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The impact of agricultural co-operatives on women's empowerment : evidence from Uganda

The impact of agricultural co-operatives on women's empowerment: Evidence from Uganda.

Els Lecoutere

Abstract

This article contributes to understanding the potential of agricultural co-operatives to boost women's empowerment and close gender gaps in sub-Saharan Africa. It provides quasi-experimental evidence of the impact of membership of an agricultural co-operative on women's capabilities, their power and ability to influence decisions, and intra-household productive and reproductive labour divisions. It uses the P'KWI Farmer to Farmer Co-operative Society in north-eastern Uganda as a case study. It shows that being a member of P'KWI has a significantly positive impact on economic wellbeing, knowledge and adoption of agronomic practices, especially among women. Co-operative membership has a particularly strong positive impact on women's decision making power at the household, group and community levels. Intra-household domestic and farm related labour divisions, however, did not change as a result of co-operative membership and remain disadvantageous for women. The article concludes that agricultural co-operatives can make a significant difference for women's empowerment, provided that they actively and consistently address the bottlenecks to achieve gender equality.

1. Introduction

In developing contexts like sub-Saharan Africa, and especially in rural areas, women remain disempowered and gender inequalities persist even if societies are changing (Silberschmidt, 2001; World Bank, 2012). Recent studies have shown that there are significant gender gaps in agriculture in sub-Saharan Africa. The productivity of the plots managed by women has been found to be systematically lower than that of the plots managed by men (e.g. Aguilar, Carranza, Goldstein, Kilic, & Oseni, 2014; Ayalew, Bowen, Deininger & Duponchel, 2015). Gender gaps in agriculture have been linked to gender differential access to and control over assets, information, labour and inputs, and higher child dependency ratios among women farmers (World Bank, 2014). Limited women's empowerment and gender inequalities are also likely to encumber future sustainable agricultural production as these constrain women's ability to adopt climate change adaptation strategies (Goh, 2012).

Studies have shown that reducing gender inequalities promotes economic growth, reduces poverty and closes productivity gaps, especially in agriculture (Ellis, Manuel, & Blackden, 2006; World Bank, 2012). The FAO (2011) projected a raise in agricultural productivity between 2.5 and 4 per cent in developing countries if women were to be empowered and gender inequalities were reduced.

Furthermore, gender inequalities and limited women's agency have been shown to negatively affect the health, nutritional status and education of children, especially girls (Quisumbing, Estudillo, & Otsuka, 2003; Smith, Ramakrishnan, Ndiaye, Haddad, & Martorell, 2003; WHO, 2013). Limited empowerment of women can therefore undermine the potential of future generations and contribute to gender inequalities persevering across generations (World Bank, 2012). Women's empowerment has been proven to have significant positive impacts on maternal and child health and education (Smith et al., 2003; Ellis et al., 2006; WHO 2013). Moreover, when women have greater agency and more rights in the political arena, there is more emphasis on public investments that favour children and consolidate women's empowerment (World Bank, 2012).

The revival of co-operatives in Africa has been identified as a promising avenue to contribute to the economic and social empowerment of women and to reduce gender inequalities for a number of reasons (Majurin, 2012). [1] Generally, co-operatives are lauded for their potential to improve livelihoods by addressing the economic and social needs of rural populations in developing countries (Develtere, Pollet, & Wanyama, 2008). Co-operatives are also appreciated in rural contexts as they combine business enterprises with a concern for communal welfare. Most importantly, theory and evidence indicate that notwithstanding a number of limitations, there can be significant direct benefits of co-operative membership for women's empowerment and important indirect benefits through socio-economic improvement (Majurin, 2012). These will be discussed in detail in the review of theory and evidence.

The existing evidence on the empowering potential of co-operatives for women in sub-Saharan Africa is mainly based on case studies. There are a few larger N studies and cross-context comparative case studies. Evidence of a causal effect of co-operative membership on women's empowerment is limited. This article aims to contribute quasi-experimental empirical evidence on the impact of membership of co-operatives on women's empowerment in sub-Saharan Africa. It uses the Popular Knowledge Women's Initiative (P'KWI) Farmer to Farmer Co-operative Society, an agricultural co-operative that operates in north-eastern Uganda, as a case study. More specifically, this paper will evaluate the impact of membership of the agricultural co-operative on women's decision making power and their ability to influence decisions at the household, group and community levels and on intra-household labour divisions. It will also analyse the impact of co-operative membership on women's empowerment in terms of enhanced capabilities by looking at the impact on economic wellbeing, livelihood diversification, knowledge and adoption of good agronomic practices and social networks.

By providing evidence of the extent to which co-operative membership can contribute to social and economic empowerment of women in sub-Saharan Africa, this study can convince policy makers that the

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[1] A cooperative, as defined by the ILO Promotion of Cooperatives Recommendation, 2002 (No. 193), is 'an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise' (Majurin, 2012).

promotion of co-operative membership of women as an avenue to address gender gaps in agriculture and to build future healthy, productive and equitable rural societies is a worthy investment.

2. Literature

Gender inequalities with regard to agency, resources, and achievements are grounded in prevailing gender relations, which are multi-dimensional and deep-rooted (Kabeer, 2005). Gender relations embody norms and values and define decision making power, roles, responsibilities and access to productive resources. As such, they govern different aspects of productive and reproductive life. In patriarchal societies, which typify many sub-Saharan African rural societies, gender relations are skewed against women (Silberschmidt, 2001). The multi-dimensional and deep-rooted nature of gender relations and inequalities, often embedded in institutions, makes it hard, though not impossible, to come up with a universally agreed set of targets and solutions to address these issues (Kabeer, 2005; Pearse & Connell, 2015: in Gammage, Kabeer, & van der Meulen Rodgers, 2016).

Women's empowerment refers to the processes whereby gender constraints, which result from gender relations or norms that are disadvantageous to women or from economic or social inequalities, are lifted (Kabeer, 1999). Such processes enable women, who have been denied the ability or the freedom to make independent, well-reasoned choices, to acquire such ability and freedom (Agarwal, 1997; Kabeer, 1999; Gasper, & van Staveren, 2003). One aspect of empowerment of women lies in enhanced and more effective individual agency, potentially reinforced through increased intra-household bargaining power or relaxed gender constraining roles (Kabeer, 2008 in: Gammage et al., 2016).

Enhanced individual agency may not be enough to achieve structural changes in gender relations, which are defined by patriarchy for instance and are sustained by social norms (Agarwal, 1997; Kabeer, 1999). Women's empowerment requires transformative agency (Kabeer, 1999; Gasper, & van Staveren, 2003). Transformative agency cannot happen in the absence of enhanced individual agency, consciousness about social perceptions and their impact on one's identity, roles and responsibilities, and collective agency. Being part of a group plays a significant role for transformative agency. It enhances people's ability to

challenge norms within and outside the household, through peer pressure and group solidarity, and by providing an arena outside the household where (gender) norms are negotiated and reconfirmed (Agarwal, 1997; Kabeer, 1999).

The theory of women's empowerment, building on the seminal work by Agarwal (1997) and Kabeer (1999), and evidence from case studies show how co-operative membership can contribute to women's empowerment through a combination of processes (Jones, Smith, & Wills, 2012). First, co-operative membership can contribute to women's empowerment by offering them opportunities to increase individual agency. One of the ways that co-operatives can increase women's individual agency is through economic enterprises that lift the intra-household bargaining power of women over the allocation of resources and time. Such economic enterprises, undertaken via the co-operative, can increase women's access to resources, common resources and exchange entitlements (Agarwal, 1997; Meinzen-Dick Quisumbing, Behrman, Biermayr-Jenzano, Wilde, Noordeloos, Ragasa, & Beintema, 2011). For instance, in Kenya, Tanzania and Uganda, co-operative membership was found to be positively related to economic activity and the income of women as well as increased joint decision making by spouses about household economics (Majurin, 2012). In addition, the economies of scale, (commercial) networks and increased credit worthiness attained via co-operatives can be advantageous for women as they generally operate with lesser means and less access to markets and financial support (Katungi, Edmeades, & Smale, 2008; Majurin, 2012).

