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Farmers as knowledge brokers: Analysing three cases from Vietnam's Mekong Delta

Quy-Hanh Nguyen
Hans-Dieter Evers

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Abstract

The paper explores the novel dimensions of agrarian change and of an agricultural knowledge-creation culture in Vietnam's Mekong Delta by examining cases of farmers engaged in knowledge brokering. Farmers empowered with knowledge, and through intensive engagement in networks and communities of practice, are taking an increasingly more important role in diffusing and (re)producing knowledge via brokering services. This research investigates the development path, brokerage undertakings and knowledge networking practiced by farmers, who act as knowledge brokers. In addition, it analyses the stories and knowledge flow networks of three selected cases. The analysis is contextualised in the diffusion of the VACB farming system, designed to make small-scale rural farming more sustainable through integrated horticulture (V), pisciculture (A), animal husbandry (C) and biogas installation (B). The findings suggest an appreciation of farmer-constructed learning structures in managing knowledge diffusion, and an integration of informal knowledge flows into the common agricultural/rural development goals of responsible organisations and the sector. An extended framework of knowledge diffusion management is also proposed. The data used in this analysis were collected during a one-year field research project in the Mekong Delta within the period April 2010-11.

Key words: knowledge brokering farmers, knowledge diffusion management, VACB farming system, narratives, network analysis, Mekong Delta

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1 Introduction: Reconnecting knowledge brokering and development

Globalisation has transformed the way knowledge is produced, transmitted and applied (Evers et al. 2009), as research results from one part of the world are transmitted over long distances to users. A wide gap has often arisen between epistemic culture, the culture of knowledge production and the social and cultural conditions in which knowledge is applied (Evers 2005). This problem is by no means new but has taken on new dimensions. In the field of agricultural extension this basic problem was recognised a long time ago (Rogers [1962] 2003), but has taken on dramatic proportions in the wake of the globalisation of knowledge. The role of "knowledge brokers", who translate knowledge to a variety of users, has therefore become more important.

Very often, knowledge brokering has to bridge the research-to-action gap crafted by the closed world-boundaries of researchers and decision makers, who increasingly need research-based evidence (Evers and Menkhoff 2010; Ward et al. 2009:2). Micheals (2009), for instance, strategises knowledge brokering to match diverse and complex environmental policy problems and settings. Knowledge brokering, in actual fact, reaches larger fields and end-users. Knowledge brokers, with their in-between world position or double peripherality (Meyer 2010), are adept at handling problems of knowledge stickiness[1] inherent in not only the nature of knowledge itself and the knowledge transfer process, but also the characteristics and relationships between knowledge producers and users (Sié and Yakhlef 2009:176). Essential attributes and skills of knowledge brokers identified by Lomas (2007:130) embrace an excellent understanding of the cultures of the knowledge source and recipients, the professional capability to deliver and disseminate knowledge and the aptitude to instill trust and credibility in the eyes of others. Taking a view from the social constructivist perspective that knowledge is locally produced and socially constructed (Micheals 2009:995), successful knowledge brokerage requires knowledge transfer feedback mechanisms and new knowledge generation and application continua.

Knowledge brokering for development is not new; for example, since 1906, an agricultural extension liaison division has been established at the University of Wisconsin to link local farmers and university researchers (Lomas 2007:131). In Germany, Friedrich Wilhelm Raiffeisen, born in Hamm near Bonn in 1818, created self-help, credit and seed distribution organisations for poor farmers in the 1860s. Knowledge brokering has recently gained growing importance in development conceptualisation and practice, particularly now that development itself is being redefined as "the ability to generate, acquire, disseminate and employ knowledge, both modern and traditional" (Oldham and McLean 1997). Acting either as knowledge managers, linkage agents or capacity builders, knowledge brokers make knowledge accessible, understandable and usable for their audiences, as well as create positive social outcomes by enhancing access to brokered knowledge within a society/community (Oldham and McLean 1997; Ward et al. 2009:2). In Vietnam, the demand of the development process that focuses on poverty reduction and rural development has encouraged the involvement of various knowledge brokering actors: international non-governmental organisations (under development projects and consultation services[2]), government agencies (mainly through agricultural extension systems and governmental programmes), universities and research agencies (via their technology transfer centres or practical research implementation), mass organisations and mass media. Relied on for their visions and resources, such knowledge brokers, who are trained experts in certain fields, transfer "proven" technology and

[1] Knowledge stickiness is understood as difficulties encountered in transferring knowledge to a form usable by knowledge seekers (Li and Hsieh 2009:426).

[2] One excellent example is the advisory work provided by the Netherlands Development Organisation (SNV) for sustainable development in Vietnam. For further information about SNV Vietnam and its consultancy services, please visit http://www.snvworld.org/en/countries/vietnam/Pages/default.aspx

knowledge to “targeted” communities that are believed capable of acquiring and using the knowledge to solve their “underdeveloped” problems. Within the rural development context, it is evident that the synthesis of the knowledge triangle of education, research and extension services has been practiced to ensure positive development impacts. Yet, under the umbrella of mainstream development based on expert knowledge, technocratic agendas and “for the common good” goals (cf. Zai 2011), in most cases farmers and rural communities are seen as passive recipients of knowledge for development.

Against this background, the present paper examines three cases of farmers who act as “professional” knowledge brokers. Constituting the main thesis of the paper is the reconstruction of agrarian change and epistemic cultures of agricultural/rural development grounded on research experts’ and farmers’ practices of knowledge diffusion and regeneration. The analysis is contextualised in the transfer of VACB, an integrated farming system of horticulture, pisciculture, animal husbandry and biogas, into Vietnam’s Mekong Delta, which will be reviewed in the next section. By analysing farmers’ stories and knowledge flow networks, the research explores the development path, brokerage undertakings and knowledge networking undertaken by knowledge brokering farmers in the subsequent sections. Based on the research findings, theoretical reflections on managing knowledge diffusion are framed, after which the paper concludes with practical recommendations for managers of development projects and the agricultural/rural development sector and suggestions for further research.

2 The VACB farming system: Trajectories, approaches and challenges

Improved water control systems, new and advanced technologies and appropriately changed economic institutions have led to a rapidly modernised and highly productive agricultural industry in the Mekong Delta, which has been long known as the greatest national rice basket (Evers and Benedikter 2009; Nguyen, N.D. 2006:1ff). However, chasing after high-yield, multi-crop mono-culture rice cultivation did not bring higher marginal income for its growers, whilst increasing pest and disease pressure and intensive pesticide application caused environmental degradation. Integrated farming systems were therefore developed and promoted.

VAC, an intensive household-scale symbiotic farming system of horticulture (V), pisciculture (A) and animal husbandry (C), was the first model of its kind, and was initiated and launched by the National Association of Vietnamese Gardeners (NAVG) in 1986. It is based on traditional gardening methods used by Red River Delta[3] farmers, and it has rapidly gained farmers' interest because it promises to combat rural hunger and malnutrition by providing diversified vegetables, fruits and animal proteins, helping to reduce economic risks that stem from their dependence on a single product, and instead increase their self-reliance and household income through saved capital input from the output-input recycling mechanism between subsystems. Additionally, the VAC itself is ecologically desirable and sometimes called the "VAC ecosystem", as it helps to vitalise and make green fallow and uncultivated land while sustaining local resources (Ikeguchi et al. 2008:12; NAVG 1995:4f; Wieneke 2005:23f). In the course of development, the model has been modified to be more appropriate for the climate and typology specifications of application areas. For example, it is observed in the Mekong Delta that an internal alum-washing drainage system is dug around and between a garden, where prominent citrus species and coconut palms are intercropped with mango, guava, pineapple, cacao and pepper plants (NAVG 1995:4f). The system can also be extended by adding more possible subsystems; for example, VACRRR[4] (R: rice, R: cash crops and R: forestation) is well developed as a typical farming model in Song Hau Farm[5] areas.

VAC and its modified versions, however, do not provide an apposite treatment of animal waste, particularly within the C component where swine raising is prominent. In order to make it a more sophisticated and practical appliance, a combined biogas module was supplemented, which created the VACB system (B: biogas) (see Figure 1). Biogas technology has long been adopted in livestock-based farming in Vietnam. Biogas construction design is principally distinguished by two models: (1) brick and concrete biogas plants[6] designed by NAVG and (2) lower-cost and easier-to-operate plastic (tubular

[3] After the Mekong Delta, the Red River Delta is nationally the second largest in the northern Vietnam. Natural conditions and historical development have created different water-shaped landscapes for the two deltas (Waibel 2010). Peasant social systems are described as distinctive in the two regions in that Mekong communities are seen as "open peasantry" while northern villages are represented by "closed corporate peasant communities" (Rambo 1973). Corresponding to models, this does not mean that closed, traditional Vietnamese villages uphold an unchanged social structure (Nguyen, D.C. 2008).

[4] Within the system, rice-fish or rice-cash crops can be grown by either intercropping or rotational cropping throughout the seasonal calendar.

[5] A detailed description and statistical data related to the model can be accessed at http://www.sohafarm.com.vn/index.php?nv=Intro&fc=view&id=9

[6] This advanced biogas design is called a "hybrid technology biodigester with automatic scum control – HTASC" or a VACVINA biodigester. Vietnam's Ministry of Agriculture and Rural Development, in Decision No. 4414/QĐ-BNN-KHCN dated 18 October 2002, recognises this initiative and permits its application nationwide. Since 2000, thanks to Toyota Foundation funding, over 300 technicians have been trained and 750 biogas demonstration models built in 61 provinces, resulting in more than 7,000 VACVINA biogas plants constructed within the project. The VACVINA

polyethylene film) biodigesters[7] introduced by Ho Chi Minh City University of Agriculture and Forestry in 1992. Biodigesters produce properly treated by-products within the system, clean domestic energy and better rural sanitation from an ecological perspective[8] (especially where both animal waste and human faeces are connected to and treated in biodigesters[9]). Farmers in the Mekong Delta widely use the latter model, as it suits their small-scale farming, initial construction investment and technical maintenance[10].

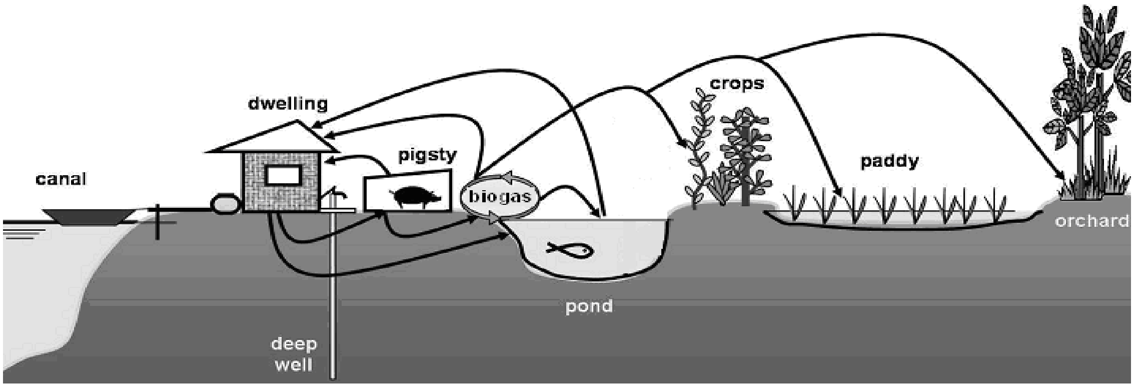

Figure 1: A universal VACB system layout in the Mekong Delta (Source: Wieneke (2005:24) with minor changes)

The transfer of integrated farming technology and knowledge is mainly designed as part of a project's framework with the participation of (inter)national project managers, universities and/or development agencies as technology developers, technical advisors and local governments and communities as beneficiaries. Following mainstream technology transfer[11], the "from model farms to extensive fields" approach is adopted as the major dissemination strategy (cf. NAVG 1995:5). The diffusion process is chronologically implemented as follows: eligible pilot households are selected by the project and local government, models are established with subsidised inputs and technical support by project technicians and development practitioners and finally dissemination seminars and meetings are organised for broader communities in order to inform them about the model and share experiences when initial

biodigester has spread further afield under the auspices of various project schemes and includes a market-oriented approach (CCRD nd.).

