COALITION-BUILDING FOR WOMEN'S EMPOWERMENT IN AFRICA'S INFORMAL SECTOR: TOWARDS PROMOTING EQUALITY

QUEENSLEY C. CHUKWUDUM
University of Uyo,
Department of Insurance and Risk Management, Uyo,
Akwa Ibom State, Nigeria.

Abstract
African women working in the informal sector are in the majority nevertheless, their national and regional impact is minimal as they do not exert significant sustainable influence within their individualized spaces. This has further constrained their ability to expand and form consolidated networks across borders with women of like-minds, even though agriculture presents a common ground for this kind of cooperation. This study first highlights a number of local women's organizations in Africa and further proposes a graded model on how African women's cooperatives/associations can maximize their benefits by forming coalitions across their respective national borders with the aid of a digital platform as the space of interaction. A simple simulated illustration is further presented to showcase how cooperative game theory can be used to model the beneficial impact of cross-border coalitions.

Keywords: Gendered spaces, game theory, grand coalition, African women's cooperatives.

1.0 INTRODUCTION

The informal sector globally, employs over 60% of all those who are working (International Labour Organization (ILO), 2018). Sub-Saharan Africa's (SSA) case is much higher at over 90% (International Monetary Fund (IMF), 2017). In Africa, women and girls make up more than 70% of those in this sector, mainly working within the agriculture and domestic worker sectors. The ILO (2018) estimates that more than 95% of women are in the informal sector in more than half of the countries in SSA. Given that most of these women come from poor households coupled with other multiple stress points such as climate change, cultural biases and stereotypes surrounding their gender-specific roles, limited access to financial services and to owning assets, as well as low opportunities for education and skills development, women in Africa are even more constrained economically and socially. This not only puts a heavy strain on their families (Olu-Owolabi et al., 2020) but also on the society at large.

Nevertheless, the African woman has continued to strive through all these major hurdles. For instance, the OECD, Sahel and West Africa Club (2019) noted that women's role in west Africa is central as the significantly contribute to the region's food economy including commerce and trade across borders. Akyeampong and Fofack (2013) also studied the contributions of African women to the continent's economy from a historical perspective. They concluded that it was both positive and significant although the impact varied from country to country. Kiteme (1992) brought to light the contributions to national development of Kenya's rural market women.

The emphasis laid on the economic empowerment of the African woman in recent years is strongly rooted in research as expressed by the International Center for Research on Women (2011). Some of the reasons they pointed out include the fact that empowering women enables them to attain their highest potential; gives them the boldness to claim their rights; causes markets and businesses to flourish; adds significantly to the national economy given that the size of women in the population is substantial. Furthermore, the advancement of sustainable development is another key benefit to empowering women noting that women financially invest in their children more when they are buoyant materially.

Several measures have been proposed and others have been implemented in a bid to empower the African woman given that it also promotes their health outcomes (Oyebanji, 2023). Some of them include the development of women's skills augmented with continous training (Adams et al., 2013); the strengthening of legal and environmental frameworks to allow women easily gain access to loans and other financial resources (Golla, 2015; Daniels, 2013); creating more room (including technology rooms) for women in decision-making spaces (Kinyanjui, 2014; Chichester, 2017; Ikpa, 2023); building stronger women's coalitions and using their networks to propagate the important role of women in the society through workshops, market meetings etcetera. (Klaa, 2020).

Although the concept of networking is pervasive, very few academic research works have focused on the study of coalition-building along with the numerous benefits it provides to African women in the informal sector. Fish (2006) critically examined how individual domestic workers in South Africa collectively organized themselves into a union. This triggered a series of events which finally led to the inclusion of the domestic sector in the country's unemployment insurance scheme. This was one resounding victory over the then existing apartheid legacies. Nanfosso (2016) examined the relationship between trade union and the informal sector in Cameroon and a few other African countries, with special focus on addressing both women and child labour challenges. Kamm (2016) narrated in detail how the Lagos women's association in Nigeria deployed stringent measures such as protests, editorials and petitions in order to coerce the British colonial officers to rescind the regulations they had placed on food prices during world war II. The author highlighted the use of both economic and political strategies by the market women. A different perspective was presented by Nwankwo (2019) showcasing the power dynamics existing within Lagos market spaces (specifically, the Oke Arin market) which are dominated by women but controlled by men given that most of the market administrators are males. This factor totally changes processes relating to market governance; political leanings along ethnic lines; clean water and sanitation; regulatory procedures; ownership rights and the ability to gain access to shops and stalls amongst others. Owing to the latter, the author narrated personal experiences of women who had had to renegotiate or move out of their shops because they were stripped off of any ownership rights.

