the “convertible production forest” or HPK), which were not part of the original law.
- *General Proportionality*: The law represents a single legal framework that is generally applicable to all producers and target groups.
- *Role of Policy makers in Implementation*: The government (and provincial governments, specifically) is directly responsible for the implementation of the law.

Network analysis

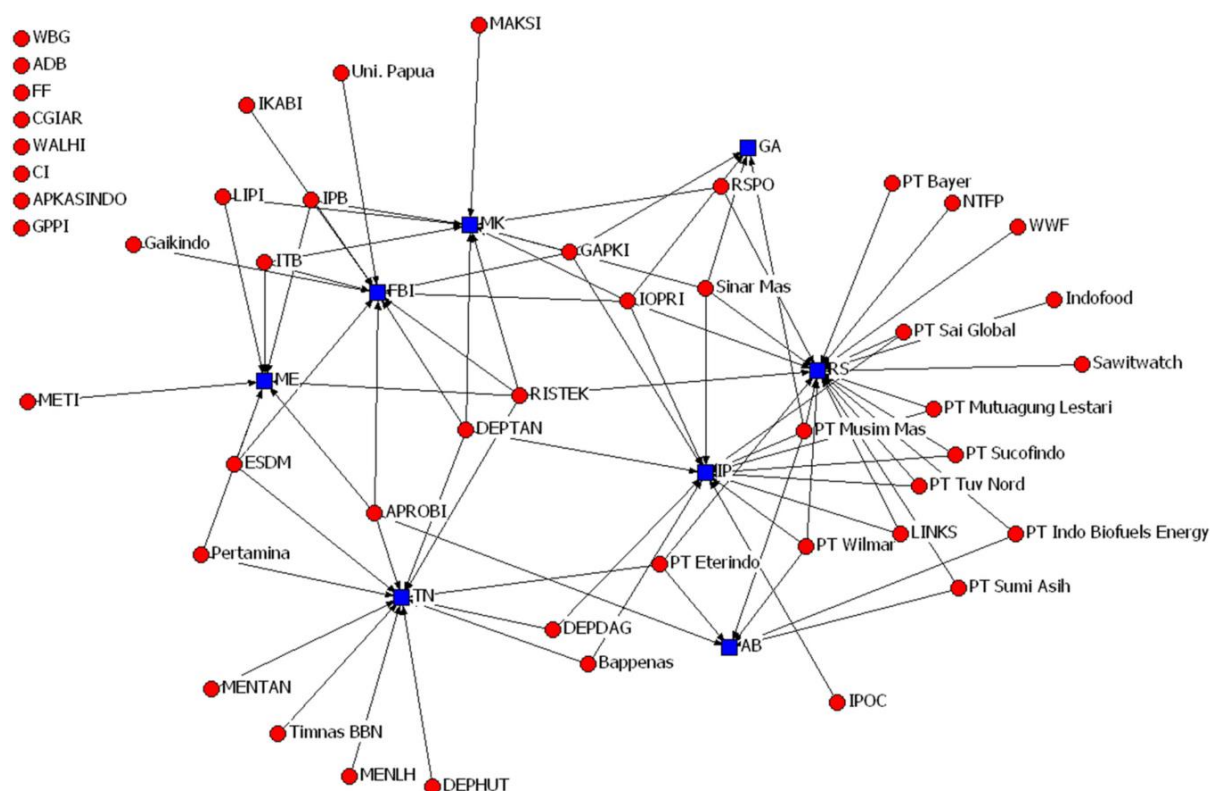
Affiliations and collaborations data were collected separately in the Indonesian biodiesel policy network to draw general conclusions about linkages within members of the network, to help test Bressers and O'Toole's (1998) instrument choice hypotheses. The different actors that constitute the biodiesel policy network have been affiliated together as members of the various associations ($n = 8$) as listed in Table 3.

Mapping interconnectedness

The eight major associations were shown to vary in terms of their number of government, private sector, international, academic, and non-government members. To understand the relative strength of these associations to each other, most (19) members of the biodiesel policy network indicated their membership with the Roundtable for Sustainable Palm Oil (RSPO), then the Indonesian Sustainable Palm Oil program (ISPO) (11) and so on. Figure 1 illustrates the (full) two-mode affiliation network that was derived based on association membership. In the diagram, policy actors are shown as red circles ($n = 47$) while associations ($n = 8$) are signified by blue squares. Membership in an association is indicated by a directed line going from an actor to an association.

