Modeling information sharing in animal health surveillance with social network analysis

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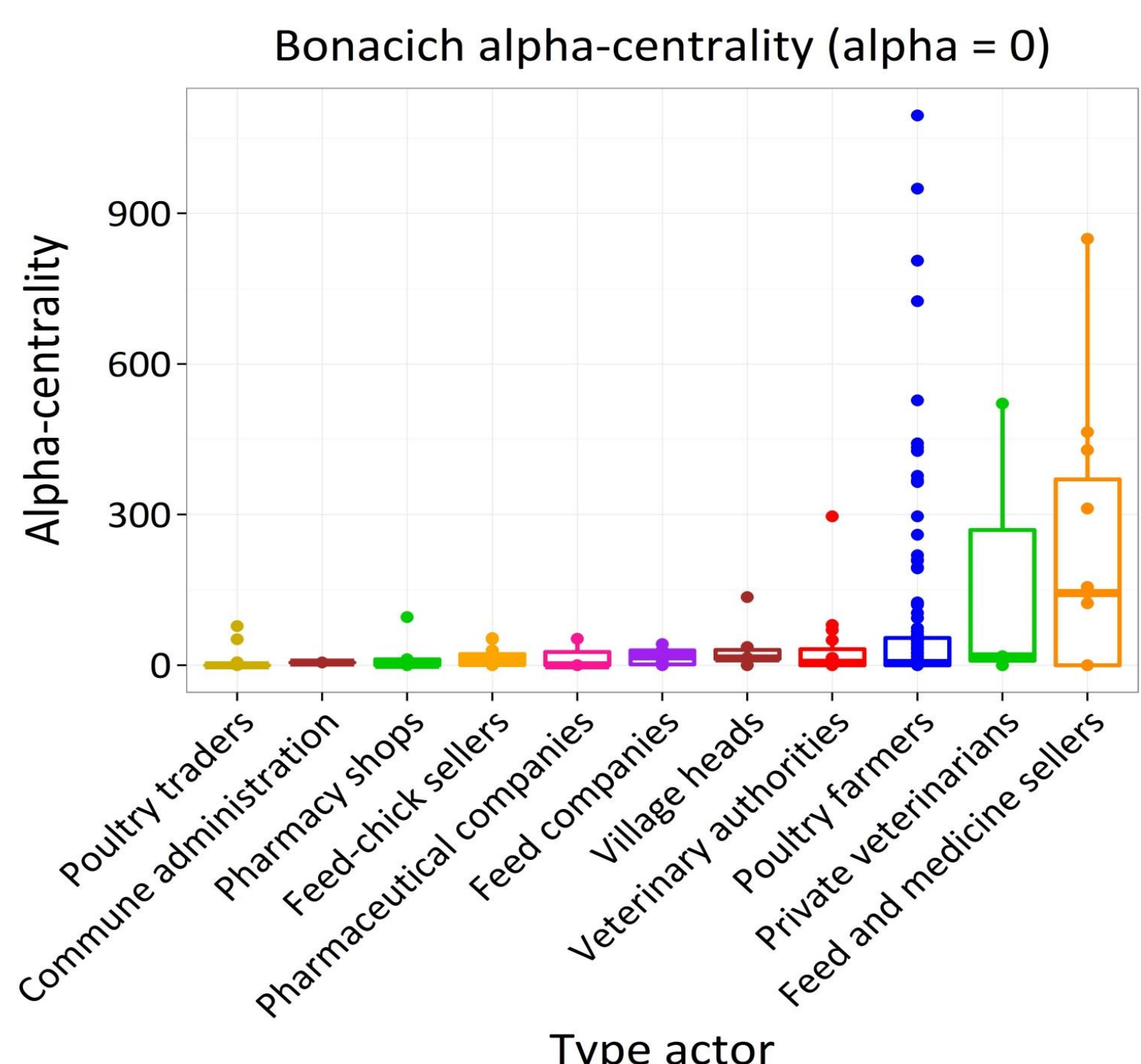[7]Tropical Veterinary Institute, University of Liège, Belgique

INTRODUCTION : The performances of public surveillance systems depend on their capacity to capture health information transmitted from private to public actors in contact. The health information network structure is driven by particular social or economic factors. The identification and analysis of such networks can help the implementation of policies aiming at associating private actors in the public surveillance of animal diseases.