Another way in which co-operatives can empower women by increasing individual agency is through service provision and skill development, especially when these are targeted at women who generally have lower education levels and have less access to agricultural extension services and inputs (Agarwal, 1997; Ferguson, & Kepe, 2011; Meinzen-Dick et al., 2011; Dol, & Hambly Odame, 2013). Particularly if the extension is provided via women and a farmer to farmer approach is used, then its capacity enhancement and empowering potential can be significant (Meinzen-Dick et al., 2011; Kondylis, Mueller, & Zhu, 2014).

In addition, in societies where women's participation in the public sphere is limited because of gender-based norms, gendered division of labour and time constraints, a co-operative can open up opportunities for engaging in the economy, exchanging experiences, exercising voice and accessing leadership training and roles (Ferguson, & Kepe, 2011; Majurin, 2012). For instance in Bangladesh, group marketing enabled women in a homestead food production program to overcome constraints in accessing markets due to 'purdah' (Hillenbrand, 2010).[2] In India, economic and social resources and capacity building accessed through women self-help groups were found to contribute to women's empowerment. Women in self-help groups gained mobility, were more aware about property and political rights, and had more decision making power within the household (IFAD/OE, 2000). These case studies also pointed out that women in co-operatives can gain more confidence and more respect within and outside their household—partly through the recognition of their economic potential. This may translate in a greater voice and agency within the household as well as in socio-political affairs in the wider community (Hillenbrand, 2010; Majurin, 2012).

Second, besides enhancing individual agency, co-operatives—and especially the group aspect thereof—can be instrumental for transformative agency (Agarwal, 1997; Kabeer, 1999). Co-operatives help in popularizing aspects of women's empowerment or provide the arena where social norms like gender roles are questioned (Ferguson, & Kepe, 2011). When women are members of a co-operative, there are likely to be interactions between negotiations in both the household and the group about responsibilities, rights and possibly gender roles. Such negotiations are known to advance transformative agency (Agarwal, 1997; Kabeer, 1999). In addition, when women make out more than one third in a mixed group, they are more likely to have a significant impact on decisions (Agarwal, 2010).

The complementary roles of greater individual agency, debating norms outside the household, and group solidarity in empowerment processes are illustrated by selected examples from women groups and co-operatives in India and Uganda. In South India, a reduction of men dominated intra-household decision making about money and time management was found to be more likely when credit—combined with

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2 Purdah refers to a cultural practice of preventing men from seeing women (Hillenbrand, 2010).

technical and social awareness training—was offered to women's groups rather than to individual women (Holvoet, 2005). In Uganda, membership of a co-operative revolving around embroidery not only offered economic empowerment to women, but it also gave them a sense of agency, an ability to control resources and a feeling of empowerment at the personal and the collective levels. Group membership also facilitated solidarity and skills transfer (Dol, & Hambly Odame, 2013). The women members of a co-operative for collective production and marketing in Uganda stated that they had gained respect for their business skills, a stronger voice in the community and greater confidence in public speaking (Ferguson & Kepe, 2011). At the household level, these women acquired more control over production and marketing decisions. Their link to markets gave them more mobility and freedom. According to Ferguson and Kepe (2011), the co-operative also popularised women's empowerment in the wider community.

However, the potential of co-operatives for empowering women is contingent on women's ability to effectively participate, their command over and returns from productive resources, and their access to leadership skills and roles (Coles, & Mitchell, 2010; Majurin, 2012; Meier zu Selhausen, 2016). The empowering potential may be constrained by exactly the same gender inequalities linked to labour divisions, institutional constraints, social perceptions, expected behavioural patterns and gender roles. The beneficial role of social networks, to which a co-operative could contribute, can also be challenged since social networks sometimes function as gatekeepers that preserve norms and gender biases (Cleaver, 1999, 2005: In D'Exelle, & Holvoet, 2011).

Other potential pitfalls linked to co-operative membership include a heavier workload for women because of the increased economic activity, especially if the economic changes are faster than social changes and changes in labour division (Majurin, 2012). Even if women contribute to an increased household income through their involvement with a co-operative, an equal intra-household distribution and command over it remain uncertain because patriarchal customs may place the responsibility for marketing and managing the household income with men (Dol, & Hambly Odame, 2013). There is also evidence that men tend to take over once the economic potential of activities increases (Coles, & Mitchell, 2010; Meinzen-Dick et al., 2011; Majurin, 2012). If there is jealously, mistrust or scepticism about the increased autonomy and

economic power of women, intra-household relationships may worsen (Coles, & Mitchell, 2010; Majurin, 2012).

Furthermore, the gender division of labour and women's disproportionate responsibility for housework and care are particularly persistent over time and across countries, irrespective of income or growth levels (World Bank, 2012). Labour division is deeply rooted in one's sense of identity, social perceptions about who one is supposed to be and what one is supposed to do, gender roles, and in many cases sustained by social norms, sometimes even taboos (Kabeer, 1999; Agarwal, 2007). Co-operative membership may not be able to bring change in this regard. In fact, co-operative membership in Kenya, Tanzania and Uganda was found to be significantly and positively related to spouses jointly contributing labour for income generation, but there was hardly any increase in joint provision of labour for subsistence agriculture, childcare or household chores; these remained the sole responsibility of women (Majurin, 2012). Other studies drew similar conclusions. Despite other empowering effects for women due to their membership of a women self-help group in India, a Ugandan embroidery co-operative and a homestead food production program in Bangladesh, intra-household decisions remained gendered and the intra-household labour division hardly changed, which resulted in an increased workload for women (IFAD/OE, 2000; Hillenbrand, 2010; Dol, & Hambly Odame, 2013).

In the following, the article will reflect back on the theory and evidence to formulate the hypotheses with regard to the impact of P'KWI membership on aspects of women's empowerment. But first, it will describe P'KWI's specific approach and the context in which it operates.

3. Context: P'KWI's approach and its potential impact on women's empowerment

P'KWI—in full the Popular Knowledge Women's Initiative Farmer to Farmer Co-operative Society—was set up by women from traumatised and impoverished families as a self-help group for farming in 1993 after a prolonged period of insurgency in the region.[3] Gradually, P'KWI took up other activities like community empowerment and capacity building, with women as their prime target group. P'KWI's focus moved from

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[3] More details on the history of P'KWI and the Teso region can be found in Lecoutere (2012) and Jones (2008) respectively.

social support to promoting more commercially oriented agriculture and income generation. In 2009, P'KWI transformed into a co-operative society. P'KWI gradually extended the membership to the whole household, rather than exclusively to women, and adopted a household economy approach. At the time of the survey, 2500 households were members of P'KWI, 60 per cent through women.

P'KWI focuses on sunflower production as an economic enterprise. Its members get extension services on sunflower production and seeds on credit. The members sell the sunflower grains they produce to P'KWI, which processes these into sunflower oil for local marketing. Members share in the profits from sunflower oil sales. P'KWI recently introduced value addition for cassava, a widely grown food crop, mainly managed by women. Other economic activities promoted by P'KWI include poultry keeping, micro-finance and ox-ploughs for agricultural intensification.

P'KWI organises community mobilisation and knowledge transfer through groups composed of geographically proximate households. P'KWI strives to have 60 per cent of women heading the groups and to attain 60 per cent of women in the groups. P'KWI uses a model of farmer to farmer extension for knowledge and information exchange. Apart from training in agronomic practices, it organises training on financial and farm management at the household level, group saving and leadership training for women. A farmer to farmer approach has been recognised as a practical model for information diffusion and adoption and also for stimulating farmers' lead processes of learning and solidarity (Nathaniels, 2005; Kondylis et al., 2014).