Several observations can be made from Figure 1. Firstly, there are eight organizations that are not part of any of the associations, and this is not surprising since the international multilateral organizations (such as the World Bank Group) are autonomous and the Consultative Group for International Agricultural Research (CGIAR) is also an independent, global research group. The palm oil smallholder grower's union (APKASINDO) and the association of Indonesian plantations (GPPI) were not identified as active members of any association, however, once the ISPO is fully implemented, members of APKASINDO and GPPI have to comply with the standard and will therefore be formally linked to the ISPO in the future. The Ministry of Agriculture (DEPTAN) as well as the constituent Indonesian Palm Oil Commission (IPOC), as the main formulators and implementing agencies of the ISPO have engaged large industry and several certification agencies in the pilot phase and this is reflected in the connections leading to the ISPO program in Figure 1. It is also apparent that the ISPO program and the RSPO have several members in common and this confirms findings that compliance with the ISPO is mandatory for all producers, who can also choose to be a part of the RSPO simultaneously (as shown by the example of PT Musim Mas and Sinarmas). The Palm Oil Producers' Association (GAPKI), is no longer a part of the RSPO as of 2011.

Figure 1: Policy network actors and membership in relevant associations of the biodiesel policy subsystem (affiliation ties based on association memberships)



Among other isolates are non-governmental groups such as Conservation International (CI) and the Indonesian Forum for the Environment (WALHI). Along with the CGIAR, these organizations represent a large proportion of research ongoing on the sustainability of palm oil and palm-oil-derived products like biodiesel. This observation is an initial indicator that these actors are likely to not be central in the formal collaboration network as they may have fewer connections to the other members. In terms of overall network interconnectedness, Figure 1 indicates moderately high interconnectedness as 83 percent of the network (39 organizations) is connected through common membership in associations.

Mapping cohesion

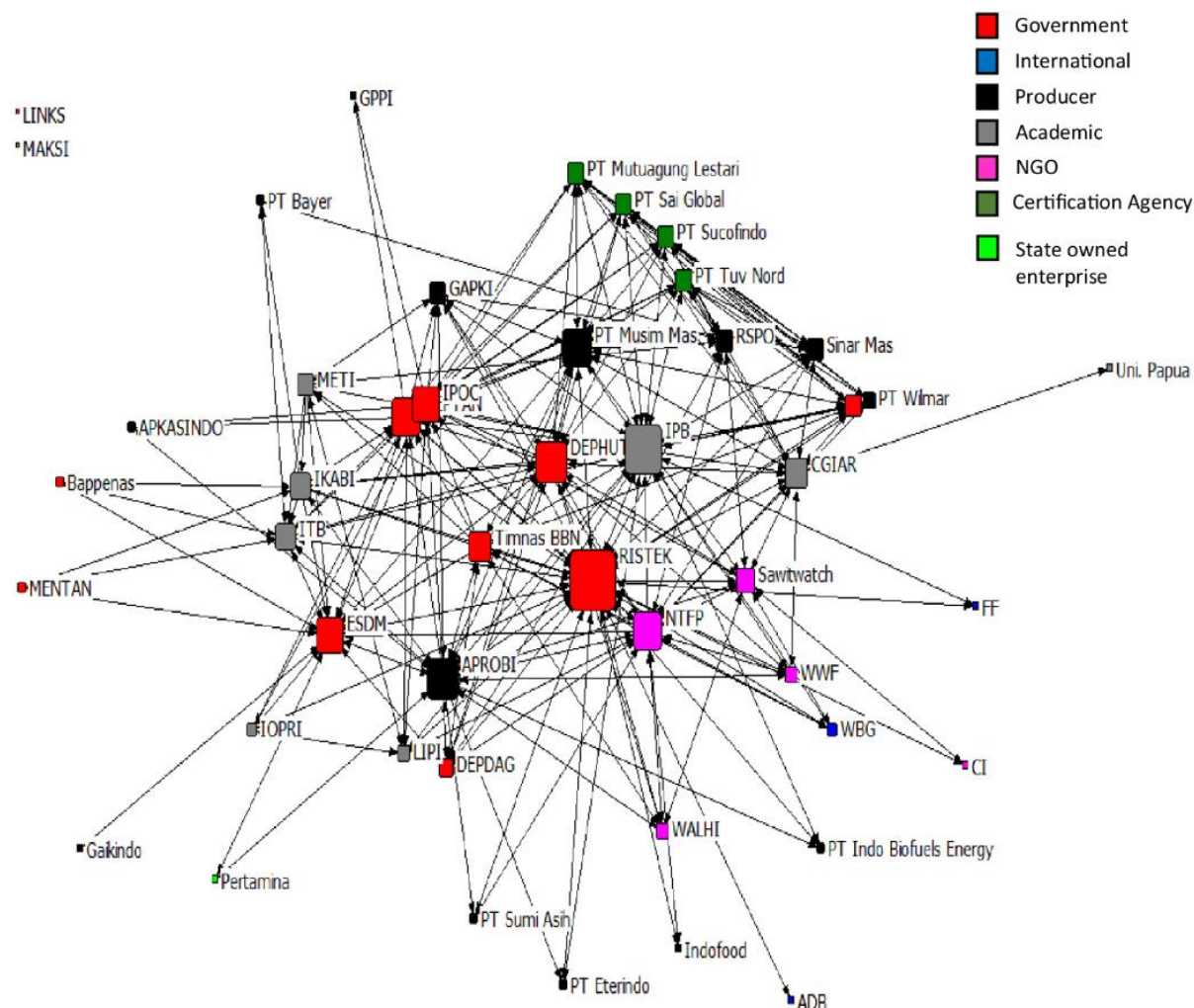
As an initial measure of network cohesion, the density of the collaboration data was calculated. For the formal collaboration network linking agents who work on sustainability and biodiesel issues presented in Figure 2, the density of 0.323 implies that 32% of all possible ties within this network exist, characterizing the collaboration matrix as a moderately sparse network.