[7] Since 1992, the Ho Chi Minh City University of Agriculture and Forestry, with support from SidaSAREC, FAO and the Ministry of Education of Viet Nam, has recorded the installation of more than 15,000 plastic biodigesters throughout over 40 provinces. The technology has also been introduced to neighbouring countries including Cambodia, Laos, the Philippines and Thailand (Duong and Le 2002).

[8] Ecological sanitation is "a holistic approach to save water, prevent water pollution, to sanitize and recycle the nutrients and organics in order to restore soil and soil fertility" (Wieneke 2005:28). The basic principles for its sustainable acceptance include: (1) consistency with cultural and social values and to meet the needs of all household members (2) easy to construct, to use and to maintain with local available resources and (3) accessible to households of different social status in the community (Wieneke 2005:28).

[9] The wide use of fish latrines in the Mekong Delta, as well as vapid changes caused by government regulations and policies, call for more practical measures, in which biogas technology can take a role. An analysis of rural sanitation and water supply in the Mekong Delta can be read from Reis and Mollinga (2009).

[10] Over time, the decomposited liquid mixture is brought to the surface by pellicle, which interrupts gas circulation. Technical know-how is needed to break the pellicle in the concrete biodigester. However, this can be done easily with direct blows from outside of the plastic biodigester (Interview, CTU senior researcher, male, 06.10.2010).

[11] By this we mean the prominent approach of agricultural and rural extension in Vietnam. Since 1993, a professional extension system has been created nationwide over four levels of administration (national, provincial, district and commune). However, service performance is confronting insufficient funding and staff and a lack of up-to-date extension principles and practices (Poussard 1999). Influenced by the top-down and hierarchical structure, in order to obtain central funding local extension divisions have to "adopt themselves to meet the criteria without consideration of local needs and ecosystem suitability" (Nguyen, N.D. et al. 2005:85).

results are achieved (cf. NAVG 1995:5). It is expected that new practices are multiplied when the model's principles and outcomes are obtained and proven through this process.

Since the system is complicated in terms of effective adoption and operation in the long run, rather than technological understanding and acceptance, on the spot and post-project consultations and support are required, as this need is hardly satisfied by a centralised project and its resource constraints. Besides "hard" technological issues related to subsystem installation and arrangement, production activities require further multidisciplinary and multi-stakeholder efforts. It is always challenging for both scientists and farmers to address the basic question: Which kinds of plants, animals and fish need to be grown within the integrated system, taking into account the dynamics of local conditions, needs, pest and disease outbreaks, as well as market demand. Furthermore, even when intensive dissemination is needed, it is crucial to keep in mind that the system is under investigation, theoretically and practically, for optimisation over the time-space axis (cf. Wieneke 2005:24).

Taking a different approach, local academics, particularly from Can Tho University (CTU), have diffused VACB technologies through their development-induced action-research interventions. Funded by governmental programmes or via individual research networks, these projects are planned and implemented directly by groups of university researchers from relevant disciplines. Due to their research-driven features, such research/development projects frequently provide better access, constant contacts, relation maintenance beyond project boundaries and learning spaces between the knowledge source and the recipient. In addition, by working closely with farmers, scientists can provide short, instantaneous problem-solving advice and extensive, well-prepared lessons to farmers as well as conduct experiments and tests and make modifications corresponding to farmer's experiences, local conditions and practical trials. Throughout this process, localised knowledge and new values are generated and added, and trained farmers have emerged as a new category of VACB knowledge brokers working across the delta, as discussed below following the Methods section.

3 Methods: Narrative inquiry and network analysis

In the research[12], a qualitative narrative inquiry was applied. From a constructivist view, stories people construct and tell are instrumental in understanding the way they make sense of and change their lives (Shkedi 2005:13). Lemmer (2009:85) explicates that narrative analysis is a powerful research tool for creating accounts of "epiphanic moments, crisis or significant events in life, relationships or careers". In the field, it turned out to be difficult to identify and select respondents for interviews, especially as farmers who act as knowledge brokers were not registered or recognised as such. Even the farmers themselves did not see knowledge brokering as a professional activity. Moreover, academic researchers who used to work with the farmers were also not fully aware of all the brokering work in which the farmers were involved[13]. The study employed snowball sampling[14] as a data accessing strategy to gain access to the "hidden population" (Noy 2008:330f). The generational participant, Farmer Z[15], was previously contacted and interviewed by the author in an attempt to effect the saturation of purposive farmer interviews for the one-year research project in the Mekong Delta. This first participant then introduced Farmer Y, while Farmer X was chosen on Farmer Y's recommendation. Farmer X reintroduced Farmers Y and Z, and also located some of his colleagues from VACB training courses; however, none of them was selected because of repetition within the sample category. Consequently, three narrative interviews conducted with farmers X, Y and Z contributed to this analysis.

The respondents were invited to tell their stories, starting with the overarching question: "Please tell me about changes in your personal and occupational life. I am interested in your whole life, especially since you work hard to transfer your farming knowledge and skills to other farmers. You have as much time as you like. I will not ask you any questions for now. I will take some notes and may raise questions later." All interviews were digitally recorded, lasted between two and two-and-a-half hours and were verbatim transcribed, from which the farmers' stories[16] were produced thematically. However, for the purpose of this analysis we are trying to construct collective stories[17] instead of individual or personal first-order narratives. In addition to the narrative interview conducted, each farmer was invited to draw on his network of knowledge flows. The findings of these enquiries were complemented by other results from the field research.

[12] This paper is based on broader research on knowledge diffusion practices in agricultural/rural development in Vietnam's Mekong Delta, designed within the period of 2009-2012 (with one year of field research in between) under the WISDOM project (www.wisdom.caf.dlh.de).

[13] As a senior university lecturer explained: "We have maintained long-term relations with several farmers as field research collaborators. They have to be enthusiastic, knowledgeable and better-off farmers who can host and give support to our trainee students and researchers. Such voluntary cooperation is without a written contract. The farmers learn many things from working with us, yet we have no knowledge whether or with whom she/he shares the acquired knowledge" (Interview, CTU senior researcher, male, 08.12.2010).

[14] Noy (2008) defines snowball sampling as a procedure in which "the researcher accesses informants through contact information that is provided by other informants" (p. 330) and argues it is not merely an instrumental procedure but effective in the research of organic social networks (p. 340).

[15] Farmer Z and others (X, Y, etc.) in this research are pseudonyms.

[16] Corvellec (2006:8) claims that "to be a story a narrative has to be emplotted – provided with a plot".

[17] "The collective story displays an individual's story by narrativizing the experiences of the social category to which the individual belongs, rather than by telling the particular individual's story […] Although the narrative is about a category of people, the individual response to the well-told collective story is 'That's my story. I am not alone'" (Richardson 1990:25f, cited in Elliot 2005:13).

4 Presentation of the farmers' stories

Farmer X's story: From fruit broker to knowledge broker
Farmer X, aged 47, was born and grew up in a poor peasant family of five children. Like most other children in his village, he dropped out of school in the fifth grade and started working full-time with his parents on a small rice field. After getting married, he and his wife inherited from his parents a small piece of residential land equal in size to those of his other siblings. Lacking land for cultivation, they became dependent on a boat steered along rivers and canals to collect fruit and vegetables from local gardens and sell them in the early-morning floating market. With the birth of their first and then second daughters, they decided to sell the boat and settled down so that their children could go to school. They were confronted with great economic difficulties, due to modest incomes from the wife's pig and chicken raising and the husband's hired labour work. For a few years, the couple hired some land in Dong Thap Province to grow rice, but due to the poor condition of the local soil and an unidentified pest and disease outbreak, they had to leave, empty-handed, and returned to their small plot. Having to make use of their limited land for living forced them to diversify their agricultural activities.

In 2009, the family was accepted onto a VACB "clean environment" project administered by CTU scientists and researchers. The project focused on pig raising technologies in response to the spread of blue ear disease. His house, easily accessible for local villagers from different sides, was selected as the project communication post and permanent class for the project training courses. Partially financed by the project, his temporary house was upgraded with extended eaves capable of housing 60-70 seats. A plastic biodigester was installed to connect waste from a newly-built toilet and animal raising facilities, facilitating farming using a complete VACB system. More than 10 courses have been conducted by CTU experts on different VACB-related topics, from horticultural diversification, swine farming techniques, swine disease prevention and treatment, fish hatching and fish stock management, to biogas plant construction and maintenance. In each thematic course, 60-70 local farmers are invited and CTU trainee students participate as observers. The training, which is structured around a theoretical component followed by practical sessions, lasts normally from one to three days or sometimes longer.

To date, Farmer X has actively attended all classes and intensively worked with experts in solving local emerging issues, as he plays the role of intermediary between scientists and locals applying for new technologies. He often communicates with other advanced farmers such as Farmers Y and Z to exchange practical experiences and lessons. Problems that cannot be solved within the group are presented to external researchers/experts, who either advise the farmers in a phone call or visit directly for sample collection and laboratory testing. Farmer X and his wife are willing to share their experience with local people, explain to them any issues they do not thoroughly understand and distribute the project's training materials. At the time when this interview was conducted, an older villager was waiting for Farmer X to check his new biogas plant operation. Farmer X also helps CTU trainee students implement their experiments in his field. It is through such formal and informal learning and practice that he can acquire essential knowledge of the VACB system. For him, passion, knowledge and practice are the key elements to his present success. In the expansion phase of the project, he was selected to follow the project's researchers in assisting new VACB households to set up the model, a testament to his persistent thirst for learning. This recruitment drive also provided him with a second job as a knowledge broker.

Farmer Y's story: Exchanges for new knowledge generation and professionalism
Farmer Y, aged 62, lives in a village famous for its citrus production, from which many local households have made a significant amount of money. After only his second harvest, he could afford the construction of their house, but in 1993, his gardens – like all others in the village – were completely

ruined due to the citrus greening[18] outbreak. As a result, he had to chop down and burn affected plants and restart a new crop. Again, though, the trees' leaves were observed with blotchy or yellowing mottles and the fruit was misshapen and fell prematurely, forcing the elimination of his entire crop. His family faced extremely hard economic times in the following years.

In assisting waning citrus-dependent farmers, in 1996 the VACB system was introduced for the first time to Farmer Y's district through a "learning by doing" principled CTU project. He joined the programme comprising 33 farmers, who were intensively trained on subsystem-based courses. He recalled that a new kind of fish, *Trichogaster pectoralis regan* (TPR), was promoted within the pond subsystem. Many registered but only he was present on the day to collect juvenile specimens. The project's scientist asked, "Now that 17 households have withdrawn, what is your decision?" He made an assertion, "I have no fear, when you are with me". He was carefully instructed how to handle and release fish into the lake, feed and take care of them. His fishery mentor maintained weekly visits to his farm. He shared that he followed all the instructions strictly and tried to understand thoroughly every procedure to induce spawning, from hormone preparation, dosage calculation and injection techniques to egg collection and larvae feeding. His first crop was a great success, with an average weight of 100 grams per six-month old fish, which surprised even provincial agriculture leaders. He became the first Mekong Delta farmer to succeed in in TPR breeding and fertilised fish egg production and was well-known in local and national mass media.