With no particular reference to the female gender, Onyishi et al. (2021) canvassed the idea of African urbanism within the context of the informal sector. They advocated for the integration of collective organizations and community units into the urban governance structure as a means to curtail the devastating impact of COVID-19. In the same vein, Dibben and Nadin (2011) investigate the employment of community unionism in Mozambique's informal sector and its subsequent benefits.

From the foregoing, two gaps have been identified. Firstly, a subregional integration of women in the informal sector is largely not documented in research literature. A possible explanation for this may lie in the fact that there is none existing despite the significant amount of cross-border trade and commerce that takes place in Africa. Secondly, a quantitative simulation showing how women coalition groups could maximize their benefits if they remained in the grand coalition has not been undertaken. Thus, this study proposes a regional-wide, community-driven grand coalition of women in the informal sector which is structured on a graded system. This takes into account all the individual benefits of coalition-building observed in literature and attempts to integrate them under the graded model. Furthermore, to showcase the changing structure of a given coalition with respect to expected payoffs as it moves from a sub-coalition to the grand coalition, a three-player game technique is implemented with the aid of the R programming language.

The rest of the paper deals with a brief overview of different local women's organization in Africa in section 2. Section 3 reviews the theory of gendered spaces and the cooperative game theory model. Section 4 proposes the grand coalition structure while section 5 provides a simple illustration of a three-player game and the attendant policy implications. Section 6 concludes.

2.0 LOCAL WOMEN'S ORGANIZATIONS IN AFRICA

Lodiaga (2020) has pointed out that women's only cooperatives operating in many developing countries often operate   individually. This keeps them isolated within the informal economy and constricts their benefits to only marginal gains. The author highlights the need for these small cooperatives to join forces in order to expand and strengthen their economic, social and political leverage. In this section we briefly study different women's associations and cooperatives in different parts of Africa. Studies in literature covering these sort of African-oriented organized women informal groups are very few.

PagSung Shea Butter and Shea Nut Pickers Association (PASNSPA), Ghana
This cooperative was established in 2008 by the poorest women living in the Northern, Upper East and Upper West regions of Ghana. It has now grown to cover over 30 communities having over 1500 members who mainly process shea butter and pick shear nuts. However, the association has expanded its activities to include rice processing, oil extraction, dawadawa processing, neem oil extraction, shea soap corn flour among other agro processing (PanSung association, 2021). Noting that the Shea tree has a life span of 200-400 years, it implies that it is a generational plant which can provide income for many families because its product (shea butter) is used in industries such as the cosmetic and, pharmaceutical industries. Sadly, those who produce/harvest the shea butter make small gains when compared to the profits raked in by the industries. In order to to mitigate this problem, PASNSPA has forged an alliance with the Self Employed Women's Association (SEWA) in India with the goal of increasing processing, production and export of shea nuts. This resulted in the establishment of new marketing plans (Nanavaty, 2018).

Femmes en Action ("Women in action"), Mali
This multifunctional cooperative is made up of more than 1500 women mostly and a few men in Mali headquartered in Bamako. There are about 39 branches present in the country mainly targeted at defending the interests of the women's and their socio-economic empowerment. The members primarily undertake cereal processing and fishing. An innovative move by the women is the participation in soil-less agriculture given the scarcity of cultivable land in Mali. A few of them are into horticulture, fabric dyeing, sewing and pottery making. (Nanavaty, 2018; RFI, 2015).

