Journal of Rural Studies 95 (2022) 391–401

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud

Transmigration programs and migrant positions in rural community knowledge networks

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ARTICLE INFO

Keywords:
Social networks
Transmigration
Agriculture
Indonesia
knowledge flows

ABSTRACT

Controversial transmigration programs have moved millions of people from the cores of domestic economies to national geographical peripheries to ostensibly facilitate a more equitable resource distribution. However, it is not well understood how transmigrants become accepted and how they position themselves within the local networks of migrant-receiving rural communities. We examine how ethnicity and transmigratory experience affect informal knowledge-sharing networks in 16 coffee and cocoa farmer groups in Lampung, Indonesia. Drawing on these social networks and key socio-economic characteristics of 315 farming group members, we examine core-periphery network structures and centrality distributions within these farming groups. We show that individuals from the majority ethnomigration group who are the descendants of Javanese migrants tend to form the core of the local farmers' knowledge networks, apparently benefiting both from strong cultural links to the central regions of the country in Java as well as strong embeddedness in local communities. Our findings also call attention to possible marginalization of original members of peripheral rural communities in central government-sponsored transmigration and export-oriented agricultural extension programs.

1. Introduction

The movement of people from core political economies of the world to more peripheral ones has long been the subject of political economy research. For example, indentured, convicted or free citizen migration of British or other 'Old World' European subjects to new colonies enabled both the exploitation of resources from and development of peripheral colonies through their integration into global trade and monetary networks (Darwin, 2009; Quijano and Wallerstein, 1992). Another example resides in the national redistribution of population from urban core economies, which both develop national peripheries and facilitate resource production and extraction (cf. Innis, 1995; Tonts et al., 2013). For instance, Indonesian government transmigration programs where residents of highly populated Java were re-located to less populated Indonesian islands such as Sumatra (Kusworo, 2014). Indeed, both inter- and intra-national forms of migration represent a colonisation of the peripheries by a central government authority often located in the core urban area (Chase-Dunn, 1988; Martinus, 2018; Wallerstein, 1974).

Transmigrant research has been a rising area of enquiry (Barter and Côté, 2015; Fearon and Laitin, 2011; Feder et al., 2010; Gatto et al., 2015). The societies that emerge from transmigration exist in a space between the core economy and settler periphery, facing issues of local inhabitant displacement with migrants receiving land possibly to the detriment of local inhabitant populations (cf. Barter and Côté, 2015). For example, in Indonesia's outer island Sulawesi, transmigration caused dramatic changes in the demographic composition and distribution of economic and political power and the eruption of inter-racial violence (Aragon, 2013). Nonetheless, findings also show that transmigrant populations facilitate government industrial and societal reform by introducing government endorsed techniques and knowledge from the core political economy to the peripheral communities (Anderson and Feder, 2004; Sines, 2002). Further, alignment between transmigrant and local knowledge systems can facilitate more economically productive communities if inclusion takes place (Bazzi et al., 2017). Indigenous knowledge can also be employed alongside mainstream scientific or Western knowledge, offering different ways of knowing and caring for country which is often specific to a particular climate and environment (Le Grange, 2007; Nakata, 2002).

But, there is still limited information on how transmigrants are positioned in migrant receiving rural community knowledge networks

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https://doi.org/10.1016/j.jrurstud.2022.09.019
Received 14 March 2022; Received in revised form 2 September 2022; Accepted 13 September 2022
Available online 3 October 2022

relative to local inhabitants. Previous research has found migrants can broker within local networks to connect geographically and socially distant community groups to exchange agricultural management practices (Isaac et al., 2014) and that even temporary exposure to farming in different areas can help introduce agricultural knowledge to rural peripheries from areas with a longer history of population and environmental stresses (Matous and Todo, 2018).

This paper seeks to understand how transmigrants from core economic and political areas, their descendants, and previous local inhabitants are positioned within their respective farming community knowledge networks. We first review literature on transmigration and the development of agricultural communities. We then outline a case study of small and remote rural communities of Tanggamus Regency, in Lampung province, Indonesia, detailing its long running transmigration programs. Lampung provides an interesting case study on the impacts of transmigrant due to its proximity to the most populated Java island and long-standing experience with early colonial settlement of populations from Java. Unlike other migrant-receiving areas with relatively large numbers of migrants, Lampung has experienced population and economic growth vis-a-vis Javanese transmigration. Next, we describe the methods used to examine the role and position of members of 16 randomly selected rural farmer groups in a major agricultural producing area in Lampung, Indonesia, where migrants from various backgrounds and their descendants work alongside local Lampungese in production of coffee and cocoa.

Recognising that assigning indigeneity to lands and peoples in South East Asia is controversial, we refer to the "migrant-receiving" Lampungese as native inhabitants. Our study site was purposely chosen to capture the patterns of knowledge networks which had formed between these native Lampungese inhabitants and more recent transmigrant communities of other ethnic backgrounds. Next, we describe our analytical results and show that farmers from the dominant ethnic transmigrant group tend to occupy positions at the core of the examined agricultural knowledge-sharing networks in Lampung, giving them disproportionate influence in how knowledge on coffee and cocoa farming is shaped, dispersed, and advanced in the host rural communities. Finally, we conclude with a discussion of how government-supported transmigration policy influences the inter-ethnic structure of settlements in national geographic peripheries as well as how knowledge is accessed by native local inhabitants.

2. Transmigration and government development programs

The central authorities of many nations have long used nationally-sponsored transmigration to develop peripheral areas, particularly when cultural dissimilarities or political resistance exist between the colonising political economic regime and local communities (Elmhirst, 2001). Economic development of such peripheries is often highly complex and intertwined with the development of core urban areas. That is, the periphery is dependent on the financial and other resources of the core urban areas, and core urban areas are dependent on the resources of the peripheries (Baber, 2001; Smith, 2019; Tonts et al., 2013). Transmigration facilitates the shift of these resources between core and peripheral territories within a specific socio-economic and political context and for a particular development objective. It is linked to significant social change and policy, being a particular population resettlement tool used by the state to fulfil its broader political agenda (Tirtosudarmo, 2018).

In general, migration studies see migrants as belonging to a minority group which is often disadvantaged due to low levels of community inclusion, civic participation and political representation. The idea of multiculturalism has been used to represent such societies and endorse societal integration by recognising and respecting difference and sense of identities (Barter and Côté, 2015; Madood, 2020). However, transmigration produces a different migrant experience which is more akin to colonialization. In transmigration, the migrant belongs to the dominant majority which dispossesses local inhabitants of their land and assumes power by imposing legal and other governance structures linked back to the colonising nation and providing substantial privileges to the new inhabitants (Côté, 2019). As argued by Quijano (2007), social domination by the migrants in local communities is a product of effective colonisation and that the 'coloniality of power has proved to be more profound and more lasting than the colonialism in which it was engendered and which it helped to impose' (pp. 45–46).