Finding new technology and knowledge for him was as important as localising such knowledge by proposing modifications, advancements or improvements gleaned from local practical application. He realised that apart from a strong educational background[19], local understanding, good communication skills and continuous learning create a high-profile knowledge broker. Besides collaboratively implementing applied research provided by the university on his farm, he has been employed as a lecture assistant and technical advisor in CTU's VACB training projects, as well as a number of other provincial and international development projects. Farmer Y is also energetically involved in local development activities. In 1998, he was appointed the head of his commune's extension club of 22 members, which went on to become the 21-participant agriculture cooperative that he has chaired since 2003. For him, farmer groups are useful for VACB technology and knowledge diffusion among members, yet his cooperative, which focuses on producing pigs and fertilised fish eggs, is on the verge of dissolution because of a series of outbreaks of bird flu and blue ear pig diseases, the escalating price of input materials and the non-operationalised cooperation in product consumption.

Recently, he has delivered on the spot training sessions to farmers from various provinces in the Mekong Delta, based on their invitations and contracts. Some initial efforts are being made to establish a VACB technology transfer association comprising state managers, scientists and knowledge brokering farmers. Throughout his knowledge brokering, new knowledge is generated through improvements, modifications and practical implications; however, little is discussed and added to VACB training materials. When asked about training material preparation, he pointed to his head: "Here, it is all inside here".

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[18] Citrus greening disease (*Citrus Vein Phloem Degeneration)* is reported to be the main cause of catastrophic crop losses in the Mekong Delta. The proposed causative agent is *Liberobacter asiaticum bacterium* transferred through the insect vector *Citrus pyrilla* (*Diaphorina citri*), the most serious sucking pest (Nguyen, T.L. et al. 2010:153). Until now there has been no cure for the disease except heat treatment on affected plants and prevention by insect vector control.

[19] Farmer X graduated from high school education. Our interview recorded some similar farmer cases of high attainment of formal education in the Mekong Delta. In a contrasting regional pattern, as the 2007 statistical data indicate, approximately 92% of employed population just have a basic education and that the region has the lowest enrolment rates in upper secondary school and in colleges and universities in the whole country (Vormoor 2010:21).

Farmer Z's story: Knowledge brokering over a production chain
Farmer Z left school before finishing his high-school education. After getting married, he had to assure sufficient food for six family members and education for his two children. He tried various new cultivation approaches he learned from radio and television programmes on agriculture extension, but to no avail. In 2000, he learnt about Farmer Y's VACB model from a local television programme and went to see him to share his experience. Back home, he decided to chop down more than 60 longan trees to create a pond, and applied for a bank loan of VND 10 million to invest in TPR and pig-raising. However, the first crop failed because of poor TPR eggs. Not discouraged, he kept on the second TPR crop, but still quite a number of fish were dying after the first 20-30 days.

In fact, after his first crop failure he started participating in a project run by CTU researchers on native fish conservation through protection zoning and local livelihood improvement. One day, while transporting a CTU scientist around the village to select suitable households for biodigester construction, he was so worried and impatient about his fish conditions that he recounted his futile attempts at fish rearing to the scientist, a fishery mentor who also helped Farmer Y in another VACB project: "If I fail this time again, I guess I will have to leave my house. I have little hope now that the fish are dying". Without delay, the scientist visited his pond. Sample testing revealed the disease was related to brachial parasites. After two days of treatment under scientific instructions the health of his fish recovered significantly. Under the continued supervision of the scientist, ten months later he had more than 10 tons of mature fish that he continued to culture, in order to satisfy market demand, into brook fish. He earned a profit of VND 30 million for this crop. In the next crop in 2003 he mastered TPR spawning and produced nearly one ton of TPR fish eggs, but still could not meet demand. He then became the direct technology transferor for nearby interested farmers and the quality checker of fish eggs for selling to out-grow farmers. He developed and led a group of 30 local farmers to specialise in TPR egg production. After learning biodigester construction techniques, under other projects or within his own schemes he instructed on and built an array of biogas plants for others in the Mekong Delta. He also helped to spread *Trichanthera gigantae*[20] as a feedstuff for livestock and fish after successful experiments carried out by CTU agro-scientists.

Similar to Farmer Y, Farmer Z first worked as a knowledge broker within CTU projects, before being introduced and connected with provincial and international development partners. His experience taught him the importance of on-farm, throughout-the-process training for farmers whereby, accompanied by his colleagues, he would stay the whole week with farmers to transfer fish breeding techniques. Essentially, he ruminated on the applicability of what he presented to farmers during his theoretical and practical courses. One of the most difficult questions that many farmers asked him during his courses was: "Thanks to your technology we can make good production, for sure, but we are now worried about the market, so can you help us with our product sales?" After a few years of VACB knowledge brokering, he formed a wide network of application farmers from his own region and all over the Mekong Delta, who agreed to connect together in a VAC fish egg supply group that was able to satisfy any immediate order for one to two tons of TPR eggs. This networking initiative helped to develop Farmer Z's knowledge brokering over the production chain, from TPR breeding to marketing.

[20] *Trichanthera gigantea*, a plant found in Colombia and other Central and South American countries, easily adapts to a wide range of tropical ecosystems. It is established simply from leaf and green stem cuttings. It has been successfully introduced to Vietnam and can be harvested after 8 to 9 months of planting and subsequently at intervals of two to four months. Its annual fresh biomass yield is about 60 tones/ha, containing about 2 tons of protein (Rosales 1997:46).

5 Analysis of farmers' knowledge flow networks

This section analyses the interaction, significance and intensification of various actors and organisations, individually or in-group, over the knowledge transfer flow network centred on Farmers X, Y and Z (see Figures 2a-c)[21]. Perceptibly, the main sources of knowledge of the three farmers are (1) the university scientist community, who have brought them new technologies and knowledge to solve current farming problems, as well as opportunities to learn and transfer new knowledge for their fellows in need and (2) the professional group of VACB farmers, in which three of them play core roles. Depending on the foci of a certain VACB project, the farmers tended to maintain close relations with scientists specialised in that particular VACB subsystem. The more intensively the farmers worked with scientists within or beyond one research/development project, the higher the importance of the scientist's roles was ranked by the farmers. In the case of Farmer Z, this role was more concentrated on one scientist, his pisciculture mentor. Farmer Z has widened his sources of knowledge by networking with groups of students[22] and farmers with whom he has had a chance to work, which is less observed in the other two cases. Within the group of brokering farmers, Farmers Y and Z maintain a stronger relationship compared to their connections with Farmer X, who is considered a new recruit and thus tends to learn and receive information/knowledge from the other two farmers. Only Farmer X retains a strong knowledge transfer tie with his wife because they both have joined in an animal husbandry development project which is designed to promote the woman's role in household livestock activities.

In the knowledge receipt sector, we can observe a trend to broaden the audience over the spatial dimension as the farmers become more experienced in their knowledge brokering. The majority of Farmer X's knowledge brokerees are within his locality and were introduced through CTU development projects in which he is involved. In contrast, Farmers Y and Z have expanded their services across the delta, through invitations by local and international projects or private farmer groups. Very often, the farmers maintain a strong relationship with the heads of the group or the most progressive farmers of the cohort to which they make the transfer. Based on this network, Farmer Z has formed a fish egg club that enjoys delta-wide membership and high productivity.

A loose knowledge-related connection between the farmers and local extension workers and/or provincial agricultural officials in the networks was observed, although an exception was Farmer Y, who was recognised as a "good farmer" by the commune and was responsible for the local extension club

[21] The VennMaker 0.9.6 VIP software was used to present the networks. Relevant by-default actor types (names and images) including female, male, actor or institutional actor were applied based on how the farmer (Ego) addressed these actors, or Alter(i). Alteri mainly included: (1) CTU academic researchers (abbreviated to "Res."), (2) CTU trainee students ("Trainee"), (3) farmers, who were further subcategorised as farmers within the village ("Villager"), farmers in a project ("Proj.far."), either CTU, local government ("Local") or international ("Int.") projects, and farmers from the delta in general ("Farmer"). As not each and every actor in one group could be individually identified, for example, cohorts of trainee students or local farmers with whom Ego worked, they were representatively demonstrated with 1,2,3, …, n in the network. The size of Alter symbolised its importance determined by Ego. Alter attributes were illustrated via (1) three sectors: knowledge source, knowledge receipt and the buffer sector where Ego had indirect VACB knowledge diffusion relationship with Alteri, for example trainee students, and (2) three concentric circles signifying the spatial proximity (district, province and delta levels) of the Alteri to Ego. Strong, simple and weak ties were used to illustrate respective types of Ego-Alter and Alter-Alter relations. Further reading includes Manual VennMaker 0.9.5 VIP by Kronenwett (2009).

[22] He was fond of talking about VACB issues with trainee students and visitors, from whom he learned a lot. He was willing to let trainee students carry out their experiments on his high-value ponds, upon which he could only take any actions with the students' agreements. In return, they helped him with sample experiments, training document preparation and report drafting. It was through old trainee relations that he was able to work for some international development projects (Farmer Z, interview, 08.12.2010).

and later the cooperative in his commune. Newly-applied knowledge and technology by CTU farmers should be prioritised by their local extensionists and agricultural officials to apply in localities with the sameness or similarity of physical and institutional landscapes. Such "dovetailed" knowledge could be widely transferred and wisely used within the locality, if more intensively linked.

