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Role of Local Institution and Indigenous Knowledge Linkages in Overcoming the Problem of Hybrid Corn Seeds in Remote Area

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Abstract
The role of local institution linkage greatly determines the sustainability of the national hybrid corn seed production system. Linking and integrating indigenous knowledge and local institution in one program is necessary to support an efficient and effective work system. This study aims to analyze the linkages between institutions and indigenous knowledge that support the smooth supply of hybrid corn seeds for farmers in remote areas. The research employed Interpretative Structural Modeling to map institutions into four quadrants (Dependent, Linkage, Autonomous, and Independent). Involved three experts in defining the institutions that play a role in the seed system: government, seed producers, and researchers. The results showed that 19 institutions played an active role, 6 of which were in the Independent quadrant, 9 in the linkage quadrant, 6 in the dependent quadrant, and none in the autonomous quadrant. This means that the identification of related institutions by experts is correct. Based on this mapping, four institutions have a very large influence on the development of corn seed system, namely Indonesian House of Representatives (IHR), Planning Bureau (PB), Directorate General of Food Crops (DGF) and Seed Certification Inspection Center (SCIC). These institutions can encourage the advancement of hybrid corn seed production systems. However, their dependence on external environmental influences is still high, so their independence is relatively low. Then the institutions that must be conditioned that they still have high Driving Power and Dependence Power are the Agency for Agricultural Research and Development (AARD), the National Seed Company (NSC), the Seed Grower Group (SGG), the Governor (GV), and the Provincial Agricultural Services (PAS). That institution only needs maintenance to continue excelling in providing farmers with corn seeds. The role of local institutions and indigenous culture (LG, EWF, EAO, and LFG) have not been seen to be involved in strengthening the seed system even though its independence is very high, so it is feared that the seed system is unsustainable.

Keywords
Indigenous knowledge, Local Institution, Linkage, Seed System

1. Introduction

The availability of seeds is a problem in developing countries. Farmers in remote areas find it very difficult to get quality seeds. Various attempts were made to obtain seeds, such as forming preparations from previous plantings, conducting exchanges between them, and contacting local governments (Anang et al., 2022). Leaders in the community should plan more activities to promote the participation of young women and involve them in the preparation, organization, and evaluation of such activities (Oyesomi, Salawu, and Olorunyomi 2017). Farmers consider that seed quality is a very strong determinant of the success of farming (Bellon et al., 2011).

The institutional role in supporting the success of a program is very important. Based on various research results show that: (1) institutions can accelerate the spread of important issues, such as trust and development information to all members so that they can quickly take adjustment actions (Witono Adiyoga, 2021; Mukarom, Z., 2020); (2) institutions can make efficient use of inputs, improve company performance, and optimize outputs (Louwaars & Manicad, 2022; Malik. A., 2018); (3) company progress is always in line with the progress of its supporting institutions because they are regulating the system of division of labor, distribution of products and income, strengthening social cohesiveness, managing resources, strengthening social participation, building social harmony, and strengthening the security system (Karyadi, 2021). Development is always in line with the commodity-based area development program, including the commodity of maize, which has been stipulated by Decree of the Minister of Agriculture No.472/ Kpts/RC.040/6/2018, which defines a total of 79 areas spread across 161 regencies. Various activities support the program. One of them is a seed supply program based on farmer corporations (Irianto, 2019).

The pilot project activity for providing hybrid maize seeds based on farmer corporations began in 2019 in the province of East Java, then was developed in the provinces of Lampung, South Kalimantan, South Sulawesi, and North Sulawesi in 2020 (Seed Director, 2020). Based on the results of observations, it is known that the provinces of East Java, South Kalimantan, and North Sulawesi showed relatively good results. East Java Province has produced quality seeds to meet the needs of farmers in East Java and other provinces, even in 2021, they have exported seeds to Thailand (Bahtiar et al., 2022). Likewise, in South Kalimantan and North Sulawesi, the seeds have been used by farmers in several districts in their areas. In contrast, in South Sulawesi Province, the progress of developing a hybrid maize seed system is considered to be very slow (Azrai, 2022; Azrai, 2021).

The unsustainability of the program is indicated the cause among others is because of involvement in a manner intensive institution in rural areas for participants as program actors (Jessen et al., 2022; Arsyad et al., 2021; Salman et al., 2021). According to Uphoff (1986a), development in rural areas will be related to three sectors: government/public sector in a manner administration activities performed and adjusted with various interests of the people in it, the private sector that has the experience to process resources efficiently and effectively to obtain profits, and the community sector that has activities and interests with the voluntary sector. All three sectors are urgently involved in actively developing the maize seed system in the region (Adigoun et al., 2022).