Femmes Vaillantes of Anié, Togo
This cooperative was created in 2007 by 12 farmers. The president of the association is Ebiro Kadokalih and their main goal is in the production of premium parboiled rice. The women of this association have received training from the West Africa Agricultural Productivity Program (WAAPP) which has seen their output triple in recent times. (Dossavi, 2020)

P'KWI, Uganda
Founded in 1993 by 12 women, this cooperative was initially set up to cater for women who had been traumatized and impoverished by the atrocities of war caused by the insurgency in the region of Teso in Uganda. However, it grew beyond a self-help group, transformed into a registered cooperative society in 2009 and has now become a well-established, recognized farm organization catering to about 2500 households with females being the majority (Lecoutere, 2014). According to Lecoutere (2012) P'kwi was able to extend its network through group formation, value addition, capacity building and knowledge exchange. For example, three geographical sub-clusters (Kachumbala, Kabarwa and Kolir) make up the P'kwi community where capacity building is a key component of the groups in each cluster. This organization has well established formal structures such as management and board directors enabling them to garner influence in local, religious and political circles in Uganda, hence the women are able to influence decisions within their communities and households. They were recognized by the president of Uganda Yoweri Kaguta Museveni who donated a sum of 15million shillings for the purchase of a service van in order to transport P'kwi products (P'kwi Cooperative, 2021).

Other key strengths of P'kwi include internship programs for training students and established partnerships with agriculture-related research institutes such as the National semi – arid research institute (NASARI) and Makerere University in Uganda.

Nronga Women's Diary Cooperative Society, Tanzania
This cooperative was established in the 1980s under the women's ruling party UWT as a means to promote the advancement of the women of Tanzania. It became a formal full-fledged cooperative in 1994 when it was duly re-registered. They main goal was to aid women market milk and distribute dairy products given that the males were the dominant owners of cattle. Moreso, market opportunities for milk sales was quite low and the women faced hazardous incidents (like drowning in the river connecting their homes to the main market) in a bid to sell their products. To better manage these risks, the women decided to collect all their milk in the evening or very early in the morning and store them in large cooling containers. In the morning the unpasteurized milk is then put into smaller containers and distributed to markets, institutions, hotels and individuals. This move not only kept the women safe but increased their income and output. Currently, the Cooperative's effort has now put the Nronga region on the map as a major area for milk production in northern Tanzania (Msonganzila, 2013).

Kamanga Women's Multipurpose Cooperative Society, Tanzania
This was another creation of the UWT women's political party in the 1970s catering to the needs of the rural women who sell cooked food at the Kamanga port, on the shore of Lake Victoria in Mwanza region. It was registered in 1994 and became a full-fledged cooperative. They women in the group have diversified their food-selling activities into other related projects such as owning a cereal milling machine and a restaurant. Their membership format is by inheritance which allows only the daughter(s) of a deceased member to take over the membership vacuum created (Msonganzila, 2013).

Igbo Women's Association, Nigeria
In Nigeria, the married Igbo women in the south eastern region (Imo, Anambra, Abia, Enugu, Ebonyi, Delta and Rivers States) have organized themselves into different clusters of community-related associations (mainly called Umuada). For example in Anambra state, different local government areas (as well as smaller clusters such as clans) have their specific women's organizations who meet regularly to promote their culture and help one another undertake major ceremonies such as marriages, child births and burials of their members. This socio-cultural group is now registered. The women's occupation range from informal (farmers) to formal (civil service) careers. The beauty of these associations is that it is established in any part of the world where these women find themselves. This helps to keep them grounded and connected to their roots.

Usually, once a year in the month of August, all the women within this region who are existing under this umbrella are expected to travel back to the eastern part of Nigeria from wherever they are situated globally. This is a summit popularly known as 'August Meeting' (AM). According to Anyaegbu and Nwamaka (2010), this so-called 'Mothers' Summit' is a grand meeting that lasts for days in which the women deliberate on issues bordering on community development and the promotion of the pride of womanhood. Some of the initiatives include ways to raise funds to build clinics, secondary schools, civic centers and the likes. AM has now become a force to reckon with and several governments in the region have partnered with the women's group. A few studies have been conducted to assess the socioeconomic impact of the women's AM in the region. Nwezi and Nkechi (2014) investigated some selected communities in Anambra state with the aim of determining if the training in the skill acquisition program and the provision of soft loans (organized by the AM) has enhanced the income of the community residents. Their result was positively significant and the authors recommended the need for more government support to the women's AM. A similar study was conducted by Ebue and Onyeze (2012) to ascertain the level of community development that the women's AM had undertaken in Enugu state. Their conclusions reveal that the women have made strides in developing their communities through the building of town halls, the rehabilitation of broken-down schools and civic centers and the establishment of markets. Ohaegbuchi (2014) on the other hand argued, within the context

