Land consolidation (contiguous farming) for sustainable crop production for the agro-industry

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Abstract. Land Consolidation or Contiguous Farming in the Philippine setting is considered a prerequisite to large scale mechanization for improved efficiencies, optimize land utilization, and increase crop productivity. It is expected to increase farmers’ income and contribute to sustainable agricultural productivity. The implementation of Republic Act 10601 or Agriculture and Fisheries Mechanization (AFMech) Law 2013, contiguous farming became one of the major flagship programs of the government. A project was conducted to study its implementation in the Philippine agricultural production system. Local and international benchmarking were conducted to document best practices and requirements of contiguous farming/land consolidation. Stakeholders from selected rice and corn producing areas in the country generally agreed on the implementation of contiguous farming. Technical, socio-economic, and institutional strategies, were identified for contiguous farming to succeed, including its strengths, weaknesses, threats and opportunities. The enabling environment were also discussed for the successful implementation of contiguous farming in the country. The study showed that land consolidation or contiguous farming is implementable in the Philippines subject to the necessary requirements crucial to its implementation.

1. Introduction

The implementation of Land Consolidation (LC) or Contiguous Farming (CF) in the Philippines has long been recognized to improve efficiency in performing farm operations, optimize land utilization, and increase crop productivity. Asian countries had implemented land consolidation or land reformation schemes which has similar concept as contiguous farming including Japan, Korea, Malaysia, Thailand, among others. In the Philippines, Republic Act 10601 otherwise known as the Agricultural and Fisheries Mechanization (AFMech) Law of 2013 [7] stipulated the implementation of contiguous farming as strategy to harness the full potentials of agricultural mechanization. The law mandates the Department of Agriculture (DA) and Department of Agrarian Reform (DAR) to implement contiguous farming projects in the country. The law complements DAR’s mandate to conduct land consolidation projects as stipulated in Section 39 of R.A. 6657 or the Comprehensive Agrarian Reform Program Law of 1988
AFMech Law of 2013 shall provide the legal basis through which contiguous farming can be applied in major crop producing areas where it is socially, technically and economically feasible. Contiguous farming is defined in RA 10601 as a farming system comprising the development and organization of parcels of adjoining and adjacent agricultural lands with a minimum total of 50-ha for the synchronized production of a particular crop, such as but not limited to rice, corn, sugarcane, coconut and high value commercial crops utilizing agricultural mechanization technology. It shall include the necessary physical and institutional infrastructures. Physical infrastructures include the overall design layout of the area (e.g. field plot size, irrigation canal, farm drain, farm ditch, farm roads, postharvest facilities, etc.), while the institutional infrastructures consist of the social base by which contiguous farming scheme shall operate.

Prior to the full implementation of contiguous farming in the country, the government through the Department of Agriculture-Philippine Council for Agriculture and Fisheries (DA-PCAF) funded a policy study on for the implementation of contiguous farming in rice and corn areas in the Philippines. The policy study was implemented by the Center for Agri-fisheries and Biosystems Mechanization, College of Engineering and Agro-industrial Technology, University of the Philippines Los Baños. This paper identified the general requirements to implement LC or CF in the Philippines.

2. Materials and Methods

2.1. Project scope
The study covered primary and secondary data, and review of literatures on LC, related models of CF, land reformation, or large-scale mechanization in the Philippines. Best practices were also collected from the local and two international benchmarking activities in Thailand and Korea. The project was implemented from July 2018 to June 2019.

2.2. Data gathering
Focus group discussions (FGDs) and key Informant interviews (KIIs) were utilized as tools in primary data collection. The benchmarking activities included institutional and field visits. FGDs were conducted in project meetings, institutional and field visits in the local and Asian benchmarking activities. Survey questionnaire was formulated to gather information from farmers/farmers’ group on socio-demographics, cultural practices, marketing information, mechanization plans and perceptions on LC or CF. A total of 551 rice farmer-respondents’ responses on CF/LC were considered; that is, 526 respondents from previous studies for [1] [3] [4], and 25 respondents from the policy study on CF [2] to verify the trend in the previous studies from 2013 to 2019 as presented in Figures 4, 7 and 8, respectively. Review of literature covered related laws and policies on LC including previous mechanization surveys/studies. It also included large-scale mechanization projects, which are generally related to CF and LC.