Referring to Norman Uphoff's institutional concept and the concept of regional development according to the Minister of Agriculture's policy, it is necessary to identify the sectors and structures of institutions/agencies involved in providing support to the program of developing a farmer corporation-based hybrid maize seed system to support seed self-sufficiency in remote areas. This study aims to analyze the linkages between institutions and indigenous knowledge that support the smooth provision of hybrid corn seeds for farmers in remote area.

2. Materials and Methods

2.1. Conceptual Framework

This research was conducted in 2021 using a qualitative approach, which refers to Norman Uphoff's theory of institutional structures, actors, and functions in rural development. Uphoff (1986a) perceives that institutions have structures ranging from the international level to the individual level, and all have functions in achieving development purposes. The strong and successful institutions are reflected in the interaction between three actors, namely: actors representing the government (public sector), actors representing the community individually or in groups (voluntary sector), and actors representing the enterprises (private sector). Interactions between institutions in the hybrid maize seed production system are illustrated with an Interpretative Structural Modeling approach (Figure 1).

2.2. Data Collection

The data required is the number of institutions involved in the hybrid maize seed supply system and their interrelationships with each other in the overall process of seed production and provision to farmers. All related institutions are identified for their function and role, whether they are included as institution movers or included as institution dependence (Rusydiana, 2018).

Data and information were collected through documentation from relevant agencies and discussions, as well as in-depth interviews using an open-ended questionnaire to explore the extent to which and in what aspects relevant institutions contribute to the hybrid maize seed development system until it reaches farmers. The results were used to determine elements and sub-elements as the basis for the questionnaire. The number of questions is determined with the formula: {(n-1) x n}/2.

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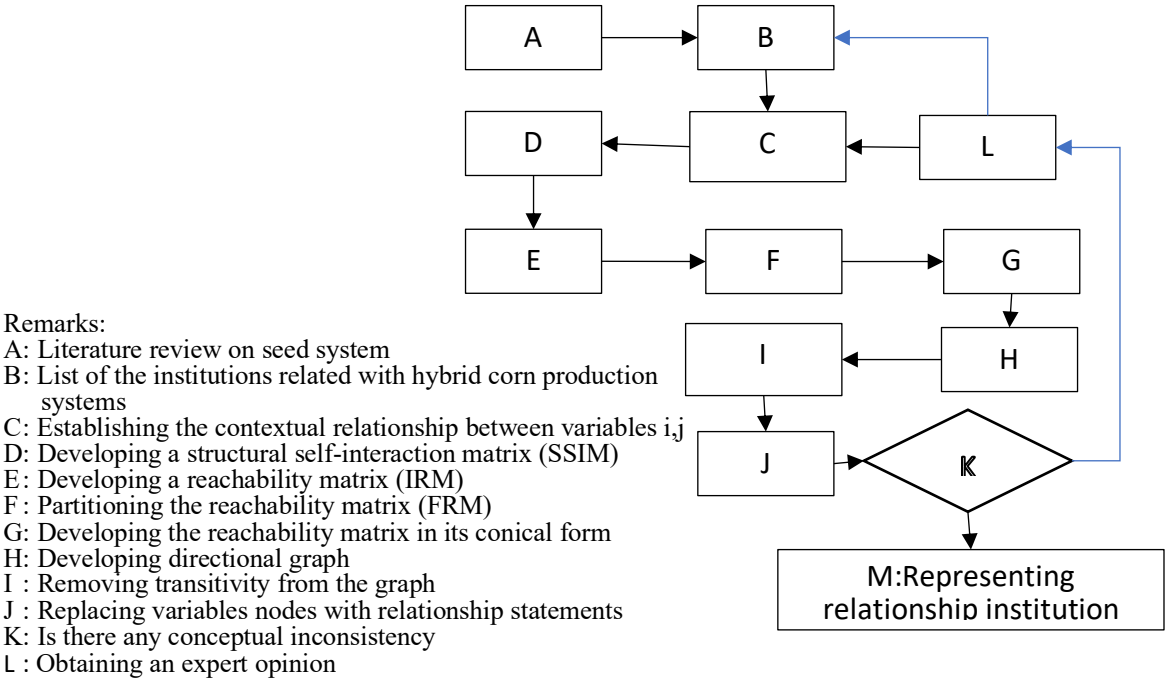

Figure 1. Flowchart for Interpretative Structural Modeling of institutional interactions in the hybrid maize seed production system