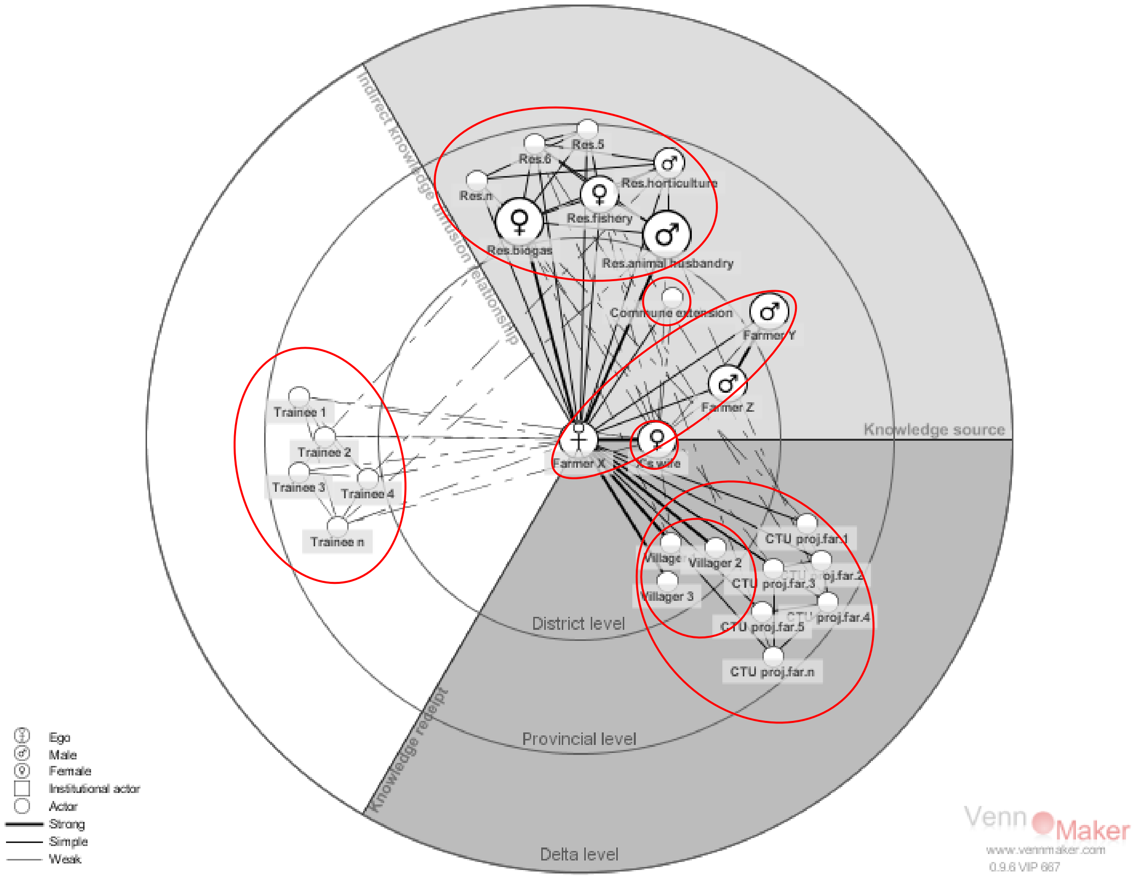

Figure 2a: Farmer X's egocentric knowledge flow network

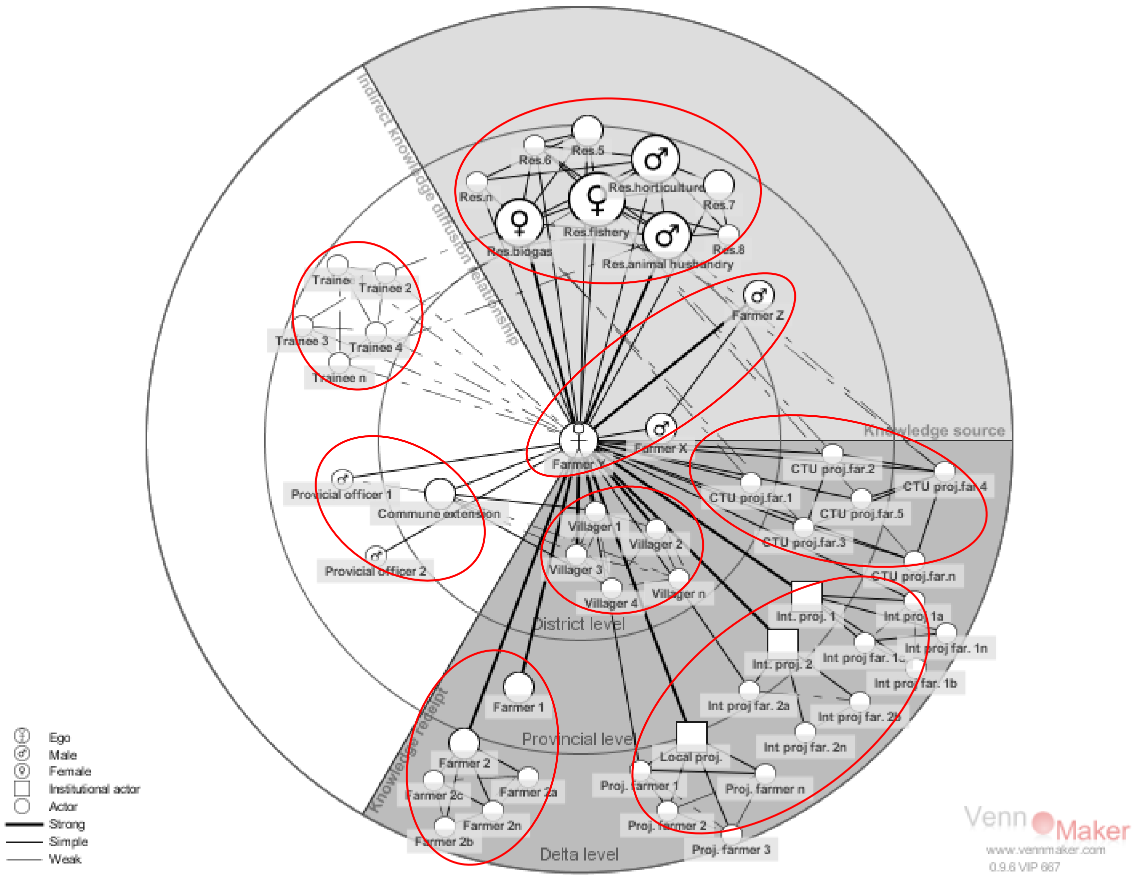

Figure 2b: Farmer Y's egocentric knowledge flow network

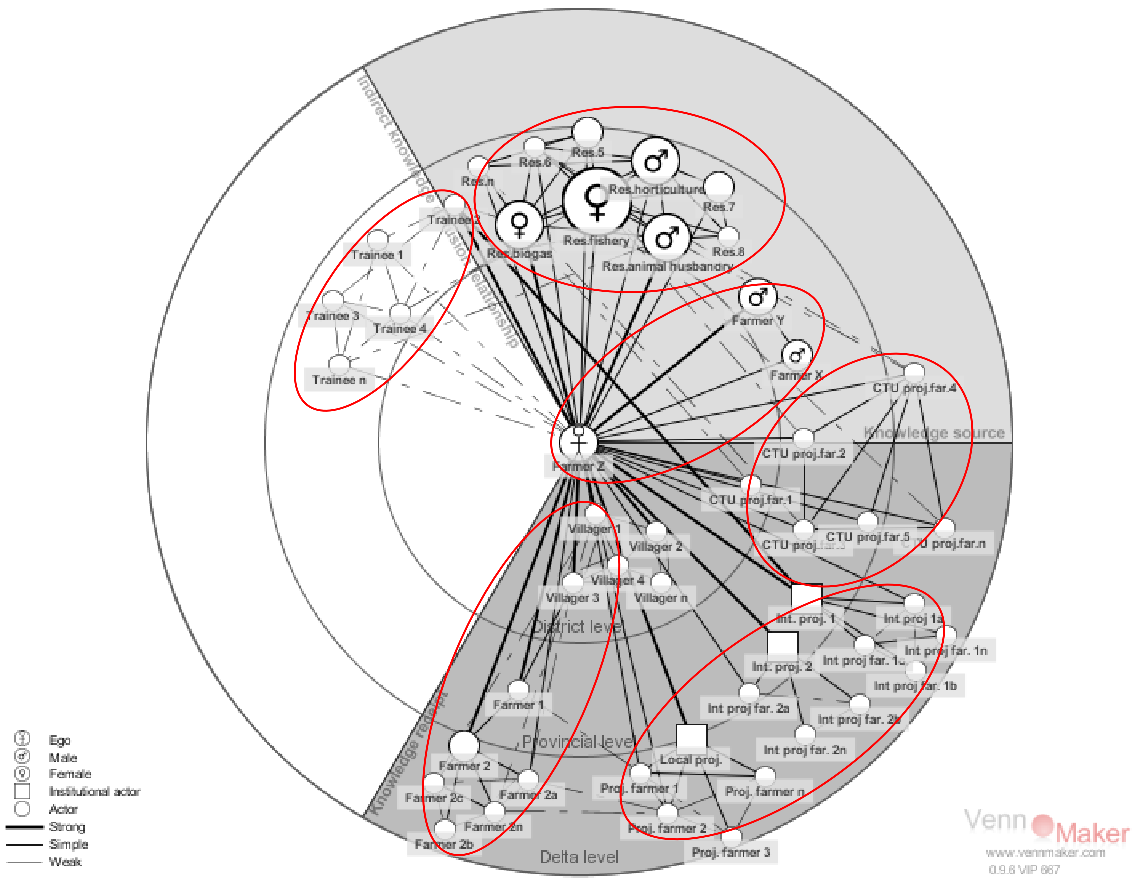

Figure 2c: Farmer Z's egocentric knowledge flow network

6 Knowledge-based development: Another peasant development path

The main theme that runs through Farmers X's story is his struggle with livelihood diversification, his engagement in applying VACB and his duplication and transformation into a knowledge broker. Meanwhile, the main feature of Farmer Y and Z's stories is their brokerage development experiences through interactions with academic researchers and farmers with whom they have worked. These complementary stories convey that the farmers, in ways different from the universally conceptualised agrarian change in Vietnam that is based on land and production accumulation (Akram-Lodhi 2001, 2004, 2005), have gone through a personal and professional change process driven by knowledge accretion from diffusion and learning. The process can be reflected in five stages: (a) nuclear household farmer, (b) active knowledge disseminator, (c) paid technical consultant, (d) "advanced" farmer and (e) professional knowledge broker.

It has been highlighted that nuclear household formation is an important landmark in the farmers' life stories. The farmers stated that as the main bread winners of their newly-formed families they (and their wife, in case of Farmer X) have worked very hard for a better life. They, like many other farmers in the Mekong Delta, have painstakingly worked to escape deprivation, but not all of them during their life can find a solution to "from where and how to get out of and not fall back into the poverty cycle" (Interview, Farmer Z, 08.12.2010). Under the increasing lack of access to cultivatable land[23], less effective traditional production methods and increasing needs for children's nutrition and education, farming intensification and diversification, as well as new technology adoption, have been commonly promoted and adopted[24]. Nevertheless, unrecognisable and uncontrollable pest and disease outbreaks and negative market demand and supply externalities have greatly hindered or even bankrupted small-scale farmers. What makes Farmers X, Y and Z different from other farmers is that, when selected as project beneficiaries, they made use of the opportunity to work with and learn from scientists/researchers in order to solve obstacles to farming and accumulate knowledge from the project courses and through their own practice. Farmer Y, for example, was the only one out of 18 farmers who accepted the opportunity to rear TPR in his pond. Given the technology was new, his decision was made based on a better educational background, confidence in scientific knowledge and even risk-taking. Formal educational attainment defines the ability of farmers to learn, but the desire to

[23] Although the formation of private large farms is observed, the main characteristic of agricultural land ownership in Vietnam and the Mekong Delta is small and distributed plots. The man-land ratio in the Mekong Delta declined from 0.6 ha/farmer in the mid-1980s to less than 0.45 ha/farmer in 2001 (Nguyen, T.K. 2009:232). Nguyen V.T. and Le (2010:156-161) describe small-scale agricultural production and its "behind the village bamboo range" traditional practice and cultural habits as a trap (*bẫy tiểu nông*) that hampers the development of a large-farm economy and the application of ecologically sound technology.

[24] "In nuclear families, the phases of creation, expansion, accumulation, and consolidation confer to the household life cycle as well as to the livelihood strategies. The phenomenon of young couples living with the husbands' family may be explained differently by anthropologists; in our study we distinguish this as a phase of preparation towards establishing an independent household since the cohabitation only starts after marriage to allow the young couple to save money. Off-farm diversification was important for all households from preparation until expansion, but for the resource-poor, it was a necessity at all times. In the expansion phase the farmers increased the farm turnover by keeping more livestock, and in a later phase they accumulated their savings either in land, houses or the education of their children. The Mekong Delta farmers diversified on-farm activities to increase food production and maximise the cash income from their limited area. This on-farm diversification and the effective integration of components affected income positively, but needed know-how, and a minimum area of land in, or close to, the homestead". (Bosma et al. 2005:64)

learn determines their knowledge diffusion and reproduction achievements[25]. The farmers gradually manipulated new knowledge for the benefit of productivity and improved livelihoods.