Whilst Quijano was referring to European colonisation and subsequent domination of Western thought and structures globally, the same holds true in nations with ethnically dissimilar regions and long running nationally-sponsored transmigration programs to address unequal development between regions, such as across the Indonesian Archipelago (cf. Elmhirst, 2001; Tirtosudarmo, 2018), China, Vietnam, The Philippines and Thailand (Barter and Côté, 2015). Duncan (2008) notes that the key aim of such projects is to 'incorporat[e] ethnic minorities into the nation-state and mak[e] them conform to the norm of the ruling majority through resettlement', he refers to these initiatives as 'civilizing projects' (p.ix). Studies of such programs have highlighted that they produce persistent and on-going economic disparities between the wealthier and more centrally connected migrant-source communities and 'poorer' migrant-recipient peripheries as well as other negative impacts. For example, The Philippine government-sponsored migration of Christians to the south not only failed to solve persistent regional economic disparities, but arguably catalysed the emergence of Islamic extremism (Duncan, 2008, p.74). As another example, the Chinese government migration program, moving residents in its eastern regions to its western ones, has been reported to create conflicts between local and migrant populations (Côté, 2019).

Bhavnani and Lacina (2018) highlight that transmigration is a characteristic of largely developing and poorer nations, and that the anti-migration politics which arise are different to those associated with the international migration between wealthier nations. Indeed, Fearon and Laitin (2011) and Côté (2019) note the prevalence of 'sons-of--the-soil' type conflicts in transmigratory locations and 'open clashes between ethnically-distinct 'native' or 'local' populations and recent migrants' (Côté, 2019, p.86). Such conflicts can occur due to two factors. First, the migrants may be poor themselves, being initially attracted through work expectations and new colony development. They face various settlement challenges associated with land reclamation and contestation, lack of government settlement support, farming in remote areas or low fertile land, and having little to no agricultural skills or experience (Potter, 2012). Second, the migrants may be disproportionally advantaged over locals or natives when they are part of a dominant ethnic group tied to the ethnicity and power structures of the ruling state (Côté, 2019). Fearon and Laitin (2011) explain the emergence of transmigratory conflict:

"First, it involves conflict between members of a minority ethnic group concentrated in some region of a country, and relatively recent, ethnically distinct migrants to this region from other parts of the same country. Second, the members of the minority group think of their group as indigenous, and as rightfully possessing the area as their group's ancestral (or at least very long-standing) home." (p.200).

To aid the integration of newcomers, address potential conflicts and develop agricultural regions, intra-national migration may be accompanied with government agricultural extension or related programs for both migrants as well as local inhabitant farmers and Indigenous communities. Such programs provide essential skills, technology and knowledge to assist in economic transitions of residents and to increase regional productivity in export industries of national importance (Anderson and Feder, 2004; Feder et al., 2010). Nonetheless, the programs primarily transfer knowledge in one direction, essentially viewing the Indigenous or local inhabitants as 'beneficiaries' who have 'backward' knowledge of limited use to advanced production systems. The role of the colonializing authority, then, is to introduce more 'advanced' knowledge and governance systems which will facilitate the

development and national integration of peripheral areas (Sines, 2002).

Nonetheless, the actual lived experience after the introduction of such programs is varied. Some scholars suggest that state-sponsored extension programs result in market failures if there is not sufficient community ownership in the introduced knowledge and crops (cf. Feder et al., 2010). And, Bazzi et al. (2017) found agricultural productivity of a mixed transmigrant communities was correlated with the level of familiarity of transmigrants to their receiving community in terms of agroclimate, language, and culture. Gatto et al. (2015) observed that communities with proportionally more transmigrants were more likely to uptake government-mandated crops, particularly if capital or subsidies were offered, as they will have more individuals which 'understand' the introduced crops and knowledge systems (including technology and know-how). Such findings point to the importance of cohesion and coherence in local human capital networks in facilitating knowledge adoption and uptake. The remainder of this paper investigates integration of transmigrant and local inhabitants in their respective farming community knowledge networks through a case study of coffee and cocoa farming villages in Indonesia.

3. Rural community development in Tanggamus Regency, Sumatra, Indonesia

Backed by the International Monetary Fund and World Bank, Indonesian central government transmigration programs officially aim to both unify Indonesia's diverse ethnic groups and promote economic development of its peripheries (O'Connor, 2004). Lampung Province on the Island of Sumatra, in particular, provides an interesting case study of the relationships between farmer migration types and their position in local agricultural networks because Lampung has historically been the main migrant destination for Javanese, with transmigration dating back to the 1905 Dutch settlement programs used to develop agricultural villages (Kusworo, 2014). The rural farming groups of this study are located in the remote sub-districts of Sumberejo and Pulau Panggung in Tanggamus district - around 100 km from the Lampung capital Bandar Lampung. Through the government programs and Dutch colonial mandates before Indonesian Independence, Sumberejo and Pulau Panggung have been developed into a major exporter of coffee, and to a lesser extent pepper, cacao, durian and banana (Central Agency on Statistics Tanggamus Regency, 2020).

As a key entry point to Sumatra, Tanggamus Regency has relatively good access to and a long history of migration from densely populated Island of Java. Sumberejo and Pulau Panggung were key destinations for Javanese during the Dutch subsequent resettlement in 1922, and again post-independence (1945) via state-sponsored transmigration programmes (Kusworo, 2014). The central government's function has been crucial in shaping the integration and growth of the country since its independence in 1945. The regional governments receiving transmigrants from Java and Bali played a passive role, with all planning and implementation of the Indonesian transmigration program controlled by the central government in Jakarta (Tirtosudarmo, 2018).

However, unlike provinces where there were less noticeable demographic impacts, Lampung provides an example of how transmigration accelerated regional population growth (Tirtosudarmo, 2018). During the transmigration period, each transmigrant household head received 1 ha of cleared land, with 0.25 ha ready for planting. Every community of 2000 households also received a seed nursery to enable intensive and commodity-specific farming, including in rice and basic staple foods (Alisadono et al., 1984). Successive waves of transmigrants from the mid-1950s to Lampung remote agricultural areas have brought a large proportion of Javanese residents, who are the largest and most politically central ethnic group on the archipelago (Elmhirst, 2001).

While officially aiming to address uneven national development, Indonesian transmigration programs have been criticized as an 'ideological policy linked to the idea of national integration based on Javanese concepts' (Tirtosudarmo, 2018) to advance Javanese political and cultural interests in two ways. First, through the relocation of Javanese government officials to these remote regions as state representatives (Kato, 1989), and second, in the resettlement of Javanese farmers who became dominant within the farming communities of the national periphery (Tsing, 1993). The resettlement of Javanese in peripheral regions reportedly threatened the political power of native Lampungese, who were then excluded from positions of control over authority, wealth, local resources and land (Fearon, 2003; Yiftachel, 2019).