Using the affiliations data that generated a two-mode network of organizations and the associations of which they are co-members, a correspondence analysis was performed to ascertain to what degree actors of the network have worked together, historically, on biodiesel issues. Consistent subgroups appearing through this type of analysis can indicate undermined overall network cohesion. The correspondence analysis on the affiliations data helped to locate the “clustering” of actors and events together along a two-dimensional plane, scaled to their joint variation, and is an indication of any cohesive groupings within the larger network.

The results of the correspondence analysis are presented in Figure 3. There is evidence of clustering along the right of the horizontal axis (of actors and events with variations between 0.6–0.9 along the first dimension) as highlighted in red. This is indicative of coordination between major private sector producers, producer unions such as APROBI and GAPKI, sustainability certification bodies such as

the RSPO and the ISPO, as well as the third-party certification agencies tasked to carry out the ISPO verification.

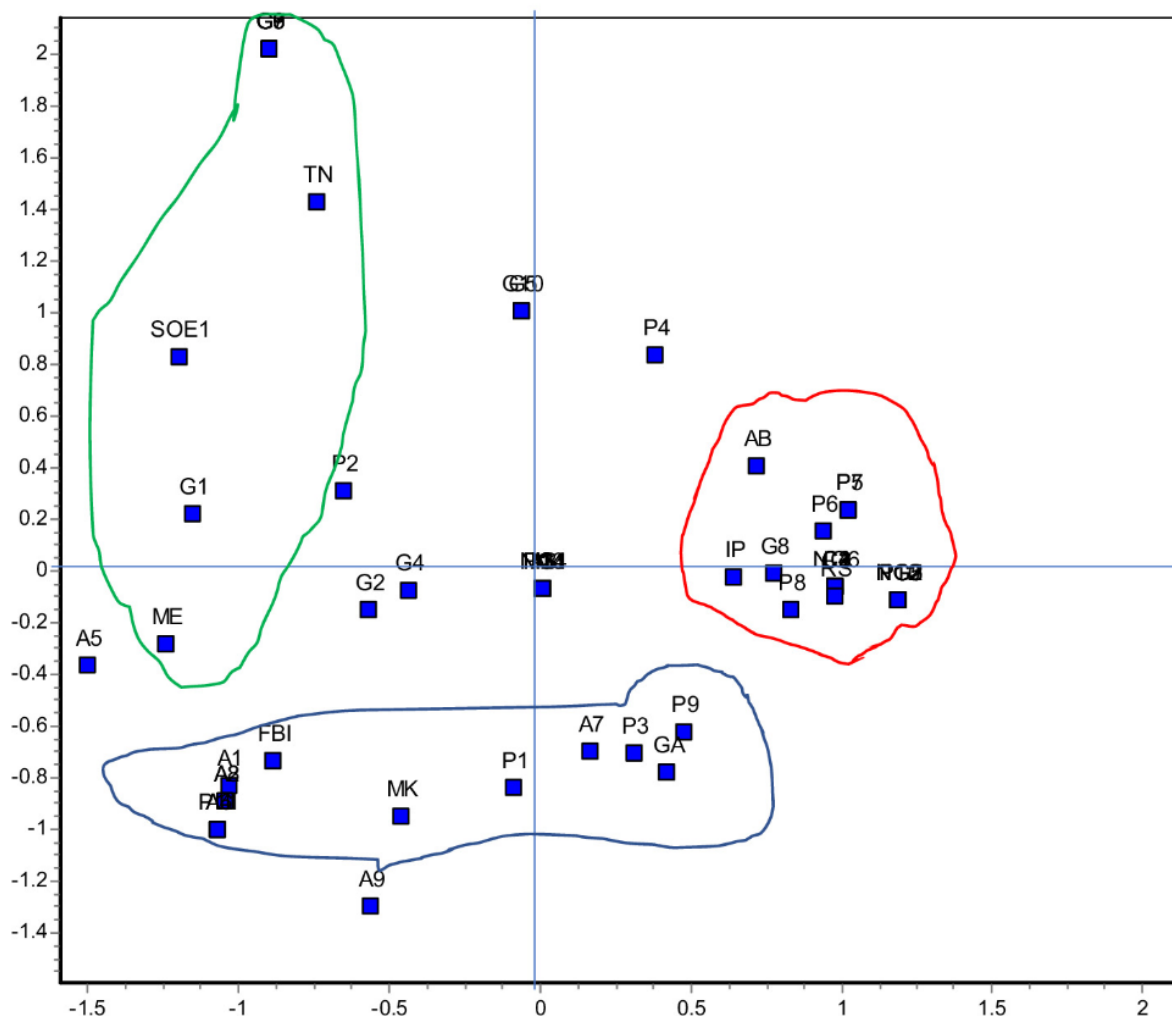
Figure 2: Network structure of the Indonesian biodiesel policy subsystem (direct collaboration ties)