The aim of this study was to apply the network paradigm to identify groups of actors significantly involved in information sharing on Highly Pathogenic Avian Influenza (HPAI) suspicions, and their links with public stakeholders. An additional objective was to assess the efficacy of two different data collection approaches and their resulting network models: questionnaire-based surveys were used to analyze inter-individual exchanges, while participatory approaches and tools were used to analyze interactions between categories of actors mentioned as targets of information releases.

2 rural study areas were selected: one commune of northern Vietnam (Hải Dương province), 3 communes of southern Vietnam (Đồng Nai province).

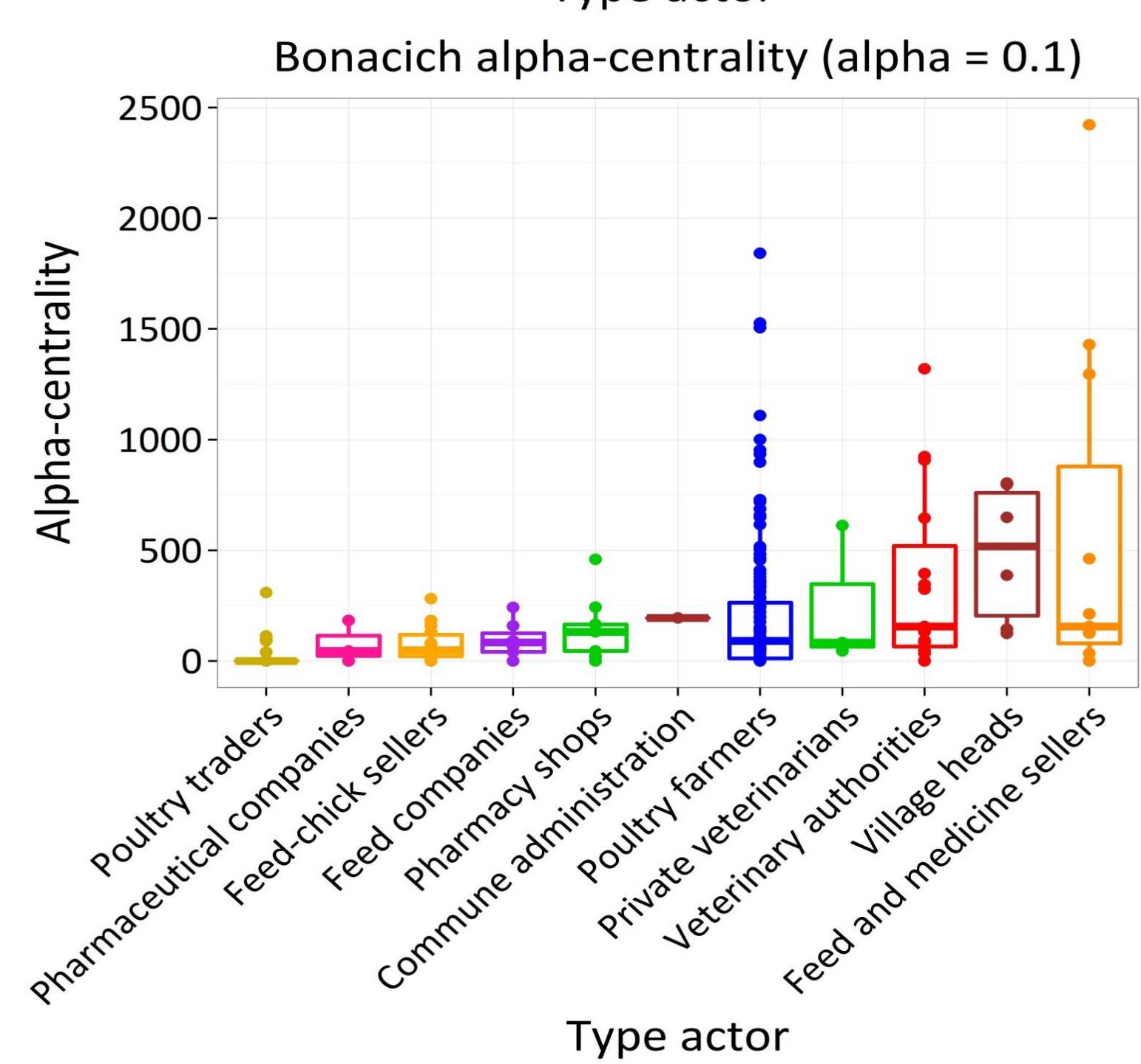## 1. Network of individuals based on questionnaires