of the social responsibility theory, that the involvement of the women's AM in community development issues will promote peace and sustainable good governance.

Maximizing the women's benefits: Identified Common Grounds and Barriers
In summary, it can be noted that the African woman's space is generally tied to the agricultural sector. This common theme cuts across most of the cooperatives/ associations thereby implying that it is easier for the women to maximize their benefits across borders within this sector. Presently however, the findings confirm Lodiaga's (2020) assertion on individualized engagements. One that stands out differently in this regard is the Igbo women's association. They showcase some form of national coalition of all the women from one of the three major regions in Nigeria.

Furthermore, these cooperatives/associations barely have a notable presence on the internet. For example, only P'kwi Uganda has a fully functional website. In the case of the Igbo women's association, no website was found (to the best of the author's knowledge) of the women's association even at state level. This significant lack of public presence highly constricts the women's voices and their ability to consolidate their gains by combing forces with other like-minded associations in other African countries.

3.0 APPLIED THEORY AND TECHNIQUE

Theories on gendered spaces
The concept of gendered spaces refers to areas where specific genders of people along with specific gender expressions are either welcomed or deemed appropriate or not appropriate, hence not welcomed The interaction-based social theory by Goffman (1979) lays emphasis on space as social systems of interaction which breeds the need for the control of settings. Thus, the gendering of spaces or landscapes is a means of organizing gender, a way of reinforcing the differences between a man and a woman. Rosaldo (1980) and Ryan (1990) describe the public realm as both a political construct and a physical space. Those in the public have the ability to create influence on their environments, and in general the economy.

Spain (1992) put this theory to test, that is, the adverse impact that compulsory gender segregation in different spaces such as homes, schools, and workplaces has on the status of women in relation to men. The author's result revealed that women who are regulated to certain dwellings especially in non-industrial societies, possess a lower status in the society. In a similar vein, Rocheleau et al. (1996) explores how strict divisions of space, particularly in agricultural settings give rise to a greater degree of inequality. The relationship of men and women with respect to farmland ownership significantly shapes the associated roles of, and relative power exerted by men and women. This is a clear reflection of what takes place in Africa given that agriculture is the main employer of labour on the continent. While men are the ones who own the land, women are the ones who undertake the farming activities and the sale of crops after harvest - mostly the basic household staples. A deeper focus on the type of crops planted reveal that men are in charge of cash crop farming which inevitably give them more control over household finances since cash crops are more economically viable food products (Rocheleau et al., 1996).

With this type of deep-rooted skewed power dynamics proliferating the agricultural sector in Africa, it can therefore be concluded that there is a low possibility of realizing agro-based industrialization which has been emphasized by the African Development Bank (AFDB, 2015) as the most viable way to achieve poverty reduction in Africa. This implies that women within the agricultural space in Africa have to be given a proportional amount of significant power, since their growth in terms of status and finance has a direct impact on their children, their families and by extension, providing a sustainable economic growth within a more peaceful society. Gender-sensitive policies can be established to this end. In the following section (section 4), the construction of a cross-border coalition of women in the informal/semi-formal sector, operating within a digital space is proposed to help resolve the inequalities exacerbated by the absence of African women's presence in spaces that empower them.

Game theory
Morgenstern and Neumann (1953) were the pioneers of game theory which is a framework created for constructing social relations that involve competing players and the science underlying the strategic decisions they take as the interact. Initially, however, the theory was developed to study economic behaviours within large spaces like firms and markets. Non-cooperative and cooperative games are the two main branches of game theory. In this study, the latter is applied. According to Churkin et al. (2021) cooperative games involve sharing the benefits accruing from the collaborative efforts of the respective participants. The implication of this is that by providing an enabling environment where utility can be transferred (mostly in monetary terms), the players are able to compensate one another.