This tendency to vary together across the vertical network space is understandable since this ‘cluster’ is purely concerned with the behavior of private sector producers toward sustainable practices. The second major grouping in Figure 3 is highlighted in green and involves those with joint variations between -0.75 and -1.02 along the second dimension), the State Oil Company (Pertamina), the National Biofuels Taskforce (Timnas BBN), the Renewable Energy Forum of Indonesia (METI) and the GOI Ministries of Energy, Forestry, Environment and Transport.

The distance between these two groupings is interesting. The first group contains those organizations primarily concerned with the production of the main raw material or feedstock (i.e., palm oil) and the second group is made up of those organizations concerned with the distribution and use of the final product (i.e., biodiesel). The Ministries of Energy and Agriculture (through the ISPO) are separated here implying that there is a cleavage between discussions of sustainability along the supply chain of biodiesel. These findings are a general indication that although interconnectedness is present in the network, it is contained within sub-groups dealing with different policy instruments.

Figure 3: Correspondence analysis of organizations and membership into associations. (abbreviation codes are listed in Appendix A)



The final grouping is indicated in blue in Figure 3 which has a joint variation between -0.55 and -0.88 . This group is decidedly academic and consists of major universities (ITB, IPB, and LIPI) along with FBI and MAKSI, two academic associations oriented toward research, with the former focused on bioenergy and the latter, on palm oil. This consistency is interesting because even though the other two groupings are clustered around policy instruments that are most relevant to them, this academic “cluster” appears cohesive despite the varying specializations of members in either palm oil or bioenergy.

The absence of CGIAR in the academic grouping of Figure 3 is indicative of cohesion among national research institutes, which may not be shared with international counterparts. The knot of nodes at the center of the graph represents those organizations that are not linked to any discernible grouping. These include CGIAR, the international organizations (WBG, ADB), WALHI and Conservation International, the isolates identified in Figure 1. The State Ministry of Research and Technology (RISTEK) and the GOI Ministry of Agriculture (DEPTAN) are closely associated with each other and occur in the middle of the green and blue clusters in Figure 3. Given that they represent major ministries, their position in the graph can indicate the equal presence in affiliations related both to biodiesel and those related to sustainable palm oil.

These findings indicate that cohesion is present to inconsistency degrees between government and targets, a factor undermining total overall network cohesion. Government-target bunching occurs at

specific points along the biodiesel supply chain, as shared values pertaining to the definition and priority given to the environmental sustainability of biodiesel varies by instrument.

DISCUSSION OF FINDINGS

The findings from this research provide several insights into the network properties of a policy subsystem that can inform the characteristics and patterns of feasible adjustments that are made to its constituent policy instruments. The results from the social network analysis done on affiliations indicated that the biodiesel policy network in Indonesia is marked by a relatively high degree of interconnectedness between state departments (Ministries of Energy and Agriculture, and Technology & Research) and target group actors (the biodiesel producers and palm oil companies), who are co-members of different committees. Interconnectedness remains high between these two groups to the extent that members of the target group can wield similar influence in the network along with government departments, as dominant actors of the policy subsystem. However, the “core” of the network also includes several major academic research organizations that along with private sector producers are co-members with government departments in relevant working committees.