P'KWI is locally embedded and maintains close interactions between management, board and members, characteristics that typify successful co-operatives in Africa (Develtere et al., 2008). P'KWI always had a woman director or manager as well as a woman chairperson. Some of the founding women are still driving forces of the co-operative's development. These women are likely to be important role models for many women co-operative members. The co-operative's leaders (men and women) are also influential in local political and religious circles, which may bind and inspire the members as much as the economic activities.

There are four aspects of P'KWI's approach that are expected to contribute to women's empowerment in their households and groups. First, in 60 per cent of the cases, women hold P'KWI membership for their household. The high proportion of women in mixed farmer groups is expected to increase women's impact on decisions (Agarwal, 2010). Second, the sunflower value chain and the other economic activities promoted by P'KWI open the scope for women to profit from farming and value addition. Third, the farmer to farmer approach to extension in combination with a high percentage of women among P'KWI's lead farmers implies that, in many cases, women introduce new farming techniques and the principle of farming as a business in the household (Meinzen-Dick et al., 2011). Fourth, P'KWI's group approach, leadership training for women and women leaders as role models may contribute to transformative agency. These factors may build women's confidence and increase consciousness about social perceptions, women's identity, roles and responsibilities. Interactions between public and private negotiations about social norms, including those defining intra-household choices and action, are facilitated within P'KWI, which is expected to further contribute to transformative agency (Agarwal, 1997; Kabeer, 1999).

The article's hypotheses are that, first, P'KWI's membership has a positive effect on women's decision making power and their ability to influence decisions, at the household (1.a.) as well as the group (1.b.) and community levels (1.c.). Secondly, it is expected that there is a positive impact of P'KWI membership on women's capabilities, more specifically on economic wellbeing (2.a.), livelihood diversification (2.b.), agronomic knowledge and practices (2.c.), and social networks (2.d.). Thirdly, we expect a more gender equitable intra-household labour division for farm (3.a.) and domestic (3.b.) activities as a result of P'KWI membership.

P'KWI does not exclusively work with women; it also hosts a large number of men as members. Hence, P'KWI offers opportunities for economic and social advancement as well as empowerment to both women and men. But we expect that the benefits from P'KWI membership will be greater for women than for men.

4. Methods

Data was collected in Bukedea district in north-eastern Uganda from March till May 2012. We conducted two focus group discussions (FGD) on prevailing gender roles and perceptions with regard to women's empowerment with 14 randomly selected women P'KWI members and 13 men members respectively. A gender value chain was drafted during an FGD with five men and four women staff of P'KWI (Terrillon, 2011). The information gathered in the FGDs was used to triangulate and interpret findings based on the survey data. Information on P'KWI's history, approach, membership and services was gathered via semi-structured interviews with the P'KWI management and partners and via secondary sources as well.

We conducted an individual survey among P'KWI members and non-members who live and work in similar conditions. We randomly selected groups from P'KWI's membership lists in 10 geographical clusters in which the group operates, from which members were randomly selected for interviews. A total of 176 P'KWI members were interviewed, of whom 60.8 per cent were women, which corresponds to the gender composition of P'KWI's member base. In order to approximate random sampling of non-members, after interviewing a member, a non-member living in the third house located to the east of the member was interviewed.[4] We interviewed 111 non-members of whom 57.7 per cent were women. The proportions of women in the member and non-member samples are not significantly different.

To evaluate the impact of P'KWI membership on empowerment, we applied a Difference in Difference (DiD) analysis on the subsamples of women and men P'KWI members and non-members. DiD analysis is mimicking an experimental set-up with a treatment and a control group which are assumed to be similar apart from the outcome variables of interest (Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2011). DiD analysis is based on information about a certain outcome for two groups in two periods of time. The treatment group is exposed to a 'treatment' in the second period but not in the first, while the control group is not been subjected to the treatment during either period. The average gain over time in the control group is subtracted from the average gain in the treatment group to measure the effect of the treatment on a current

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[4] In some cases, this criterion had to be slightly adapted because of topographic reasons (e.g. second house, to the west...).

outcome, while excluding observed or unobserved permanent differences between the treatment and the control group and biases linked to trends (Imbens, & Wooldridge, 2007). In this case, the treatment is membership of P'KWI.

As we are specifically interested in the impact of membership among women, we split the member and non-member sample into women and men by including a dummy variable equal to one for male respondents. We interacted the dummy variable with each of the variables included in the DiD equation. As such, women non-members form the control group for women members and men non-members for men members, while at the same time we can assess the differential empowering effects of membership for women as compared to men.

The DiD analysis starts from the following equation:

$$y_{it} = \alpha + \beta x_i + \gamma T_t + \delta x_i T_t + \theta z_i + \alpha' m_i + \beta' m_i x_i + \gamma' m_i T_t + \delta' m_i x_i T_t + \theta' m_i z_i + \epsilon_{it}$$

With y_{it}=outcome variable measured for individual i in period t

With x_i=1 if for individuals who received treatment; x_i=0 for individuals in the control group

With T_t=0 in pre-treatment period; T_t=1 in post-treatment period

With m_i=1 for men; and =0 for women

With z_i=control variable(s)

We calculate the difference in change over time between women members and non-members:

$$\Rightarrow \{(y_{it} : x_i = 1, t = 1, m_i = 0) - (y_{it} : x_i = 1, t = 0, m_i = 0)\}$$
$$- \{(y_{it} : x_i = 0, t = 1, m_i = 0) - (y_{it} : x_i = 0, t = 0, m_i = 0)\}$$

This results in the treatment effect δ among women[5]:

$$\Rightarrow \{(\alpha + \beta + \gamma + \delta + \theta) - (\alpha + \beta + \theta)\} - \{(\alpha + \gamma + \theta) - (\alpha + \theta)\} = \delta$$

We calculate the treatment effect δ + δ' among men as follows:

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5 We estimated the average treatment effect on the treated.

$$\Rightarrow \{(y_{it} \vdots x_i = 1, t = 1, m_i = 1) - (y_{it} \vdots x_i = 1, t = 0, m_i = 1)\}$$

$$- \{(y_{it} \vdots x_i = 0, t = 1, m_i = 1) - (y_{it} \vdots x_i = 0, t = 0, m_i = 1)\}$$

$$\Rightarrow \{(\alpha + \beta + \gamma + \delta + \theta + \alpha' + \beta' + \gamma' + \delta' + \theta') - (\alpha + \beta + \theta + \alpha' + \beta' + \theta')\}$$

$$- \{(\alpha + \gamma + \theta + \alpha' + \gamma' + \theta') - (\alpha + \theta + \alpha' + \theta')\} = \delta + \delta'$$

If the estimated treatment effect for women δ is significantly different from zero, we can conclude that the treatment has had a significant effect on the outcome for the treatment group. In case of men, if δ + δ' is significantly different from zero; there is a significant treatment effect.

DiD analysis is based on observations for the same individuals at different periods of time. This implies that the assumption of independently and identically distributed measurements is violated. Therefore, in order to avoid inconsistent standard errors and overestimated significance levels, we corrected for correlation within individuals by using Huber White sandwich estimators (Bertrand, Duflo, & Mullainathan, 2004).

By definition, quasi-experiments lack random assignment. Even if there are no significant pre-treatment differences between the treatment and the control group (See Table 1 below), we cannot completely rule out self-selection or selection by P'KWI, for instance, of people with a particular interest in women's empowerment (Shadish, Cook, & Campbell, 2002; Gertler et al., 2011). Furthermore, DiD analysis is based on the assumption that, in the absence of the treatment, the average outcomes for the treatment and the control group would have followed a similar evolution over time (Gertler et al., 2011). To increase the likelihood of a similar evolution and reduce the likelihood of selection bias, we combined DiD analysis with propensity score matching, which is a procedure to match treated and control observations on the estimated probability of being treated (i.e. the propensity score) conditional on pre-treatment characteristics (Gertler et al. 2011).