FIG.1. Scatter plot and boxplot representation of measured alpha centrality of individuals included in the individual information network of Hải Dương province.

A specific study was performed in the area of Hải Dương (northern Vietnam). 49 individuals belonging to 10 different pre-determined categories of actors were interviewed using standardized questionnaires. The questions concerned their information exchanges with other individuals on outbreaks of high mortality in poultry and the estimated yearly frequency of these information exchanges.

The resulting network included 265 individuals and comprised only one strong component of 175 individuals who were susceptible to receive information about at least some outbreaks. A small proportion of poultry traders were found to be included in the strong component, despite having regular contacts with poultry farmers to buy their animals. On the contrary, other categories such as poultry farmers, veterinary authorities, feed or chick suppliers and medicine sellers were well included. Farmers usually fear traders could use the information on diseases to reduce the poultry sale price.

Questionnaire-based interview (A. Delabouglise, CIRAD, 2012)

A poultry trader (A.Delabouglise, CIRAD, 2013)

Alpha centrality was used as an indicator of the quantity of information received by individuals of the network (FIG.1). The quantity of information received can result from direct reports from affected farms (α=0) or from both direct and indirect information exchanges (α=0.1). Highest values of alpha-centrality, resulting both from direct and indirect exchanges, were associated with a feed and medicine selling activity. Veterinary authorities and village heads also received a significant amount of information, resulting mostly from indirect exchanges.