While interconnectedness appears to be strong, information transfer remains concentrated and centralized in the biodiesel policy subsystem given the high *degree* of centrality—or the measure of the number of direct collaboration connections—of a few actors. Cohesion among network members, albeit present, is variable and often low, defined by how the actors are involved in the formation and implementation of each of the three instruments, prioritize sustainability. Instrument-specific cohesion exists between government and target populations, with evidence of cohesive “clustering” scattered along different segments of the biodiesel supply chain. For example, the relationship between the GOI Ministry of Energy and the Indonesian Association of Biofuel Producers (APROBI), the main parties concerned with the biodiesel mandates, is concentrated downstream near the final product, whereas that between the Ministry of Agriculture and GAPKI (with the ISPO as their main instrument of concern) is situated upstream near the feedstock.

The characteristics displayed by the instruments of the Indonesian biodiesel subsystem are summarized in Table 5. They are listed alongside those postulated by Bressers and O’Toole (1998) for networks structures depicting strong interconnectedness and relatively weak cohesion (also listed earlier in Table 1, as ‘H2’). In the observations listed in Table 5 as indicated by asterisks, are those that fully (**) or partially (*) confirm the original hypotheses.

TABLE 5. Biodiesel policy instrument characteristics Vis-à-Vis hypotheses for network showing high interconnectedness and low cohesion

Instrument characteristics	H2: Interconnection (high) Cohesion (low)	ISPO—Ministry of Agriculture regulation (19/2011)	Biodiesel mandates—Ministry of Energy Regulation (32/2008)	New basic forestry law (41/1999)
Provision or withdrawal of resources	Limited withdrawal	Withdrawal**	Provision present	Limited withdrawal**
Freedom of choice to apply	Absent	Absent**	Absent, yet flexible implementation*	Absent, yet flexible*

Instrument characteristics	H2: Interconnection (high) Cohesion (low)	ISPO—Ministry of Agriculture regulation (19/2011)	Biodiesel mandates—Ministry of Energy Regulation (32/2008)	New basic forestry law (41/1999)
Unilateral/bilateral action on target groups	Many bi- or multilateral arrangements	Unilateral	Some bilateral*	Unilateral
Normative appeal	Present	Present**	Present, along with incentives*	Present, along with facilitation*
Proportionality (Individualized or generally applied)	Present (individualized)	Generally applied	Present (individualized)**	Generally applied
Role of policy makers in the implementation	Implementation by policy maker or by affiliated organizations	Implementation through third party auditor*	Implementation by policy maker**	Implementation by provincial governments*

Note: * H2 partially confirmed, ** H2 fully confirmed.

The mandates strongly confirm three assumptions (proportionality, the role of the policy makers, and normative appeal), weakly confirm two of the remaining (freedom of choice to apply and multilateral covenants), and it does not decidedly confirm the assumption of limited withdrawal. The mandates are characterized by more provision of resources than withdrawal, as shown by the repeated adjustments and subsidies that have been given to biodiesel in step with the price of fossil fuels. While the formation of the mandates does not give the target group a freedom of choice, their implementation has shown flexibility when it comes to adjustments made to target blends. Where the regulation is largely furnished unilaterally to the target group, discussions between the Ministry of Energy and distributors and those between the Ministry of Energy and APROBI are regularly ongoing for negotiating the various stages of the mandate. While the regulation makes a normative appeal to the target group by imposing a mandatory obligation, this is done in the presence of several incentives for increasing production and distribution, including tax exemptions and direct subsidies. There is proportionality between the mandates when it comes to production, where variations in the target group's behavior are heeded by the government, as well as distribution, where blending mandates are calibrated and adjusted based on the prices of related goods. The policy maker (in this case ESDM) is directly involved in the implementation of the mandate.

Unlike the mandates that have shown some degree of agreement for all six parts of the hypotheses posed by Bressers and O'Toole (1998), the characteristics of the ISPO fail to confirm three. In the biodiesel policy subsystem that is decidedly characterized by strong interconnectedness and weak cohesion, this instrument entails a withdrawal of resources from the target group and no freedom of choice to apply on the part of the target group since strict sanctions are in place for non-compliance, for when the ISPO gets fully rolled out. The ISPO is unilaterally and generally applied to all palm oil businesses operating in Indonesia and multiple bilateral or multilateral covenants do not apply in this case. As the ISPO is a compulsory standard backed up by existing laws, the normative appeal is made to the target group without any incentives. Finally, while the policy makers designate the criteria and

indicators of the ISPO, the actual certification is to be carried out by third-party auditors who are trained by the policy makers on the specifics of the ISPO's implementation.