We used the method 'nearest neighbour matching' to construct a match of control observations for each treatment observation based on proximity (i.e. nearest propensity score).[6] We matched the treatment and the control observations on pre-treatment characteristics including gender, age, household composition, land and livestock assets in the pre-treatment period, i.e. before membership for members and five years ago for non-members.[7] Table 1 presents descriptive statistics of the variables used for matching.[8] After matching, the sample included 107 women and 69 men members and 39 women and 29 men non-members. Then we ran DiD analyses on the matched samples to estimate the treatment effect of P'KWI membership on different outcome variables.

Table 1: Descriptive statistics of pre-treatment characteristics

One could argue that the way in which the control group was sampled does not completely exclude spill-over effects. It is possible that non-members (in the third house east of a member) learned from their 'neighbours' (for instance about agronomic practices or gender relations). Our research design does not permit to control for that. Yet if we see significant treatment effects while there could have been spill-over effects, the net treatment effects without spill-over effects are likely to have been even larger.

The different outcome variables that we used to measure empowerment are based on the survey data. Some outcome variables in the pre-treatment period are based on data obtained through retrospective questions rather than on baseline data collected prior to treatment. For members, the data on the pre-treatment period (y_{it} for t=0) is based on inquiry about the state of the outcome variable before P'KWI membership, which is on average five years prior to the data collection in 2012. Non-members were asked about the situation

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[6] We used the procedure MatchIt as provided in the MatchIt package for R and the method nearest neighbour matching using logistic regression to estimate the distance measure. We used matching with replacement, which allows control observations to be included in more than one matched set.

[7] We used current household composition, measured by the proportion of adult women (men) household members, assuming that, on average, changes over time in household composition have been similar for both members and non-members.

Tropical livestock units are calculated by making a weighed sum of all livestock owned by the household. More specifically, the weights are: cattle = 0.70, sheep and goats = 0.10, pigs = 0.20, chicken = 0.01, turkey = 0.05, donkey = 0.50; pigeons = 0.005, ducks = 0.02 and rabbits = 0.02 (Jahnke, 1982).

[8] Even if propensity score matching may have levelled out bias linked to the significant difference in average age of women members and non-members, we still decided to control for age in the analysis to distinguish effects on the outcome variables linked to age from the treatment-linked effects (z_i = Age).

five years ago.[9] Data for the post-treatment period (y_{it} for t=1) is based on inquiry about the state of that outcome variable at the time of the survey, for both members and non-members. We always inquired about the current (post-treatment) situation first, and then about the past (pre-treatment) situation. For other outcome variables, information about the pre-treatment and the post-treatment periods was derived from questions in which the respondents compared their current situation with that before the treatment (five years prior to the survey for the control group). In this case, we recoded the variable in the following way: If the status of the outcome variable improved over time, then y_{it}=0 in t=0 and y_{it} =1 in t=1; if it remained the same, then y_{it} =1 in t=0 and y_{it} =1 in t=1; and if it deteriorated, then y_{it} =1 in t=0 and y_{it} =0 in t=1.

If the members wanted to inflate the positive effects of their membership, we expected an understatement of the pre-treatment situation rather than an overstatement of the current situation and possibly to a larger extent than among non-members. Such bias is expected to be larger when the question asked for a comparison of the pre- and the post-treatment situations. Apparently, members did not systematically understate their pre-treatment situation as for some measures we did not see a significant difference between the pre- and the post-treatment situations. Ideally, baseline data collected in the pre-treatment period or similar gender disaggregated data collected in a comparable setting five years prior to our data collection could have helped to avoid such bias and enabled a robustness check. However, to our knowledge, such data is not available.

The indicators to measure empowerment in the form of enhanced capabilities include economic wellbeing, livelihood diversification, knowledge and adoption of good agronomic practices, and social networks. Economic wellbeing is measured on the basis of self-reported household food and basic need insecurity levels, subjective household wellbeing and household assets. We inquired about food insecurity and basic need insecurity currently and before membership (or five years ago in the case of non-members).[10] A lower value corresponds to lower food (basic need) insecurity level. The subjective household wellbeing indicator

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[9] In fact, long (short) term members may refer to more (less) distant past (more than 5 years) than non-members whose reference period is five years ago and changes may be larger (smaller). Averages are expected to level that out.

[10] The food insecurity and basic need insecurity indicators are coded as follows: 1= respondent never had difficulties providing daily food (basic needs) for her/his household; 2= rarely had difficulties; 3= sometimes; 4=often; and 5= difficulties all the time.

is based on a respondent's self-reported change in the economic wellbeing of her/his household (in terms of income and consumption) as compared to that before membership/five years ago. We recoded the data as described above. The indicators for household assets are tropical livestock units and a dummy variable taking the value one if the house has an iron roof. There is data for t=1 and recall data for t=0. Self-reported (current) sources of household income, excluding pension and remittances, were used as an indicator for livelihood diversification.[11]

The indicators for agronomic knowledge and practices include a recoded measure of the respondent's self-reported evolution in knowledge about ways to improve agricultural production since membership/five years ago, a recoded measure of the self-reported evolution in the use of innovative farming techniques (like row planting, intercropping, manure, ox-plough, and so on), and a measure of the use of improved seeds based on data for t=1 and recall data for t=0.[12]

One of the measures for social networks is the number of households the respondent visits or exchanges goods with, lends or loans money to, assists with help or labour, cares for children or the sick and the elderly at least once a month (in t=1 and t=0 recall). The other measure is the number of different groups, clubs, organisations, (church) committees that the respondent is a member of in t=1 and t=0. For members, we subtracted 1 in t=1 to exclude P'KWI.

Our indicators for empowerment in the form of power and ability to influence decisions are based on a respondent's perception on the evolution of her/his power and ability to influence decisions in her/his household since her/his membership of P'KWI, or since five years in case of non-members. We asked similar questions about the respondents' sense of empowerment in groups and in the community. We recoded as explained above.

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[11] Even if respondents were asked to list sources of income for the household, we assume they emphasize on their own income sources. Hence, gender differences in income sources may still be reflected to some extent.

[12] The variable for use of improved seeds is coded as follows: 4= respondent uses improved seeds for all crops; 3= for some crops; 2= for one crop; 1= for none.

To measure intra-household domestic and farm-related labour divisions, we asked the individual respondents to compare the number of hours the husband and the wife in her/his household spend on work in the house and on the farm respectively.[13] A lower value corresponds to a lower workload for women. Data on intra-household domestic (resp. farm-related) workload division is available for t=1 and t=0 (recall).

5. Results

First, the impact of P'KWI membership on empowerment of women through enhanced capabilities is explored by looking at the impact on economic wellbeing, agronomic knowledge and practice, social networks, and livelihood diversification. Then the impact of co-operative membership on women's power and ability to influence decisions in different spheres and on intra-household labour divisions is evaluated.

5.1. The impact of P'KWI membership on capabilities

We estimated the effect of being a member of P'KWI—the treatment—on the different indicators of economic wellbeing by comparing the members (treatment group) and the non-members (control group) by DiD analysis combined with propensity score matching (Table 2).

