ORIGINAL ARTICLE

Agricultural stakeholders' priorities using Q method for initiation of an innovation platform in Nan, Thailand

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ABSTRACT

As a consequence of intensive maize mono-cropping practice on sloping lands in northern Thailand, Nan province, farmers face extremely low yields, soil erosion, and prolonged drought. Research and development efforts are needed to identify possible solutions, evaluate and scale them out to farmers. Consequently, an innovation platform has initiated a network of stakeholders, including farmers, government officers, researchers, and private sector actors, who meet regularly to coordinate the development of long-term solutions. Therefore, this study aims to identify which interests and goals are shared and which are conflicting among the various stakeholders involved in the Nan R4D platform, which was initiated as part of the Humidtropics project. Q methodology was employed, and 29 participants were selected from the R4D platform to conduct a Q-sort activity. The results showed that the two distinctive framings shared ways of thinking about research and development (R&D) and environmental issues. Additionally, participants' interests and goals were diversifying agriculture, livestock promotion, growing vegetables, government aid, rubber plantation profitability, pesticide damage, deforestation, growing own food, and the possibility of growing maize sustainably. However, they disagreed on whether maize cultivation leads to food insecurity and high debt among farmers, and if planting fruit trees on sloping land is advisable. Ultimately, this study delivers agricultural stakeholders' perspectives from the platform including recommendations on further potential policies for agricultural development in Nan.

Key words:
innovation platform; Q methodology; Q technique; Northern Thailand; agricultural stakeholders; R4D platform

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INTRODUCTION

Agriculture is undoubtedly noted as a crucial engine leading economic growth in Thailand, since the early 1980s, Thailand has owed its steady economic progress to its expanding agricultural sector.[30] Even in 2020, the Gross Domestic Product (GDP) from the agricultural sector shrank by -3.3 % due to the COVID-19 pandemic, but it still earned 14.44 billion USD.[4] Moreover, 9.36 million Thai people were engaged in the agriculture sector, with approximately 23.88 hectares of agricultural land, accounting for 46.5% of Thailand's total land.[17,22] Thus, agriculture is one source of national income, and farming is the main source of livelihood for Thai people. Nonetheless, Thailand's agriculture still has many unresolved issues. For instance, 2.44 million farmers,[23] in Northern Thailand face various problems, including weather-related disasters, overuse of pesticides, poor water resource management, soil degradation, and unsustainable farming practices. In Nan Province, agriculture is a dominant industry, a major income, and a key source of livelihood. Nan's Gross Provincial Product (GPP) from the agriculture sector was 122.15 million USD in 2018, with 132,191 people engaging in the sector (accounting for 55.79% of the total population).[19,24] Farmers typically grow tobacco, cotton, sesame, lychee, and gold oranges using monoculture cropping systems. Lately, these crops have been ineffective in providing farmers with a sufficient income. Therefore, farmers shifted to maize cultivation for livestock, which has led to a reduction in rice production in the area. The expenses for seeds and chemical fertilizer are also a constraint facing maize production. In addition, Nan faces water shortages in the dry season and immense flooding during the rainy season. Besides, the lack of information on protected community forest areas and reserves has led to a situation where preserved community forest reserves are sacrificed for the sake of maize cultivation.[12,18] Hence, the major crop for cultivation is maize, which caused farmers to encountering various environmental problems.[14,16,26] In particular, farmers who have been growing maize in steep areas have experienced social and environmental problems that have gradually extended to the downstream side of the area's main river, where deforestation in watersheds,[34] has led to erosion and flooding, and soil degradation owing to the unsustainable intensive land use practice.[6,29,32] Maize grown on steep lands is of lower quality compared to that grown on flatlands and is also associated with greater costs of production. Additionally, feed manufacturers are the stakeholders who gain the highest in negotiating to buy maize for feed since they are the last tier in the process. The supply chain management of maize feed for animals could help to manage Nan's water sources.[2] However, maize farmers need more environmentally sustainable weed management through the application of herbicides and alternatives. Likewise, maize farmers already have medium-level knowledge of chemical herbicides and usage; however, they are uncertain that organic herbicides would provide effective results.[20] Problems in the agriculture sector in Nan province have persisted for several years and have been of great concern. Consequently, on May 31st, 2013, more than twenty agencies gathered to brainstorm and find ways to balance agricultural development in a sustainable manner over the next ten years.[35]