The sharing formula is usually based on some rational and obvious principles either through binding written or oral agreements. Their study examined the cooperation in (energy) power systems with the aid of cooperative game theory. Repeated games theory highlights how mutual help and cooperation can be sustained via repeated interaction and cooperative solutions to allocation problems. The basic assumption in cooperative game theory is that the grand coalition which is the group consisting of all players, will form. A game where utilities can be transferred is referred to as transferable utilities or TU-games.

Let $N \in \mathbb{N}$ represent the set of participants. Then the characteristic function v is the function which assigns a real number to each subset of participants (or coalition) denoted by Q contained in N. Thus for each $N \in \mathbb{N}$, the pair (N, v) with v defined by $v: 2^N \to \mathfrak{R}$ is called a TU-game. $v(Q)$ represents the worth of the coalition, that is, the amount that the participants can guarantee themselves if they work together. This means that if they do not cooperate, they will not benefit $(v(\emptyset) = 0)$.

Suppose we have a pair of coalitions $P, Q \subset N$, with $P \cap Q = \emptyset$. The grand coalition G consists of all the players present in the coalition game. For a grand coalition to form, the worth of forming the coalition should exceed the worth generated if the individual participants work independently (that is, $v(P \cup Q) \geq v(P) + v(Q)$). This is called the supper additive property.

The Shapley value presents a solution for TU-games. It is used to compute marginal level contribution or worth at the individual level using the characteristic function $v(Q)$ of the game (N, v). The Shapley value for player i is given by

$$x_i = \varphi_i(v) = \sum_{Q \subseteq G \setminus \{i\}} \frac{|Q|! \, (N - |Q| - 1)!}{N!} \, (v(Q \cup \{i\}) - v(Q))$$

Solution techniques, other than the Shapley value, exist as well. TU-cooperative games have been applied to understand the cooperation between political parties with the goal of forming coalition governments and between countries for example the European Union and the United nations (Bullock, 1996; Hermans et al., 2012). In section 5, a coalition is simulated between women drawn from the informal sector of three countries in the Francophone west African region - Benin (Cotonou), Burkina Faso (Ouagadogou) and Senegal (Dakar) to illustrate the benefit of cooperation across borders.

4.0 THE GRAND COALITION: A GRADED MODEL CONCEPT

The general structure of the scheme
First, it is important to also note that the scheme will not allow for individual entry. A woman can only join grand coalition through her local association, organization or union. That is, she must first be a member of any valid and verifiable community in the informal sector because the scheme only caters to the integration of community ecosystems. However, a woman would possess her own unique identity once on the platform. A graded model is adopted. Four major levels of participation exist (with levels one, two and three having two to three 'in-level' steps).

Level zero (base level)
This is the pool of unemployed women who are looking for jobs or are ready to participate in vocational training programs or employment creation schemes.

Level one
Level 1 step 1 will accommodate the women who fall below the lowest income threshold (which will be determined based on the NEEDS assessment). Here, a woman is provided with incentives such as a livestock to rear (for a woman in the Agric sector) or raw materials (for those in the textile sector) or even equipment like a sewing machine in order to motivate her and provide her with an extra source of income. In a situation where a woman's reputation score has not yet been established, the women can be grouped into small groups of 3-5 women. They will be given the incentives and they are expected to earn using the strategy of shared turnover. They will also receive regular skills training that will improve their abilities. This will mostly be organized at the community level.
An in-kind contribution is given in exchange. The women must agree to keep their children (especially their girl child) in school. They are also expected to regularly take their children for health checks. For those who do not have children, other in-kind contributions such as community works and voluntary services will be assigned to them (based on the NEEDS assessment).