The significant negative treatment effect δ in Model A indicates that P'KWI membership has significantly reduced household food insecurity among women, in addition to a trend of declining food insecurity, which is evident from the significant negative time factor γ. The significant negative treatment effect δ in Model B points to reduced basic need insecurity in the household as a result of women's membership of P'KWI. The significant positive treatment effect in Model C shows that there is a positive impact on subjective household wellbeing among women members of P'KWI.[14]

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[13] Coding of the variable intra-household domestic (farm-related) workload sharing: 5= wife works much more hours in the house (resp. on the farm) than husband; 4= wife works more hours than husband; 3= wife and husband work the same number of hours; 2= wife works less hours than husband; and 1= wife works much less hours than husband.

[14] The positive significant coefficient of x_i for women members in t=0 in Model B can be due to an exaggeration by women members of their pre-membership basic need insecurity. There is no indication of such exaggeration among men respondents.

The negative significant coefficient of x_i in Model C is an indication that more women members reported an improvement in their level of subjective wellbeing than women non-members. Thus, a larger number of women members had $y_{it}=0$ in t=0 (changing to $y_{it}=1$ in t=1) than non-members.

There is larger positive impact on subjective household wellbeing among men than among women (significant positive treatment effect $\delta + \delta'$ in Model C), while the effects of P'KWI membership on household food insecurity and basic need insecurity are similar (δ' is not significant in either Model A or Model B).

The economic empowering effect of P'KWI membership for women is not apparent from the changes in asset holding, as measured by tropical livestock units and roof type. The treatment effect δ is insignificant in Model D and Model E. This is not different among men.

Table 2: Impact of co-operative membership on economic wellbeing

Second, women P'KWI members on an average reported more sources of household income than women non-members (Table 3). A closer look shows that a higher percentage of women P'KWI members gain a household income out of selling sunflower, other staple crops and poultry than women non-members. As this is not based on an evaluation of impact, a careful conclusion is that there is a positive correlation between P'KWI membership and livelihood diversification among women. Men members also reported more diversified income sources than their non-member counterparts, but the gain is smaller as compared to women.

Table 3: Household income sources

Third, we found that women's membership of P'KWI had a positive impact on their knowledge in improving agricultural production, adoption of innovative farming techniques and the use of improved seeds. This is evident from the significant positive treatment effects δ in Models A, B and C in Table 4.[15]

While there is a positive trend in the use of improved seeds among women (evident from a significant positive γ in Model C), there is a negative trend in the adoption of innovative farming techniques (γ is significantly negative in Model C), which P'KWI membership manages to curb. In contrast, among men, membership contributed to an overall positive evolution in agronomic knowledge, adoption of innovative

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[15] Note that the negative significant coefficients of x_i in Models A and B are linked to coding and indicate that more women members reported an improvement than women non-members.

practices and improved seeds ($\gamma + \gamma'$ is significantly positive in Models A, B and C in Table 4**Fout! Verwijzingsbron niet gevonden.**).

Fourth, we also expected an effect of P'KWI membership on social networks, especially given P'KWI's farmer to farmer extension approach, its work on group formation and community mobilisation. Yet, we did not find any significant impact of women's membership of P'KWI on their social networks, measured by the number of social exchanges and memberships of organisations (Insignificant δ in Models D and E in Table 4).

Table 4: Impact of co-operative membership on agronomic knowledge, adoption of practices and social networks

5.2. The impact of P'KWI membership on women's decision making power and intra-household labour divisions

We now look at the impact of P'KWI membership on women's empowerment in terms of the power and ability to influence decisions in their households, in groups and in the community, and on the intra-household division of labour for farm and domestic activities.

P'KWI membership had a significant positive effect on women's power and ability to influence decisions at all levels: their households, groups and the wider community. This is evident from the significant positive treatment effects δ in Models A, B and C in Table 5.[16] The effect of P'KWI membership was smaller on women's decision making power in households than in groups and the community. But the significantly positive γ in model A points to a general positive trend in women's decision making power in the household, which is boosted by P'KWI membership. Remarkably, the overall trend in decision making power in groups and in the community seems to have been negative for women, which is indicated by the significant negative γ in Models B and C. Yet, women's membership of P'KWI has had a large and compensating positive impact on decision making power at these levels.

Note that being a member of a co-operative like P'KWI has stronger effects on women's decision making power than on that of men. Men experience a negligible but negative impact of co-operative membership

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[16] The negative significant coefficients for women members x_i in t=0 in Models A, B and C indicate that more women members reported an improvement in their level of empowerment than women non-members.

on decision making power at the household (small but significantly negative δ + δ' in Model A in Table 5). While there is positive trend in decision making power at the group and community levels among men, rather than a negative one as is the case among women, the impact of membership is smaller for men than for women (significant positive γ + γ' and δ + δ' < δ in Models B and C).

Next, we evaluated the impact of women's membership of P'KWI on the intra-household labour divisions for domestic and farm related activities in their households. Despite significant effects of membership on women's decision making power, even at the household level, we did not find any significant effect of P'KWI membership on the intra-household divisions of domestic and farm-related workload in these women's households (Insignificant δ in Models D and E in Table 5).

There is also no sign of changes over time in the domestic and farm-related intra-household labour divisions, based on women's accounts (Insignificant γ). Only women's age makes a difference. Older women reported slightly more disadvantageous domestic and farm-related labour divisions in their households, as compared to younger women (Significant positive θ in Models D and E in Table 5).

The overall average score for domestic labour division, as reported by women, is approximately four, which corresponds to a situation where the wife works more hours than the husband (α in Model D in Table 5). The average score for farm-related labour division, reported by women, is about three, which corresponds to the wife and husband working the same number of hours on farm-related tasks (α in Model E). Men do not have a different opinion (insignificant α' in Models D and E). These findings are in line with other studies on labour divisions in rural Uganda (Ellis et al., 2006).

Finally, Table 6 presents an overview of the empirical support for the hypotheses formulated in section 2 about the impact of P'KWI membership on different aspects of women's empowerment.

6. Discussion and recommendations

This article aimed to evaluate the impact of membership of agricultural co-operatives on women's empowerment in sub-Saharan Africa. We used a quasi-experimental empirical analysis combining Difference-in-Difference analysis with propensity score matching of members and non-members to assess the impact of women's membership of an agricultural co-operative on different aspects of empowerment. We used the Popular Knowledge Women's Initiative (P'KWI) Farmer to Farmer Co-operative Society, operating in north-eastern Uganda, as case study.

The analysis showed that women's membership of the co-operative has a significant positive impact on enhancing capabilities. Co-operative membership is economically empowering, which translates into reduced household basic needs insecurity, reduced household food insecurity and leads to a greater sense of relative wellbeing in these women's households. Men experience similar effects of co-operative membership. There are also indications that co-operative membership is beneficial for income diversification, especially for women.

Being a member of P'KWI has a positive impact on agronomic knowledge, adoption of innovative farming techniques and the use of improved seeds among women. It adds to a positive trend of using improved seeds and curbs a negative trend in the adoption of innovative farming techniques. The latter points to a stronger influence of membership among women than men as the positive effects with regard to agronomic knowledge and adoption among men members all build on positive trends. This could be an indication that P'KWI's gender promoting farmer to farmer extension approach is effective. By targeting women and having a relatively high number of women lead farmers who deliver extension services, knowledge and adoption of better agronomic practices is advanced among women.

Co-operative membership has a positive impact on women's empowerment in terms of decision making power at the household, group and community levels. What is more, women members of the co-operative feel their power and ability to influence decisions in groups and the community have increased despite a seemingly negative trend. In contrast, a similarly positive effect of membership on men's decision making

power in groups and in the community goes hand in hand with positive trends. Men's decision making in the household is slightly reduced through co-operative membership. Hence, the gains for women with regard to decision making power by being a member of P'KWI are substantial when compared to the gains for men. Part of the reason why empowerment at the group and community levels generally decreased over time among women while it increased among men could be that, in the past, women gained empowerment due to increasing participation in self-help groups, (agricultural) co-operatives or SACCOS (Majurin, 2012); but that this empowerment of women has faded over time. The latter may be related to the fact that men often become involved—and take over—when women's initiatives prove to be economically successful (Coles, & Mitchell, 2010; Meinzen-Dick et al., 2011).