Very similar to the ISPO, the Forestry Law confirms some of Bressers and O'Toole's (1998) conjectures while failing to confirm others. As a law, this instrument practices limited withdrawal to the target group which faces penalties for illegal clearing of the forest. The law is carried out by the policy makers but more specifically, by regional or provincial governments and therefore subject to varying degrees of effective implementation. This national law is unilaterally applied to all sectors of the economy that entail land-use/land-cover change. As a result instrument proportionality is not that pronounced since the law is generally applied. The normative appeal is present in the law itself, however, the regulations borne out of the law have made several adjustments that create incentives for land-use change, specifically the designation of convertible production forest (HPK) areas out of production forest (HP) land parcels that facilitate the transformation of forest areas into plantations. These directives which smooth the progress of large-scale businesses do provide opportunities for land-use change despite the original forestry law leaving no freedom of application.

Out of the six characteristics listed by Bressers and O'Toole (1998) for networks displaying high interconnectedness and low cohesion, the two that were the most unlike the three Indonesian biodiesel instruments included individualized proportionality and bilateral action on target groups. These two characteristics are decidedly linked whereby with the individualized application of instruments, there is perhaps greater opportunity for bilateral action between the government and instrument targets. In the cases that were examined, however, apart from the mandates that specify different targets for broad sectors, unilateral action, and generalized application were prevalent. According to Bressers and O'Toole (1998), unilateral action and generalized application are characteristic of formulation styles exhibiting low interconnectedness, yet these properties are present in the Indonesian biodiesel scenario that is marked by high interconnectedness.

CONCLUSION: NETWORKED INSTRUMENT CHOICE AND POLICY STYLES

The findings of this study indicate that despite occupying the same policy subsystem, different instruments need not display similar characteristics and can have a bearing on how we comparatively approach policy formulation styles. And this is especially the case for regulatory instruments, the choice of which exhibit policy styles defined by “the mode of state intervention” (hierarchical versus self-regulation, as well as uniform and detailed requirements versus open regulation allowing for administrative flexibility and discretion), as well as the mode of “administrative interest intermediation” (Knill, 1999, p. 59). That is, the choice of how regulatory instruments are designed directly follows from policy subsystem structures that, for example, lend themselves more favorably to hierarchical regulation versus more self-regulation; formal versus informal implementation; or open versus closed relationships of knowledge transfer. As argued by van Waarden (1995) “national regulatory styles are formally rooted in nationally specific legal, political and administrative institutions and cultures. This foundation in a variety of state institutions should make regulatory styles resistant to change, and hence from this perspective, one would expect differences in regulatory styles to persist, possibly even under the impact of economic and political internationalization” (Van Waarden, 1995, p. 346). To this end, this paper implicitly adds to the debate about whether only central policy making characteristics of national political systems affect policy instrument choices or is there also a significant contribution made by sector-specific policy styles. Similarly, it adds to a growing body of work that is calling for more analytical exploration of causal relationships between policy styles and formulation patterns for different policy instrument categories or specific sectors (Acciai & Capano, 2021).

These observations suggest a more nuanced reexamination of policy network determinants of instrument choice. Specifically, findings such as those of this study reveal the need to include more

primary variables related to *centrality* (including degree, closeness, and betweenness centrality) as well as network *dominance* when theorizing the network properties of policy instrument design choices. The original network choice propositions tested in this paper make little mention of policy networks characterized by strong central concentrations, and the influence that intensely connected central political actors can yield during instrument formulation. The network examined by the study briefly provides a glimpse of a policy network with a tight “core” where central actors and the connections they forge are detrimental to overall network consistency. While overall network interconnectedness and cohesion are important first indicators of instrument selection, it is perhaps intuitive to extend the discussion to include an examination of network centrality and the characteristics of central actors who are in favorable positions to formulate policies.

The strong presence of a dominant cluster of actors in a policy network alludes to the possibility of a wider variety of policy styles than are currently considered in the realm of policy instrument design. Dominant actors in a network marked by high interconnectedness, effect instrument selection in ways that resemble conditions of low interconnectedness. These actors may be placed in the network as important conduits of technical knowledge sharing, influencing both political and instrumental policy learning. Furthermore, this cluster may be strongly dominated by state actors as is the case for a largely legalist governance scenario, and this would translate to a heavier emphasis on regulations and a strong degree of normative appeal backed by the threat of penalties. And indeed, the instruments examined here show the presence of normative appeal made by the targets. However, this appeal is not purely based on exercising the legitimacy of the government to control the target behavior. Despite a preponderance of laws and regulations, incentives for compliance may also have to follow. Furthermore, even if the freedom of choice to apply the instrument is officially absent for a law or regulation such as the mandates, a flexible implementation may also result subject to exogenous trends such as the price of substitute or complementary goods.