Elmhirst (2001) noted that the 'official sanction' of Javanese migrants meant they were 'incorporated directly into Javanese administrative structures that had arisen alongside established transmigration settlements' (p.297). These 'Javanese pioneering settlements' were autonomous from Lampung administrative systems, with Lampung elites welcoming newcomers given they received government 'indemnities' (p.297) for land given up for new colonies. This migration by largely Javanese to Tanggamus significantly changed its demographic and cultural profile. By the 1970s and 1980s, transmigration programs directed migrants away from Tanggamus to less developed and economically vulnerable regions (Kusworo, 2014). The economic justification for transmigration disappeared after the mid-1980s with Java experiencing faster economic growth than other islands (Tirtosudarmo, 2018), such that previous migrant-receiving provinces became migrant-senders.

The Indonesian government has used local farmer groups to develop rural communities since the 1948 program of *Balai Pendidikan Masyarakat Desa* or Community Village Council of Education (Raya, 2016). Farmer groups attached to agricultural extension programs typically include around 20–30 farming households producing similar commodities (Sugarda et al., 2001). Farmer groups meet regularly to discuss farming challenges and practices, with those associated with government agricultural extension program led by a government official (as mandated by the Ministry of Agriculture). While the responsibility for enhancing farmer group capacity initially lay with the provincial government, this shifted to the district-level in 2006 following the introduction of Law No. 16 on agricultural extension services (Government of Indonesia, 2006).

Farmer groups are expected to gather monthly in meetings that tend to have both an information-sharing and social nature. In general, farmers join the nearest group in their own village. However, some groups initiated by the government include farmers who live in the same location but are not necessarily perceived to function as a cohesive community. In this study, the farmer groups were the main unit of analysis, being the means by which agricultural policy and extension support was implemented. The data collection and analysis to test how different farmer migrant groups were positioned in agricultural knowledge networks of these groups is described in the next section.

4. Methods

4.1. Data

The data was collected by a face-to-face survey in September 2012. Official records were obtained directly from the Tanggamus district Crop Estate and Forestry Services (*Dinas Perkebunan dan Kehutanan Kabupaten Tanggamus)* listing 36 farmer groups in the study region that were formally established in 1997 and specialized in coffee and cocoa. From these 36 groups, we chose 16 farmer groups in 14 villages by generating random numbers. The approximate locations of each farmers group are displayed in Fig. 1. According to obtained official government records, there were 410 households growing coffee and cocoa in the 16 studied farmer groups. Our research team was able to identify and interview representatives of 315 of them (77%, Table 1). The survey was designed to be administered to one representative of each household, the self-identified "household head", by locally recruited female and male research assistants whom the authors personally trained for the

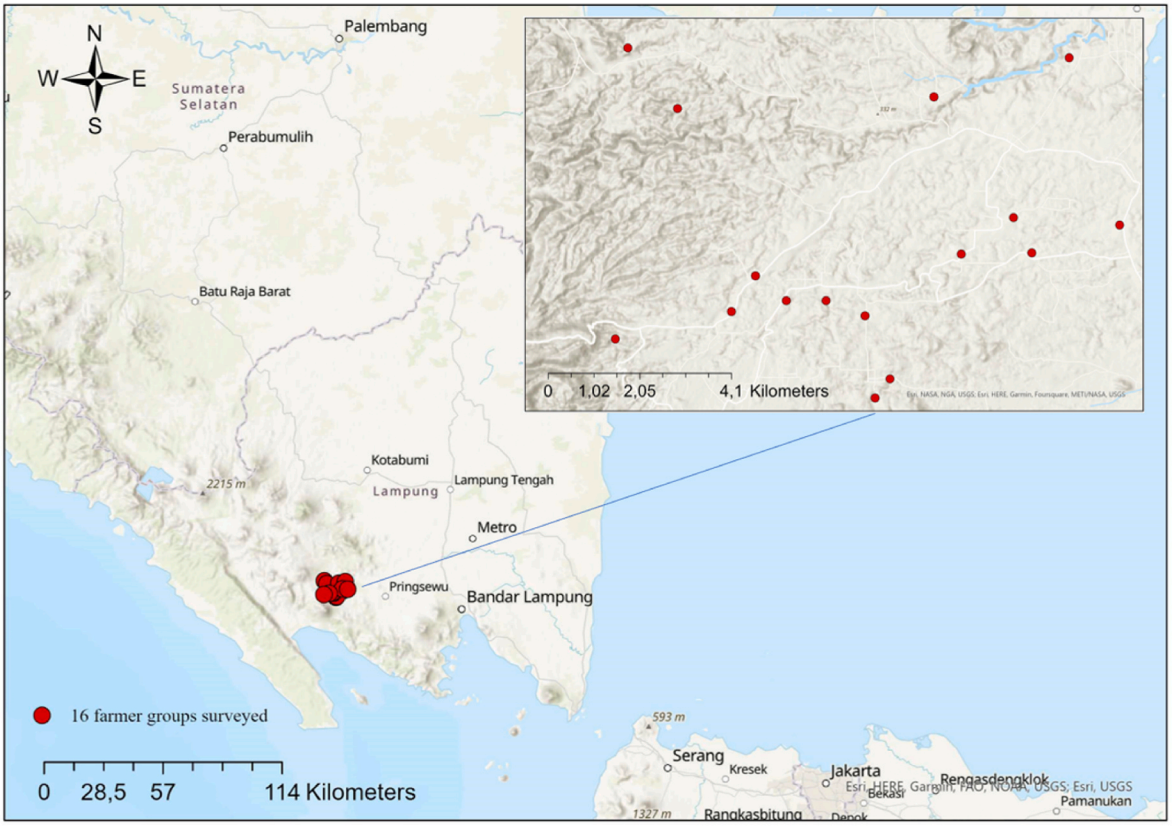

Fig. 1. Farmer group locations.

Table 1
Farmer group membership.

1	2	3	4	5
Farming group no	Sub-district	N interviewed	N in census	% interview (interview/N census)
Group 1	Sumberejo	20	20	100%
Group 2	Sumberejo	23	24	96%
Group 3	Sumberejo	10	20	50%
Group 4	Sumberejo	20	20	100%
Group 5	Sumberejo	21	22	95%
Group 6	Sumberejo	18	18	100%
Group 7	Sumberejo	15	23	65%
Group 8	Pulau Panggung	29	33	88%
Group 9	Pulau Panggung	13	24	54%
Group 10	Pulau Panggung	23	36	64%
Group 11	Pulau Panggung	17	20	85%
Group 12	Pulau Panggung	34	42	81%
Group 13	Pulau Panggung	24	33	73%
Group 14	Pulau Panggung	15	28	54%
Group 15	Pulau Panggung	26	26	100%
Group 16	Pulau Panggung	7	21	33%
TOTAL		315	410	77%

task in the field (see Appendix 1 for further survey information). The researcher assistants visited the informants and asked them all questions verbally and recorded the answers. The language of the interviews was Bahasa Indonesia.