Hence, an innovation platform (IP) has been brought up with the aim of using it widely for agricultural development.[27] An IP is a space for learning and change, which gathers a group of individuals (i.e., farmers, traders, processors, wholesalers, and others) with different backgrounds and interests to diagnose problems, identify

opportunities, and find ways to achieve their goals.[13] IPs do not simply provide a mechanism to follow; instead, it is a way to bring different stakeholders together and consists of a series of value chain actors to convene and find a means to solve a common problem.[5] In agricultural value chain development, a group of people may determine what farmers want and how to help them achieve their desires. The main point is to find out the possible ideas or to create new platforms that suit the culture and stakeholders' vision by supporting it with a wide range of differently-abled participants while having effective ways of dealing with its members. The members may use the IP to express their interests and guide activities intended to benefit the group. Moreover, IP is not limited to knowledge and skills in the production process but it expands to the entire value chain. Three main types of platforms are available: farmer-based platforms emphasize knowledge and skills for farmers and direct stakeholders who are relevant to agriculture; value-chain-based platforms provide knowledge to other stakeholders who are in the feed market; and, accidental platforms provide contingency plan knowledge and skills for accidental situations.[5] In addition, IPs may introduce new trends that simultaneously bring benefits or disadvantages (e.g., providing information and resources to all stakeholders).[11] Stakeholders have access to the platforms to be informed about relevant issues and brainstorm to figure out solutions. Furthermore, researchers are allowed to inform participants about research results and provide scientific and reliable solutions. Therefore, all stakeholders are encouraged to argue and provide supportive evidence through negotiation and persuasion. Ultimately and though challenging, IPs can create change through lobbying and advocacy, while persuading the secondary stakeholders like the government or the market to understand and approve the new change. Several studies have initiated IPs in agricultural areas, such as livestock development in the Tanga region of Tanzania,[21] climate-smart agriculture in Colombia and Honduras,[1] and the development of climate-smart agriculture in West Africa.[25]

The Consultative Group for International Agricultural Research (CGIAR)[9] Research Program on Integrated Systems for Humid Tropics (known as "Humidtropics") has four "Flagship Projects." These projects are developed as place-based integrated Research for Development (R4D) programs focusing on Action Areas with main agricultural production systems nexus. The area-based Flagship Projects aim to improve the livelihoods of smallholder farming communities in the respective areas, based on sustainable productivity improvements and social and technical innovations in institutions and natural resource management. The four area-based Flagship Projects included East and Central Africa Highlands, West Africa Lowlands, Central Mekong, Central America and the Caribbean. This study falls under an Action Area of the Central Mekong Flagship. In Asia, the program aims to diversify cropping systems in the upland regions of Southeast Asia.[9]

For Thailand, Humidtropics works mainly in the northern province of Nan through an IP entitled "Together Making Nan Better" (TMNB) by Nan's stakeholders. TMNB is a special kind of IP called an "R4D platform", since it coordinates a range of R4D activities. The platform was initiated in Nan Province because Nan's topography is hilly in the uplands and most of the farmers grow maize using a mono-cropping system.

Although IPs have recently been used as one of problem-solving approaches in agriculture in developing countries, "few studies support ex-ante appraisal of when and for what purpose innovation platforms provide an appropriate mechanism for achieving development outcomes, and what

kinds of human and financial resource investments and enabling environments are required."[39] Without this information, it may be assumed that IPs are the silver bullet tool that can solve all agricultural problems. Until the summer of 2014, there were no systematic studies related to IPs in Thailand. This study aims to identify which interests and goals are shared and which are conflicting among various stakeholders involved in the R4D platform in Nan during the initiation stage of IP. Besides, we provide valuable suggestions for initiating IPs, which could provide opportunities for future policy development.

DATA AND METHODOLOGY

Data collection was conducted from July to August of 2014 in Nan Province (Figure 1), located at 100.3362–101.3572°E and 18.0133–19.6344°N, on the eastern boundary of northern Thailand and adjacent to the Lao People's Democratic Republic (Lao PDR). The province area is approximately 1,147,207.2 hectares in size, with highlands and mountains accounting for over 85% of its total area, which flattens only in the central valley surrounded by steep mountains on all sides. The central valley is mainly utilized as agricultural sites, urban area, savannah and grassland, water bodies, golf course, and the airport, with an average of about 730-meter above sea level.[19,34,38]