2.3. Encoding, processing and analysis of data collected
Encoding of survey data, processing and analysis of data were done by using available Microsoft office applications. Based on the collected, encoded, and analyzed data, strategies were identified for the implementation of contiguous farming in the Philippines. The study employed quantitative and qualitative research methods to determine farmers’ acceptance on LC /CF.

3. Results and Discussion

3.1. Benchmarking in Thailand and South Korea
3.1.1. Thailand
Mega farm is the complementation strategy to the full-scale implementation of LC in Thailand. LC was implemented based on the Agricultural Land Consolidation Act (B.E. 2558) of 2015. The Low Land Consolidation Division, Bureau of Land Consolidation of the Royal Irrigation Department Government agencies oversees the implementation of LC in Thailand. LC follows specific procedure of implementation. The Department of Extension (DoE) of the Ministry of Agriculture provide necessary
support services for Mega Farms and LC. The focus group discussions of the project team with the DoE, and mega farm farmers-group in Thailand, indicated that Mega farms for rice, corn, high value crops, livestock, and other crops are implemented by the Ministry of Agriculture and Cooperatives. Land consolidation fund provides the working capital for agricultural water management and Land Consolidation. Farmers’ equity is about 7% of the land development cost [4]. The mega farms are managed by and organized group headed by a farmer-leader or chairman. Most often the rice and corn mega farms provided custom hiring services for planting, land preparation and harvesting using combines. Mega farms allowed harvested crops to have assured market [5].

3.1.2. South Korea
The government of South Korea implemented land reformation with a comprehensive plan for irrigation and drainage for agricultural crops. Land reformation involved reformation of farm and infrastructure development, which included: surveying and profiling, removing old levee and providing new one, constructing farm roads, installation of drainage canal, constructing the irrigation canals and canal structures, and rough and fine land levelling. The FGDs conducted by the project team with Korean Rural Community Corporation (KRCC) offices and Rural Development Administration (RDA) indicated that the government funded the infrastructure and land development, while the Korean Rural Community Corporation (KRCC), agency to oversee the implementation of land reformation, disaster management, water resources allocation, and agri-infrastructure development. Farm layout and plot size were established in farm reformation. Farm plot size started at 0.3 ha then increased to 1 ha (100 m x 100 m) per plot with the future goal of increasing it to 3 ha per farm plot. Social preparation and participatory strategies were implemented as part of the land reformation project. This also involved farm re-allocation/relocation is implemented upon farmers’ mutual agreement. Farmers’ equity is about 10% of the land development cost. Model farm was first established to showcase the feasibility and viability of land reformation [10].

3.2. Local Benchmarking
The study documented various related models of contiguous farming implemented in the country which are being coordinated by government agencies, namely, the Department of Agrarian Reform (DAR), National Irrigation Administration (NIA) (Figure 1), Sugar Regulatory Administration (SRA), and Philippine Rice Research Institute (Philrice). The institutional visits provided vital information on land reform, production consolidation and mechanization and different models of contiguous farming. Based on the local benchmarking activities, various models related to contiguous farming were identified.

Figure 1. The project team during one of the institutional visits and FGD with NIA personnel.

3.2.1. Related contiguous farm models in the Philippines
Corporate Farming - Corporate farming is implemented by the Palawan Agrarian Reform Community Cooperative Federation (PARCOFED) (Figure 2) in Palawan Province. It is an accredited farm service provider of the Department of Agriculture. As part of the government’s poverty alleviation program in assisted in forging tripartite agreement with institutional buyers. The cooperative consolidated rice production and marketing for sale at an agreed price to the Ayala Multi-purpose Cooperative, with orders
from Ten Knots Development Corporation. The agreement allowed assurance of market and feedback mechanisms to improve the program.

Cooperative - The San Agustin - San Ramon Farmers’ Cooperative (SARFC) in Bula, Camarines Sur, is one of the pioneer LC projects decades ago in the country through the project with Japan International Cooperation Agency (JICA). Land reformation activities and irrigation facilities were constructed for the project covering around 419 hectares as service area. One of the important components of the project is the construction of irrigation facility to service the consolidated areas (Figure 3). LC allowed consolidation of produce for assured marketing for the cooperative members.