A limitation of the study was that 99% of the interviewed "household heads" were male, which demonstrates the highly gendered bias of smallholder farming in Indonesia. Women's diverse contributions to agriculture are often less recognized than that of men, leading to a misrepresentation within research regarding decision making processes by farmer groups and in terms of household technology adoption choices (Siapno, 2000; Wijers, 2019). Indeed, women have been found to have distinct knowledge networks in agriculture (Friedman et al., 2022). In our study, respondents were asked to name everyone outside of their household to whom they go to for advice, learn from, or who can generally provide information on farming practices. This advice included information on maintaining productive soil and plants, newly available farming technologies, market news and government support programs facilitating access to subsidised input. The survey also included 'control' questions for the analysis gathering household socio-odemographic and farming data, including ethnicity, migration experience, age, education, social preferences, and other cultivated crops.

The remainder of this section describes our two-step analytical process. First, social network analysis was used to quantify diverse centrality measures for all members in each farming group. Second, an Ordinary Least Square OLS regression and the Linear Mixed Model (LMM) was employed to understand the relationship of an individuals' ethnicity to their centrality in a farmer group network and to test the hypothesis that Javanese transmigrants or their descendants hold central positions in the migrant-receiving communities (Elmhirst, 2001).

4.2. Social network analysis methods

This section describes how we quantified the relative "importance" of each respondent's position within their farmer group network. The two main approaches used were: (1) assessing whether the respondent is part of the structural "core" of the network; and, (2) quantifying their rank within the farmer group using a range of widely popular network

centrality measures.

Social networks of information sharing in each farmer group were constructed by connecting respondents' answers to the question about agricultural information sources stated above. These networks were first examined for a core-periphery structure (Borgatti and Everett, 2000), i.e., whether there is a subset of central actors densely interconnected with each other at the core with remaining actors on the periphery linking only to the core but not to other peripheral actors. In information-sharing networks, the core members may be considered to have advantageous access to and the control of information, while peripheral actors may be dependent on them (Borgatti and Everett, 2000). A theoretically perfect core-periphery structure occurs when all core actors are connected to all other core actors and all peripheral actors are connected to all core actors but no other peripheral actors. Real-world networks do not generally possess such idealized structures. Core-periphery analysis on real-world empirical networks can be thought of as an optimization problem of iteratively searching for an assignment of actors to the "core" and "periphery" that maximizes the correlation ρ between the real structure network $a_{i,j}$and the commensurate idealized core-periphery structure $\delta_{i,j}$.

Formally, this can be expressed as follows:

$$\rho = \sum_{i,j} a_{i,j}\delta_{i,j} \tag{1}$$

Where $a_{i,j}$ is based on an adjacency matrix of the real network with ones indicating presence of a network connection between nodes *i* and *j,* and zeroes otherwise. $\delta_{i,j}$ is a network of the same size in which all core actors are connected to each other and all peripheral actors are connected to the core, but no one else. It is written formally as:

$$\delta_{i,j} = \begin{cases} 1 \text{ if } c_i = CORE \text{ or } c_j = CORE \\ 0 \text{ otherwise} \end{cases} \tag{2}$$

Where c_i denotes whether node *i* is in a core (1) or periphery (0) position, and$\delta_{i,j}$ denotes whether a tie exists between nodes *i* and *j* in the network with idealized core-periphery structure.

Equation (1) is corresponds to an unnormalized Pearson correlation between the two adjacency matrices. The measure ρ is higher when the observed network has a higher overlap in terms of presence and absence of links between all pairs of nodes as compared with the theoretical idealized corresponding core-periphery network. ρ achieves its maximum value only in the theoretical cased when the matrix of $a_{i,j}$ and the matrix of $\delta_{i,j}$ are identical. Networks with core-periphery structures are denoted by large ρ and significant p-value (Borgatti and Everett, 2000).

Through the above-described process, we identified whether a core-periphery structure was present in each network and which individuals form the potential core. To obtain a more complete picture of the situation from different angles, we used also other standard and complementary measures of network actors' centrality, namely indegree, closeness and betweenness. Wasserman and Faust, (1994) provide an overview of these centrality measures. All these measures denote different ways that a node is somehow "important" in a network. None are objectively superior measures but obtaining qualitatively similar results with a wider range of complementary measures supporting the robustness of findings.

In our study, an actor's indegree centrality equals the number of respondents that named the actor as an important source of agricultural advice. Higher indegree means that more farmers seek the actor for information. Indegree centrality is most robust to missing data. The remaining two centrality measures consider the entire network structure, which may be a conceptual advantage but also a potential vulnerability in terms of missing data anywhere in the network. Closeness centrality measures an actors' average inverse distance by the number of network steps to all other actors in their network. Farmers with high closeness centrality are closest to the topological centre of their farmer group network. They are only a few network steps from most group members, which gives them superior access to information and potentially higher influence in spreading information across the farmer group. While the substantial meaning of this measure may sound similar to the above measure of "coreness", closeness centrality can be computed on networks regardless of a core-periphery structure. Finally, betweenness centrality expresses the number of shortest pathways that an actor is positioned on between all pairs of nodes (farmers) in a network. High betweenness centrality in information-sharing networks indicates a node that acts as a bridge on many shortest pathways of information transmission.

4.3. Regression analysis

The purpose of the regression analysis was to assess the relationships of farmers' ethnicity and migration experience with the relative centrality in their farmer group networks, while controlling for their socio-demographic characteristics. We applied Ordinary Least Square (OLS) regressions with heteroscedasticity-robust standard error and Linear Mixed Model (LMM) using individual fixed-effects and random effects at farmer group level coefficients. In OLS, the dependent variable is predicted with a linear combination of "independent variables". However, as the data is nested at the farmer group level, the LMM can control for random effects at the group level. LMM can also correct for non-independence assumption in the social networks variables, as some centrality measures depend in part on the scores of other network actors (even though our primary focus of network measurement, the in-degree centrality, is more robust to the dependency of the overall network structures). The likelihood-ratio test was not significant for the LMM, indicating that the linear regression model - in which a single intercept is estimated - fits better with the data. Moreover, because some network measures can be highly sensitive to missing data, we also tested the LMM model on a subset of the data limited to farmer groups with more than 70% response rate in Appendix 2 table.