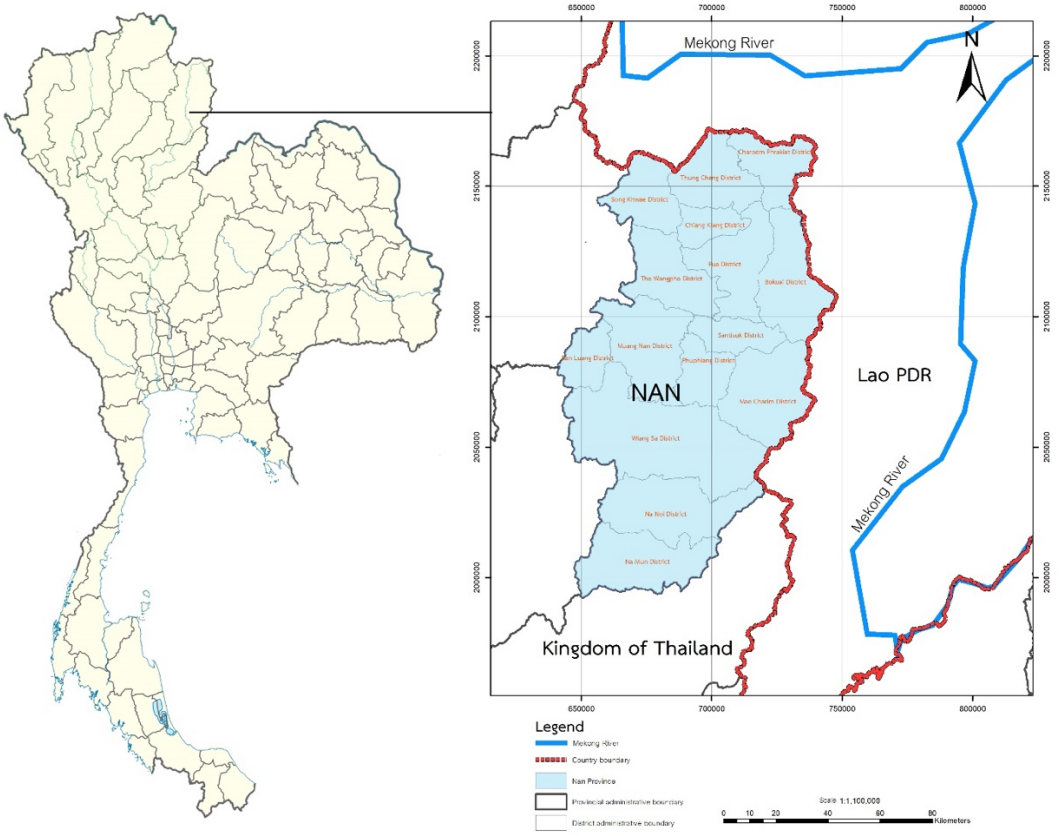

Figure 1 Study area for innovation platform initiation in Nan province, Thailand.

The first meeting to establish the R4D platform was held in May of 2014 in Nan. There were 50 people from different fields including governmental sectors and

private sectors. The R4D platform was implemented in five districts: Nan Wiangsa, Ban Luang, Santisuk, Muang, and Thawangpha. All five districts are maize farming areas, with the topography being mostly mountainous and slightly upland.

The process of establishing an IP follows several steps: initiating the platform, deciding on its focus, identifying the options, testing, refining solutions, developing capacity, implementing and scaling up, and finally analyzing and learning. The first step involves stakeholders from a research, governmental or non-governmental organization identifying the target area for the IP. This organization also identifies the various stakeholders, gathers them together, and arranges the meeting. Stakeholders then discuss the problems and opportunities within that area. Following that, the platform members decide how to possibly solve the problems or take advantage of the opportunities that have been identified. In addition to this, the platform needs to test new tools or methods to see how effective they are. Subsequently, the IP finds ways to develop farmers' required capacity to enable them to fulfill their needs and meet the challenges identified or access the opportunities available. Lastly, the members implement the identified solutions.[13]

Population and Sample

The population of this study was all participants in the first R4D platform meeting. Purposive sampling was used to decide which participants should be involved in the Q methodology. Twenty-nine (29) participants were selected for Q methodology interviews based on the Nan name listing platform and their general knowledge about Nan. Table 1 shows the detailed information about Q methodology participants. The selected participants were from six sectors: international organizations, Thai universities and other educational institutions, government organizations, non-governmental organizations, private organizations, and farmers. Farmers involved in this Q methodology were those who participated in the first R4D platform meeting in May 2014 in Nan. The total number of participants was 29, with one participant from an international organization, 13 participants from Thai universities and other educational institutions, 5 participants from governmental organizations, 7 participants from non-governmental organizations, one participant from a private organization that is providing a sustainable source of energy for both Laos and Thailand, and 2 farmers.

Table 1 Research Participants' Information.

Sector	Organization	# of participants
A) International organization	a) ICRAF	1
B) Thai universities and other educational institutions	a) Chiang Mai University b) Chulalongkorn University c) Mae Fah Luang University d) Maejo University e) Nan Community College f) Tanchum High School, Nan	13
C) Government organizations	a) Bank for Agriculture and Agricultural Cooperatives (BAAC)	5

Sector	Organization	# of participants
	b) Dept. of Agricultural Extension (DOAE)	
	c) Land Development Department (LDD)	
	d) Nan Provincial Administrative Organization	
	e) Nan Agricultural Extension and Development Center	
D) Non-governmental organizations	a) Muang Jung Sub-district Administrative Organization/Hag Muang Nan Foundation	7
	b) Pong Kum Temple Learning Community Encourage Foundation	
	c) Thai Research Fund (TRF), Nan	
E) Private organization	Hongsa power	1
F) Farmers who participated in the first agricultural IP meeting on May 2014 in Nan	Farmers	2
	Total	**29**

Q methodology

Q methodology helps to elucidate the priorities of stakeholders through statement ranking and clarifies stakeholders' subjective opinions.[37] In this study, participants ranked 23 statements using the 7-point Likert scale format, measured from "strongly agree" to "strongly disagree" ("strongly agree" with a rating of 3 to "strongly disagree" with a rating of -3). Table 2 shows the statements used for this study. These statements were developed from brainstorming sessions focused on issues that emerged from the first R4D platform meeting and are, therefore, relevant to current agricultural issues in Nan.