Next, experts were determined by considering expertise and interest. Expertise was measured by knowledge and experience as a speaker, consultant, or seed policy maker, while interest was measured by social and economic involvement in the hybrid maize seed supply system. Based on the second consideration, five experts were determined, namely: The Director of Seeds representing the government (public sector), the Agricultural Research and Development Agency as the source of technology and variety owner, and three seed companies each representing a developed company, a moderately developed company, and a not developed company. The results of interviews and discussions from the five experts were used as guidelines in determining 19 institutions that needed support in the hybrid maize seed development system in Indonesia, namely: Indonesian House Representatives (IHR=A1), Planning Bureau (PB=A2), Director General of Food Crops (DGF=A3), Agency for Agriculture Research and Development (AARD=A4), Agriculture Human Resource Agency (AHRA=A5), National Seed Company (NSC=A6), Seed Grower Group (SGG=A7), Governor (GV=A8), College (CLG=A9), Provincial Agriculture Services (PAS=A10), Regent (RG=A11), Seed Certification and Inspection Center (SCIC=A12), District Agriculture Services (DAS=A13), Food Crop and Horticulture Protection (FCHP=A14), Leading Farmer Group (LFG=A15), Agricultural Extension Office (AEO=A16), Agricultural Extension Worker (AEW=A17), Production Input Supply (PIS=A18), and Local Government (LG=A19).

The compilation of the completed questionnaire was then shared with the experts to determine the contextual relationship between elements with the symbol VAXO. The symbol V means that the row element affects the column element, symbol A means that the column element affects the row element, X means that the row element and the column element affect each

other, and O means that there is no relationship between the row element and the column element (Jabeen & Faisal, 2018).

2.3. Data Analysis

Data analysis techniques using Interpretative Structural Modeling are widely used in determining the interrelationship model of various elements for specific purposes. (Rimantho & Rosdiana, 2018; Saskia & Rispianda, 2022). Stages of usage: (1) finding experts to discuss with in identifying and defining which institutions agree to be involved in the hybrid maize seed production system; (2) compiling questions based on the number of institutions with the formula {(n-1) x n}/2; (3) the answers to the questions that have been compiled in the form of a VAXO matrix are then transferred into the Structural Self-Interaction Matrix (SSIM); (4) create a Reachability Matrix (RM) by replacing VAXO symbols with number 1 and 0; (5) create Driver-Power by summing the numbers in the column, then sorted based on the highest score; (6) create Driven-Dependence by summing the numbers in the row. Then determine the hierarchy based on the highest score. The lowest hierarchy is the highest score; (7) categorizes institutions into four quadrants, namely: Independent, Linkage, Dependence, and Autonomous. (Figure 2).

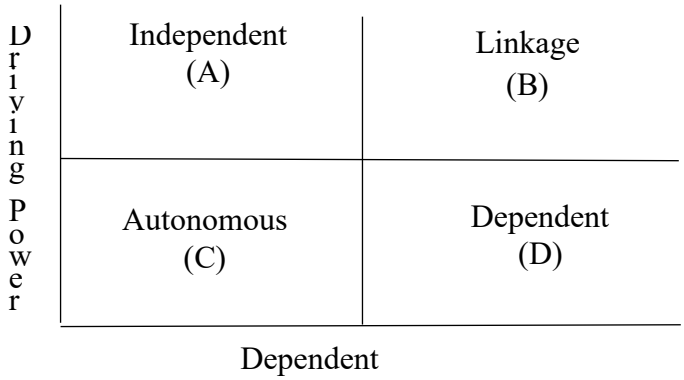

Figure 2. Driving and Dependence Power ISM

Quadrant A, placing institutions that have a strong driving power but are very dependent on other institutions to be able to carry out their functions properly (independent). Quadrant B, placing institutions that have high independence and strong driving power. This type of institution only requires maintenance in order to function properly (linkage). Quadrant C, an institution that is very weak in both driving force and dependency (autonomous). Quadrant D, placing institutions with high dependency, but weak driving power, so a touch is needed to increase its driving power (dependent). Put institutions into hierarchies and ranks. The lowest level institution is the one with the highest hierarchical score by the number of numbers in the row, while the highest-level institution is the one with the highest score by the number of numbers in the column, the structure of which is shown in Figure 3.

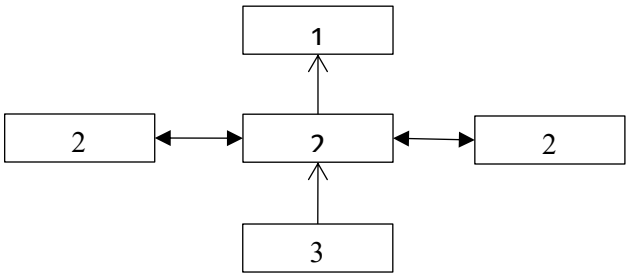

Figure 3. Institution hierarchy in the development of seed production systems

The characteristics of the vertical structure describe the priority order of which institutions should be improved first to strengthen the hybrid maize seed supply system based on institutional innovation, while the horizontal structure describes institutional improvements that can be done simultaneously (Arsiwi & Adi, 2020).