Women's membership of the co-operative, however, did not have any effect on the intra-household labour divisions for domestic or farm related activities. The absence of any effect of co-operative membership on domestic and farm related intra-household labour divisions despite its impact on decision making power of women—even at the household level—is in line with observations in the literature and other case studies in rural development contexts that gender roles and intra-household labour divisions are persistent. In this case, gender-based unequal labour division perseveres in all households, including those of P'KWI members. Both women and men agree that the former generally spend more hours on domestic chores than men and approximately the same number of hours on farm related work. But note that sunflower production, which is the economic enterprise introduced by P'KWI, and especially post-harvest handling and storage of sunflower, is likely to have created an additional workload, particularly for women. In this sense, the observed unchanged farm related workload for women after membership may hide some rearrangement in the intra-household farm-related labour division.

Our recommendations based on this case study are the following: First, it is recommended to promote co-operatives that evolved out of women's groups because these have a high chance of contributing to women's empowerment. But the gender balance in membership and leadership should be carefully guarded.

Second, our results support other studies that emphasize the need for a farmer to farmer extension approach with women as lead farmers and in which women are targeted. Such an approach appears to be highly effective to empower women, possibly because of the knowledge and skills transfer via women and the forum it creates for discussion and interactions between household and group level issues. Activities that economically advance the co-operatives' members are essential for greater economic wellbeing—of both women and men—and probably also contribute to other aspects of women's empowerment.

Third, changing gender-based unequal intra-household labour divisions remains a challenge even for a co-operative with a gender promoting approach that is relatively successful at enhancing women's decision making power at the household, group and community levels, improving their economic wellbeing and also increasing knowledge and adoption of agronomic practices among its women members. Either the power of women to influence decisions in their households is not strong enough and power at the group and community levels does not help bargaining within the household, or labour divisions are not a priority for women, or social norms prevent bargaining over labour divisions.

Even if intra-household labour divisions have been found to be notoriously persistent, not only in patriarchal development contexts (World Bank, 2012), co-operatives with attention to women's empowerment should not only carefully assess to what extent their activities could increase women's workload, but also actively incorporate labour saving interventions targeted at women. An often observed downside from economic advancement through co-operatives is an increased workload for women. In P'KWI's case, the commercially oriented sunflower farming is labour intensive. The farm related work burden of women members is likely to have increased, while they were already under time constraint. P'KWI has introduced labour saving technology, such as the ox-plough, but this has mainly benefitted men as ploughing is their responsibility. The ox-weeding implement, which P'KWI is experimenting with, should be promoted to reduce women's work burden as weeding is mainly the women's responsibility. There is also scope for accessible technology that reduces the required labour for post-harvest handling of sunflower, typically women's responsibility, or to integrate this at the processing level.

Fourth, P'KWI's move from exclusive membership for women to a household economy approach probably opened the scope for intra-household negotiations as it promotes joint planning and decision making for the household as a farming enterprise and increases awareness about the endowments, contributions, roles and responsibilities of each household member. It could also have reduced intra-household tensions by placing discussions on gender relations in a more public sphere. However, since such an approach works within patriarchal structures, there is a risk that traditional gender roles, labour divisions and intra-household resource allocations are not challenged as strongly anymore (Lecoutere, 2012). In accord with others (i.e. Meier zu Selhausen, 2016), we recommend that co-operatives and other socio-economic groups should maintain a household approach, but more explicitly stimulate discussions, group pressure and negotiations about gender roles and social norms that guide intra-household decision making and labour divisions. Practically, such topics could be systematically taken up in extension work, in (mixed) group discussions and training. Apart from that, interventions that are sensitive about intra-household relations and roles in combination with labour saving techniques that target women should be integrated into co-operatives' tool boxes.

Fifth, as in other case studies (i.e. Dol, & Hambly Odame, 2013), women members of P'KWI mentioned in the focus group discussions that their command over income generated through the co-operative remained a challenge. This is linked to (patriarchal) norms about intra-household resources and roles. Marketing is traditionally the responsibility of men. Women often also lack the physical strength or the means to transport their produce to the market or processing plant. When this is done by men, women may not personally receive the income from selling their produce, which likely reduces their command and decision making power over that income. But there could be ways around this bottleneck. P'KWI, for instance, is trying out whether the requirement that both men and women should be present at the time of selling sunflower will improve the women's control over that income. The outcome still remains to be evaluated. Other organisations are experimenting with alternating selling days for women and men. Alternatively, one could think of individual micro-finance services for co-operative members and separate payments through the accounts of men and women. Mobile money technology, which is fast emerging in

rural Uganda, could solve issues pertaining to the organisation and accounting of micro-finances (McKay, & Kaffenberger, 2013).

Finally, further study is needed to extend the evidence base of the potential of co-operatives to enhance women's empowerment and to close gender gaps in agriculture. Although there might be challenges linked to both implementation and data collection, a randomised control trial of cooperative membership would allow a rigorous and unbiased evaluation of the impact on different aspects of women's empowerment. A second best option would be to ensure that baseline and endline data are collected from a treatment group, who become members of a cooperative, and a control group. This would allow establishing the impact by using quasi-experimental methods, but without the limitations of using recall data. A useful addition to an impact evaluation of cooperative membership on women's empowerment would be a follow up study to also capture the effects that take longer to materialise such as changes in intra-household labour divisions.

The case we studied, P'KWI, is an agricultural co-operative with a gender promoting approach. P'KWI is similar to other agricultural co-operatives or women groups when it comes to opening up economic opportunities, group formation and capacity building. P'KWI's unique gender promoting features include farmer to farmer extension, which often happens via women, a legacy as a women's self-help group, women leaders and role models, training in leadership for women, a non-confrontational household economy approach and auto-targeting activities such as poultry keeping or value addition for cassava. The study was neither designed to distinguish what elements of P'KWI's approach—the co-operative or the gender promoting features—contributed most to the empowerment of women nor to establish the extent to which decision making power, economic empowerment, social or human capital development have been mutually reinforcing. Probably the combination of the different features, the changes instigated by P'KWI in different domains and the negotiations about gender norms and roles in the space created by the organisation contributed to different aspects of women's empowerment (Agarwal, 1997; Kabeer, 1999). A comparative case study approach, comparing co-operatives with and without gender promoting features, could clarify the importance of the latter. One could also think of a factorial randomised control trial within co-operatives involving members in different combinations of general co-operative related and gender

promoting interventions. Mediation analysis could shed light on possible underlying causal chains by which certain aspects of empowerment are not (only) influenced by co-operative membership, but (also) by other intermediary variables, such as economic advancement.

In conclusion, supporting co-operatives in sub-Saharan Africa while minimizing the limitations of their contributions to women's empowerment is a sensible way to address gender gaps in agriculture and build sustainable, equitable and productive rural societies. Agricultural co-operatives can make a significant difference for women's empowerment, especially if they have a gender promoting approach that is pursued consistently. Changing intra-household gender roles proves difficult, but extra attention should be paid to ways to reduce women's excessive work burden and to enhance their control over income gained through the co-operative. Co-operatives should therefore keep the discussion about gender roles alive.