Table 2 Statements used for the Q methodology interviews in English and Thai.

Statements (English)	**Statements (Thai)**
1. We must diversify agriculture in Nan	1. เราต้องทำเกษตรเมืองน่านให้หลากหลาย
2. Growing vegetables profitably is too difficult	2. ปลูกผักให้ได้กำไรเป็นเรื่องยาก
3. Farmers do not get enough help from government organizations	3. เกษตรกรไม่ได้รับความช่วยเหลือที่เพียงพอจากหน่วยงานรัฐ
4. We must promote livestock production	4. เราต้องส่งเสริมการเลี้ยงสัตว์

Statements (English)	Statements (Thai)
5. Rubber plantations are not profitable	5. การปลูกยางพาราไม่ได้สร้างกำไร
6. Pesticides damage farmers' health more than anything else	6. ยาฆ่าแมลงทำร้ายสุขภาพของเกษตรกรมากกว่าสิ่งอื่นใด
7. Maize growing is for lazy farmers	7. การปลูกข้าวโพดมีไว้สำหรับเกษตรกรที่ขี้เกียจ
8. Farmers are to blame for deforestation	8. เกษตรกรปลูกกล่าวโทษว่ามีส่วนในการทำให้พื้นที่ป่าลดลง
9. Maize growing leads to food insecurity	9. การปลูกข้าวโพดก่อให้เกิดความไม่มั่นคงทางอาหาร
10. Farmers should grow their own food	10. เกษตรกรควรผลิตอาหารทานเอง
11. Earning enough cash is more important than growing your own food	11. การมีรายรับที่เพียงพอสำคัญกว่าผลิตอาหารไว้ทานเอง
12. The role of researchers is to provide farmers with better technologies	12. บทบาทของนักวิจัยคือช่วยจัดหาเทคโนโลยีที่ดีกว่าให้เกษตรกร
13. Universities provide farmers with useful knowledge	13. มหาวิทยาลัยจัดหาความรู้ที่มีประโยชน์ให้แก่เกษตรกร
14. Maize growing is the main cause of soil degradation	14. การปลูกข้าวโพดเป็นสาเหตุทำให้ดินเสื่อมความอุดมสมบูรณ์
15. It is impossible to grow maize in a sustainable way	15. เป็นไปไม่ได้ที่จะปลูกข้าวโพดในแบบยั่งยืน
16. Maize growing makes farmers have a high debt	16. การปลูกข้าวโพดทำให้เกษตรกรเป็นหนี้สูง
17. Local communities have no interest in reforestation	17. ชุมชนท้องถิ่นไม่สนใจการปลูกป่าทดแทน
18. Land rights should be provided for the hill tribe people	18. ควรมีการให้สิทธิการถือครองที่ดินให้กับชาวเขา
19. The burning of fields must be stopped	19. ต้องหยุดการเผาไร่
20. Research does not benefit local communities	20. งานวิจัยไม่ก่อให้เกิดประโยชน์กับชุมชนท้องถิ่น
21. We must plant fruit trees on sloping lands	21. เราต้องปลูกไม้ผลบนพื้นที่ลาดชัน
22. Maize contract farming drives unsustainable land use	22. การทำไร่ข้าวโพดแบบพันธสัญญาเป็นตัวผลักดันให้เกิดการใช้ที่ดินแบบไม่ยั่งยืน
23. Chemical pesticides are essential for a productive agriculture	23. ยาฆ่าแมลงจำเป็นต่อการทำเกษตรอย่างมีประสิทธิภาพ

In using the Q methodology to proceed with this study, 23 cards, each containing one of the above statements, were presented to various participants from six sectors in Chiang Mai and Nan in July 2014. The 29 participants chose cards that expressed their opinions in terms of agreeing or disagreeing with the statements and to what extent they agreed or disagreed. Each participant placed their cards on the paper board in a partial-diamond shaped grid (Figure 2).