3. Results and Discussions

3.1. Identification of Institution

Institutional deepening in the corporate-based seed supply system based on Norman Uphoff's ideas is done through institutional classification based on structure, sector, and function. At the national level, it is known that the institutions that play a very important role are IHR in charge of the agricultural sector as the determinant of development budget allocation, PB representing the secretary general of agricultural development budget distribution, DGF as the determinant of seed supply policy, AARD as a source of technological innovation, Extension Centers and Training Centers representing AHRA as assistants and instructors of agricultural technology applications. The private sector involved is NSC which has demonstrated its performance.

At the provincial level, the institutions involved are the Governor and the Provincial Agriculture Office (GV and PAS). The Provincial Government is the determinant of agricultural development policies in its region, including in determining the seeds distributed to farmers. PAS regulates the bureaucracy of providing facilities and infrastructure (inputs) and regulates the allocation of seeds (handling results), oversees SCIC which conducts seed quality control, FCHP conducts prevention and control of pests and diseases. The private sector involved are seed companies that have catalogs.

Furthermore, at the regency level, the relevant institutions are government agencies, the private sector, and farmer groups. Government agencies that play a role are RG, DAS, and AEO. They identify prospective farmers and locations that will be proposed to the province and conduct intensive training, both training related to technology application, as well as training related to the group's institutional function in developing agriculture as a whole. Private institutions are seed producers that pass provincial-level verification. Then, the community institution (self-help sector) is the SGG. In their interaction, the role of group leaders, and community leaders, as well as the sub-district and the village-level government is needed, especially in motivating farmers to work seriously.

The effective use of Interpretative Structural Modeling analysis requires several conditions, including the selection of qualified experts who have knowledge of the matter under study and have an interest in it. The expected number of experts is one to seven people, they describe the distribution functions of institutions that need to be strengthened and which institutions do not need to be ignored because their influence is very small (Sianipar, 2012 ; Analys, 2022). Based on discussions with three experts (Directorate General of Food Crops staff, NSC Director, and Variety Owner of Research Institution), it was determined that the total number of institutions related to the national hybrid maize seed system is 19 institutions with the order of roles as shown in Table 1.

Table 1. Related institutions with national hybrid maize seed provision system

Institution	Function according to Expert
IHR	in the field of Agriculture, establishing policies on the use of national hybrid maize seeds, the implementation of monitoring and evaluation, and the performance of the provision of hybrid maize seeds for farmers.
PB	Allocate funds for the provision of national hybrid maize seeds.
DGF	Implementing, evaluating the provision of national hybrid maize seeds, coordinating with all relevant agencies, both at the central and regional levels, including seed producers.
AARD	Provide Standard Operational Procedure (SOP) for hybrid maize seed production, provide parent seeds, conduct training, provide mentoring, conduct monitoring and evaluation.
AHRA	Mentoring the implementation of SOP for hybrid maize seed production with R&D researchers in hybrid maize seed production activities in fostered farmer groups.
NSC	Communicate with IHR to show seed products and to know what seeds to recommend. Communicate with DFC regarding: seed type, quality, quantity, location, and timing, as well as price.
SGG	Breeding hybrid maize seeds based on the SOP. Participate in training organized by researchers, extension workers, and seed companies.
GV	Encourage the use of national hybrid maize seeds, and encourage the development of a hybrid maize seed industry for self-sufficiency and export. Allocate budget for seed industry development.
CLG	Providing hybrid maize seed production technology. Designing hybrid maize seed agribusiness incubation business through research activities. Building breeders through research and community service activities.
PAS	Provide prospective farmers and prospective locations for seed allocation (DASS). Coordinate the planning of hybrid maize seed provision to the Directorate of Seeds. Synchronize central and local programs on hybrid maize seed provision for farmers. Socialize the hybrid maize seed supply plan to the NSC, DAS, SCIC, and FCHP. Establish policies on seed provider partners, types of varieties, number of seeds, area/district, planting season. Monitoring and evaluating the implementation of seed distribution.

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RG	Establish a policy on the use of national maize seeds and encourage the growth of hybrid maize seed breeders. Develop partnerships with seed companies to improve the ability of breeder groups to produce quality seeds.
SCIC	Provide guidance in the form of SOP implementation for hybrid maize seed production and seed quality monitoring and certification.
DAS	Follow up on assignments from PAS and RG policy on germination. Strengthen integration with SCIC, FCHP in the implementation of production activities by SGG cooperators. Issue instructions to AEO and AEW to accompany maize seed production activities at SGG level.
FCHP	Conduct monitoring, prevention, and control of pests and diseases. Conducting guidance on integrated pest management.
LFG	Coordinate with NSC for the smooth provision of seeds to farmers in the region. Coordinate with PAS/DAS for the provision of hybrid maize seeds in the region.
AEO	Assign AEW to assist with the implementation of seed SOP at the group level. Coordinate the provision of production inputs. Teach farmers about cultivation. Monitor the implementation of seed production activities.
AEW	Provide assistance in SOP implementation. Serve as a trainer in training. Monitoring the provision of production inputs.
PIS	Supply production inputs to SGG on a cash or credit basis.
LG	Provide support, motivation and encouragement to SGG to produce quality seeds.