In the four main presented models (and their adaptations), the dependent variable Y_i stands for the three applied social network centrality measures (namely in-degree, closeness, and betweenness centralities) and the core/periphery dummy assignment, respectively. The three centrality measures were transformed into cumulative distribution functions (CDF), a function to map an individual's percentile rank in a set distribution to capture an individuals' relative social ranking in each farmer group (for example, within top 10% of indegree centrality in their network). The purpose of this transformation was to express the relative centrality of an individual vis-à-vis the rest of their group and enable comparisons of an individuals' relative local prominence across networks of different sizes, structures and compositions.

Next, we describe the independent variables as given in Table 2. We first constructed a composite categorical variable of ethnicity and migration type, hereafter called *ethnomigration classification,* denoted by coefficient β_1. This composite categorical variable captured all combinations of self-identified ethnic affiliation and whether the respondent was born in or outside Lampung. The coefficient β_2 represented the effect of an individuals' majority or non-majority ethnomigration status within their farmer group on Y_i. The *major ethno-migration* status was conceptualized both as a dummy and a ratio. As a dummy variable, it designated if an individuals' ethno-migration group was the largest in the village. That is, as a dummy variable it takes one for members of the largest ethno-migration group within their farmer group, and 0 for all others. As a ratio, it indicated the proportion of the respondent's ethno-migration category within their village. Both specifications were tested.

β_3 are the village dummy variables and X_{ip} is the vector of basic household and individual characteristics and ε_i is the error term. X_{ip} controls for attained formal education, the size of cultivated land, years of experience cultivating coffee, age of household head, and a dummy of whether the household has mobile phone which in 2012 was a proxy of affluence, technology adoption, and an opportunity to conveniently

Table 2
Variable descriptions.

No	Variable name	Description
Majority/minority ethnomigration indicator (β_2)		
1	Major_ethnomigtype	Dummy variable of whether the respondent's share of their ethnomigration type in their farmer group is the largest
Ethnomigration type by migration experience and birthplace (β_1)		
2	Lampungese without migration experience	Lampung ethnic without migration experience (born in Lampung)
3	Lampungese repatriates	Lampung ethnic with migration experience (not born in Lampung)
4	First generation Javanese migrants	First generation migrants (not born in Lampung) from Javanese ethnicity dummy
5	First-generation non-Javanese	First generation migrants (not born in Lampung) from non-Javanese ethnicity dummy
6	Second-generation Javanese	Second generation migrants (born in Lampung) from Javanese ethnicity dummy
7	Second-generation non-Javanese	Second generation migrants (born in Lampung) from non-Javanese ethnicity dummy
Household characteristics (X_{ip})		
8	Culland	Size of cultivated land (in Ha)
9	Max_coffee_exp	Years of experience cultivating coffee crops
10	Educ_head	Years of education of household head
11	Age_head	Age of household head
12	Num_mem	Household size
13	Dummy_mobile	Mobile phone dummy
14	Motorcycle	No of motorbikes owned
15	ln_altitude	Log of household altitude (elevation) in m
Social Networks Indicators (Y_i)		
16	Indegree	Normalized indegree centrality score
17	Closeness	Normalized closeness centrality score
18	Betweenness	Normalized betweenness centrality score
19	Indegree CDF	Indegree centrality as per cumulative distribution function in each farmer group
20	Closeness CDF	Closeness centrality as per cumulative distribution function in each farmer group
21	Betweenness CDF	Betweenness centrality as per cumulative distribution function in each farmer group
22	Core_member	Dummy variable of 1 if an actor belongs in the core and 0 if belongs in the periphery for the thirteen networks which fit the core/periphery structures with $p < 0.05$

communicate with others. We also controlled for motorcycle possession as proxy for wealth and mobility, and the altitude of the household location in the natural log form to capture the spatial geographical variation.

Therefore, we estimated a farmer's relative centrality in their village networks as:

$$Y_i = \beta_1 \quad ethnomigration\ type_i + \beta_2\ major\ ethnomigration\ type_i + \beta_3 village\ dummy + \beta_p X_{ip} + \varepsilon_i \quad (3)$$

Our model includes the dummy indicating membership in the largest ethnomigration category in the village and the controls. The size of cultivated land, years of coffee growing experience, years of formal education, age, and the ownership of mobile phones and motorized vehicles were all significantly associated with the social network centrality measures, and therefore included in the final model specification. However, even after controlling for these characteristics, ethnicity and migration remained significant predictors for all centrality measures.

5. Results

5.1. Descriptive results

First, the descriptive results provided background information on the intersection of ethnicity and migration experience in the studied area. These are given in Table 3. Ethnically Lampungese inhabitants form only 10% of the sample. Ten ethnically Lampungese respondents were not born in Lampung because their parents left the region but the respondents returned to Lampung and therefore are classified as Lampungese repatriates. Most ethnically non-Lampungese respondents were born in Lampung because their parents had migrated to Lampung during government sponsored initiatives (hereafter, the "second-generation migrants" born in Lampung). Sixty-two percent of respondents were second-generation migrants, followed by first generation migrants (28 percent). Most respondents identified as ethnically Javanese (79.2 percent) and among them the majority were second-generation migrants born in Lampung (53.2 percent of the entire sample).

Table 4 presents summary statistics for the main independent, dependent and control variables used in the analysis. On average, respondents completed around 8 years of formal education, owned and cultivated 1-ha farming plots and had almost 13 years of experience cultivating coffee. Most owned a mobile phone and motorbike as a means of communication and transportation. Appendix 3 shows that the second-generation Javanese and non-Javanese migrants tended to have longer formal education of almost 9 and 10 years respectively. The second-generation Javanese migrants were also more likely to have alternative non-farm sources of income, particularly from manufacturing. In contrast, the smallest minority group of the ethnically Lampungese who were born outside of Lampung but returned to the region tended to have the lowest levels of formal education - only 6 years on average. They were also more likely to be fulltime farmers without alternative income sources.

5.2. Results of two-step analysis process

Thirteen of the local farmer group networks exhibited a core-periphery structure with $p < 0.05$ and all networks exhibited core-periphery structure with $p < 0.1$ (Table 5). The network topologies of each group are visualised in Fig. 2, where a circle represents one respondent and arrows point from respondents to the information sources they named. The first-generation and Lampung-born second-generation Javanese (green circles) visually appear central in most groups, which is quantitatively confirmed by the subsequent statistical

Table 3
Ethnicity and migration status.