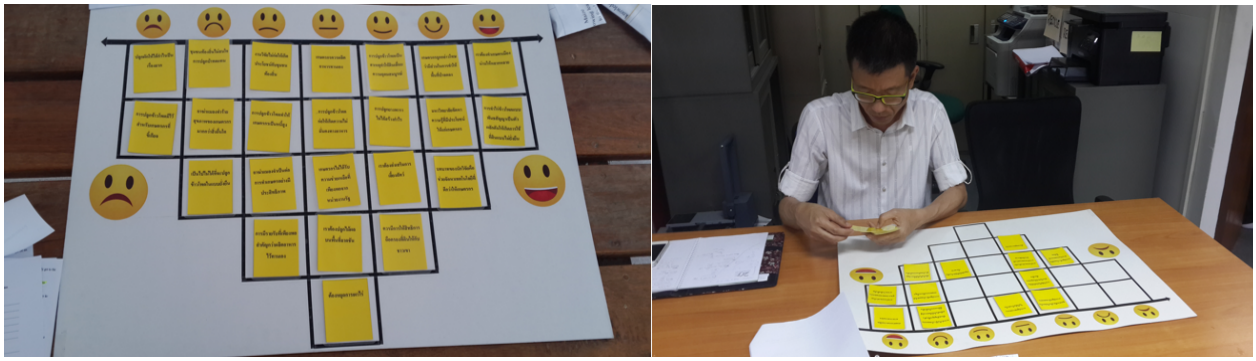

Figure 2 Instruction of how Q method applied in the field by placing the cards (left), sorting Q cards (right).

The researcher instructed the participants to place their cards on blank spaces, working from top to bottom. Each column on the paper board had its own ranking value. The scores were defined as -3, -2, -1, 0, 1, 2, and 3 (Figure 3). After sorting the statement cards, the participants were asked to confirm their ranking and explain their choices, especially with respect to the top five (ranking 2 to 3) and the bottom five (ranking -2 to -3) statements. The researcher recorded and took notes of this process.

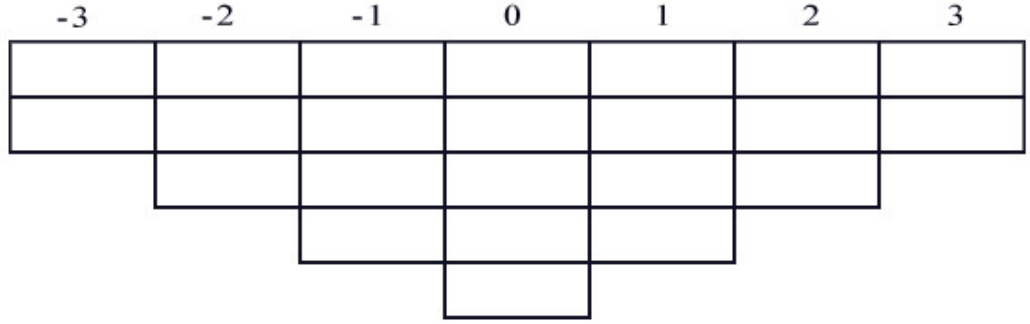

Figure 3 Q sort diagram.

Instrument Development for Q Methodology, Data Analysis, and Validity

The researcher generated 23 statements in both English and Thai to allow participants to sort their priorities in their preferred language. These statements were created from secondary data relating to the current agricultural issues in Nan and partly retrieved from the R4D platform meeting (May 2014) report. This study used the PQ method Version 2.35 software to investigate patterns in the Q sorts for the data analysis. Unrotated factor, rotated factor loading, and factor array were used in the process of analysis. Regarding Q sorting, the statement ranking was first coded and then entered into the Q method software.

Content validity is employed to examine the domain of the concept and the analyst judges whether the measures fully represent the domain. There are basically two ways of assessing content validity: (1) ask a number of questions about the instrument or test; and/or (2) ask the opinion of expert judges in the field.[10] For this study, the researcher obtained the validity judgment and suggestions of two

researchers in the field from the World Vegetable Center (AVRDC). AVRDC is an international nonprofit research and development institute, dedicated to mitigating poverty and malnutrition in developing countries. AVRDC researchers have reviewed the statements and created questions based on the objective of this study. In addition, unstructured questionnaires and English statements for Q methodology that were to be used when conducting the Q methodology were checked, modified, and confirmed by the two AVRDC researchers.

The statements were translated into Thai as needed for conducting a Q sorting with Thai research participants and were checked by a Thai researcher.

RESULTS

To investigate patterns in the 23 Q sorts, the PQ method Version 2.35 software was used for factor analysis. Table 3 shows the unrotated factor matrix. Two factors were extracted using Principal Component Analysis and then rotated via the Varimax orthogonal method. The extraction of two factors was based on screening for eigenvalues greater than one on the screen test plot, and on two or more significantly loading Q sorts.[36] A significant factor loading at the 0.01 level can be calculated using the following equation[40] : 2.58× (1 ÷ √ n), where n is the number of statements in the Q sample: 2.58× (1÷ √ 23) = 0.5379 round up to ±0.54. Then accepting those factors that have two or more significant factor loadings from the unrotated factor matrix. Results suggest that both of these study factors satisfied the criterion and could legitimately be extracted.