The facts on the ground show that in general, the tasks expected by these institutions have not gone well (Bahtiar et al., 2022). In general, they carry out partially based on their respective budget instructions and pay less attention to important work in an integrated manner. Creativity in using the budget to achieve professional targets has not been apparent, especially in supporting the implementation of national hybrid maize seed supply (Sayaka 2016). To find out which agencies play a role in encouraging the provision of national hybrid maize seeds, an Interpretative Structural Modeling analysis was conducted with the following expected coordination (Figure 4).

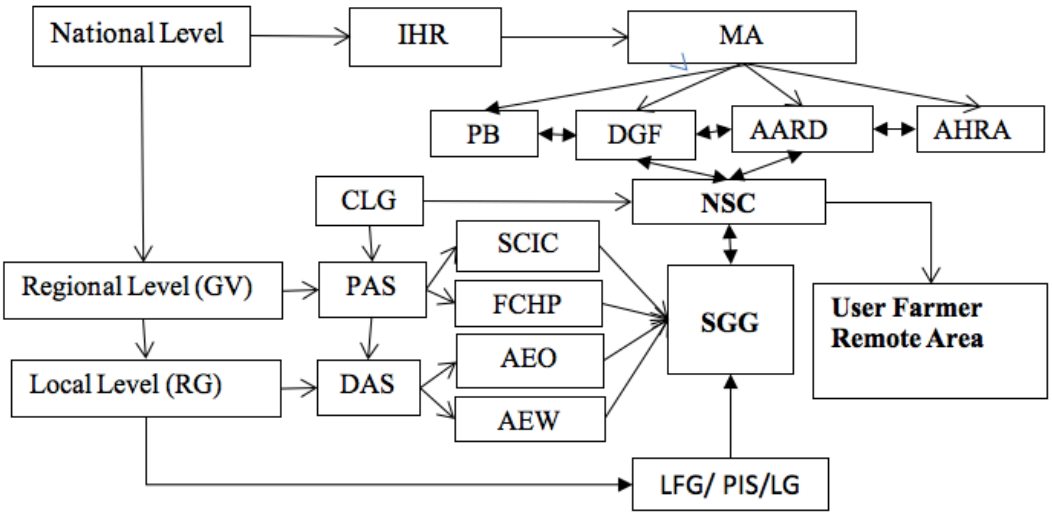

Figure 4. Maize seed coordination channel for farmers

3.2. Frequency Appearance VAXO symbol

The Interpretative Structural Modeling (ISM) analysis of 19 institutions shows that the frequency of the ability to influence other institutions (V) is higher than the ability to be influenced (A). This shows that the role of institutions is urgent even though some of them have not provided maximum support to the national hybrid maize seed system (Dey et al., 2022). Furthermore, the frequency of occurrence of unrelated or non-affecting roles is higher (O) than the frequency of occurrence of roles of equal importance (X), indicating that many institutions have not coordinated with other institutions in improving the national hybrid maize production system (Table 2). Both ratios indicate that there are still many challenges to be resolved to improve inter-institutional linkages or integration in supporting the national hybrid maize seed production system (Nkongho, R. N.at al., 2022).

3.3. Structural Self Interaction Matrix (SSIM)

The inter-institutional interaction matrix addresses the interactions of the 19 institutions whose roles were analyzed. The form of interaction consists of four possibilities, namely: influencing (V), being influenced (A), influencing each other (X) and being unrelated, or not influencing each other (O). Because of the 19 institutions analyzed, 171 forms of interaction emerged as follows: 67 interactions in the form of V, 18 interactions in the form of A, 34 interactions in the form of X, and 52 in the form of O (Table 2).

Table 2. VAXO symbol frequency of 1-19 institutions.

Code	Institution	Frequency *			
		V	A	X	O
A1	IHR	68	18	34	51
A2	PB	68	20	34	49
A3	DGF	60	26	26	59
A4	AARD	66	18	36	51
A5	AHRA	61	25	34	51
A6	NSC	67	19	35	50
A7	SGG	68	18	39	46
A8	GV	68	18	34	51
A9	CLG	61	18	23	69
A10	PAS	66	20	41	44
A11	RG	64	22	34	51
A12	SCIC	68	18	34	51
A13	DAS	67	19	34	51
A14	FCHP	44	34	34	59
A15	LFG	55	31	33	52
A16	AEO	45	53	36	37
A17	AEW	52	41	29	49
A18	PIS	46	18	23	84
A19	LG	67	50	34	20

*) V: Rows more important/affecting Column A: Column more important/affect Row
X: Mutual Affect O: No each other influence

High interactions in the V and O shapes indicate that many institutions do not interact with other institutions in the production and supply of hybrid maize seeds to farmers (Kumar et al., 2017; Bellon et al., 2011). This is a problem that needs to be solved to strengthen hybrid maize seed institutions nationwide (Dey et al., 2022).