Remarks: Ensuring that girls are kept in schools will go a long way in reducing child labour and early child marriages. The 'on-the-ground' communities will monitor and ensure that the women keep to the rules of the scheme.
Level 1 step 2 will require, in addition to step 1, that each woman makes a small financial contribution to the general savings pool.
Level 1 step 3: At this level, it is expected that the woman's income has stabilized a bit and she is making a higher level (than step 2) of contribution into the general savings pool.

Level two
This is the asset acquisition level. Step 1 and step 2 differ in the number and size of loans a woman can receive. This will be based on her credit ratings and reputation score. Loan groups and cooperatives within the scheme can serve as the first lending partners. A woman in this level is eligible to obtain sufficient loans to enable her purchase an asset such as land, house etc.
A higher contribution (than level 1) into the saving pool is expected. Those in this level will be provided with opportunities to reskill/upskill.

Remarks: Community supervision is key to ensuring that the loans are specifically used to purchase the needed asset.
Repayment patterns are tracked. They will have a significant impact on a woman's reputation score.
Research has shown that the ability of a woman to own her own asset (which is not through a relationship with a male relative) makes her more resilient to displacement and exploitation. It improves her status and increases her participation in household decision making.

Level three
This is the human capital investment / community goodwill level. This level houses women with higher incomes within the informal sector in West Africa. Here, a woman is expected to contribute in the following ways:
1. Train other women (up to 3 by the third step and possibly more if one wants to go further)
   These apprentices will be chosen from the pool of unemployed women in the scheme (level zero)
2. Act as angel investors
   They will invest in start-ups. That is, in women who have just graduated from a vocational or apprenticeship training and are ready to start their own business.

3. Incentive providers
    In collaboration with ECOWAS, they will also participate in providing incentives to those women in level 1 step 1. Other options include lending out their assets to say, women who are about to give birth. The expecting mothers can rely on the asset as a source of extra income (say, an asset that can be hired out) during the first few months after birth.
4. Community goodwill
    This involves investing in the growth of both offline and online communities. Community projects such as borehole drilling to provide clean drinking water, makeshift clinics especially during emergencies etc are some of the projects that can be accomplished by an individual or a group of women within this level.

A much higher level (than level 2) of financial contribution into the general savings pool is required.
A core benefit of being in this level is having the opportunity to serve in a leadership position within the scheme. The grade of leadership will vary based on the step number (1, 2 and 3) a woman is on. Women in this level will also have access to higher level trainings on leadership, business etc.

Digital enablers
1.Digitization of the women's data
The first critical step is to identify the women. Biometric identification will be made use of. Their names, fingerprints and facial photographs will be collected. Each woman will receive an ID card to prove that she is a member of the scheme.

2. Digitization of the profiles of the women on a digital platform
This is needed for a network around both similar and dissimilar businesses. It will take the form of an e-commerce/ social media platform.
The women will be able to track theirs and other women's credit histories, reputation scores, information about the current level a woman is on and her business economic inputs and outputs. This type of longitudinal data is needed for growth within the different value chains on the platform. Buyers can get information on the price, availability and the actual quantity of goods present. Sellers can get information on who needs their products, lenders can get information on the credit worthiness of each woman etcetera.
These digital profiles can also be assessed offline through an e-catalogue. Furthermore, excerpts can be made available in the form of handbooks.

3. Mobile money account
With the aid of biometric authentication, financial transactions can be carried out by the women on the established mobile money platform for the scheme. One in which it is easy to transfer both in local and foreign currencies.
Other more traditional options like banks will also be made available. The women will be provided with smartcards with which they can use to either make contributions to the scheme or withdraw payments.

4. Blockchain technology
Given that subgroups are allowed to thrive within the grand coalition among women who share similar ideas or businesses, the use of blockchain for business will be encouraged within the subgroups that are majorly formed for business transactions, peer-to-peer lending or for asset pooling.
This will allow for transparency and accountability in the system. The women will also be able to build their credit ratings.