	Born in Lampung		Not born in Lampung		
Ethnicity	Lampungese without migration experience	Second generation migrant	Lampungese with migration experience	First generation migrant	Total
Lampung	21 (7%)	0	10 (3%)	0	31 (10%)
Non-Lampung					
Javanese	0	167 (53.2%)	0	82 (26.1%)	249 (79.3%)
Others					
Sundanese	0	7(2.2%)	0	3(0.9%)	10 (3.1%)
Sumendonese	0	21(6.7%)	0	2(0.6%)	23 (7.3%)
Others	0	0	0	1(0.3%)	1 (0.3%)
Total	21 (7%)	195 (62%)	10 (3%)	88 (28%)	314 (100%)

Note: The total sample N = 315 with ethnicity data from one respondent missing.

Table 4
Variable summary statistics.

No	Variable name	Mean	Std. Dev.	min	max	N
1	Major_ethnomigtype	0.66	0.473	0	1	314
2	Lampungese without migration experience	0.07	0.25	0	1	314
3	Lampungese repatriates	0.03	0.18	0	1	314
4	First generation Javanese migrants	0.26	0.44	0	1	314
5	First-generation non-Javanese	0.02	0.14	0	1	314
6	Second-generation Javanese	0.53	0.5	0	1	314
7	Second-generation non-Javanese	0.09	0.29	0	1	314
8	Culland	1.04	0.78	0	5	308
9	Max_coffee_exp	12.74	12.02	0	60	310
10	Educ_head	8.42	3.48	0	18	299
11	Age_head	45.09	11.80	16	87	299
12	Num_mem	4.15	1.51	1	12	299
13	Dummy_mobile	0.82	0.39	0	1	315
14	Motorcycle	1.29	0.85	0	5	315
15	ln_altitude	6.01	0.25	5.50	6.53	309
16	Indegree	0.15	0.14	0	0.75	260
17	Closeness	0.55	0.12	0.24	1	260
18	Betweenness	0.06	0.09	0	0.68	260
19	Indegree CDF	0.53	0.29	0.03	1	260
20	Closeness CDF	0.53	0.29	0.03	1	260
21	Betweenness CDF	0.53	0.29	0.03	1	260
22	Core_member	0.36	0.48	0	1	248

analyses.

From the results shown in Table 5, around 66% of respondents belonged to the largest ethnomigration group in their village (see Table 4), which for most villages was Javanese. Second-generation Javanese migrants were the major ethnomigration group in 12 out of 16 groups, followed by first-generation Javanese migrants and second-generation non-Javanese migrants. Non-Javanese migrants were mostly of Sundanese ethnicity coming from the neighbouring west Java province. Appendix 3 also shows that the majority ethnomigration group of second-generation Javanese migrants are significantly more educated compared to other respondents. Despite having relatively higher education, the second-generation Javanese were less experienced in coffee cultivation (with 11 years of experience, compared to 15 years of experience average of the rest). This is likely due to the younger age, smaller land possession, and a higher propensity to venture out to non-farming jobs such as manufacturing.

Table 6 shows OLS regressions for the relationship between ethnomigration status and the respondents' relative position in local farmer group networks, while controlling for other farmers' characteristics. This demonstrated that lower farming experience did not prevent second-generation Javanese from occupying more central positions in local farmers' information-sharing networks. Being an ethnomigration majority raised an individuals' relative centrality rank in a farmer group network by 7–9 percentage points in terms of indegree, closeness and betweenness centrality. It all also increased a farmer's chances of being a part of the core by 12 percent in the 13 networks with clear core-periphery structures. The results remain robust even after including ethnomigration dummy and village dummy variables in the alternative model (see Appendix 4).

6. Concluding discussion

This paper investigated the position of transmigrants from a national administrative and cultural core in social structures of peripheral communities. Whilst there is a growing body of transmigration literature, little has been said on how transmigrants and their descendants are positioned within their host rural communities nor what their influence is on rural community networks given possible cultural differences between transmigrants, their descendants and native inhabitants of migrant-receiving regions. We sought to address this gap by examining the role and position of smallholder farmers from different ethnicities with different migration experience in 16 farmer groups. The analysis sheds light on how each farmer group had been socially shaped through the Indonesian government's transmigrant and agricultural extension programs implemented across the outer islands with two key points emerging.

First, our results show that belonging to an ethnomigration majority group correlates significantly to a position of influence in local farming group knowledge networks. Lampung-born second-generation migrants, especially from the Javanese ethnicity, were found to be most central actors in the informal networks of local coffee and cocoa farming groups. This result holds after controlling for their distinct personal characteristics such as their levels of education, farming experience, wealth, assets, and landholding size, which also seem to give them an advantage in gaining central network positions. However, it cannot be definitely stated from our data whether Javanese high centrality is a consequence of possibly different levels of agronomical expertise, cultural capital, political connections or access to markets, for example. Importantly, we found that first-generation migrants were not positioned as influentially in networks as their descendants, who still had ties to the Javanese culture and place as well as abundant connections within the local region. This suggests that it takes time before migrant families embed themselves in local migrant-receiving networks and that second-generation migrants were the well placed to negotiate both worlds. Second generation Javanese migrants were likely to be positioned in the most advantageous network positions with a high indegree, indicating they were the most frequently reported as information sources in local agricultural advice networks. The same results were obtained with alternative specifications of social network centrality. High centrality is likely to reflect high social status and benefit individuals in these prominent positions by supporting their economic productivity, but it does not mean that social network structures that elevate the status of members of one particular ethnicity benefit the community collectively. The high social centrality conveys to these individuals' opportunities to work as connectors between ethnically diverse group to the benefit of everyone as well as opportunities for personal advantage by gate-keeping and brokering information between others in a context of competition and ethnic fragmentation (see Barnes et al., 2016 for an example of such case). Such scenarios and mechanisms are not discernible from the presented analysis and deeper explorations are needed.

Second, our results illustrate how the government-backed transmigration policy of Indonesia has shifted the majority-minority composition in peripheral communities. Combining the analytical results with accounts and observations obtained during the field work, it appears that the agricultural extension system may benefit those ethnic groups who can better adopt suggested farm technologies and management styles, as well as have a better cultural connection (and therefore rapport) with government officials delivering the extension programs. The agricultural extension system has historically been centralized and undertaken under the Ministry of Agriculture, with limited consultation of local beneficiaries in the type of know-how and technology being adopted. While the system does not officially give preference to any ethnicity and aims to promote ethnic cohesion, our results demonstrate that Javanese migrants tend to have advantageous positions in the informal information networks that these formal systems tap into. This gives them preferential access to the knowledge provided to as well as shared, adapted and generated within the local farmer groups. This likely goes hand in hand with the shared cultural understandings between Javanese individuals, and that the extension systems are largely imported from Java. It is also perhaps why the second generation may have gained prominent status in local farmer groups, as they may bond well both with the dominant Javanese groups, as well as embed themselves in local networks, despite their shorter history of Javanese cocoa farming in Sumatra.

Table 5
Core-periphery characteristics of farmer group knowledge networks.