Table 3 Unrotated Factor Matrix.

participants	Degree of correlation of Q sorts with each factor							
	1	2	3	4	5	6	7	8
1	**0.6852**	-0.1451	0.3461	0.1417	-0.0085	-0.3174	0.2355	-0.0254
2	0.3609	-0.053	0.4918	-0.3209	-0.3419	-0.4189	-0.0635	-0.1693
3	0.2367	-0.0986	0.4592	-0.1881	0.6066	0.1267	0.2241	0.2886
4	**0.634**	-0.387	0.1393	-0.3281	0.0521	-0.0559	-0.173	0.2742
5	**0.6369**	-0.5254	0.2147	0.0222	-0.067	-0.0267	0.2066	-0.2827
6	**0.6474**	**-0.618**	-0.0373	0.0716	0.1308	-0.2643	0.0305	0.0966
7	**0.7898**	-0.0142	-0.115	0.3347	0.2267	0.1091	0.1682	0.2125
8	0.4847	**0.5799**	0.099	-0.0001	0.3672	-0.0248	-0.2492	-0.0321
9	0.3741	-0.3118	**-0.5943**	-0.0847	-0.4217	0.0172	0.1891	-0.2399
10	**0.8763**	-0.0912	-0.2072	-0.0714	0.0982	0.2902	0.1037	-0.0639
11	0.5386	0.2691	0.0136	-0.2979	0.3734	-0.084	-0.2788	-0.2597
12	**0.553**	-0.097	0.1815	0.3596	0.2488	-0.0981	-0.0684	-0.1372
13	**0.7637**	0.1629	-0.034	0.3486	-0.13	0.1095	-0.2655	0.1227
14	**0.6131**	-0.0808	-0.2984	0.4623	-0.1836	-0.2519	-0.1349	0.1642
15	**0.6755**	0.3372	-0.1886	-0.2426	-0.0204	-0.1931	-0.381	0.0107
16	**0.7209**	-0.3102	-0.0607	0.2114	-0.105	-0.0825	-0.0459	0.4122
17	0.4043	0.2092	0.519	0.3726	-0.0553	0.1299	0.1913	-0.0847
18	**0.6857**	-0.2295	-0.1573	-0.0775	-0.1056	0.0051	-0.2829	-0.1492
19	**0.8359**	0.2524	0.0599	-0.1422	-0.0462	-0.0698	-0.0558	-0.1735
20	**0.6466**	-0.1224	0.4033	-0.0609	-0.0979	0.3428	-0.2142	-0.1761

participants	Degree of correlation of Q sorts with each factor							
	1	2	3	4	5	6	7	8
21	0.4805	0.0594	0.1244	-0.3317	-0.2976	0.4925	-0.0836	0.2177
22	0.5087	0.3464	0.2794	-0.1842	-0.4984	0.1673	0.1304	0.3339
23	0.4138	**0.5953**	-0.2028	0.3675	-0.0532	-0.2266	0.0037	0.1468
24	0.3997	**0.5535**	-0.1692	-0.2505	0.0621	-0.3437	0.3729	0.022
25	0.4927	0.0321	-0.4832	-0.4783	0.1965	-0.0052	0.3312	0.0792
26	**0.6543**	0.25	0.2563	0.2141	-0.1219	0.075	0.2933	-0.304
27	**0.7188**	0.388	-0.1104	-0.2442	-0.1122	0.044	0.1847	0.0103
28	**0.6934**	-0.4871	-0.1166	-0.2225	0.1831	-0.0476	-0.0412	-0.0121
29	**0.5505**	0.0475	-0.4319	0.275	0.2088	0.4224	0.0415	-0.2244
Eigenvalues	10.7224	3.0211	2.3563	2.0227	1.6591	1.3668	1.2004	1.1039
% expl.Var.	37	10	8	7	6	5	4	4

Notes: Bold typed numbers indicated significant factor loadings at the 0.01 level.

Table 4 Rotated Factor Matrix.

participants	Factor	
	1	**2**
1	**0.6139**	0.3372
2	0.3081	0.1954
3	0.2437	0.0797
4	**0.7329**	0.1205
5	**0.8254**	0.0175
6	**0.8939**	-0.0459
7	**0.6077**	0.5047
8	-0.0111	**0.7557**
9	**0.4869**	0.0079
10	**0.7235**	0.5027
11	0.2325	**0.5554**
12	**0.4823**	0.2874
13	0.4723	**0.6218**
14	**0.5173**	0.3389
15	0.2918	**0.6963**
16	**0.7487**	0.2354
17	0.1698	**0.4224**
18	**0.6694**	0.2736
19	0.4686	**0.7367**
20	**0.5698**	0.3292
21	0.3254	0.3586
22	0.1594	**0.5945**
23	-0.0749	**0.7211**
24	-0.0583	**0.6803**
25	0.3523	0.3458
26	0.3326	**0.6163**

participants	Factor	
	1	2
27	0.2915	**0.7631**
28	**0.8432**	0.0834
29	0.3861	0.3952
% expl.Var.	**26**	**22**

Notes: Bold typed numbers indicated significant factor loadings at the 0.01 level

To assess the extent of association of each participant with each of the two factors, the factor loadings were calculated for each individual Q sort (see Table 4). Based on the statistical significance of the factor loadings, 24 out of the 29 Q sorts were considered factor-defining Q sorts for at least one of the two extracted factors.