The second development stage involves the farmers' knowledge sharing and diffusion with other project participants and local neighbours. After a (sub)system has been successfully implemented on their farms, the farmers are then instructed by project researchers/technicians to set up the same model for other project participants. Through this process, new knowledge is transferred to other households, whilst the farmers' knowledge and capacity are also enhanced via the training-the-trainer mechanism. They most frequently start their diffusion work with close friends and neighbours through unofficial channels. The three farmers in our case studies expressed a strong commitment to continuing to assist other farmers in an attempt to build up a VACB (sub)system. Knowledge sharing willingness, sometimes coined the "responsibility" of the farmers, can be explained through their relationships with the university researchers who enthusiastically taught and instructed them. Farmer X pointed out that "I am greatly grateful to my mentors – CTU scientists who passionately worked to transfer to us the necessary knowledge and skills to build up and develop the VACB system. Therefore, I promised myself to willingly share what I learned and successfully applied in my house with anyone who needs my help. Currently, I am working closely with my two neighbours on their systems" (Interview, Farmer X, 08.03.2011). Farmer Z explains that there seems to be a natural bond between CTU scientists, who are looking for "advanced" farmers to further disseminate the VACB model, and those in dire need of new knowledge to solve farming problems, and that the best testimony to his mentors is to learn harder so that he can help even more people. As the farmers note, communication skills are very important for any farmers wishing to diffuse VACB knowledge. Farmers X and Y mentioned some other farmers in the project who had achieved the same good results but were not able to systematically re-explain the process they undertook in front of a group of people.

The third stage seems to start when the farmers, following the termination of the project and based on their capacity and personal qualities, are selected from among other project beneficiaries to become collaborators with university faculties. They are paid to assist in running the more technical components of VACB training courses held by the university, and are responsible for on the spot practical training in a certain VACB subsystem, during which they try to link their instruction with the theoretical element taught by university researchers, by using their own language and experience to achieve the course objectives. At this stage, the farmers mainly focus on efficiently using and transferring already produced knowledge or knowledge exploitation (cf. Liu 2006).

In the fourth stage, through the continual process of situated learning in action in close consultation with the researchers, the farmers become what is viewed as "advanced"[26]. Acquiring knowledge can increase their productive ability to grow particular crops and in turn raise their human capital and capability (Howie 2011:73). Very often, "advanced" farmers relate to big land owners with higher economic power, and they sometimes enjoy higher educational attainment compared to average farmers. According to Nguyen, N.D (2006:110ff), "advanced" farmers are characterised as experienced,

[25] Farmer X, who attained an elementary education, has to spend more time learning and practicing new knowledge delivered by researchers/experts. He does not have many initiatives or innovations compared to other farmers with higher standards of education. Yet, constant learning and practice have provided him with the knowledge and confidence to broker VACB knowledge to his wider community.

[26] Different from "good" farmers, an officially certified category used by farmers' unions, the "advanced" farmer tag is used by local agricultural officials and extensionists to refer to de facto technologically progressive and socially respected farmers in a community, whether or not they are "good" farmers. The differentiation between the two categories remains possibly due to the fact that decisions on the certification process are made within the hierarchical structure of farmers' unions at all levels (as our interviews point out whereby agricultural officials and extension workers are frequently not informed about the "good" farmer list) and selection criteria are largely biased towards economic profit records.

technologically progressive, economically well-off and socially prestigious. For this reason, they are usually selected by project leaders to be the models of new technology introduction. One common pathway to becoming an “advanced” farmer is through the accumulation of cultivated land, which leads to the demand and consequent application of new technology. However, an “advanced” farmer does not always mean someone who advances knowledge sharing. The cases of Farmers X, Y and Z provide another development roadmap of “advanced” farmers, with its departure based on advanced technology/knowledge acquisition and mastering. Their economic growth is generated from intensive farming on their current land, while proactive knowledge sharing and brokering bring them professional confidence and local trust and respect.

Reputation facilitates the farmers to expand their knowledge brokering services beyond the university network in which they started. Particularly in the cases of Farmers Y and Z, they have developed partnerships with international non-governmental organisations and local authorities and inter-provincial client groups. Their job has also become more professional through diversified farmer clients and new issues and problems they have faced. Besides technological transfer, they have to take care of the whole course of knowledge transfer and practical application of their clients while maintaining interest in their colleagues’ motivations, investment capacity and other traditional and cultural factors that influence the transfer process. To make VACB knowledge/technology locally useable and upscaleable, brokering farmers are involved in cycles of identification, rescaling, transformation and distribution of knowledge. Through such processes, new values are added to farming initiatives, improvisation and innovations, for example improved biodigester construction or TPRs spawning through the use of less modern equipment developed by Farmer Y, or various TPR rearing scales suggested by Farmer Z. Their brokerage professionalism has triggered the moving from mere knowledge exploitation to knowledge exploration at this final stage.

In summary, it has been configured the five stages of development towards a “professional” knowledge broker from a “normal” farmer. Such staging is relative, though, as the phases are not necessarily chronologically distinctive; for example, becoming an “advanced” farmer involves a continuous process of previous phases without clear borders. Furthermore, the knowledge brokerage career of a certain farmer, depending on his/her individual educational background and socio-economic situation, can flourish to professional status or just over some certain stages. The path includes multi-directional learning processes between and among farmers and experts, challenging the single, project-based engagement and development consultation by short-time experts prominent in development cooperation practices (cf. Evers and Gerke 2005:7). It involves a long-term process of selection, apprenticeship training, practice, capacity building and knowledge exchange. Understanding the stages involved in the knowledge brokering development path of the farmers has implications for interventions aiming to develop the number and quality of a cohort in various fields. For example, recent efforts by a research institute in the Mekong Delta to educate fruit farmer experts, through intensive formal training and involvement in mobile fruit tree “doctor” teams, may be oriented to the formation of farmer-based brokerage networks. More potentially, recent research indicates a number of examples of farmers who work as local technicians, local innovators and community motivators (Nguyen, N.D. 2006:101-108), and who advance from growers to the breeders of new varieties that are then widely adopted (Tran, T.B. 2009:251-256) in the Mekong Delta.

7 Knowledge brokerage undertakings: Counteracting knowledge stickiness

As discussed earlier, conventional VACB diffusion, like many governmental agricultural and rural development programmes in Vietnam, adopts a technology-focused and "model"farmer-based approach (see Figure 3).

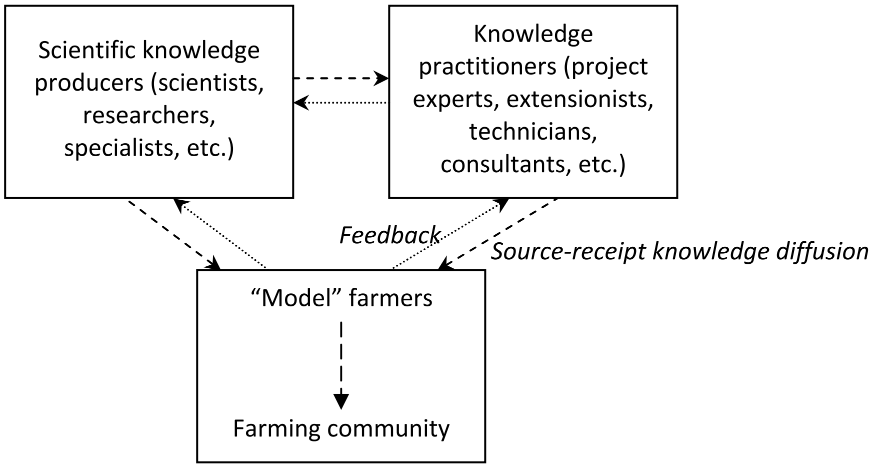

Figure 3: "Model" farmer-based knowledge diffusion

Such a knowledge transfer mode can be captured within a dual system, which includes (1) the institutionalised process whereby knowledge transfer is funded, planned and implemented by project experts and targeted at a certain group of participants and (2) the un-programmed or non-institutionalised process whereby knowledge is diffused from project participants to the larger farming population. While institutionalised knowledge transfer has concentrated on transporting knowledge from project scientists/researchers to selected "model" farmers, it is widely assumed that in the non-institutionalised sub-system knowledge is spread from "model" farmers to other farmers – without difficulty – via farm visits and observations. A senior researcher in Can Tho explained:

> "Training is the main channel through which we transfer our research results or new techniques to farmers. We cannot manage to work with all farmers individually. Through training, some "advanced" farmers will adopt new technology and develop "model" farms where other farmers can come to learn. Normal farmers participate in training merely to receive information; they take action only when they see good results from model farmers. Through this natural process, new technology can gradually spread. We have no time and resources to support an apprenticeship approach" (Interview, CTU senior researcher, female, 06.10.2010).

We argue that in a less exchange-enabling environment, horizontal farmer-to-farmer knowledge transfer can be impeded further by amalgamative conditions and factors such as motivation, capacity and knowledge tacitness[27] (cf. Blackman and Benson 2010; Feng et al. 2010). Obviously, in disseminating

[27] Blackman and Benson (2010:3f) state that knowledge stickiness constitutes inhibitors to the knowledge transfer process through nine main predictors: causal ambiguity, unproven knowledge, source lacks motivation, credibility of source, recipient lacks motivation, recipient lacks absorptive capacity, recipient lacks retentive capacity, arduous relationship and the unrecognised "freedom to" possibilities for learning.

the VACB system from model farms to wider communities, knowledge transfer becomes impossible when knowledge sharing and receiving are totally restricted by "model" farmers and/or refused by recipient farmers. From the side of the "model" farmer, the case possibly occurs when the selection and development of "model" farmers are biased and lacking in knowledge transfer orientations. The aforementioned farmers' stories listed a number of "model" farmer selection biases: by project (nicely demonstrated models), by person ("advanced" or "qualified" farmers or those in close relationships with local government officials) or by location (easily accessible for researchers and visitors) (cf. Zolvinski 2008:42f). Accordingly, the "model" farmer's willingness to transfer newly acquired knowledge to wider recipients is not always pledged[28] (as in the farmer cases analysed above). Besides the willingness to share, the ability to share draws more attention, as it suggests that "people have to engage in similar or shared practices to be able to share knowledge about those practices" (Duguid 2005:117). There are many possible reasons why "incomplete" knowledge, with or without being recognised by the transferring side, is transferred from farmer to farmer. Although trained within the project, "model" farmers' dissemination capacity is still in question. Besides that, due to its tacitness, VACB knowledge needs practical involvement and learning from doing and practice, rather than merely through farm visits and talks. More serious than it is very often thought, the application of partially understood knowledge can result in knowledge traps[29], which are dangerous in the way they mislead localised VACB application, misinterpret its applicability or even undermine the system's philosophy. The breakdown of VACB replication by wider farmers is a lucid explanation of a knowledge trap created from failing to understand the unknown, particularly when confronting the complex system-based knowledge and technology involved in VACB. Equally importantly, experience supremacy triggers knowledge traps. For example, some farmers who insisted on applying higher TPR rearing density than recommended by VACB trainers explained their experience based on visual cues and simple calculations that higher fish rates produce higher yields. In other cases, knowledge traps are caused by complexities, particularly locally specified conditions, for example the situation when Farmer Z correctly applied what Farmer Y instructed but still TPR died.

Keeping inhibitors of farmer-to-farmer knowledge diffusion in mind, "model" farmers can only carry out their assigned transfer work if they feature a combination of the willingness to share, the capability to disseminate and an understanding of the environment in which knowledge transfer takes place. In other words, "model" farmers, to some extent, are required to work as knowledge brokers if knowledge is to be transferred appropriately to their farming communities. Our analysis of knowledge exchange and the interaction between CTU academic researchers and farmers suggests an emerging approach in which knowledge brokering farmers continue to spread knowledge to the farming community (see Figure 4).

[28] Nguyen, T.T. (2010:137ff) uses the metaphor of a "knowledge oasis" to describe the accumulated knowledge locked in the Vietnamese rural communities. Knowledge is not shared, he proffers, due to the lack of media channels (knowledge oasis on island) or because it becomes a business secret (knowledge oasis in the mindset).