1	2	3	4	5	6	10	11	12	13	14	15	16	17	18
Group no	Core/ periphery correlation (discreet model)	p-value	N in core	N in periphery	N in networks	Major ethnomigration group	Share of second-generation Javanese migrant	Share of first-generation Javanese migrant	Median of in-degree centrality score	Median of closeness centrality score	Median of betweenness centrality score	Median years of education	Median age	Median size of owned farmland (in Ha)
Group 1	0.745	0.0002	7	13	20	Second generation Javanese migrant	0.65	0.35	0.30	0.625	0.003	10.5	41	0.5
Group 2	0.360	0.0842	10	14	24	Second generation Javanese migrant	0.65	0.22	0.09	0.522	0.032	10.5	47	0.75
Group 3	0.732	0.0008	6	11	17	Second generation Javanese migrant	1	0	0.188	0.668	0.033	9	44	0.75
Group 4	0.525	0.0175	4	16	20	Second generation Javanese migrant	0.75	0.05	0.16	0.527	0.07	12	45	0.75
Group 5	0.384	0.0773	7	15	22	Second generation Javanese migrant	0.52	0.33	0.05	0.5	0.069	6	51	0.5
Group 6	0.729	0.0006	7	11	18	Second generation Javanese migrant	0.83	0.11	0.29	0.7	0.030	9	40.5	0.61
Group 7	0.553	0.0213	6	11	17	First generation Javanese migrant	0.20	0.73	0.09	0.611	0.203	6	50	0.5
Group 8	0.472	0.0055	10	23	33	First generation Javanese migrant	0.24	0.41	0.09	0.484	0.014	6	45	1
Group 9	0.507	0.0318	6	12	18	Second generation non-Javanese migrant	0.23	0.15	0.15	0.531	0.069	12	40.5	1.75
Group 10	0.353	0.0653	11	17	28	Second generation Javanese migrant	0.61	0.26	0.07	0.54	0.033	6	45	1
Group 11	0.639	0.0024	6	14	20	Second generation Javanese migrant	0.65	0.12	0.13	0.575	0.018	9	35	1
Group 12	0.382	0.0165	13	26	39	First and second generation Javanese migrant equally	0.41	0.41	0.08	0.456	0.017	9	48	1
Group 13	0.552	0.0012	7	24	31	Second generation Javanese migrant	0.63	0.21	0.042	0.470	0.011	6	47	0.5
Group 14	0.502	0.0090	7	16	23	Second generation Javanese and non-Javanese migrant equally	0.33	0.20	0.10	0.560	0.0226	9	45	1
Group 15	0.578	0.0025	8	17	25	Second generation Javanese migrant	0.64	0.20	0.13	0.551	0.007	6	36	0.5
Group 16	0.639	0.0187	4	9	13	Second generation non-Javanese migrant	0	0	0.17	0.6	0.0277	12	42	1

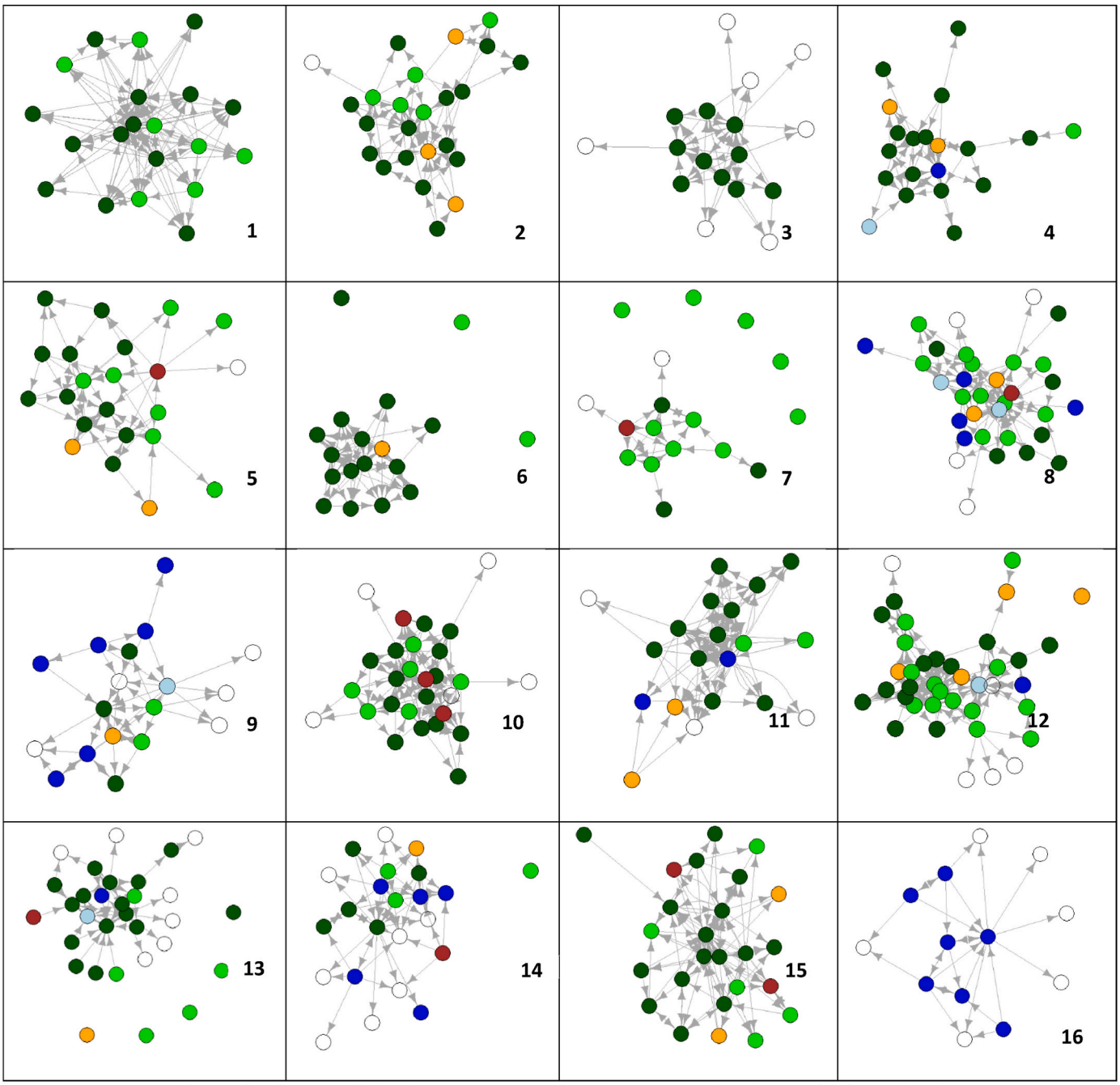

Fig. 2. Knowledge network structures of the 16 farmer groups. Note: White nodes denote individuals who were mentioned as sources of agricultural information, but not interviewed in our survey.