Figure 2. The project team during the visit in PARCOFED, 2019.

Figure 3. The project team during the visit in SARFC, 2019.

Farm Clustering - The Villa Luna Multi-purpose Cooperative (VLMPC) in Cauyan City, Isabela is a beneficiary of the government’s clustering initiative on corn production systems. The DA clustering program provided tractor for the cooperative for custom hiring services covering around more than a thousand hectares, for its members and non-members. Some members are now converting into tobacco farming due to higher incentives from excise taxes. Some significant benefits of farmers-members are discounted farm inputs and custom hiring rates, assured buyer, and loan services.

Irrigators’ Association - Turn-out Service Area Group – Munoz, Talugtog, Guimba - Pandalla, Linglingay, Labney, Villa Isla, Rang-ayan, Villa Santos, Severona, Santa Ana, Cavite and Faigal (MTG PLIVIRISCAF), Nueva Ecija. Rice farmers and their farms are grouped based on the turn-out service area of the NIA national irrigation system. One TSAG is composed of about 30 hectares comprising of 15-30 rice farmers. The availability of irrigation allowed the TSAG members to plan their cropping schedule. It is one of the most successful IA in the country being the recipient of numerous awards and citations from NIA and different agencies.

Private Initiative - BM Domingo Corn World, Isabela - The company is a 100% Filipino-owned seed company that is engaged in breeding, production and sales of hybrid corn and rice seeds. It has around 125 hectare-contiguous farms for seed production complemented by irrigation and postharvest facilities. It is one of the private agricultural entities in the country with highly mechanized operations and providing machinery custom hiring services in the nearby barangays or towns.

Block Farming - Dama Farm Workers Agrarian Reform Beneficiaries Association (DAFWARBA) in La Castellana, Negros Occidental is an Agrarian Reform Beneficiaries Organization for sugarcane production. It is composed of about 29 member-holders of the original mother Certificate of Land Ownership Agreement (CLOA) granted by DAR. The CLOA area is about 78 hectares comprising of 42 has for sugarcane, and 10 has for rice. Other areas are devoted for residential, forest, corn, coffee, coconut, bamboo, and other crops. The group is operating with a chairman and officers for the overall
management of the association. The chairman leads the group in managing the farm, and members may opt to work as farm workers with corresponding labor wages. Net profits from all agricultural economic activities are divided equally among the members.

Block farming just like CF or LC consolidates small parcels of farms to take advantage of the economies of scale. Block farming for sugarcane involves clustering of sugarcane farms varying from 10 to 30 hectares [9]. The farms can be adjoining/adjacent or non-adjointing/non-adjacent farms within a two-kilometer radius area. On the one hand, contiguous farming considers a minimum total of 50-hectare adjoining and adjacent agricultural lands grouped together for synchronized farming. While land development and other physical land alteration, such as resizing and reshaping of farm plots are requirements in CF, these are not major requirements in block farming.

3.3. Previous surveys on contiguous farming in rice areas

The consolidated responses of 470 respondents from the surveys of rice farmers in Leyte, Iloilo, Camarines Sur, Oriental Mindoro in 2013 [2], and Oriental Mindoro in 2017 [4] showed that 54% of the respondents owned contiguous farm or farmed in contiguous farm with only 30% of them heard about LC. About 58% of the respondents were willing to engage in large scale mechanization but only 38% agree to venture in LC (Figure 4). Figure 5 shows the acceptance of land consolidation from the four provinces while Figure 6 shows their willingness to engage in large scale mechanization. The results from Oriental Mindoro in Figure 5 showed and there was an increased in acceptance of the LC concept from 2013 to 2017A study on strategic implementation of LC that some constraints to its implementation, were farmers’ social acceptance and other apprehensions on farm layout, giving up of some portions of land for rights-of-way and farm structure, payment of direct cost, among others [6]. Figure 7 shows the top six farm operations that the farmers would like to mechanize with harvesting operation as top priority of the respondents. Farmers believed that harvest may increase through reduction of field losses harvesting is mechanization.