[29] Evers et al. (2006:246) elucidate that the knowledge trap "lies in the fact that data, information and knowledge are often taken over without any understanding of the corresponding unknowns. This is particular so when the people acquiring such knowledge simply copy solutions. Failing to import an understanding of the unknown consequently leads to bad investment and stagnation."

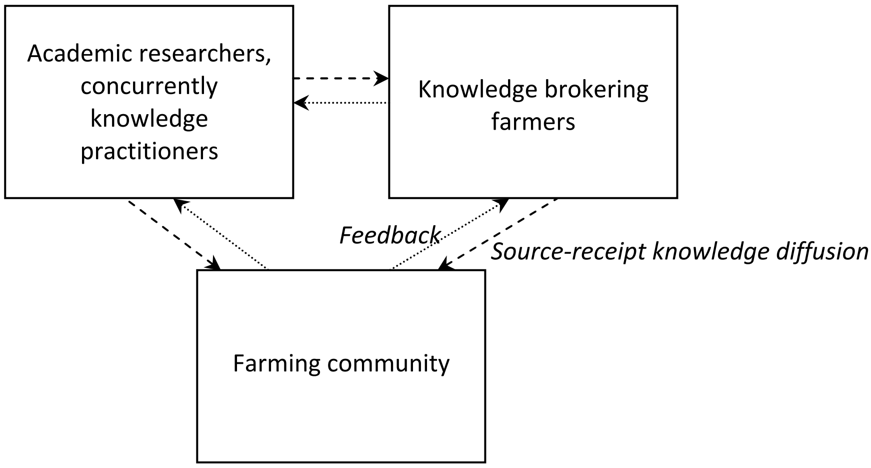

Figure 4: Brokering farmer-based knowledge diffusion

It is evident from our case analysis that farmer-led knowledge brokering functions as a key link in connecting the complete knowledge diffusion cycle of the VACB farming system to the broader farming community. Farmer knowledge brokers can best perform their task on account of their position between experts and farmers, knowledge users and knowledge generators, producers and consumers. To start their brokerage work, Farmers X, Y and Z voluntarily helped neighbours to set up VACB systems through regular contact. Now paid to carry out this task, mainly in the form of travel and working day allowances, in neighbouring provinces, Farmers Y and Z stay and work with local people for days until related theory and practical processes are completed. System monitoring visits are also planned. Expressions in local language, the development of locally appropriate options for innovation adoption and exemplification of their own lessons learnt are effective ways and methods of brokering farmers that external experts rarely have:

> Living the same life other farmers are experiencing, Farmer Y finds it easier to explain, illustrate and clarify any hitches or problems farmers encounter. He uses more dialects and simplified expressions, for example 10 "*tấc*" instead of 10 centimetres, or "fish can live in different places" instead of "fish can be adaptive to different water environments" (Extract from Farmer Y's narrative).
>
> The options were what Farmer Z tried to develop his trainees, as he understood the heterogeneous nature of the other farmers. In fish classes, he provided three fish density-based structures including natural, landscape and industrial models relevant for poor, average and better-off farmer groups. This method facilitated the decision-making of his colleagues based on their own socio-economic situations. However, not all trainee farmers followed his guidance because of their strongly perceived high density, high productivity correlation unless some of their crops failed. He said he had to pay a lot so that his fellows could avoid these mistakes; otherwise, they themselves would have to pay, which sometimes cost too much and led to rumours of a model's dismal failure (Extract from Farmer Z's narrative).
>
> From a farmer's error, Farmer X recognised and used it as an example in other classes that the biogas tube should not be fixed in the ground (for aesthetic reasons), as methane liquidises in a cool environment (Extract from Farmer Y's narrative).

Understanding local natural conditions, power structures and cultural values helps broker farmers accomplish their brokering jobs in a more sustainable manner.

> The construction of biogas plants was very much dependent on the type of local soil in deciding suitable size and construction types for the digester's main ditches. Farmer Z suggested a simple construction for biodigester ditches in one province, while in more sandy areas he insisted on a cement-solidified construction, which did not please farmers from the outset because of the higher costs. However, his one month later the very same farmers were offering high praise for the good operation of their biodigesters (Extract from Farmer Z's narrative).
>
> In one of CTU project, in which he participated as a technical consultant, some days before the course was officially started with community participation, Farmer Y managed to talk to and present all the tactics of fish spawning to the village head. Convinced of the viability of the scheme, and armed with the necessary knowledge, the village head agreed to be a knowledge transfer facilitator for the community's households. In another project, he recalled, each project beneficiary was provided with two cows, 20 kilograms of fish eggs and a biodigester construction, as well as training courses. Many householders who were relatives of commune leaders, and even better off in some cases, were selected, which threatened the success of the model transfer. He discovered this when he made a field tour around the project area, but he could not change the situation because the list was approved by the local government. What he could do, though, was to persuade the project management board to accept one more local "real" poor farmer whom he met during the field investigation and who was passionately looking for a development model to change his life. This man, upon the completion of the project, provided the best sample of the project's values. In a biodigester construction project, he called a halt to the local practice of fish toilets by diverting both animal waste and human faeces into the new biogas plants. As project beneficiaries explained that they could not afford a concrete toilet, he proposed a very simple design with an expenditure of approximately VND 100,000, which was accepted by local people. Ultimately, beyond his expectation, only one household constructed a toilet according to his design, whereas the rest invested in nicely constructed ones through their own funding (Extract from Farmer Y's narrative).

Moreover, other factors beyond knowledge acquisition contribute to farmers' determination to run VACB units. Together with technology and knowledge, the financial investment, production input demand and output supply of the new farming system motivates or demotivates its duplication. The way Farmer Z promoted various household resource-based models of TPR raising and organised TPR farmers to control a massive and qualified product supply operation has provided practical solutions throughout the VACB production chain, a task most rural extensionists claim is not their responsibility.

In summary, under the two systems of knowledge diffusion – "model" farmer- and brokering farmer-based – knowledge stickiness has been analysed from various economic, epistemic and ethical perspectives (cf. Duguid 2005). With the help of constant scientific consultation with academic researchers, a high commitment to sharing knowledge with other farmers and learning in practice, a farmer's brokering can better handle locally specified situations and issues, knowledge tacitness, knowledge traps and matters beyond the knowledge transfer boundary, such as production options or marketing issues. Thus, knowledge brokering farmers work across the traditional divide of institutionalised and non-institutionalised diffusion.

8 Networks/communities of practice: Coordinating knowledge and innovation flows

Tracing the farmers' stories and redrawing knowledge flows by connecting their egocentric networks elucidate networks and communities of practice[30] engaged in VACB system brokering/diffusion and its adoption in the studied cases. The following diagram (Figure 5) shows these interwoven networks and communities.

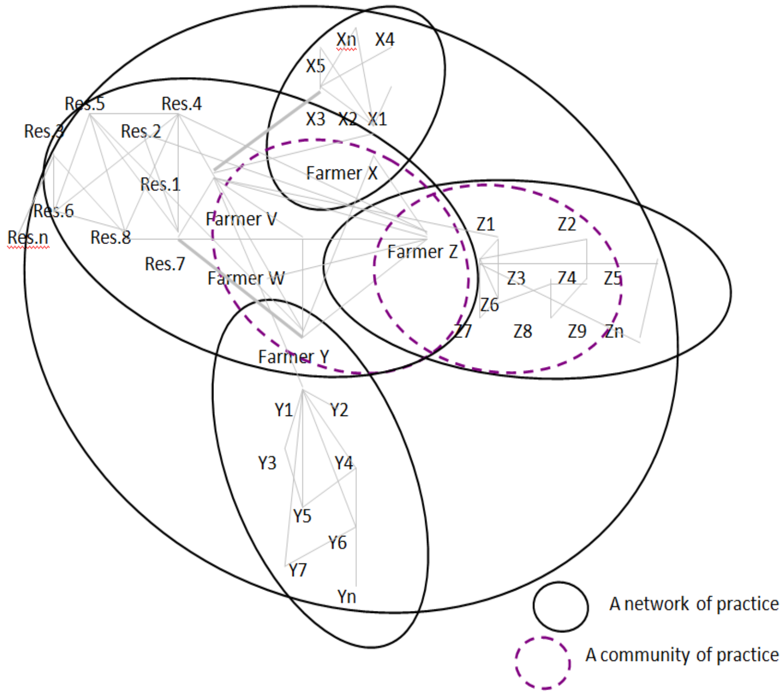

Figure 5: A constellation of networks/communities of practice identified within VACB knowledge brokering/diffusion (Notes: Res.: academic researchers; X1-n, Y1-n, Z1-n: farmers 1-n within the egocentric knowledge networks of Farmers X, Y or Z)

[30] Wenger et al. (2002:4) define communities of practice as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis". Collaboratively informal, independent, off-the-grid networks, a community of practice consists practitioners who develop shared understandings, engage in work-relevant knowledge building and create norms of direct reciprocity (Hara 2009:118 cited in Correia et al. 2010:12; McDermott and Archibald 2010). It is a tightly knit group of members who know each other and typically negotiate, communicate and coordinate with each other directly (Wasko and Faraj 2005:37). Three distinctive features of communities of practice include the mutual engagement of participants, a joint enterprise as a process of negotiation and a shared repertoire combining both reificative and participative aspects (Wenger 1998:72-85). Conversely, networks of practice connote larger and more geographically distributed groups of individuals engaged in a shared practice with weaker relationships than those among the members of a community as participants who may not know each other nor necessarily expect to meet face to face (Tagliaventi and Mattarelli 2006:294; Wasko and Faraj 2005:37). Despite their indirect contacts and unfamiliarity, participants in networks of practice can share and exchange a great deal of knowledge, as "networks often coordinate through third parties such as professional associations, or exchange knowledge through conferences and publications such as specialized newsletters" (Brown and Duguid 2000 cited in Wasko and Faraj 2005:37). Communities and networks of practice are self-organising, open activity systems, which develop on their own depending on the voluntary engagement of their members and internal leadership, and flourish whether or not the organisation/sector recognises them (cf. Wenger et al. 2002:12f).

As demonstrated in the diagram, three different levels of practice network overlap: VACB farmer networks under brokering farmers X, Y and Z, the network of academic VACB researchers and brokering farmers and the network of academic VACB researchers and farmers. During several years of VACB knowledge brokering, the three farmers and other local farmers working with the VACB system have developed and maintained their own networks of practice. The networks shrink from a wider network of VACB knowledge transfer by connecting only those farmers who follow their farming and living development based on VACB, not all VACB learners. While the networks develop on the active engagement of all members, brokering farmers play the principal roles in maintaining and coordinating the operation of the networks. Furthermore, the working experience and brokerage coverage of brokering farmers determine the network membership size. For example, the network of Farmer X consists of five to ten farmers in the commune, while Farmers Y and have fifty to sixty members from all regions of the Mekong Delta. The domains of the networks are generally described as practical information and knowledge sharing and exchange for the sustainable development of VACB system at the participant's household. Depending on the expertise and the practice of each network, the practice of each network is negotiated and becomes specialised in one or two VACB system components while the whole system structure practice is continued. For instance, the VACB farmer network centered around Farmer Y seems to balance the development of all subsystems, while Farmer X's network tends to focus on the animal husbandry component. More specialised, Farmer Z's network concentrate ostensibly on large-scale TPR egg production. Through experience sharing and practical idea exchanging, these networks are intended to help members to solve everyday problems related to the application of the VACB system. They flourish accordingly through the expansion of VACB knowledge transfer projects. Farmer X's network, which currently is at its coalescing stage, represents this tendency whereby the network is important in allowing members to exchange and acquire practical knowledge that they cannot find elsewhere. Thus, active interactions between members can be seen in this stage. Farmer Y's network, after nearly 20 years of operation, has now reached maturity, which is characterised by low communication levels among members, who have now mastered the necessary techniques. However, the network cannot help them with new problems such as product consumption or marketing. In contrast, Farmer Z's network seems to maintain the relevance of the domain while finding cutting-edge practice. The operation of the network depends on the intellectual input of many if not all active members, especially the coordinator, as illustrated by Farmer Z's description of their activities:

> "Our grouping is not an officially announced club, nor does it hold any certified establishment decision. We connect together in a so-called *équipe* (a French word synonymous with a team or organised group) to help each other in the production and distribution of our products. It has become a routine whereby members who live nearby meet on Saturday afternoons or Sundays to drink coffee or wine and chat at a member's house or at the coffee house. Such informal talks have no specific themes but go around the current production situation of farmers and the problems we face. Solutions are often gained from sharing experiences of members or new experiments they hear of. Our members who live 10-20 kilometres away communicate mainly through telephone. We also meet once a year to review the previous year's production and to come up with lessons learnt and evaluate market demand in order to plan our production focuses for the next season. We follow a 'slow but sure' approach. We concentrate our investment in our key product, TPR eggs, but allocate resources to other fish varieties and VACB system components. We build our network on mutual trust and quality control. I do not even meet in person some members of the network, but the quality of our product must be met" (Interview, Farmer Z, 08.12.2010).

