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# Identification of Context-Specific Knowledge as a Tool for Biogas Facilitators and Their Quality Involvement—Using Vietnamese Practice as an Example <sup>†</sup>

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† The present work is an extension of the paper “Identification of Context Specific Knowledge as Tool for Facilitators and their Quality Involvement” presented at the 11th International Conference of Efficiency and Responsibility in Education (ERIE 2014), 5–6 June 2014, Prague, Czech Republic.

Received: 1 March 2019; Accepted: 1 April 2019; Published: 6 April 2019



**Abstract:** In Central Vietnam, two key actors are involved in the extension performance of biogas technology: The owners of biogas plants and facilitators. Facilitators as the immediate providers of advice and services are in direct contact with local farmers and belong to the Vietnamese national extension network. This paper aims at identifying the current state of extension services and creating proper recommendations for further processes of training in the target area through the identification of context-specific knowledge (CSK). CSK can serve as a tool for facilitators and their quality involvement and for the improvement of current training practices in the area. It also provides performance indicators (PIs) for facilitators’ quality assessments. PIs should be consistent parts of the educational process for the evaluation of knowledge transmission success. More research in terms of facilitator’s impacts on the knowledge transition process towards the biogas owners should be done to prove the sustainability of the extension services.

**Keywords:** biogas technology; quality assessment; extension services; biogas; small-scale biogas

## 1. Introduction

Energy is an indispensable part of daily life and with environmental issues, it has become the most important problem of common concern. Its transition is one of the most debated challenges of our time [1] and the production of renewable energy is a core building block of its transition. Current increasing energy consumption in rural areas of Central Vietnam can be covered by use of family-size biogas technology and can lead to healthier and more sustainable ways of living [2]. Biogas produced via the anaerobic digestion (AD) of organic waste materials is considered as an important technology for improving the environment because it solves waste management problems and simultaneously produces biogas as a main product and digestate as a by-product, which can also be used as fertilizer [2–4]. Technology transfer is the application of information into use [5]. Each technology shall unarguably be supported with the proper maintenance and management by the local actors. The two key actors in the extension performance in case of Central Vietnam consist of owners and facilitators of biogas technology. Facilitators, as the immediate providers of advice and services for farmers, are a part of the Vietnamese extension system. The Vietnamese national extension system was officially founded by the Government under the jurisdiction of the Ministry of Agriculture and Rural Development (MARD) in March 1993. In 2003, Department of 39 Agriculture and Forestry Extension (DAFE) under MARD was divided into two following sections: The Department of Agriculture and

the National Agriculture Extension Centre (NAEC). In the same year, National Fishery Extension Centre (NFEC) within the Ministry of Fishery was established independently. In 2008, when Ministry of Fishery incorporated into MARD, Agriculture and Fishery Extension Centres merged into a unique NAEC. Currently, there are Extension Centres in all 63 Vietnamese provinces and cities. In 648 districts there are 585 Extension Stations [6], which are directly under the control of the provincial Extension Centres, or the District People Committees. NAEC has the following responsibilities:

- (i) Developing policies and mechanisms of management for extension in agriculture, forestry, fishery, and rural industry;
- (ii) Developing economical-technical cost-norms for extension work (to lead, organize and guide the transfer of advanced techniques through demonstration models, information dissemination, trainings, services, and international cooperation).

The agricultural extension system in Vietnam is organized as five-levels: National, Provincial, District, Commune, and Village levels. According to Van Bo [6], one public extension worker covers 280 farming households. Agricultural extension in Vietnam is based on a top-down approach with its content determined by the government; specifically, by governmental planners, officials, politicians, and researchers and social leaders. Its governmental determination and strict top-down approach results in it lacking adequate responses to urgent current needs (social, financial) of farmers.

Vietnamese agriculture is mainly crop-oriented, as reflected by higher facilitators experience with crop production, and in contrast, facilitators' experience with husbandry is lower, as well as in the case of biogas technology (where main feedstock is pig manure). The topic of information transmission shows its importance through positive effects on small-scale householders in developing countries. It is important to realize that nearly 70% of households generate their income via agricultural activities (such as farming, forestry, fishery, and livestock). All of these activities are linked to the extension services. Proper extension services contribute to poverty reduction and household income improvement in the long-term period [7,8]. It is essential to realize that the basic condition for prosperity and development in any society is the development of human capital, and this development will not be achieved without proper training, extension services, and information transmission [9]. These improvements can lead, hand in hand, to the progress and development of all aspects of society and move the imaginary engine of development [10]. However, in the present century and especially in Third World countries, including Vietnam, agriculture extension is facing serious problems. These problems are linked mainly with low development of agriculture extension services due to the lack of support services, a large population of farmers, poor compliance of extension services with aims of farm owners, lack of appropriate training and support for facilitator [9], as well as lack of long-term strategy and visions. Hence, the actual situation calls for effective resolution.