3.4. Enabling environment for the implementation of contiguous farming in the Philippines

The study identified the enabling environment for the implementation of contiguous farming project shall include policy and legislation; capacity development; information; financial support system; marketing system; and management of CF and monitoring and evaluation (Figure 10):

Policy and legislation – The AFMech Law of 2013, this study, and appropriate administrative orders from DA shall be a strong policy support for CF/LC. A national law focused on contiguous farming will reinforce its implementation. Capacity development – Capacity development shall be an important
component of each CF/LC project for the farmers’ group, operators of machinery, and the professional management group. The machinery distributors/manufacturing industry shall have an important role in CF/LC in providing the appropriate production, processing machinery, after sales service, and training of the machine operators. Information – The implementation of CF/LC should be backed-up by a strong information campaign to educate, inform and disseminate the CF/LC projects to the target beneficiaries as part of their social preparation. Support System – The allocation of government funds is needed for the implementation of CF/LC projects, particularly on the area of land development, land reformation/transformation/alteration and provision of infrastructures requirements for CF/LC, among others. Marketing System – Prior to the implementation of CF/LC, a viable market for the product should be identified and ensured for sustainable implementation. Funding - Government fund is necessary for land and infrastructural development, which shall comprise of physical reformation/alteration of appropriate farm terrains required for the construction of farm roads, irrigation and drainage systems, and other logistical support.

![Figure 6](image1.png)
**Figure 6.** Respondents’ willingness to engage in large scale mechanization, rice areas [2] [1].

![Figure 7](image2.png)
**Figure 7.** Top six (6) farm operation to be mechanized (526 respondents), rice areas [2] [1].

![Figure 8](image3.png)
**Figure 8.** Rice survey results, 2019.

![Figure 9](image4.png)
**Figure 9.** Top five (5) farm operation to be mechanized in rice, 2019.

Management of the CF/LC and monitoring and evaluation, and R&D Component – A professional management group shall have a central role in implementing the CF/LC projects. Management of the CF/LC project should be complemented by a sustained monitoring and evaluation system by the government. Continuous R&D should be implemented by concerned RDE government agencies in support of CF/LC. These projects may include but are not limited to identifying optimum plot size or dimensions of farm layout, development, and fabrication of locally made or assembled agricultural mechanization technologies suitable for contiguous farms to spur agro-industrial development.
3.5. **Strength, weaknesses, opportunities, and threat (SWOT) analysis of contiguous farming**

Based on the data gathered for the study, the SWOT for the implementation of CF was analyzed (Figure 11).

![SWOT Analysis on the implementation of contiguous farming.](image)

4. **Conclusions**

Contiguous farming or land consolidation can be implemented in the Philippines subject to the general requirements crucial to its implementation, including water, funding, social preparation, management, technical requirements, national agency for monitoring and evaluation, establishment of model farms. These findings are summarized as follows: **Water** - Water for irrigation purposes, together with the irrigation and drainage structures is a prerequisite for CF/LC projects. **Social Preparation** - Agreement, willingness, and participatory planning, among stakeholders to participate in CF/LC project are critical requirements for CF/LC since willingness of farm owner-members to allocate a certain portion of land for land and infrastructure development A strong extension program for campaigning, organizing is needed in implementing the CF/LC in the country. **Management** - The CF project requires professional management group to oversee the sustainable operation and management of CF projects. **Technical Requirements** - Physical alteration such as farm layout and sizing of existing farmlands are necessary
for large scale mechanization technologies’ for optimum and efficient utilization. A master plan (showing all individual farm layouts, irrigation and drainage, and infrastructure facilities) should be formulated for sustainable development and implementation of contiguous farms. National Agency for monitoring CF - A government agency shall be established to oversee the implementation of contiguous farming in the Philippines. It should comprise of multi-discipline professionals to address the social, technical, economic, and environmental aspect of CF projects. Model farms - Model farms for rice and corn production systems should be established to showcase the benefits and advantages of contiguous farming. CF shall vary according to the socio-economic, technical, agro-ecological situation of production areas. The socio-political structure may have been a significant factor in implementing CF/LC in the Philippines, Korea, and Thailand. In the Philippines, the need for social preparation for the acceptance of CF/LC may have been one of the major constraints in implementing CF/LC. It has taken decades for the full implementation of CF under the AFMech Law of 2013.

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