The second network of practice comprises academic VACB researchers from CTU and VACB knowledge brokers. This network originates from formal VACB knowledge transfer projects administrated by CTU agricultural scientists who, besides following knowledge transfer objectives, select and train potential farmers to be trainers for up and coming farmers. After project completion, the farmers continue to work closely with some experts in their training or scientific projects, and maintain uninterrupted communication channels with these experts for consultations when the farmers carry out their own brokering (see above sections). Similar to farmer's networks of practice, this type of network is also a subset of the VACB knowledge transfer network. It connects approximately 10-15 members: half are agronomists, including some currently retired from CTU, and the rest are VACB knowledge brokering farmers, including Farmers X, Y, Z and a few new brokers from other provinces (as Farmers V and W in the above diagram). They meet and work directly with each other during their involvement in projects or when problems require them to do so; otherwise, they communicate via telephone. What makes this network different from farmers' networks of practice is that its domain, apart from helping farming members to share ideas and solve practical problems, focuses on innovation[31] (cf. Wenger et al. 2002:74-77). Innovative ideas and initiatives offered by the farmers are the results of knowledge exchange and situated practices within the networks:

> In his second TPR breeding trial, Farmer Y came up with a method for injecting fish using a washing basin and without oxygen tools, which was afterward approved by his mentor and adopted by many farmers. In order to inject a hormone supplement into brook fish, he was instructed in the first trial that the needle should be inserted directly into the scaleless fin. He found this hard to properly manage, especially as he was an "all fingers and thumbs" farmer, which thus led to an inefficient amount of hormone injected into the fish. He instead suggested injecting the hormone into the most muscular part of the fish, and the result was accepted by CTU researchers. In addition, he proposed a number of modifications for biodigester construction. With concrete biodigesters, he recommended the replacement of PCV hooks with glazed terracotta ones because of their local availability, better durability and leakage prevention (Extract from Farmer Y's narrative).

The farmer's successful application of TPR fish several years previously, the current growing of *Trichanthera gigantae* as a feedstuff for livestock or using methane for lighting besides igniting in the brokering farmers' fields and ponds are also the successes of beyond-the-lab experiments carried out by CTU agro-scientists. It is through their implementation of experiments and testing in local conditions that new ideas and improved products are realised. The energy of the network is fuelled by new research efforts by experts and innovative questions asked by brokering farmers in which they both actively engage to answer.

The third network of practice is the literal combination of all described networks. The domain and practice of the network are not clearly identified. In reality, the performance of the network relies on brokering farmers facilitating knowledge flows from experts to farmers and vice versa. Network analysis shows that knowledge brokering farmers are situated in structural holes, as they bridge the two networks (see Andersson et al. 2007:33), so they have power over controlling the flow of knowledge among networks or actors. The development of this network provides more opportunities for new membership and direct communication between experts and farmers.

The network analysis has also revealed two communities of practice growing inside, and as the core of, networks of practice. One is the community connecting Farmer Z and VACB practitioners living within the province. Their geographical proximity allows for more intensive face-to-face contact, thus the domain and practice of the entire network are frequently the upscaled agreement of what has been negotiated in the community. The other is the practice of VACB knowledge brokering farmers. The members are Farmers X, Y, Z and farmers recently trained to become VACB trainers. Again, they reside

[31] Innovation, much more than "new" technologies. It connotes "different ways of thinking and different ways of doing things". It relates to strategy, marketing, organisation, management and design (Knickel et al. 2009:138).

close to each other, within two neighbouring districts, which helps them easily to meet face-to-face once or twice a week, without fixed schedules and agendas. However, different from the practice of the network, the community focuses on sharing technical VACB knowledge as well as knowledge transfer/brokerage methodologies. Besides its membership inclusion of different "generations", another advantage is that the community links with the expert group, who can provide consultations on issues that members are not able to solve by themselves. Therefore, the community's stock of knowledge is both locally and scientifically defined and embedded in epistemic cultures beyond a single practice (cf. Mørk et al. 2008).

Summing up, the analysis has presented a constellation of networks and communities of practice consisting of knowledge brokering farmers, local farmers and agronomists involved in applying and improving the VACB system in the Mekong Delta. Networks and communities of practice foster an enabling environment for knowledge sharing, especially traverse the stickiness of tacit knowledge which resides in individual skills, understanding and collaborative social arrangements and can only be transferred through the mutual engagement of participants into practice (cf. van Baalen et al. 2005). Not only ways of improving the effectiveness of knowledge sharing and use, they are critical sources of local innovation because of their constant improvisation and active reflection of interactions beyond formal project arrangements and canonical practices (cf. Swan et al. 2002:479). Geographical locality is still a factor in maintaining members' close contacts and active engagement, as shown in the development of communities within networks. The geographical condition becomes significant when a large proportion of network members are connected through telephone communication and without any technological assistance, such as a website. However, physical proximity no longer determines the thriving of networks/communities of practice (cf. Amin and Roberts 2008:335-336). For example, the lack of new ideas and approaches when new problems arise, as in the case of Farmer Y's network, delays the lively engagement and interactions of members who do not live far from each other. Rather, as stated by Wenger (1998:131), "the relations that constitute practice are primarily defined by learning. As a result, the landscape of practice is an emergent structure in which learning constantly creates localities that configure the geography".

It has highlighted the crucial role of knowledge brokering farmers in coordinating knowledge flows within and between networks/communities of practice and innovation flows initiated by agronomists and experienced brokering farmers, while adding value for the entire networks/communities entails the active engagement of all members. However, as networks/communities of practice are embedded in broader networks and epistemic cultures, inter-community knowledge communication (cf. Gherardi and Nicolini 2002:420) remains challenging for the managers of agriculture and the rural development sector. Still harnessing the power of such informal and seemingly invisible networks and communities for formal organisational/sectoral development goals is a difficult undertaking (see Cross et al. 2005) that needs further integrated governance efforts.

9 Theoretical reflections: Managing knowledge diffusion

A recent critique of knowledge management underlines that knowledge should not be reduced to a "thing" (Zeleny 2005:32f) or a "static body of information" (Wenger et al. 2002:9). Rather, from a constructivist perspective, knowledge is "a process which functionally fits into the environmental structure" (Feschl 2007:137). In addition, "Knowledge lives in the human act of knowing" (Wenger et al. 2002:8). Nevertheless, pervasively in the information/knowledge transfer literature, despite varied philosophical foundations (Reed and Simon-Brown 2006) and mechanisms (Nokes 2009), knowledge diffusion is represented as a process in which knowledge, as scientifically proven, is translated and transported from those who have a good deal of it to those who have less and need to receive it. Thus, the focus on managing knowledge diffusion is restrictively framed within effective transfer outcomes (with a recent expansion to knowledge adoption and application).

Our case analysis of knowledge brokering provides insights in re-conceptualising knowledge diffusion management[32]. Crystalising dynamics, complexity and the uncertainty of knowledge diffusion, and application in cases such as the VACB system, requires the integration of "successful" knowledge transfer objectives and new knowledge generation cycles. New or extended knowledge as the object of this "second order" of knowledge diffusion management comprises knowledge which is created through interactions of knowledge flows between source and receipt systems and through the management of both knowledge and non-knowledge[33] or ignorance.

Defined in reference to knowledge, non-knowledge, or ignorance, refers to a lack of knowledge or information. Different from false knowledge, ignorance as a fundamental part of social life attempts to circumscribe the unknown: "Whenever new knowledge arises, the perceived amount of non-knowledge increases at least proportionally" (Gross 2007:743, cf. Evers and Wall 2006). For the purpose of this analysis, knowledge and ignorance are categorised and defined as follows:

i. Knowledge: a belief that was justified as true and is accepted by groups or individuals studied by sociologists*
ii. Relational ignorance (unknown knowledge): lack of knowledge in one knowledge system[34] in relation to another knowledge system
iii. Rational ignorance (known unknown): knowledge about the limits of knowledge and knowledge about what is not known, but taking it into account for future planning*
iv. Natural ignorance (unknown, nescience): lack of any knowledge, beyond anticipation*

(* entry borrowed from Gross 2007:751)

Managing new knowledge generation from knowledge diffusion should consider interactive knowledge flows between the source and the recipient. The added element of relational ignorance is fundamental in widening the knowledge brokering/diffusion framework from its sole planned goal of the successful transfer of knowledge to the negotiated diffusion processes between the source and recipient's

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[32] "Knowledge" when used in collocation with "transfer/diffusion" and/or "management" in the paper implies knowledge (*sensu lato*) composed of four subsystems within the epistemological pyramid: data, information, knowledge (*sensu stricto*) and wisdom. Senge (1990) clearly distinguishes between the two types of knowledge.

[33] The debate on non-knowledge goes back at least to "Socrates' insistence that his 'wisdom' lay in knowing what he did not know". Translated from the German word Nichtwissen, non-knowledge or ignorance is more commonly used than other versions as nescience, not knowing or unawareness. (Gross 2007:743)

[34] Ackoff (1971:662) defines a system as "a set of interrelated elements". We see knowledge stocks and knowledge flows to, between and within social systems as the knowledge system (cf. Bell and Albu 1999:1722). For example, Wall (2008) examined peasant, research project and post-Socialist knowledge systems to understand how agricultural knowledge is used differently in the Khorezm province of Uzbekistan.

knowledge systems. Given the superficially prominent tendency from the source (experts) to the receiver (farmers), it would be a mistake to conclude that "knowledge can be transferred only from a person having a higher knowing level toward a person with a lower knowing level"[35] (Bratianu 2010:198). Interactive knowledge flows occur at any time between the systems, and over time the direction seems to get reversed more from the receiver side when feedback and evaluations are invited. Relational ignorance implies a lack of knowledge of both the recipient and the source about the other. Even from the very start of the transfer, ineffective knowledge circulation between the systems can cause potential failure of the knowledge transfer project. A commonly observed shortcoming of many agricultural knowledge transfer projects, succinctly reviewed by Anderson and Feder (2003:13), is that "research-extension linkages were generally weak, and neither research nor extension was sufficiently conscious of the need to understand the constraints and potentials of the different farming systems as a basis for determining relevant technology and technology development requirements". The farmers' stories and the above discussion on institutionalised VACB transfer are relevant to the argument made by Chambers (2010) whereby development fails to live up to its expectations when professionals provide solutions built on stereotypes contrasting with the complex realities of poor, marginalised and vulnerable people[36]. It is crucial that knowledge diffusion management should not be trapped in the predisposition that the source "knows better", which sustains a modernist and colonial approach to development (Westoby and Dowling 2009:188). The authors (ibid) advocate an "elicitive" training approach that honours the receiver's knowledge and validates creation through reflection and action over the co-discovery of knowledge transferors and recipients. The achievements and empowerment of VACB knowledge brokering farmers have demonstrated the intensive and long-term interactions and exchanges between academic experts' and farmers' knowledge systems. It is emphasised here that the adoption of a knowledge partnership mindset and relevant tools in knowledge brokering/diffusion management could provide a multidirectional approach to managing knowledge diffusion processes, as well as new knowledge generation and re-link knowledge management with broader learning and innovation systems.