Generalizing networked policy instrument choice: Current scope and future research

At the time when they were first proposed, Bressers and O'Toole's (1998) original hypotheses brought a significant degree of nuance to the study of instrument choice. Building on earlier models of policy design through the 1970s and 1980s, which were more broadly concerned with macro-level arguments around abating the perceived negative impacts of state regulation, Bressers and O'Toole's (1998) work joined several others (e.g., De Bruijn & Hufen, 1998; Van Nispen & Ringeling, 1998) in highlighting the primacy of the subsystem context. These studies brought scholarly attention to contextual variables that could explain why specific policy tools are chosen, combined, and become preferred over time, eventually establishing unique policy tool combination regimes that are difficult to change (Howlett, 2020). As mirrored by the case of Indonesian biodiesel and its generalizable findings, the introduction and implementation of new regulations (e.g., the biodiesel use mandate) are heavily subject to conditions pre-established by existing policies (e.g., the ISPO certification standard). Research on such “layering” of policy instruments has become mainstream in the policy design literature, as it is understood that the formulation of policy instrument components seldom begins *de novo* and instead is contingent on past and prevailing policy design choices (Capano, 2019; Steinbach, 2020).

Embedded policy design actors

The political clout or comparative influence of actors strategically positioned during the policy design process is an emerging key research area, further echoing the generalizability of the findings of this study and supporting the recommendation of including key centrality measures in theorizing about policy network impacts on policy design. Haelg et al. (2019) for example, in examining the role of dominant actors “coalitions” of the Swiss renewable energy policy domain, find that the position of these actors in the subsystem shifts in relation to the design of individual elements of instruments such as feed-in-tariffs. Emphasizing the important network role of policy design agents, the authors reiterate that “policy design may not solely be introduced by a set of rational policy designers, but rather through interaction between various actors who move in the confinement of the present

institutions and on the basis of different interests and resources” (Haelg et al., 2019, p. 254). These findings provide further evidence of strategic actions of dominant policy actors or instrument-specific coalitions impacting the characteristics of policy instruments (Simons & Voß, 2018).

While the scope of the current study is limited in terms of temporality (i.e., It is a ‘snapshot’ of a particular policy network at a particular time), further research is needed to measure the consistency of policy networks over time to explain the diversity of policy instrument design more authoritatively. Furthermore, the time-delimited findings of this study also allude to how transient policy networks can be. They warrant further investigation of the effect that changing network membership can have on changing the settings and objectives of policy instruments and their implementation. These efforts can be further corroborated by aligning future research on dominant policy actors and central coalitions with the literature on path dependence (Béland, 2010), policy layering (Capano, 2019), and feedback loops in environmental policy (Jordan & Moore, 2020), all of which are emerging yet currently disjointed strands of research in the policy sciences and policy design literatures. By operationalizing network variables as explanatory elements of policy instrument design, the Indonesian biodiesel study joins an emerging body of knowledge taking forward agent-based theorization efforts for policy design. Further research is necessary to not only address the current dearth of empirical studies testing policy network hypotheses for policy instrument design but to also align existing premises better.

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APPENDIX A METHODOLOGICAL NOTE:

Individuals Interviewed and Network Member Organizations:

	Key informant interviews (individuals)	Network surveys and interviews (individuals)	Network members in questionnaire (organizations)
Government	3	9	10
Private industry	3	6	14
International	3	3	3
Academic/Research	7	5	8
Non-government	3	3	6
Others	3	-	5
Total	22	26	46

Summary descriptive statistics

Variable	Mean	St. Deviation	Variance
Collaboration	0.322	0.467	0.218
Agreement	0.296	0.456	0.208
Affiliations	0.441	0.691	0.478

Coding guide for Figure 3

Organization name	Abbreviation	Organization Type	Code
Ministry of Energy and Mineral Resources	ESDM	Government	G1
State Ministry of Research and Technology	RISTEK	Government	G2
Ministry of Forestry (DEPHUT)	DEPHUT	Government	G3
Ministry of Agriculture (DEPTAN)	DEPTAN	Government	G4
Ministry of Trade (DEPDAG)	DEPDAG	Government	G5
State Ministry of Environment (MENLH)	MENLH	Government	G6
National Biofuel Development Team (TimnasBBN)	TimnasBBN	Government	G7
Indonesian Palm Oil Commission (IPOC)	IPOC	Government	G8