This paper aims at identification of the current state of extension services in Central Vietnam and the creation of proper recommendations and comments for further processes of training focused on small-scale biogas owners in the target area. The paper identifies the context-specific knowledge, which should serve as a tool for facilitators and their quality involvement in the improvement of current training practices in the area. In addition, in order to design an effective evaluation, performance indicators for the facilitators' quality assessment are provided.

## 2. Materials and Methods

The survey was conducted at the level of randomly selected owners of biogas plants ( $n = 141$ ) and local facilitators ( $n = 9$ ) in Huong Tra and Phong Dien districts, Thua Thien Hue province in Central Vietnam from July–September 2012. Consequently, local facilitators ( $n = 9$ ) were interviewed in semi-structured personal interviews from August–September 2013. Methods of data collection in 2012 included focus group discussions ( $n = 41$ ) and direct observations of participants during discussions, semi-structured personal interviews ( $n = 100$ ), and questionnaire surveys ( $n = 100$ ). Biogas plant (BGP) owners and facilitators were interviewed through semi-structured interviews; each interview took

around one hour. The questionnaire was pilot-tested based on the results adjusted and approved by the experts from Agricultural Forestry Fishery Extension Centre (AFFEC) before final distribution. Collected data were categorized, coded and analyzed in the Microsoft Excel 2016 (Microsoft, USA). Due to the nature of data, Pearson's correlation coefficient ( $\rho$ ) was used to detect possible relations between the average diameter of knowledge at the level of BGP owners and their commune facilitators. Pearson's correlation was done through using an average diameter of knowledge at the level of the BGP owners and the knowledge of their commune facilitators at the critical value of 5%.

### 3. Results and Discussion

#### 3.1. Characteristics of Biogas Technology Facilitators

The purpose of the inquiry was to identify the context-specific knowledge (CSK) for facilitators. Local facilitators are from the communal, district or provincial levels. Commune facilitators are employees of the commune. The summary of the commune characteristics of facilitators is presented in Table 1. On average, facilitators have 5.3 ( $\pm 2.4$ ) years of experience in the field of maintaining biogas technology. Facilitators supervise on average 10.0 ( $\pm 1.9$ ) villages with 122.2 ( $\pm 65.5$ ) biogas plants (BGPs). In the extension service hierarchy commune, facilitators are subordinated to district facilitators. In our case, the commune facilitators are subordinated to the facilitator  $\alpha$  from the Huong Tra district Agricultural Forestry Fishery Extension Service (AFFES) with 10 years of experience, 60 villages under administration, and 4 commune facilitators under administration, and to the facilitator  $\beta$  from Phong Dien AFFES with 7 years of experience, 70 villages under administration, and 4 commune facilitators under administration. Technical management connected with the issue of biogas technology of the whole province—150 villages and 40 facilitators—is up to the facilitator  $\gamma$  who is a provincial technician from the Agricultural Forestry Fishery Extension Centre (AFFEC). Facilitator  $\gamma$  has 6 years of experience with biogas technology and has the deepest education background in the field of biogas technology. As presented in Table 2, all of newly built BGPs in the province are under the administration of facilitator  $\gamma$ .

**Table 1.** Data of the commune facilitators.

	Commune Facilitators ( $n = 6$ )			
	Mean	Standard Deviation	Minimum	Maximum
Years of experience	5.3	2.4	2	10
Number of villages under administration	10.0	1.9	7	12
Number of BGPs under administration	122.2	65.5	76	264

**Table 2.** Data of biogas plants (BGPs) under the administration of district and province facilitators.

Name	District	Employer	District and Province Facilitators ( $n = 3$ )	
			Number of BGPs Under Administration	
Facilitator $\alpha$	Huong Tra district	Huong Tra AFFES	340	
Facilitator $\beta$	Phong Dien district	Phong Dien AFFES	380	
Facilitator $\gamma$	province technician	AFFEC	1000	

#### 3.2. Knowledge of Biogas Technology by Facilitators

Facilitators' knowledge about a specific topic is essential for the knowledge transmission process. Their visits positively influence farmers in adopting new methods and improve technology maintenance [11]. If facilitators have adequate knowledge, they are able to motivate and encourage farmers to acquire further knowledge [12]. Facilitators' level of knowledge about specific issues

connected with biogas technology is presented in Table 3 (commune, district and provincial facilitators). The levels of knowledge about biogas technology, biogas, and digestate (as by-product) are quite satisfying; however, knowledge about digestate management and its handling is rather weak. This is more obvious in cases of district and provincial facilitators. However, knowledge development and proper diffusion are elementary parts of the knowledge transmission process [13].