Indeed, the local agricultural-information sharing networks form mostly core-periphery structures, with the network core primarily comprised of Javanese migrants. The local Lampungese cocoa and coffee farmers are predominantly on the local knowledge network periphery, depending on information coming from individuals at the core. It is unclear whether this Javanese network advantage would extend beyond high-value export commodities, such as coffee and cocoa. It is possible that the Javanese apparent superior connections to state institutions, cooperatives and exporters, might not translate to social centrality in other more local networks and/or communities growing crops other than those analysed here.

With the major macro-economic shift towards increasing export

Table 6
Estimation results of being ethnomigration status by centrality measures.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS regression				Linear mixed-model			
	indegree_CDF	closeness_CDF	betweenness_CDF	core_fit	indegree_CDF	closeness_CDF	betweenness_CDF	core_fit
Fixed-effects								
major_ethnomigtype	0.072*	0.070*	0.090**	0.122*	0.0724*	0.0704*	0.0903**	0.122*
	(0.038)	(0.039)	(0.041)	(0.067)	(0.0384)	(0.0387)	(0.0394)	(0.0683)
culland	0.051**	0.015	−0.004	0.032	0.0509**	0.0154	−0.00391	0.0321
	(0.025)	(0.026)	(0.026)	(0.047)	(0.0258)	(0.0260)	(0.0265)	(0.0458)
max_coffee_exp	0.003*	0.002	0.001	0.004	0.00258*	0.00228	0.00115	0.00416
	(0.001)	(0.001)	(0.002)	(0.003)	(0.00150)	(0.00151)	(0.00154)	(0.00287)
educ_head	0.007	0.012**	0.014**	0.012	0.00656	0.0115**	0.0135**	0.0120
	(0.005)	(0.006)	(0.006)	(0.010)	(0.00551)	(0.00556)	(0.00566)	(0.00986)
age_head	0.002	0.003*	0.004**	0.000	0.00205	0.00296*	0.00375**	0.000429
	(0.002)	(0.002)	(0.002)	(0.003)	(0.00167)	(0.00168)	(0.00172)	(0.00298)
dummy_mobile	0.097*	0.119**	0.059	0.146*	0.0966**	0.119**	0.0594	0.146*
	(0.050)	(0.056)	(0.055)	(0.083)	(0.0492)	(0.0496)	(0.0505)	(0.0877)
motorcycle	0.045*	0.037	0.042*	0.024	0.0452*	0.0370	0.0423*	0.0242
	(0.024)	(0.024)	(0.025)	(0.041)	(0.0233)	(0.0235)	(0.0239)	(0.0421)
ln_altitude	0.064	0.045	0.063	0.109	0.0636	0.0454	0.0628	0.109
	(0.073)	(0.074)	(0.075)	(0.117)	(0.0701)	(0.0707)	(0.0721)	(0.116)
Constant	−0.272	−0.219	−0.313	−0.728	−0.272	−0.219	−0.313	−0.728
	(0.481)	(0.486)	(0.497)	(0.784)	(0.460)	(0.463)	(0.472)	(0.774)
Random effects at farmers group-level								
Random intercept term					−27.49***	−27.38***	−27.83	−25.03***
					(4.942)	(6.492)	(19,928)	(5.946)
Residual					−1.306***	−1.297***	−1.278***	−0.759***
					(0.0450)	(0.0450)	(0.0450)	(0.0469)
Observations	247	247	247	227	247	247	247	227
Number of farming groups	16	16	16	13	16	16	16	13
R-squared	0.107	0.092	0.072	0.056				
F-test of joint significance	0.0001	0.0009	0.0063	0.1066				
Likelihood ratio test					1.0000	1.0000	1.0000	1.0000

Robust standard errors in parentheses ***p < 0.01, **p < 0.05, *p < 0.1.

commodities post oil-boom in the 1980s (Tirtosudarmo, 2018), the focus of agricultural extension services has been to push for better cultivation strategies and productivity of these commodities, which (unintentionally) further elevated the Javanese position due to their familiarity with these agricultural extension systems. Côté's (2019) also proposed that the Lampungese local tradition to accept migrants in harmony has also contributed to the successful inclusion of the transmigrant families and it is plausible that Lampungese have more agency and prominence in other socio-cultural, including religious, realms outside of cash crop farming. Furthermore, it should also be reiterated that while certainly research-worthy for its success in peacefully integrating large volumes of transmigrants, Lampung may be a somewhat special case even within the Indonesian context for its immediate proximity to Java, a long history of transmigration and relatively low levels of other types of migration. Conducting comparisons with further network studies in other regions would be welcome.

In summary, a possible but not definitive interpretation of regarding lack of local inhabitants at the core of their home agricultural information and knowledge networks may be linked to the government's nation building strategies, where migration distributes resources and Javanese-centric know-how from the national core to peripheral regions. If ethnicity is utilized to obtain access to resources and spaces, the government may risk ethnic aggravation unless economic inequality is addressed (cf. Ford, 2003). Our research provides a reminder that government migration and extension programs need to consider and accommodate native local inhabitants, for example, by providing platforms to connect and share local agricultural knowledge. Our findings of the Sumatran rural agricultural communities provide insights into broader social and economic changes which have occurred across Indonesian peripheral regions, setting an agenda for further research to understand the socio-economic impact of transmigration programs in delivering planned objectives across diverse regions. The current findings would be enhanced with the alternate viewpoints of other network actors and by understanding forms of knowledge. Future research is needed on the role and position of women in agricultural knowledge as well as how different crops, such as those traditionally farmed in the areas, might influence the positionality of different ethnic groups. Indeed, who occupies the core and peripheral of the agricultural knowledge networks would significantly differ depending on what type of crop is analysed and who is included in the data. Such understandings are critical in generating more inclusive farming communities and addressing the uneven development of peripheral agricultural communities.

Author statement

AP: Conceptualization, Methodology, Data collection and Data curation, Visualization, Writing -Original draft preparation. PM: Conceptualization, Data collection, Methodology, Writing -Original draft preparation, Writing- Reviewing and Editing. KM: Conceptualization, Visualization, Writing Original draft preparation, Writing-Reviewing and Editing.

Data availability

Please contact the authors to discuss data availability.

Acknowledgement

We would like to thank the editor and an anonymous referee for their thorough comments, which helped to significantly improve the manuscript. We also thank Professor Yasuyuki Todo and the members of the Sydney South East Asia Centre for their support and advice. The authors would also like to thank the Australian Research Council (grant number DE170100727), Maj and Tor Nessling Foundation (grant number 202000186) and The Australian National University Indonesia Project.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrurstud.2022.09.019.

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