Betweenness was used as an indicator of the importance of each actors in relaying information to the individuals of the network. Feed and medicine sellers and veterinary agents were found to be important relays. Veterinary agents said they regularly transfer information to higher ranking officers and administrators during official meetings. Feed and medicine sellers actively relay the information to their customers.
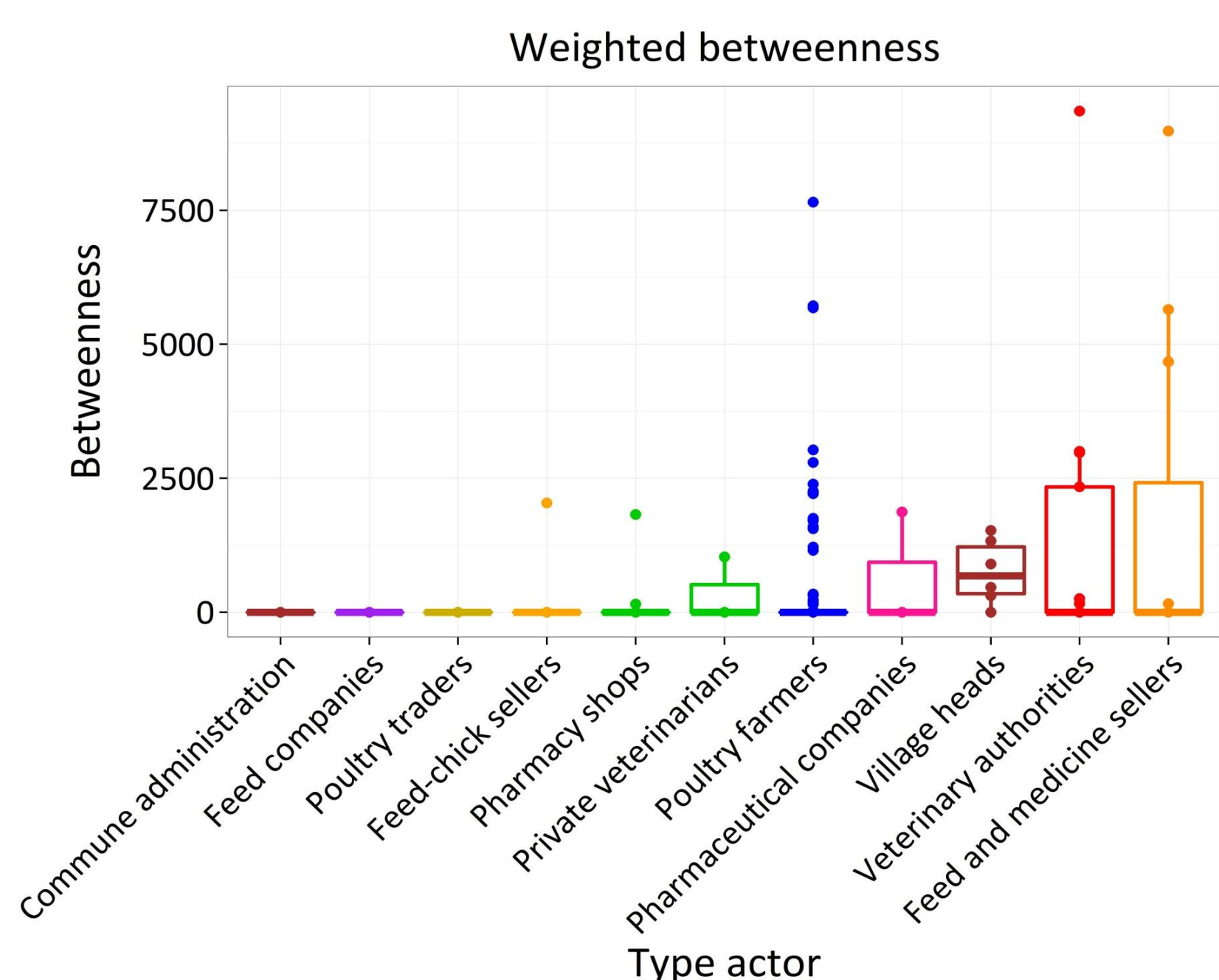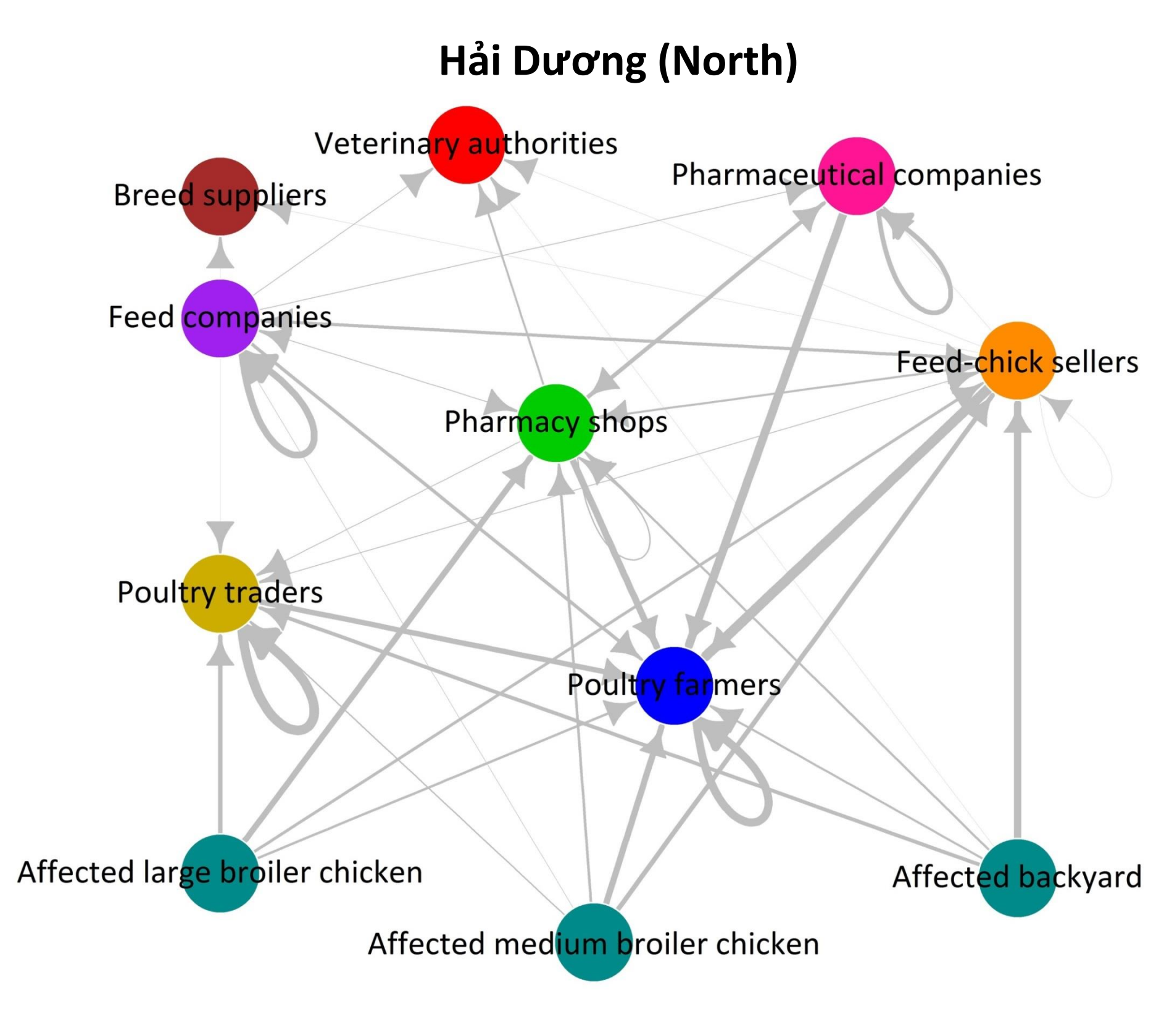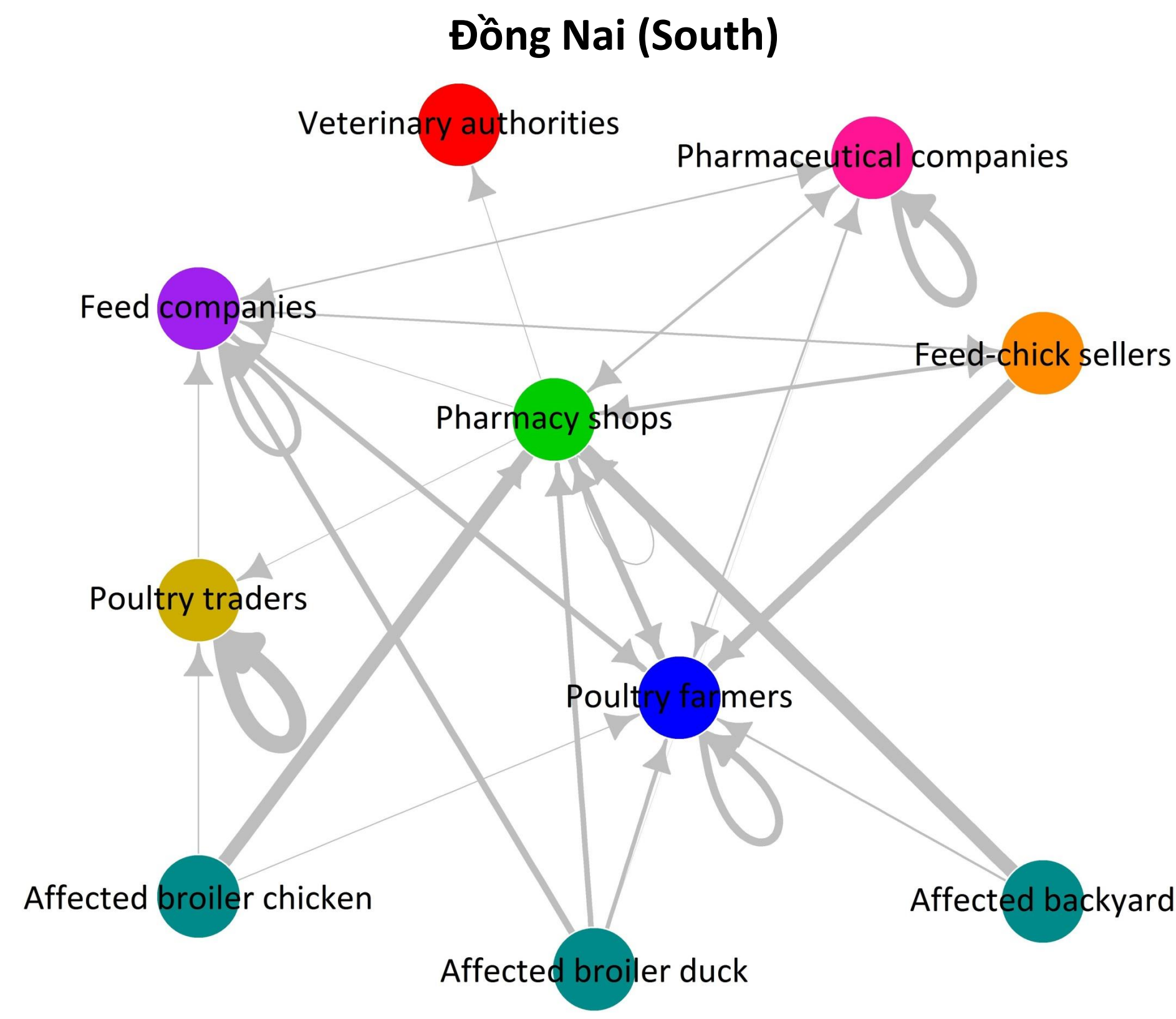
FIG.2. Scatter plot and boxplot representation of betweenness centralities of individuals in the network of Hải Dương province.