**Table 3.** Self-assessment of specific issues connected with biogas technology—commune facilitators ( $n = 6$ ) and district and provincial facilitators ( $n = 3$ ).

Knowledge Related to	Mean *	Minimum	Maximum	Standard Deviation	Mean *	Minimum	Maximum	Standard Deviation
Commune Facilitators				District and Provincial Facilitators				
BGP technology	1.33	1	2	0.47	1.33	1	2	0.47
biogas	2.00	1	3	0.82	1.33	1	2	0.47
digestate	2.33	1	4	1.10	2.33	2	3	0.47
digestate management	2.75	1	3	0.89	5.00	5	5	0.00

\* the five-point scale: 1—very good, 2—good, 3—moderate, 4—low, 5—very low.

### 3.3. Characteristics of BGP Owners and Their Knowledge Related to Biogas Technology

The second target group surveyed are BGP owners ( $n = 141$ ). The highest educational attainment in the household of the respondents is tertiary (34% of respondents), secondary (55%), primary (10%), and without education (1%). There is an expectation that with higher education there is growing ease to adapt to the new possibilities [14] 2001 that could be connected to better maintenance of the BGPs. The respondents (BGP owners) in our survey attended training (related to BGPs) in 79% of cases, and on average, they attended 1.9 training sessions, with reported satisfaction in 61 cases (48.2%). The importance of focusing on this topic is linked to the view that education is one of the principal routes for poverty alleviation in developing countries [15], and the willingness to pursue new possibilities increases with increased education [14]. Hence, there is an obvious substantiation for the improvement and proper maintenance of the training. Farmers' knowledge about technology is directly affecting farmers behaviors connected to technology maintenance. The BGP owners' self-assessments of specific issues connected with biogas technology are summarized in Table 4. They feel confident in their knowledge about technology in general. On the other hand, they assessed their level of knowledge about digestate management as being lower. This is caused by recent problem with the digestate issue, and so far, minimal information has been provided from facilitators towards the BGP owners.

**Table 4.** Self-assessment of specific issues connected with biogas technology—BGP owners ( $n = 100$ ).

Knowledge Related to	Mean	Minimum	Maximum	Standard Deviation
BGP technology *	1.66	1	5	0.85
Biogas *	3.01	1	5	1.07
Digestate *	1.81	1	5	1.04
digestate management *	3.16	1	5	1.15
Counted knowledge mean	2.41	1	5	0.89

\* the five-point scale: 1—very good, 2—good, 3—moderate, 4—low, 5—very low.

### 3.4. The Relationship between Levels of Knowledge of Facilitators and Beneficiaries (BGP Owners)

There is a big potential in the form of changing farmers' knowledge and adopting new practice through the extension facilities in the form of extension workshops and facilitators' knowledge transmission [12]. In order to identify/define the relationship between levels of knowledge of facilitators and knowledge of BGP owners, a Pearson's correlation was calculated. The results show

the positive correlation between examined factors ( $\rho = 0.45$ ). It confirms the importance of proper education and the proper maintenance of the training. The reverse effect from growth to education is crucial [16], as evidenced in the cases of 40 African states. An association at the examined aspect of knowledge transmission confirms our hypothesis and shows the importance of proper education and correct maintenance of the trainings. Recently, there has been a wave of decentralization of educational systems in many countries, and these reforms are downsizing the bureaucracy and modifying its functions [14], and this can lead as well to the dilution of the function. There is also the importance of the facilitator's role [17]. The issues of causality and dynamics in identification of training needs have been largely ignored until recently [16]. Due to the above-mentioned facts, there were designed comments and recommendations on the training process.