5.0 THREE-PLAYER COALITION GAME: AN ILLUSTRATIVE EXAMPLE

Data was obtained from Benjamin and Mbaye's (2012) report on the informal sector within the French-speaking regions of Africa. This is the latest data available with in-depth statistics on the informal sector for a major region within Africa (to the best of the author's knowledge) with sources ranging from the World Bank to country-specific industry reports. Three countries in the Francophone west African region were highlighted - Benin (Cotonou), Burkina Faso (Ouagadogou) and Senegal (Dakar). In addition the informal sector is divided into small and large informal sectors. The empirical analysis makes use of the GameTheory R package by Cano-Berlanga et al. (2017).

Assumptions: These have been simplified for easy computation.

1. The monthly salary per person for each considered country from the informal sector is taken as the income value or expected payoff. Both the large informal and small informal statuses are accounted for and only the data for the percentage of those earning less than 35000 CFA Franc (CFAF) are used. No expenses are assumed

2. Since research indicates that women are more in the informal sector in West Africa, a conservative proportion is adopted, that is 60%. For instance, in Cotonou 44% of individuals in the large informal sector receive less than 35000 CFAF as indicated by the data (see Table 3.13, Benjamin and Mbaye's, 2012). Thus, 60% of 44% will give 26.4% which is set as 27 women in this category. Similar computation for the other countries are shown in Table 1.

3. Coalitions can be formed within borders (national coalitions) or across borders (regional coalitions). It is assumed that for a regional coalition, the expected payoff will be maximized based on the combined country-specific informal sector GDP contributions. In other words, the expected combined payoff increases by the average proportion of the informal sector's contribution to their respective (that is, each country's) GDP.
For example, from the data, the percentage contribution of the informal sector to the GDP of Benin and Senegal are 70% and 49% respectively. Thus, assumption 3 implies that if a coalition is formed between these two countries, the payoff will increase by 59.5% ((70%+49%)/2). This is used as a proxy for the 'power' wielded by the specific coalition on their 'combined' economies. Table 1 displays the informal sector's proportion to GDP in all the countries considered.

Table 1: Estimates of the number of women representing the small and large informal sectors.

Monthly salary range <35000 CFAF	Benin	Senegal	Burkina Faso
Large informal (% of persons)	44%	6%	28%
Small informal (% of persons)	66%	41%	66%
60% of women gives:			
Large informal (number of persons per 100 people)	27	4	17
Small informal (number of persons per 100 people)	40	25	40
Informal sector as a percentage of GDP	70%	49%	47%

Procedure
Given that this study focuses on only those that are earning less than 35000 CFAF, a simple sampling procedure is implemented to randomly pick women earning less than 35000 CFAF. That is, those earning between 1 to 34999 CFAF. Using Benin as an example, the steps include:

1. The large informal sector in Benin is made up of 27 women per 100 persons (Table 1), hence 27 random values are drawn from the range 1 to 34999.

2. This procedure is replicated 27 more times to give a matrix of 27x27.

3. The column averages were then computed to give the final results. These results represent the randomly selected women (identified by their salaries) having a large informal status who form the sub-coalition at the national level .

A similar process was used to select the women from both the large and small informal sectors for all the countries considered. The case for the women in Senegal's large informal sector is shown in Table 2. Since they are 4 in number, the Table displays the 4x4 matrix (the C's represent the columns and the R's the rows of the matrix).

Table 2: 4x4 matrix obtained from the sampling results for Senegal (large informal).

	C_i	C_j	C_k	C_l
R_i	14376	190	17125	17090
R_j	34602	4895	21386	16122
R_k	24001	21898	29572	1429
R_l	10794	13126	7889	27588
mean	20943.25	10027.25	18993.00	15557.25

In essence, from the sampling exercise, 4 women from Senegal's large informal sector earning 20943.25 CFAF, 10027.25 CFAF, 18993.00 CFAF and 15557.25 CFAF have been chosen. In Table 3, the national and regional coalitions are constructed. In order to obtain the payoff at the national coalition level, the salaries of the selected women from both the large and small informal sectors of the country are added together. These sums give the characteristic values. For instance, for Senegal, the combined monthly salary of the four women drawn from the large informal sector plus the 25 women drawn from the small informal sector gives 502234.8 CFAF.

Table 3: National and regional coalition forming based on the women's salaries (in CFAF).