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Tables: **The impact of agricultural co-operatives on women's empowerment: Evidence from Uganda.**

Table 1: Descriptive statistics of pre-treatment characteristics

		Age				Proportion adult women household members			Proportion adult men household members			TLU			Land (acres)		
		N	Avg	St.Dev	t-value	Avg	St.Dev	t-value	Avg	St.Dev	t-value	Avg	St.Dev	t-value	Avg	St.Dev	t-value
Women	Member	107	40.07	12.09		.279	.142		.245	.119		2.60	3.33		5.50	4.92	
	Non-member	64	33.70	13.20	-3.15*	.294	.149	0.64	.242	.150	-.14	2.69	4.95	0.13	4.56	4.67	-1.25
Men	Member	69	42.52	13.53		.258	.111		.254	.138		2.66	3.56		7.16	7.11	
	Non-member	47	39.72	15.19	1.018	.282	.158	-.901	.302	.134	-1.871	2.59	2.64	0.121	7.13	7.51	0.02

Significance levels: *** = 0.001, ** = 0.01, * = 0.05, . = 0.1; Unmatched samples

Table 2: Impact of co-operative membership on economic wellbeing

y_{it}		A. Household food insecurity			B. Household basic need insecurity			C. Subjective wellbeing of the household			D. Tropical livestock units of the household			E. Housing quality (iron roof)		
		Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)
Constant	α	3.523	0.153	0.000 ***	3.612	0.138	0.000 ***	0.704	0.113	0.000 ***	1.243	0.755	0.100	0.258	0.098	0.009 **
x_i (member)	β	0.003	0.115	0.978	0.232	0.104	0.027 *	-0.243	0.086	0.005 **	0.901	0.571	0.115	0.112	0.074	0.131
T_t (period)	γ	-0.267	0.140	0.056 .	0.149	0.126	0.241	-0.129	0.104	0.215	-0.345	0.691	0.618	0.059	0.089	0.506
z_i (age)	θ	0.003	0.003	0.230	-0.003	0.003	0.228	-0.002	0.002	0.416	0.011	0.014	0.415	-0.003	0.002	0.063 .
m_i (men)	α'	-0.385	0.246	0.118	-0.028	0.218	0.897	-0.067	0.179	0.708	-0.033	1.190	0.978	-0.351	0.154	0.023 *
$m_i \times x_i$	β'	0.347	0.182	0.057 .	-0.214	0.162	0.188	-0.140	0.133	0.292	-0.754	0.885	0.395	-0.036	0.115	0.756
$m_i \times T_t$	γ'	0.265	0.216	0.220	-0.215	0.194	0.267	-0.085	0.159	0.595	0.508	1.058	0.631	-0.059	0.137	0.664
$m_i \times z_i$	θ'	0.000	0.004	0.952	0.005	0.004	0.235	0.001	0.003	0.707	0.019	0.021	0.369	0.007	0.003	0.009 **
$x_i \times T_t$	**δ**	-0.284	0.163	0.082 .	-0.494	0.148	0.001 ***	0.456	0.121	0.000 ***	0.219	0.807	0.786	-0.003	0.104	0.975
$m_i \times x_i \times T_t$	**δ'**	-0.352	0.255	0.168	0.112	0.229	0.626	0.381	0.188	0.043 *	0.788	1.250	0.529	0.076	0.162	0.640
Valid N members Women		107			107			107			107			107		
Valid N members Men		69			69			69			69			69		
Valid N non-members Women		39			39			39			39			39		
Valid N non-members Men		28			29			29			29			29		

A.	B.	C.	D.	E.
Residual standard error: 0.617 on 477 degrees of freedom	Residual standard error: 0.5586 on 478 degrees of freedom	Residual standard error: 0.4584 on 478 degrees of freedom	Residual standard error: 3.051 on 478 degrees of freedom	Residual standard error: 0.3947 on 478 degrees of freedom
Multiple R-squared: 0.1642, Adjusted R-squared: 0.1484	Multiple R-squared: 0.09719, Adjusted R-squared: 0.08019	Multiple R-squared: 0.1689, Adjusted R-squared: 0.1532	Multiple R-squared: 0.05061, Adjusted R-squared: 0.03273	Multiple R-squared: 0.04366, Adjusted R-squared: 0.02565
F-statistic: 10.41 on 9 and 477 DF, p-value: 9.549e-15	F-statistic: 5.718 on 9 and 478 DF, p-value: 1.505e-07	F-statistic: 10.79 on 9 and 478 DF, p-value: 2.527e-15	F-statistic: 2.831 on 9 and 478 DF, p-value: 0.002967	F-statistic: 2.424 on 9 and 478 DF, p-value: 0.01064

Significance levels: *** = 0.001, ** = 0.01, * = 0.05, . = 0.1; Matched samples; Standard errors corrected for clustering within individuals

Table 3: Household income sources

Household income source:	Staple crops	Sunflower	Other crops	Poultry	Livestock	Commercial	Salary	Casual labour	Pension	Remittances	Avg nbr income sources	StDev	t-value	N
Women members	89.7%	73.8%	74.8%	55.1%	6.5%	35.5%	7.5%	31.8%	0.9%	60.7%	4	1.5	3.23**	107
Women non-members	78.1% .	37.5% ***	62.5%	32.8% ***	4.7%	40.6%	0.0%	29.7%	1.6%	57.8%	3.1	1.9		64
Men members	91.8%	78.1%	74.0%	71.2%	11.0%	32.9%	9.6%	41.1%	2.7%	46.6%	4.6	1.5	1.78 .	73
Men non-members	73.9% *	48.9% ***	76.6%	61.7%	8.5%	36.2%	12.8%	61.7% **	2.1%	40.4%	4.1	1.5		47

Significance levels: *** = 0.001, ** = 0.01, * = 0.05, . = 0.1; Unmatched samples

Table 4: Impact of co-operative membership on agronomic knowledge, adoption of practices and social networks

y_{it}		A. Knowledge on how to improve agricultural production			B. Use of innovative or new farming techniques			C. Use of improved seeds			D. Visits			E. Membership of groups, associations (Excl. P'KWI)		
		Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)
Constant	α	0.721	0.099	0.000 ***	0.853	0.108	0.000 ***	1.258	0.164	0.000 ***	2.485	0.717	0.001 ***	0.134	0.212	0.529
x_i (member)	β	-0.384	0.074	0.000 ***	-0.420	0.081	0.000 ***	0.086	0.124	0.489	0.683	0.542	0.208	0.094	0.160	0.559
T_t (period)	γ	0.010	0.090	0.913	-0.277	0.099	0.005 **	0.446	0.150	0.003 **	0.653	0.655	0.319	0.317	0.194	0.103
z_i (age)	θ	-0.002	0.002	0.301	-0.001	0.002	0.617	-0.005	0.003	0.112	0.011	0.013	0.406	0.001	0.004	0.784
m_i (men)	α'	-0.332	0.155	0.033 *	-0.314	0.174	0.071 .	-0.113	0.258	0.662	1.594	1.130	0.159	-0.029	0.334	0.931
$m_i \times x_i$	β'	0.142	0.116	0.221	0.092	0.128	0.473	0.166	0.192	0.390	-0.738	0.843	0.382	0.261	0.249	0.294
$m_i \times T_t$	γ'	0.363	0.138	0.009 **	0.377	0.154	0.015 *	0.394	0.230	0.087 .	-0.573	1.004	0.568	0.323	0.297	0.277
$m_i \times z_i$	θ'	0.002	0.003	0.505	0.000	0.003	0.876	0.002	0.005	0.719	-0.003	0.020	0.886	-0.001	0.006	0.823
$x_i \times T_t$	**δ**	0.598	0.105	0.000 ***	0.651	0.115	0.000 ***	0.405	0.175	0.021 *	0.016	0.766	0.983	0.235	0.227	0.301
$m_i \times x_i \times T_t$	**δ'**	-0.188	0.163	0.249	-0.041	0.181	0.821	-0.274	0.272	0.314	0.725	1.190	0.543	-0.208	0.351	0.554

Valid N members	Women	107			107			107			106			107		
	Men	69			69			69			67			69		
Valid N non-members	Women	39			39			39			39			39		
	Men	29			28			29			29			29		