### *3.5. Strengthening of Agricultural Extension with Gender Outlook*

It is essential to involve contextual approaches to the trainings and agricultural extension services. The call for the recognition of inequalities and injustices in climate governance is present [18]. Trainings need to be tailored to recipients' (farmers') educational needs. Tight cooperation between extension centres and universities provides educational leadership; however, it does not reflect properly the needs of poor rural farmers [19]. There is a call for the improvement of community-based organizations, which would be able to transmit knowledge in more accessible and locally-appropriate forms and raise awareness about the issues. In addition, gender issues must be considered. In Vietnam, the head of the household is mainly trained. In 95% of surveyed cases, a man is the head. Our survey also revealed that participants in trainings related to biogas technology are men (90%). Only 10% of participants trained were women. As the respondents were randomly selected from total population of BGP owners, and the gender disproportion of the sample reflects reality. In many studies (e.g., [20]), women are often emphasized as those who benefit most from biogas technology. However, despite the gender-sensitive policy and legislation (e.g., the Law on Disaster Management and Strategy on Climate Change), women have not been engaged in real actions. In addition, the participation of women in decision-making in formal political and management structures remains low [21]. The trainings often reach only male end-users of biogas [22]. One of the main reasons for the prevalence of male trainees is also the fact that the trainers and facilitators are only men in the study area. Findings from the Gender Analysis Report [23] point out widely held persisting gender stereotypes proclaiming less capabilities and limited skills of women in leadership positions (in and out of home), as well as technical positions (within 12 years of implementation of the National Biogas Programme, SNV [22] recognised only 0.2% of female trained masons in Vietnam). Furthermore, the mid-term evaluation of the SNV Biogas Programme implementation (2007–2015) revealed that project documents did not specifically involve gender-mainstreaming strategies [24]. Therefore, the further involvement of gender-sensitised approaches should be considered. Inspiration can be taken from Bangladesh, where women are trained to act as energy service technicians and have opportunity to earn additional money from this role through training and servicing of other users [19,25]. Due to their natural differences (physical abilities) and cultural predispositions, men are involved mainly in non-agricultural jobs like transportation and construction. Therefore, there are increasing numbers of women working in all stages of agricultural production and trading. Apart from rice cultivation, rural households also produce varieties of vegetables and fruits in the garden to sustain business and daily living expenditures. Men are more likely to be involved in long-term decision planning and making (such as choice of fish species to be raised, timing for stocking, and harvesting). In contrast, women are responsible for daily activities (such as feeding, grass collecting and further small-scale processing). Women also have to do the housework and raise children; women's contributions are closely related to wifehood and motherhood in domestic economy [26]. Therefore, their further involvement in biogas maintenance would be appreciated. Their education as energy service technicians (as in the case of Bangladesh) could improve their roles in the household economy and help them to earn additional money together with achieving better maintenance of the biogas technology. Since 2016, this has been

partially reflected in SNV biogas programme activities focusing on women's empowerment in the cycle of biogas technology implementation (construction, utilization, and benefits, including business opportunities) [22].

### 3.6. Recommendations for Further Training Practices

According to Edgar Dale's extensively cited "Cone of Learning" [27], the importance of non-formal education (NFE) must be noticed, even if the "Cone of Learning" and its authenticity has been criticised [28]. Through the "Cone of Learning", the importance of having an active approach to the learning process is presented. BGP owners showed higher involvement during focus group discussions (FGD) with the use of NFE than with conventional methods. As one of the respondents (a farmer from Duong Son Village) said: "Trainings are sometimes very long and tiring. I am losing my attention. Trainings should be more focused on practical information". This has led us to an assumption that NFE is an important part of the educational and training process and should be more involved in conditions of Vietnamese Extension Service procedures which are currently strictly top-down. The long-term impact on knowledge must be examined in further studies. Our research results also have shown the importance of continuously repeated training. During FGDs, the respondents reported a decrease of specific knowledge about the topic with delays in time. This finding conforms with the study by Steyn [29], who points to the need for continuous education and submits criticisms of traditional approaches using one-day trainings. This was also supported by studies done by Hunzicker [30] and Chappuis et al. [31], as these trainings may raise awareness of specific topics and create a foundation of knowledge, but do not lead to sustained continuing professional development or fundamentally improved practices [30,31]. In cases where one-day trainings are kept as a part of the traditional educational approach, additional support to facilitators must be given before, during, and after trainings to ensure a long-term relationship between the facilitator and the training participant. The learning capacities of farmers, their time availability, resource constraints, and desired learning outcomes must be always taken into account. However, methods of learning which include deeper participation of the trained participants should be involved. As said by one farmer from the Phong Son commune during the FGD: "I am not able to remember all the information said during the training. I would appreciate much more if facilitators visit me on my farm and show it to me and other members of my family directly with biogas plant." Introducing demonstrations of BGPs and active participation of the people during the training process would be an effective tool. Trainers must use as many relevant real-life examples as possible [32]. According to Dale's research, the least effective method at the top involves learning from information presented through verbal symbols (listening to spoken word). The further you progress down to the bottom of the Cone of Learning, the higher the impact of the used methods. The most effective method is at the bottom, and it involves direct purposeful learning experiences, such as field experience. The discussions should be guided and modelled, and facilitators should encourage their listeners (BGP owners) to respond in an assertive manner [27]. The success of extension services is based on the performance of extension agents. Only qualified, enthusiastic, and self-confident extension agents can improve farmers' livelihoods [33]. The pedagogy is bound with the purpose of meditating the methods and educational processes [27]. Facilitators—knowledge transmitters—are some of the most important persons (besides family and peers) influencing the value formulation process. Therefore, this requires from facilitators the ability to answer questions while keeping an eye on BGP owners during the training process in order to empower them to reflect more; otherwise, there is a danger of participants easily losing the interest. The facilitator's role should not be only as a teacher, but also as a designer of a learning scenario, encouraging listeners to participate and learn according to their social and psychological characteristics. Similar conclusions were reached also by Rodrigez-Hernandes et al. [27]. Based on our findings, a scheme called the "Set for Facilitators and their Quality Involvement" (Figure 1) was developed.