In one respect, knowledge diffusion management deals with knowledge reproduction and innovations as the outcomes of the diffusion process, while managing VACB brokered knowledge illustrates what this involves. Managing knowledge also needs to take into account both formal and non-formal

[35] In criticising Nonaka's knowledge creation model, among others, which ignores pressure difference in generating the flow of knowledge, Bratianu (2010) adopts another metaphor of "knowledge as energy". Although Bratianu's critical analysis is helpful in broadening our understanding of knowledge transformation processes by questioning the role of knowledge stickiness, reusable knowledge (multiple flows through the cycle) and emotional knowledge (generated by emotions and considered as states of our body and mind), his suggestion of uni-direction of source-receipt knowledge flow may misinform the attempt to present holistic knowledge dynamics.

[36] The full quote of the argument is: "Non-linearity, adaptive agents, and unpredictability are three concepts which resonate with, illuminate and confirm the realities of poor, marginalised and vulnerable people, and their lives, livelihoods and aspirations. The conditions of the lives and livelihoods of many of them are non-linear, as we have already seen, typically lcdduu – local, complex, dynamic, diverse, uncontrollable and unpredictable. The farming systems of many small farmers have been characterised as CDR – complex, diverse and risk-prone […] Farmers in these conditions complicate and diversify their farming systems in many ways to reduce risk as many poor people do in other conditions. A largely valid stereotype may be that to survive, to be more secure and less vulnerable, and to achieve a better livelihood and life depends for them on a committed and energetic search for opportunities, being aware of and sensitive to changing conditions, open to communication and learning, and adapting, improvising, diversifying, complicating and multiplying the activities and linkages in their livelihoods. And most critically, their future is unpredictable.

As we have seen, these realities of poor people contrast with the conditions which many professionals assume or seek to create and where they can exercise their expertise" (Chambers 2010:34).

knowledge flows. The role of VACB farmer-centered knowledge networks and communities of practice in promoting tacit knowledge diffusion and local innovations is well-developed in this paper. However, tacit knowledge, which is interacted with and learnt in such informal practices, is not always responsive in a formal system. "Informally" reproduced knowledge is therefore easily lost, unless it is recognised as properly managed (see Evers and Wall 2011, Wenger et al. 2002:9).

The second relates to managing knowledge about the unknown or rational ignorance. The earlier discussion on the challenges of VACB transfer demonstrates a number of unknowns in terms of the optimalised development of the system's "contents" over the time-space axis. For example, the first TPR experiments on farms required new knowledge generation and application provided by interactive expert and farmer knowledge systems. Newly-developed incurable diseases in crops, such as citrus greening disease, or in fish and animals are more visible examples of the unknowns that need to be managed for further research and practical solutions. Consequently, scientists working in cooperation/coordination with knowledge brokering farmers can also frame and formulate problems, which can generate new values (Heiman et al. 2009) and maintain the learning cycle in complex environments.

By and large, as a conceptual framework, "second order" knowledge diffusion management attempts to integrate knowledge and non-knowledge, and formal and informal knowledge, flows into interactions of knowledge systems when managing knowledge diffusion and new knowledge creation (see Figure 6). At the operational level, within an institutionalised social structure, for example research institutes or programmes/projects, the application of the model can be effected by implementing management strategies in its departments, sections or project teams in their organisational context. Nevertheless, it requires much more time and effort to maintain the success of integrated knowledge diffusion management in a social environment where actors are distributed in both spatial and temporal scales. Farmer-led and informal learning networks/communities in practice should be used as prime examples of managing knowledge.

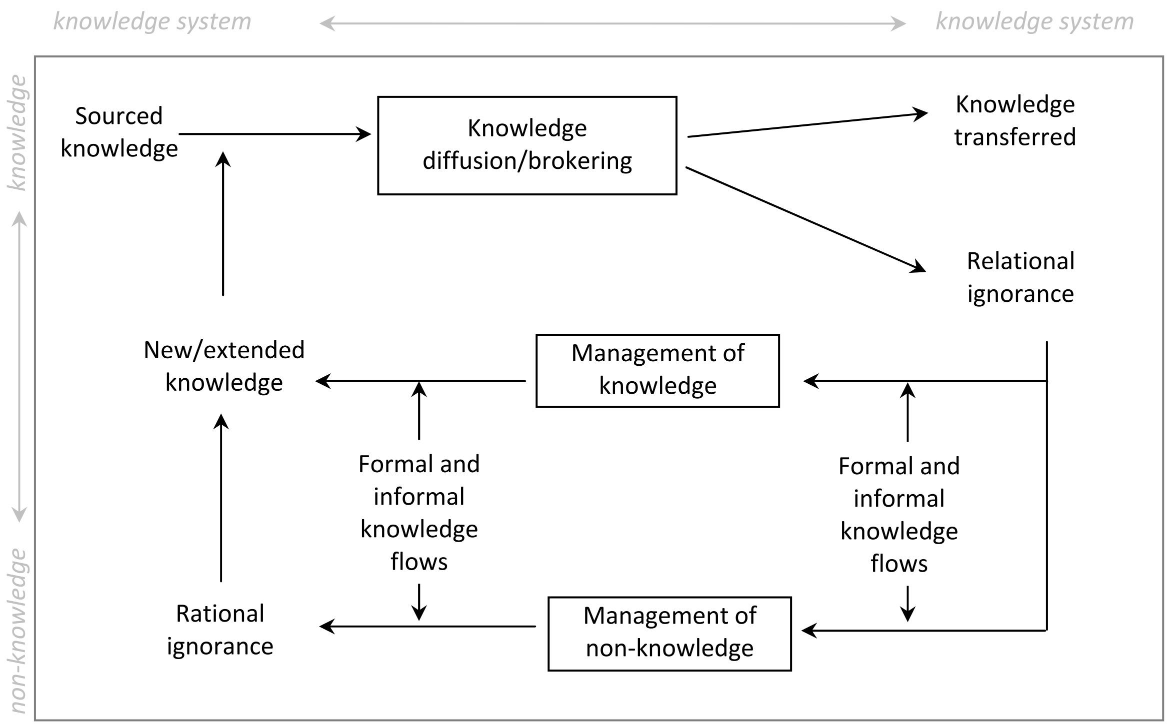

Figure 6: "Second order" knowledge diffusion management

10 Conclusions

"The boundaries between knowledge and society are blurred and epistemic cultures are complex blobs of knowledge, actions and emotions" (Evers 2005:15). Set in the Mekong Delta's context of integrated farming knowledge diffusion, this analysis contributes to the growing body of research on knowledge for development by illustrating cases of farmers who act as knowledge brokers, a profession which is largely claimed to be that of experts. Another suggestion is an alternate approach to research into agrarian change and rural differentiation in contemporary Vietnam, a knowledge-based peasant development, apart from the classical political economy viewpoint which focuses on production and accumulation. Above all, the findings have constructed new dimensions of the epistemic culture of agricultural development, in which interactions and networking in practice between local agronomists (pursuing the dual profession as a researcher and a knowledge practitioner) and horticulturists (taking the dual work as a farmer and a knowledge broker) have further extended and co-created knowledge and innovative alternatives for the sustainable development of small-scale farming communities.

Farmers are no longer merely homogenous recipients of knowledge for development, evidenced by those in our cases, who have actively engaged in knowledge diffusion through brokerage practices and networking. They also play a crucial role in cultivating networks/communities of practice and connecting experts in the fields and farmers across the delta, from whom knowledge is shared, used and re-produced, as well as the unknowns framed and formulated. Thus, managing knowledge diffusion should involve managing knowledge transfer and creation processes encompassing knowledge from the source and receiving actors, the knowns and (relational and rational) unknowns. It should also appreciate farmer-led learning structures in practice and encourage the connection of frequently ignored informal knowledge flows with the common "knowledge for development" goals of responsible organisations and the agricultural/rural development sector. In other words, the agricultural extension system, knowledge system and innovation system need to place significant emphasis on multi-agents, multidimensions and interactive learning in agricultural and rural research and development.

Practical implications for knowledge diffusion project managers are as follows. First, ecologically sound agricultural systems that inform small-scale farming such as VABC should receive further research and development efforts for improvement and adoption, and aim to promote sustainable development in the Mekong Delta and Vietnam.

Second, interventions should facilitate farmers' personal development and learning processes. It is evident from our study that "training the trainer" is appropriate for building the capacity of farmers, who potentially continue to diffuse technology and knowledge to their wider rural community. The training of trainers is a long-term process involving the careful selection of participants, communication design and monitoring mechanisms. It is important to create chances for these trainers to get involved in training and in different environments. This task relates to human resource development strategy rather than immediate transfer quantity focus. Research/development projects should put forward the objective to generate more farmers who will and can share knowledge rather than more better off and technology haboured ones.

And third, the farmers' stories imply that the learning process is not well defined and newly explored knowledge is not codified or externalised. A learning cycle can be conducted by the construction of a feedback loop, which not only provides a participatory tool for a project's evaluation, but also helps to manage new knowledge produced and lessons learnt.

For managers in the agricultural and rural development sector, firstly, research/development projects conducted by scientists with the participation of farmers should be encouraged and prioritised for funding. The study cases show that "professional" knowledge brokering farmers interact and work together with project scientists/researchers to generate new knowledge through problem solving or by framing and formulating problems to create new values and maintain the learning cycle in complex environments. Local extension workers should consider the imitation of the participatory research approach, though less elaborate, in their diffusion planning (cf. Ton 2005). Secondly, besides recognised formal farmers' groups and associations, farmers connect in networks and communities of practice to help each other to develop, including sharing and exchanging knowledge. Despite their effective contributions to sector development, such networks and communities tend to be invisible to managers. As such, local rural development agencies should identify these networks and communities to cultivate their learning culture and/or inter-community learning. Some concrete interventions or measures could involve: participation directory compilation; training invitations to coordinators; experience, techniques and stories selected and published; invitations to deliver presentations in seminars/conferences, utilisation of lessons learnt of the community/network as well as other motivation/incentive mechanisms. Thirdly, the way farmers organise their communities/networks of practice calls for an alternative approach to managing knowledge flows beyond the traditional administrative boundaries. In the case of Farmer Z's network, management interventions and support can be more effectively implemented via the NAVG, as a national professional association, and provincial sectors rather than single, unconnected efforts only at the local level.

To understand knowledge for development practices that are locally specified and culturally contingent, further research will have to consider the dynamics of knowledge alliancing and networking between and among actors in the agricultural and rural development sectors. Knowledge diffusion and brokering can be researched within the epistemic cultures in which they are embedded and/or knowledge management and governance frameworks. Knowledge sharing between communities of practice could also be further investigated, while research on contemporary Vietnamese farmers could explore how technology and knowledge are adopted and how they impact on production and the lives of different groups of farmers, or how knowledge is extended within formal arrangements set up by external interventions in comparison with informal networks built up by the rural community to promote knowledge and experience sharing for their own development.

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