Organization name	Abbreviation	Organization Type	Code
World Bank Group (IBRD-IDA, IFC, MIGA)	WBG	International	I1
Asian Development Bank (ADB)	ADB	International	I2
Ford Foundation	FF	International	I3
Indonesian Palm Oil Producers Association (GAPKI)	GAPKI	Producer/Private	P1
Association of Indonesian Biofuel Producers (APROBI)	APROBI	Producer/Private	P2
Roundtable for Sustainable Palm Oil (RSPO)	RSPO	Producer/Private	P3
PT Eterindo group	–	Producer/Private	P4
PT. Indo Biofuels Energy	–	Producer/Private	P5
PT Wilmar	–	Producer/Private	P6
PT Sumi Asih	–	Producer/Private	P7
PT Musim Mas	–	Producer/Private	P8
Sinar Mas	–	Producer/Private	P9
Salim/Indofood	–	Producer/Private	P10
Indonesian Institute of Sciences (LIPI)	LIPI	Academic	A1
Bogor Agricultural University (IPB)	IPB	Academic	A2
CGIAR (Including CIFOR and ICRAF)	CGIAR	Academic	A3
Indonesian Bioenergy Experts Partnership	IKABI	Academic	A4
Renewable Energy Forum of Indonesia	METI	Academic	A5
Wahana Lingkungan Hidup Indonesia	WALHI	NGO	NG1
Sawitwatch	–	NGO	NG2
World Wildlife Fund (WWF)	WWF	NGO	NG3
Conservation International (CI)	CI	NGO	NG4
Non-Timber Forest Products/SETARA	NTFP	NGO	NG5
University of Papua - Tanjung Pura	–	Academic	A6
Indonesian Palm Oil Research Institute (PPKS/IOPRI)	IOPRI	Academic	A7
Institute of Technology Bandung (ITB)	ITB	Academic	A8
Gaikindo (automobile association)	–	Producer/Private	P11
PT Mutuagung Lestari (certification)	–	Certification Agency	C1

Organization name	Abbreviation	Organization Type	Code
Pertamina (Persero)	–	State Owned Entrp.	SOE1
PT Bayer	–	Producer/Private	P12
LINKS	LINKS	NGO	NG6
PT Sai Global	–	Certification Agency	C2
PT TUV Nord	–	Certification Agency	C3
PT Sucofindo	–	Certification Agency	C4
APKASINDO (Palm Oil Smallholder Association)	APKASINDO	Producer/Private	P13
GPPI (association of plantations)	GPPI	Producer/Private	P14
Indonesian Palm Oil Society	MAKSI	Academic	A9
Ministry of Transport	MENTRAN	Government	G9
National Development Planning Agency	Bappenas	Government	G10
Multistakeholder associations			
Name	Code	Indegree value	
Gabungan Produsen Kelapa Sawit Indonesia	GA	4	
Masyarakat Energi Terbarukan Indonesia	ME	7	
Indonesian Palm Oil Society	MK	9	
Forum Biodiesel Indonesia	FBI	10	
Roundtable on Sustainable Palm Oil	RS	19	
National Team on Biofuel Development	TN	9	
Assosiasi Produsen Biofuel Indonesia	AB	6	
Indonesian Sustainable Palm Oil program	IS	11	

Network analysis limitations and validity considerations

As explained by Scott (2000), network data can be collected using three styles of research: surveys and interviews, ethnographic studies and document analyses. Although the roster method for this paper remains the most popular for SNA, it has some important limitations that a low response rate can bring in, for which data derived from document analyses can as a supplement. A low response rate is a common problem while gathering network data using surveys (Chan & Leibowitz, 2006; Kossinets, 2006). Ideally, a network level survey exercise requires a response rate of 70% or above to be considered accurate (Lesser & Prusak, 2004, Kossinets, 2006). In the case of a lower response rate,

such as that in this study (57%), three particular methods were used to clean the data and create datasets that are as complete as possible:

- **Compensating with data from written records:** Content analysis of existing written records were used in some cases to indicate the presence or absence of formal collaboration ties. These included, for example, official statements and press releases made by ministries about their joint ventures with universities, industry associations and research organizations. However, even though this method may be able to imply the existence of a tie during the time frame of this research, it is not an accurate measure of the strength of a perceived tie. As a result, only binary data was used in the final analysis.
- **Symmetrizing:** Using the available data from one participant about a tie to another, to reconstruct the response from that other. This transformation of data takes directed information (unidirectional link between two nodes) and makes it undirected (bidirectional link between two nodes). This was only done in cases where it was a Ministry-level participant of a dyad was supplying information about the tie.
- **Reconstruction:** Using the data from one participant about their ties, to reconstruct the response for similar participants. This method needs to be utilized with significant caution. For reconstruction to happen meaningfully, two conditions that need to be met are that “(1) non-respondents must not be systematically different from respondents and (2) information provided by respondents about the relation to non-respondents must be considered reliable and precise” (Bergenholtz & Waldstrom, 2011, p. 48). Reconstruction was only done in this study for three certification organizations, based on information provided by one certification organization. All four of these organizations are equally and similarly involved in formal collaborative ties in the network and are members of the same association.