3. Networks based on participatory investigations

Interviews using participatory methods were used in southern and northern Vietnam study areas. Categories of actors involved in information exchanges were progressively identified and snowball sampling of interviewees was performed. In total 20 individual and 2 focus group interviews were made in the South, 23 individual and 7 focus group interviews in the North. The concerned farmers were : backyard and chicken broiler farmers in the north, backyard, commercial broiler chicken and commercial broiler duck in the south.

Probabilities of information exchanges on high mortality outbreaks with different categories of actors spontaneously mentioned by participants were estimated by proportional piling.

Interview with a farm owner (A. Delabouglise, CIRAD, 2013)

Interview with the owner of a pharmacy shop (A. Delabouglise, CIRAD, 2013)

The resulting networks involve similar categories of actors (FIG.3). Affected farms inform in priority the animal feed retailers of the commune (in the northern area) or the veterinary pharmacy shops (in the southern area) in order to seek medicines, diagnosis and advices to treat their animals (FIG.4).

Afterwards, other poultry farmers receive most of the information, which comes from feed sellers or pharmacy shops (FIG.3). These actors are directly interested in the security of the farm's income, and commonly inform their customers of the disease outbreaks occurring in the surrounding area.

Meanwhile Agribusiness and Pharmaceutical company technicians gather information from local distributors and actively inform each other. These actors play a significant role in relaying information on a large scale, in order to protect the income of their customers.

Poultry traders are not common targets of information exchanges because private actors fear their influence on market prices. However they get information from farmers who call them to sell rapidly their sick animals.