Table 5 Factor arrays.

Statement number	Statement	Factor array	
		1	2
1	We must diversify agriculture in Nan	3	3
2	Growing vegetables profitably is too difficult	-2	-1
3	Farmers do not get enough help from government organizations	0	0
4	We must promote livestock production	1	0
5	Rubber plantations are not profitable	-1	-1
6	Pesticides damage farmers' health more than anything else	1	1
7	Maize growing is for lazy farmers	-3	-2
8	Farmers are to blame for deforestation	1	1
9	Maize growing leads to food insecurity	-1	1
10	Farmers should grow their own food	2	2
11	Earning enough cash is more important than growing your own food	0	-1
12	The role of researchers is to provide farmers with better technologies	3	0
13	Universities provide farmers with useful knowledge	2	0
14	Maize growing is the main cause of soil degradation	0	2
15	It is impossible to grow maize in a sustainable way	-1	-1
16	Maize growing makes farmers have a high debt	-2	1
17	Local communities have no interest in reforestation	-1	0
18	Land rights should be provided for the hill tribe people	0	-2
19	The burning of fields must be stopped	1	2
20	Research does not benefit local communities	-3	-2
21	We must plant fruit trees on sloping lands	2	-3
22	Maize contract farming drives unsustainable land use	0	3
23	Chemical pesticides are essential for a productive agriculture	-2	-3

The weighted averages of the sorts were used to calculate an idealized sorting pattern for each factor along the original response scale (-3 to +3) and these idealized sorting patterns, called factor arrays,[7] are listed in Table 5. Being a weighted average, the factor array looks like a single complete Q sort. For each factor, a single Q sort was generated, which could be taken as an ideal representative of that factor. It is those factor arrays that provide the bases for interpretation.[28] The degree of correlation between factors is given in Table 6

Table 6 Correlations between factors.

	Factor 1	Factor 2
Factor 1	1	0.4721
Factor 2		1

The factors were interpreted based on the results from the rotated factor loadings (Table 4) and the factor arrays (Table 5).

Factor 1: Research and development are needed

From Table 4, there were 13 participants in factor 1 (F1), which are 1, 4, 5, 6, 7, 9, 10, 12, 14, 16, 18, 20 and 28. Those sorted factors corresponded to 0.6139, 0.7329, 0.8254, 0.8939, 0.6077, 0.4869, 0.7235, 0.4823, 0.5173, 0.7487, 0.6694, 0.5698 and 0.8432, respectively. Participants were from the following sectors: farmers, universities/ educational institutions, international organizations and non-governmental organizations. Participant number 6, who was from a university, had great influence on factor 1, as indicated by the high value for F1.

Table 5 shows that statements 1 and 12 attracted participants in F1 because they strongly agreed with "we must diversify agriculture in Nan" and "the role of researchers is to provide farmers with better technologies." Statements 7 and 20, "maize growing is for lazy farmers" and "research does not benefit local communities" respectively, did not elicit positive thoughts, and participants ranked them as "strongly disagree". In addition, F1 had S4, S11, S13, S18 and S21 since these were ranked higher for F1 than for F2, and these are: "we must promote livestock production", "earning enough cash is more important than growing your own food", "universities provide farmers with useful knowledge", "land rights should be provided for the hill tribe people" and "we must plant fruit trees on sloping lands".

Factor 2: Environmental conditions are critical

Table 4 shows that factor 2 (F2) had 11 participants with significant values; these were participants 8, 11, 13, 15, 17, 19, 22, 23, 24, 26 and 27. Their corresponding values are 0.7557, 0.5554, 0.6218, 0.6963, 0.4224, 0.7367, 0.5945, 0.7211, 0.6803, 0.6163 and 0.7631, respectively. This shows Q-sorting of each participant had similar vision and high correlation. Participants were from universities/ educational institutions, government organizations, private organizations and non-governmental organizations. Eleven participants were influential in F2, particularly participant number 27 who was

from universities/ other educational institutions.

Table 5 indicates that under F2, statements 1 and 22 attract participants since they strongly agree with the concepts that, "we must diversify agriculture in Nan" and "maize contract farming drives unsustainable land use." Statements 21 and 23 brought forth negative reactions as shown by the fact that participants strongly disagreed with "we must plant fruit trees on sloping lands" and "chemical pesticides are essential for a productive agriculture." According to the Q-sort analysis, S2, S7, S9, S14, S16, S17, S19, S20 and S22 were ranked higher for F2 than for F1. These are "growing vegetables profitably is too difficult", "maize growing is for lazy farmers", "maize growing leads to food insecurity", "maize growing is the main cause of soil degradation", "maize growing makes farmers have a high debt", "local communities have no interest in reforestation", "the burning of fields must be stopped", "research does not benefit local communities" and, "maize contract farming drives unsustainable land use."