A.	B.	C.	D.	E.
Residual standard error: 0.3982 on 478 degrees of freedom	Residual standard error: 0.4355 on 476 degrees of freedom	Residual standard error: 0.6625 on 478 degrees of freedom	Residual standard error: 2.894 on 472 degrees of freedom	Residual standard error: 0.8568 on 478 degrees of freedom
Multiple R-squared: 0.3657, Adjusted R-squared: 0.3538	Multiple R-squared: 0.2331, Adjusted R-squared: 0.2186	Multiple R-squared: 0.3201, Adjusted R-squared: 0.3073	Multiple R-squared: 0.04654, Adjusted R-squared: 0.02836	Multiple R-squared: 0.1281, Adjusted R-squared: 0.1117
F-statistic: 30.62 on 9 and 478 DF, p-value: < 2.2e-16	F-statistic: 16.07 on 9 and 476 DF, p-value: < 2.2e-16	F-statistic: 25.01 on 9 and 478 DF, p-value: < 2.2e-16	F-statistic: 2.56 on 9 and 472 DF, p-value: 0.007001	F-statistic: 7.803 on 9 and 478 DF, p-value: 9.229e-11

Significance levels: *** = 0.001, ** = 0.01, * = 0.05, . = 0.1; Matched samples; Standard errors corrected for clustering within individuals

Table 5: Impact of co-operative membership on decision making power and intra-household labour divisions

y_{it}		A. Decision making power in household			B. Decision making power in groups			C. Decision making power in community			D. Women's domestic workload			E. Women's farm-related workload		
		Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)	Est	SE	Pr(>|t|)
Constant	α	0.326	0.079	0.000 ***	0.710	0.103	0.000 ***	0.770	0.105	0.000 ***	3.671	0.195	0.000 ***	2.660	0.257	0.000 ***
x_i (member)	β	-0.167	0.059	0.005 **	-0.471	0.078	0.000 ***	-0.405	0.080	0.000 ***	-0.107	0.144	0.458	-0.101	0.190	0.593
T_t (period)	γ	0.426	0.072	0.000 ***	-0.446	0.095	0.000 ***	-0.505	0.096	0.000 ***	-0.122	0.176	0.489	0.208	0.232	0.372
z_i (age)	θ	0.000	0.001	0.880	0.001	0.002	0.682	0.000	0.002	0.881	0.022	0.004	0.000 ***	0.024	0.005	0.000 ***
m_i (men)	α'	-0.273	0.124	0.028 *	-0.198	0.163	0.225	-0.485	0.166	0.004 **	0.122	0.301	0.687	-0.602	0.397	0.131
$m_i \times x_i$	β'	0.147	0.092	0.111	0.082	0.121	0.500	0.269	0.123	0.030 *	0.110	0.209	0.599	0.126	0.276	0.649
$m_i \times T_t$	γ'	0.494	0.110	0.000 ***	0.646	0.145	0.000 ***	1.118	0.147	0.000 ***	0.096	0.252	0.704	-0.267	0.333	0.424
$m_i \times z_i$	θ'	0.001	0.002	0.709	-0.001	0.003	0.831	0.000	0.003	0.891	-0.010	0.006	0.069 .	-0.008	0.007	0.293
$x_i \times T_t$	**δ**	0.322	0.084	0.000 ***	0.950	0.110	0.000 ***	0.807	0.112	0.000 ***	0.013	0.204	0.949	-0.099	0.268	0.713
$m_i \times x_i \times T_t$	**δ'**	-0.343	0.130	0.009 **	-0.397	0.171	0.021 *	-0.667	0.174	0.000 ***	-0.084	0.296	0.777	0.142	0.391	0.717
Valid N members	Women	107			107			106			81			81		
	Men	69			69			69			62			62		
Valid N non-members	Women	39			39			39			30			30		
	Men	29			29			29			25			25		

A	B	C	D	E
Residual standard error: 0.3173 on 478 degrees of freedom	Residual standard error: 0.4175 on 478 degrees of freedom	Residual standard error: 0.4248 on 476 degrees of freedom	Residual standard error: 0.6502 on 387 degrees of freedom	Residual standard error: 0.8573 on 387 degrees of freedom
Multiple R-squared: 0.6047, Adjusted R-squared: 0.5972	Multiple R-squared: 0.3147, Adjusted R-squared: 0.3018	Multiple R-squared: 0.2897, Adjusted R-squared: 0.2763	Multiple R-squared: 0.107, Adjusted R-squared: 0.08626	Multiple R-squared: 0.2271, Adjusted R-squared: 0.2091
F-statistic: 81.24 on 9 and 478 DF, p-value: < 2.2e-16	F-statistic: 24.39 on 9 and 478 DF, p-value: < 2.2e-16	F-statistic: 21.57 on 9 and 476 DF, p-value: < 2.2e-16	F-statistic: 5.154 on 9 and 387 DF, p-value: 1.296e-06	F-statistic: 12.64 on 9 and 387 DF, p-value: < 2.2e-16

Significance levels: *** = 0.001, ** = 0.01, * = 0.05, . = 0.1; Matched samples; Standard errors corrected for clustering within individuals

Table 6: Overview of the empirical support for the hypotheses about P'KWI's impact

Hypotheses about the effect of women's membership of P'KWI	Observed effects of women's membership of P'KWI	Hypothesis: Benefits from P'KWI membership are greater for women than for men (4) — Observation
Positive impact on women's capabilities, more specifically on		
- Economic wellbeing (2.a.)	CONFIRMED - Reduced household food insecurity and basic need insecurity	CONFIRMED - Similar reduction of household food insecurity and basic need insecurity among men as among women
	- Increased subjective household wellbeing	UNCONFIRMED - Larger positive impact on subjective household wellbeing among men than among women
	UNCONFIRMED - No effect on household asset holding, measured by tropical livestock units and roof type.	*(Similarly, no effect among men)*
- Livelihood diversification (2.b.)	CONFIRMED - Women P'KWI members report more diversified sources of household income than women non-members	*(Similar positive effect among men)*
- Agronomic knowledge and practices (2.c.)	CONFIRMED - Positive impact on women's knowledge in improving agricultural production - Positive impact on adoption of innovative farming techniques despite a negative trend - Positive impact on the use of improved seeds adding to a positive trend	CONFIRMED - Similar, but among men, membership contributed to an overall positive trend in agronomic knowledge, improved seeds and adoption of innovative practices
- Social networks (2.d.)	UNCONFIRMED - No effect on social networks, measured by the number of social exchanges and memberships of organisations	*(Similarly, no effect among men)*
Positive impact on women's decision making power and their ability to influence decisions		
- At the household level (1.a.)	CONFIRMED - Positive impact on women's power and ability to influence decisions at the household level - P'KWI membership boosts positive trend in women's decision making power in the household - Effect at household level is smaller than at group and community level	CONFIRMED - Negative impact on decision making power at the household among men
- At the group level (1.b.)	CONFIRMED - Positive impact on women's power and ability to influence decisions at the group level - P'KWI membership compensates a negative trend in women's decision making power in groups for women	CONFIRMED - Impact of membership on decision making power at the group level is smaller for men than for women despite a positive trend
- At the community level (1.c.)	CONFIRMED - Positive impact on women's power and ability to influence decisions at the community level - P'KWI membership compensates a negative trend in women's decision making power in the community	CONFIRMED - Impact of membership on decision making power at the community level is smaller for men than for women despite a positive trend
More gender equitable intra-household labour division for - Farm-related activities (3.a.)	UNCONFIRMED - No significant effect on the intra-household divisions of farm-related work	*(Similarly, no effect among men)*
- Domestic activities (3.b.)	UNCONFIRMED - No significant effect of women's membership of P'KWI on the intra-household divisions of domestic work	*(Similarly, no effect among men)*