FIG.3. Networks built from the results of the participatory study in the two locations. Nodes at the bottom represent the different types of farms potentially affected by high mortality outbreaks.
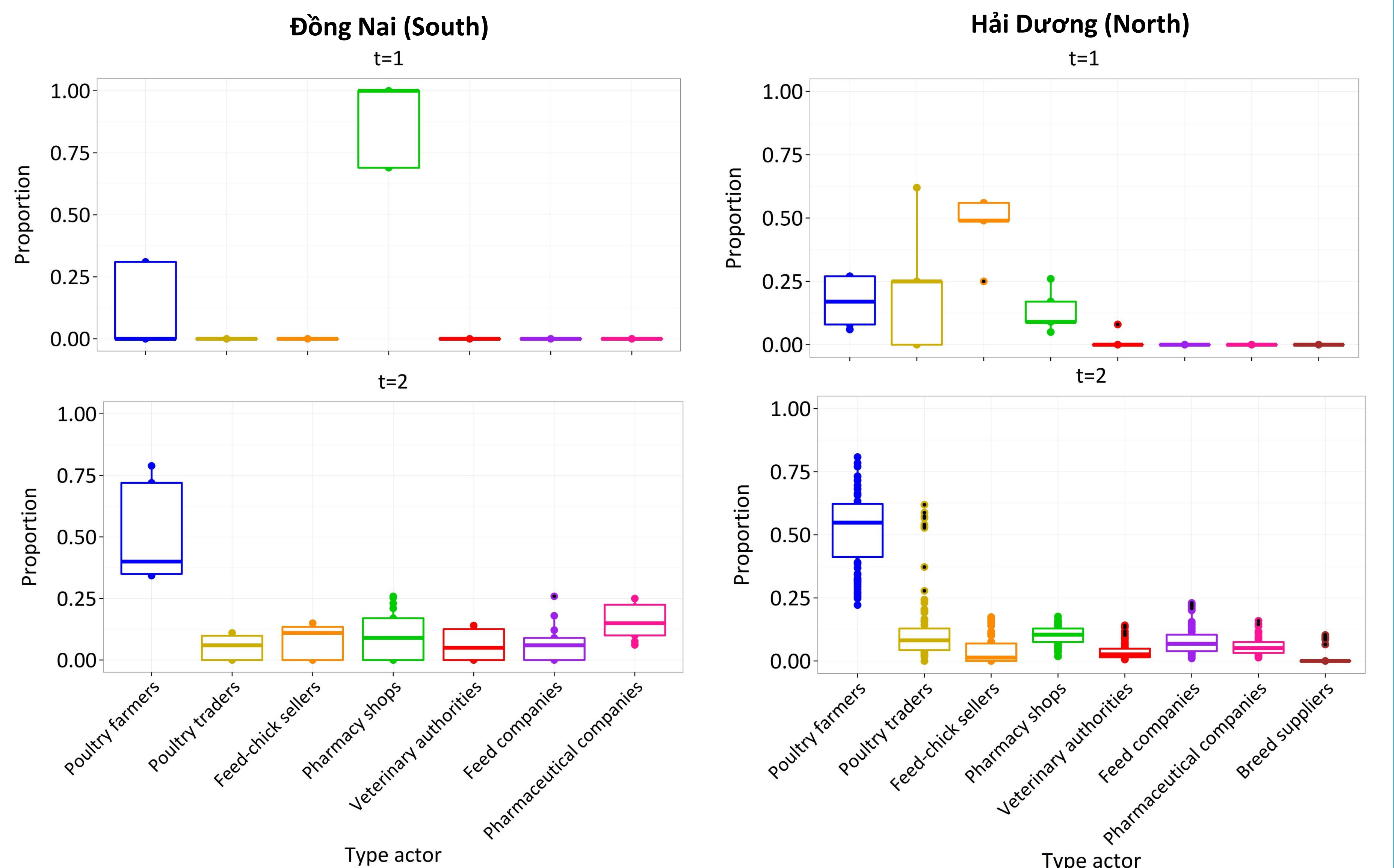

FIG.4. Scatter plot and boxplot representation of relative proportions of information received by each category of actors from direct reports of affected backyard farms (t=1) and from following indirect exchanges (t=2) according to the results of participatory investigation.

CONCLUSION: Currently in Vietnam private information networks have a crucial role in the management of epizootic poultry diseases. They are mainly relayed by local feed and medicine sellers and the agribusiness industry and have little connection with veterinary authorities.

However, analysis of inter-individual information exchanges show that veterinary agents are well included in the local private network because of their private activity, such as farming or medicine selling.

The need of early warning systems informing actors of poultry production of sanitary threats while preserving them from risks of price lowering constitutes an opportunity for public decision makers to significantly improve the acceptability of surveillance.

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