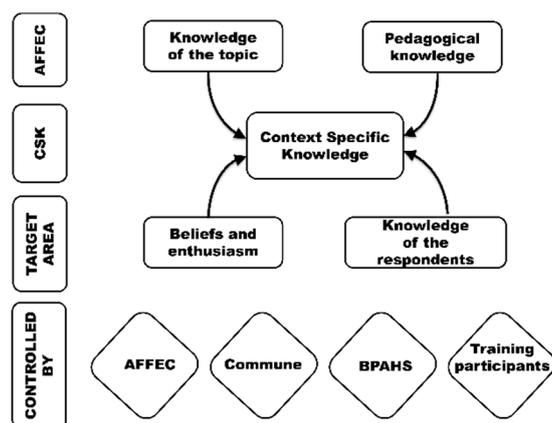


Figure 1. The Set for Facilitators and their Quality Involvement.

### The Set for Facilitators and Their Quality Involvement

Context-specific knowledge (CSK) as the main indicator of proper educational impact during trainings shall consist of the following parts: Knowledge of the topic (provided by AFFEC and obtained through personal experiences), pedagogical knowledge (for proper behavior and teaching methods, taught by AFFEC, The Biogas Programme for the Animal Husbandry Sector in Vietnam (BPAHS), or state educational centres), beliefs and enthusiasm (trainers' beliefs are important because of the way that knowledge about technology and trust in technology is transmitted), and knowledge of the respondents/target group (as various rural areas are bringing their own specific qualities). All topics must work in mutual harmony. Knowledge of the topic must always connect local and external knowledge [34], and despite the differences, keep both knowledge systems in synergy [35]. Pedagogical knowledge is essential for appropriate methods of knowledge transmission. Both, formal and informal methods must be involved and kept in balance [5] with adequate teaching methods which address the recipients. Beliefs and enthusiasm are important characteristics of knowledge transmitter effectiveness [36]. A knowledge transmitter—enthusiasm—is considered as one of the key conditions for effective instruction and for recipients' motivation [37], and finally, for the knowledge of the respondents. The importance of a respondent's attitude and its knowledge was also evaluated by facilitators in the study by Mazancova and Havrland [33], where it was considered as a crucial factor for a successful information transfer process. In addition, the informal institutional context in which facilitators operate results in impacts which must be taken into account [38]. The whole educational process shall be controlled through several institutions, such as AFFEC, the Commune, BPAHS, and training of participants (through the checking of performance indicators).

### 3.7. Introduction of Performance Indicators

When training improvements are incorporated, there is need for establishing accurate measurements and indicators, which are vital to the process of evaluation. Too many indicators will make the comparison difficult and time-consuming. Too few indicators will not give sufficient information to evaluate the results. Successful indicators of facilitators' performances rely on the relevant ones, which are the most suitable for comparison. Currently there are no adequate performance indicators available in the region. For these purposes, our study introduces a new set of performance indicators (PIs) based on the results of the facilitator–farmer interactions. PIs rely mainly on the facilitator–farmer relationship. When the facilitator (within the CSK involved) provides appropriate trainings and knowledge transmission to a farmer, the farmers' satisfaction, availability, and service usefulness should be evaluated retrospectively. This information should be collected by a controlling body (AFFEC, Commune, BPAHS) together with information about the farmers' knowledge, satisfaction, and technology problem rates. The controlling body should evaluate the

facilitators' knowledge and their time spent by providing services (Figure 2) and should have the authority to remedy shortcomings apparent in the case.