Consensus and lack thereof between the factor participants

In Table 5, there are 20 statements that show the points of consensus between F1 and F2 participants. They are: S1 (We must diversify agriculture in Nan), S2 (Growing vegetables profitably is too difficult), S3 (Farmers do not get enough help from government organizations), S4 (We must promote livestock production), S5 (Rubber plantations are not profitable), S6 (Pesticides damage farmers' health more than anything else), S7 (Maize growing is for lazy farmers), S8 (Farmers are to blame for deforestation), S10 (Farmers should grow their own food), S11 (Earning enough cash is more important than growing your own food), S12 (The role of researchers is to provide farmers with better technologies), S13 (Universities provide farmers with useful knowledge), S14 (Maize growing is the main cause of soil degradation), S15 (It is impossible to grow maize in a sustainable way), S17 (Local communities have no interest in reforestation), S18 (Land rights should be provided for the hill tribe people), S19 (The burning of fields must be stopped), S20 (Research does not benefit local communities), S22 (Maize contract farming drives unsustainable land use) and S23 (Chemical pesticides are essential for a productive agriculture). Participants from F1 and F2 were in consensus that they agreed with or were neutral about statements 1, 3, 4, 6, 8, 10, 12, 13, 14, 19 and 22. On the other hand, they were in consensus that they disagreed with or were neutral about statements 2, 5, 7, 11, 15, 17, 18, 20 and 23.

In Table 5, there are three statements that showed a lack of consensus between F1 and F2 participants. They were: S9 (Maize growing leads to food insecurity), S16 (Maize growing makes farmers have a high debt), and S21 (We must plant fruit trees on sloping lands). F1 participants disagreed and F2 participants agreed with S9 and S16, while the opposite was true for S21. These are the issues in which participants clearly differed in their opinions.

DISCUSSION

IPs have been recognized as essential for finding solutions to the problems faced by agricultural communities.[42] The data for this research activity were collected for about two months, from July to August 2014. Within that period, researchers conducted the investigation using note-taking, voice recorders, pictures, and observations. After which the data were compiled and interpreted. All stakeholders engaged in this

research had different points of view. However, there were two distinct interests and priorities, according to the results from the Q method:

1. Research and development were seen as the most crucial element required to solve the difficulties faced in Nan. Farmers, government organizations, non-government organizations, international organizations, and universities/ other educational institutions all seemed to concur on that point. They ranked diversified agriculture in Nan and the researchers' role in providing farmers with better technologies as "strongly agree". Furthermore, a supportive paper from Indonesia revealed that modern agriculture and technological approaches emphasize identifying sustainability perspectives in agriculture.[41] By that ranking, they mean that these are first priorities. Also, farmers would like to see integrated farming. Officials see diversified agriculture as being capable of replacing the mono-cropping system and allowing the Nan Mountains to be forested again.

Universities/other educational institutions supported the idea of farmers growing their own food, especially home gardening on their own land. In addition, it is recognized that modern technology should be emphasized as part of the solution for the farmer. Nan needs more research and development to help improve incomes and farmers' well-being.

2. Environmental conditions stand out as the other critical issue in Nan. Private organizations, universities/ other educational institutions, government, and non-government organizations were all in consensus on that point. They strongly agreed that agriculture must be diversified and that maize contract farming drives unsustainable land use. Environmental issues in Nan have been exacerbated by damaging practices such as the burning of fields, monoculture, chemical pesticide abuse and residues, destruction of the upstream areas, and deforestation. Similarly, Indonesian agricultural sector participants who participated in the Q-flip chart agreed that deforestation and overuse of fertilizer are unsustainable.[41]

This research showed that areas of goal sharing were diversified agriculture, raising funding, the use of alternative crops, reforestation, beneficial research, and growing farmer's own food. However, there were also conflicting interests among the various stakeholders.

CONCLUSION

Overall, this research demonstrated effectively the priorities of stakeholders, as well as showed that the IPs should be effective in achieving shared goals by brainstorming with stakeholders and changing their behavior towards the farming environment. Empowered stakeholders can enable the IP to think through the problems and find solutions to these problems. The fact that there is consensus about most statements in Table 5 bodes well for the Nan R4D platform to move forward with positive change. Based on these findings, it would be suggested that the Nan R4D platform can be developed as a farmer-based platform that will emphasize knowledge and skills of integrated farming or diversified agriculture for farmers and direct stakeholders who can work with the farmers to improve Nan's environmental conditions.

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