3.4. Initial Reachability Matrix (IRM)

The SSIM matrix, which has been refined by filling in half of the empty boxes and changing the letter symbols V, A, and X to 1, and the letter O to 0, is presented in the initial achievement matrix (Table 3). The shape of the interactions in the empty boxes serves as a guide to measure the inconsistency of relationships between institutions designated as IRM (Attri et al., 2013). The data in Table 3 shows that there are 171 inter-institutional influences and 45 or 26% of the relationships are inconsistent and should be revised.

Table 3. Initial Reachability Matrix (IRM) of 19 institutions

Code	Institution	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A1	IHR	**1**	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
A2	PB	0	**1**	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0
A3	DGF	0	1	**1**	1	1	1	1	1	0	1	1	0	1	0	1	0	1	0	0
A4	AARD	0	1	0	**1**	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
A5	AHRA	0	1	0	1	**1**	1	1	0	0	1	1	0	1	0	1	0	1	0	1
A6	NSC	0	0	0	1	0	**1**	1	1	0	1	1	1	1	1	1	0	1	1	1
A7	SGG	0	0	1	1	1	1	**1**	1	1	1	1	1	1	1	1	0	1	1	1
A8	GV	0	0	0	0	1	1	0	**1**	0	1	1	1	1	1	1	0	1	1	1
A9	CLG_	0	0	0	1	0	0	1	0	**1**	1	1	1	1	1	1	1	1	1	1
A10	PAS	0	0	0	1	0	1	1	0	1	**1**	1	1	1	0	1	0	1	0	1
A11	RG	0	0	0	1	0	0	1	1	1	0	**1**	1	1	0	0	0	1	0	1
A12	SCIC	0	0	0	1	0	1	0	0	1	1	1	**1**	1	1	1	0	1	1	1
A13	DAS	0	0	0	0	0	1	0	1	1	1	1	0	**1**	1	1	0	1	0	1
A14	FCHP	0	0	0	0	0	1	0	0	1	0	0	0	0	**1**	1	1	1	1	1
A15	LFG	0	0	0	0	0	1	0	1	1	0	0	0	0	0	**1**	1	1	0	1
A16	AEO	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**	1	0	1
A17	AEW	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	**1**	0	1
A18	PIS	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	**1**	1
A19	LG	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	1	**1**

The IRM matrix illustrates the consistency of inter-institutional interactions in providing hybrid maize seeds to farmers. A good level of consistency is less than 10%. The data in table 4 shows that there is an inconsistent relationship between institutions of 26%, so the relationship between some institutions must be improved by changing the relationship between institutions. The results of these improvements are used as the basis for the Core Reachability Matrix (CRM).

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3.5. Final Reachability Matrix (FRM)

Improving the symbols of inter-agency relationships resulted in a new matrix, the Final Reachability Matrix. The comparison results show that there are 45 or (26%) inter-agency relationships that are indicated as inconsistent (bolded numbers). Inconsistencies generally occurred with the Indonesian House Representative, Planning Bureau, Director General of Food Crops, and National Seed Companies (Table 4). This is due to the respondents' lack of knowledge about the tasks that must be carried out by the institutions concerned, so that the interactions between one institution and another are less consistent (Louwaars & Manicad, 2022). Focusing on the concepts of indigenous wisdom and institutions, it is shown that significant local, regional and national benefits are generated by Indigenous hybrid economies. A role is foreseen for resource economists and the Neo-Institutional Economics in quantifying these benefits, including positive externalities, so that they can be more actively supported by the state (Altman, 2004)

Table 4. Final Reachability Matrix (FRM) of 19 institutions.