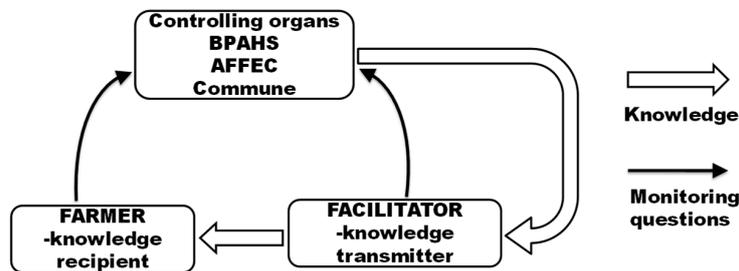


Figure 2. Indicators of assessment.

These indicators can be easily collected and evaluated. In the case of adoption, a method used by Hu et al. [39], the cross-sectional Tobit estimation of the facilitators' time allocation model, can be used. The Tobit model is a statistical model (proposed by James Tobin in 1958) describing the relationship between a non-negative dependent variable and an independent variable [40]. In our case, time would serve as a dependent variable compared with independent variables such as the facilitators' characteristics: Years of experience with biogas technology; competency in biogas technology (process of anaerobic digestion and biogas production, suitability of feedstock, construction and maintenance of a digester, digestate management); knowledge about specific issues (knowledge about technical supports including the availability of masons, and knowledge about financial supports like the availability of subsidies, loans, credits) and regional scope, and knowledge transmission performance (the farmers' satisfaction, farmers' knowledge, farmers' independence in decision-making related to biogas technology, and the technology problem rate). Results will be easily explained as performance indicators: Farmers' satisfaction (satisfaction with biogas technology and biogas production, satisfaction with technical support, satisfaction with information about financial support); availability and services usefulness (frequency of regular visits, availability of facilitators in emergency cases, the level of usefulness of advice/information provided by a facilitator) of facilitators and their functional knowledge transmission processes. The feedback should contain monitoring questions about farmers' satisfaction with the facilitator (satisfaction, availability, and usefulness of services), and with the technology itself (farmers' knowledge of specific issues, farmers' independence in decision-making related to biogas technology, and monitoring of the problem rate).

#### 4. Conclusions

This study was designed to determine the current state of the relationship among facilitators (as knowledge transmitters) and BGP owners (as knowledge recipients and beneficiaries) and their facilitator-farmer relationships. The level of knowledge at the level of the facilitators and BGP owners was assessed in two districts of the province of Thua Thien Hue, Vietnam. This assessment was based on a random sampling of BGP owners and local facilitators. The research results have proven the relationship between the knowledge of the facilitators and the BGP owners, showing a direct influence on the knowledge transmission occurring between the two examined groups. Gender outlook was taken into consideration and recommendations for proper trainings were presented. Based on Dale's Cone of Learning, CSK (context-specific knowledge) for facilitators and their quality involvement was created. CSK consists of the following parts: Knowledge of the topic, pedagogical knowledge, beliefs and enthusiasm, and the knowledge of the respondents. Further, performance indicators for the evaluation of the facilitators' knowledge transmission were introduced. The performance indicators should be a consistent part of the educational process for the evaluation of knowledge transmission success. Deeper research in terms of understanding facilitators' impacts on the knowledge transmission process to the BGP owners and the findings of further limitations should be carried out to prove the sustainability of the extension services outputs.

**Author Contributions:** Conceptualization, H.R.; Methodology, H.R. and J.M.; Formal Analysis, H.R. and J.M.; Data collection, H.R.; Resources, H.R. and J.M.; Writing-Original Draft Preparation, H.R.; Writing-Review & Editing, H.R. and J.M.; Funding Acquisition, H.R. and J.M.

**Funding:** This research was conducted with financial support by the Internal Grant Agency of the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, project number (20195004).

**Acknowledgments:** We thank the participating farmers and facilitators for their valuable time and patience in providing data and information for this study.

**Conflicts of Interest:** The authors declare no conflict of interest.

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