	National coalition	National coalition	National coalition	Regional coalition	Regional coalition	Regional coalition	Grand regional coalition
Coalitions	Benin (B)	Senegal (S)	Burkina Faso (BF)	B and S	B and BF	S and BF	B, S and BF
Characteristic values	1156825.0	502234.8	1022469.0	2646201.0	3454181.0	2256562.0	4165219.0

To form a regional coalition, assumption 3 is applied. So, in a situation where Senegal decides to form a regional coalition with Benin we get,

$$(N_B + N_S) * [1 + (GDP_B + GDP_S)/2]$$
$$= (1156825.0 + 502234.8) * (1.595) = 2,646,201.0 \text{ CFAF}$$

where N_i represents the national coalition's characteristic value and GDP_i, the contribution of the informal sectors to the GDPs within their respective countries. This is an essential game given that the total value of the grand coalition exceeds the sum of the values to the each country's coalition when they decide to form national coalitions.

The shapley values for each country's coalition is given in Figure 1. Their respective cities are used.
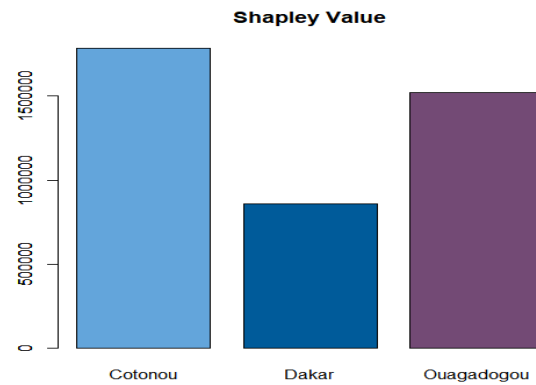

Figure 1: Shapley values at national level.

This represents the marginal contribution of each country to the grand coalition if they decide to cooperate. For the purposes of comparison, the pro-rata method is also applied to compute each country's marginal contribution as shown in Table 4. Both methods give similar estimates. The pro-rata is not a solution for TU-games, it is a simple distribution which provides the proportional estimates of the payoffs each country gets to keep in the event of forming the grand coalition.

Table 4: Marginal contributions of each national coalition (in CFAF) to the grand (cross-border) coalition.

	Benin	**Senegal**	**Burkina Faso**
Pro-rata	1,796,896	780,121.4	1,588,201
Shapley values	1,784,440.4	858,335.8	1,522,442.9

Comparing these values (Table 4) with the actual income (characteristic value) in Table 3, it can be deduced that forming the grand coalition allows for more gain by each country's national coalition in contrast to the payoff they would get if they were to stay within their borders. For instance, if Burkina Faso decides to participate in the grand coalition, its payoff will increase by 499973.9 CFAF which is obtained by subtracting the national coalition's characteristic value from the marginal contribution (1522442.9-1022469.0).

5.1 POLICY IMPLICATIONS
Given that African women are mainly engaged in micro and small scale enterprises within the informal sector, their ability to expand is highly limited. However, by just becoming a member of a coalition, the woman is able to diversify and expand her business in terms of skills acquisition and knowledge transfer. Furthermore, this sort of support system is empowering by its very nature. Forming cross-border women coalitions will play a huge role in closing the very wide gender gap in Africa. The access to international market information within the informal sector alone, creates a whole new level of business opportunities for the women involved.
Although not easily quantifiable, this heightened level of awareness may also be viewed as one of the reasons the marginal contribution of a given country to the grand coalition is significantly higher than at national coalition levels. It is therefore imperative for African governments to put in place policies that drive the formation of these kinds of cross-border coalitions.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Women's associations and cooperatives in Africa within the informal sector are more or less invisible. This tone constricts their ability to voice out their minds, share ideas on a larger scale and effect significant changes within their environment. It is on this premise that this paper focused on women in this group and proposed a graded qualitative model upon which women in the informal section can form cross-border coalitions. The empirical illustration further confirmed the beneficial impact of enabling cross-border cooperation. Future research that fully accounts for the heterogeneous nature of the women in this sector needs to be carried out. This should take into consideration their different levels of skills and literacy levels as well as their age groups and enterprise sizes.

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