Code	Institution	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A1	RH	**1**	1	1	1	1	1	1	1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	0	**1**	**1**	**1**
A2	PB	0	**1**	1	1	1	1	0	1	**1**	**1**	**1**	**1**	1	**1**	**1**	0	**1**	**1**	**1**
A3	DGF	0	1	**1**	1	1	1	1	1	**1**	1	1	**1**	1	**1**	1	**1**	1	**1**	**1**
A4	AARD	0	1	0	**1**	1	1	1	1	1	1	1	1	1	1	1	**1**	1	1	1
A5	AHRA	0	1	0	1	**1**	1	**1**	1	0	1	1	0	1	**1**	1	**1**	1	0	1
A6	NSC	0	0	0	1	0	**1**	1	**1**	**1**	**1**	1	**1**	**1**	**1**	**1**	0	**1**	**1**	**1**
A7	GG	0	0	1	1	1	1	**1**	1	1	1	1	1	1	1	1	**1**	1	1	1
A8	GV	0	0	0	0	1	1	0	**1**	0	1	1	1	1	1	1	**1**	1	1	1
A9	CLG_	0	0	0	1	0	0	1	0	**1**	1	1	1	1	1	1	1	1	1	1
A10	PAS	0	0	0	1	0	1	1	0	1	**1**	1	1	1	0	1	**1**	1	0	1
A11	RG	0	0	0	1	0	0	1	1	1	0	**1**	1	1	0	0	0	1	0	1
A12	SCSA	0	0	0	1	0	1	0	0	1	1	1	**1**	1	1	1	**1**	1	1	1
A13	DAS	0	0	0	0	0	1	0	1	1	1	1	0	**1**	1	1	**1**	1	**1**	1
A14	FCHPA	0	0	0	0	0	1	0	0	1	0	0	0	0	**1**	1	1	1	1	1
A15	LFG	0	0	0	0	0	1	0	1	1	0	0	0	0	0	**1**	1	1	0	1
A16	EAO	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**	1	0	1
A17	EWF	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	**1**	0	1
A18	PIS	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	**1**	1
A19	LG	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	1	**1**

3.6. Canonical Matrix

Matrix (FRM) is a matrix that organizes Driving-Power and Dependence-Power that will guide in determining the level/hierarchy and ranking of each institution. The analysis shows that the institutions IHR (A1) in the first level followed by the Directorate General of Agriculture (A3) and the Planning Bureau (A2) and the highest hierarchy is the Agricultural Extension Center (A16). Then the highest ranks are Higher Education (A9) and Village Government (A19), which are in the figure 7 level of independence, while the lowest are DPR Commission IV (A1), Director General of Agriculture (A3), Planning Bureau (A2) and Agricultural Human Resources Agency (A5) (Table 4). Mapping each institution involved in hybrid maize seed

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supply onto the diagram shows that there are five institutions in the Independent quadrant: IHR (A1), PB (A2), DGF (A3), AHRA (A5) and SCIC (A12). These five institutions have a very strong influence in promoting and succeeding in the provision of hybrid maize seeds to farmers, so it is necessary to expand their authority and encourage them to improve their performance in seed provision activities (Table 5).

Table 5. Canonical Matrix of 19 institutions in hybrid maize seed provision system.

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	DrP	Lvl
A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	18	1
A2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	17	2
A3	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	1
A4	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17	2
A5	0	1	0	1	1	1	1	0	0	1	1	0	1	1	1	1	1	0	1	13	4
A6	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	14	3
A7	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17	2
A8	0	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	13	4
A9	0	0	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	13	4
A10	0	0	0	1	0	1	1	0	1	1	1	0	0	0	1	1	1	0	1	10	6
A11	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	0	1	6	8
A12	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	14	3
A13	0	0	0	0	0	1	0	0	1	1	1	0	1	1	1	1	1	1	1	11	5
A14	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1	1	1	1	1	10	6
A15	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	1	0	1	7	7
A16	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	3	10
A17	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	0	1	6	8
A18	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0	1	0	5	9
A19	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	1	1	6	8
DpP	**1**	**5**	**4**	**11**	**7**	**16**	**10**	**11**	**17**	**12**	**13**	**9**	**12**	**16**	**14**	**14**	**16**	**13**	**17**		
Rank	**12**	**10**	**11**	**6**	**9**	**2**	**7**	**6**	**1**	**5**	**4**	**8**	**5**	**2**	**3**	**3**	**2**	**4**	**1**		

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3.7. Structure

Figure 6 explains that of the 19 institutions that make up the ten structures, the IHR and DGT are top priorities to support consistent policy implementation and outreach to authority holders at every level, so that oversight of functions that use the budget is also carried out. IHR needs to invite relevant ministries to discuss with governors to help develop maize seeds in the regions. The Directorate General of Horticulture as the person in charge of seed availability at the farm level needs to develop a hybrid maize seed procurement program in accordance with the preferences of target farmers.

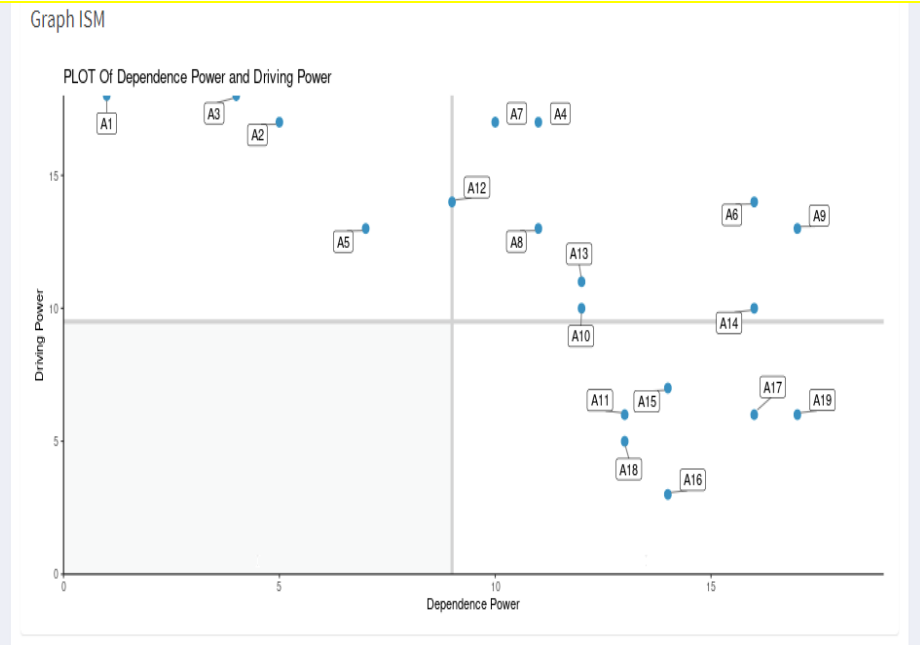

Figure 5. Mapping of 19 institutions in hybrid maize seed provision.

The next institutions whose functions need to be addressed simultaneously are government institutions, local institutions and indigenous knowledge such as PB, AHRA, and SGG. PB needs to ensure a budget to support the seed supply system, AHRA organizes training programs for all participants such as extension workers, SGG, farmer groups and local traders as suppliers of production inputs to support the maize seed production system (Edda Tandi Lwoga 2010). Various benefits can be achieved if each province can be self-sufficient in seeds, including: suitability to farmers' preferences, affordable prices for farmers, timely availability, efficient transportation, and seed producers can spread to rural areas with the right approach (Makate, 2010).

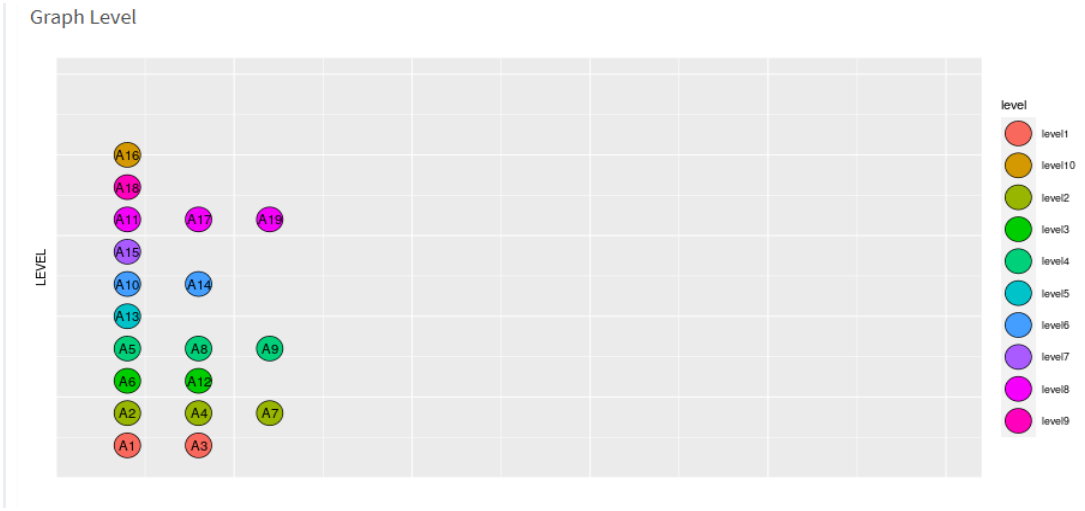

Figure 6. Structure of 19 institutions in hybrid corn seed provision.

4. Conclusion

Through the Interpretative Structural Modeling analysis of 19 agencies involved in the national hybrid corn seed supply, it is concluded that there are four agencies whose functions are very important and need to be maximized, namely the Indonesian House of Representatives, Planning Bureau of the Ministry of Agriculture, Directorate General of Food Crops, and Agricultural Human Resources Agency. The first institutions that must be improved simultaneously to strengthen the seed supply system are the Indonesian House of Representatives and Director General of Food Crops, followed by Planning Bureau, Agricultural Human Resources Agency, and Seed Grower Group. The Seed Grower Group, Local Government, extension workers, and input suppliers as representatives of local institutions that adopt local knowledge are less responsible. Nine institutions provide good support, namely: Agricultural Research and Development Agency, National Seed Company, Seed Growers, Governor, Universities, Provincial Agriculture Office, District Agriculture Office, Food Crops and Horticulture Protection, and Seed Monitoring and Certification Center.

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