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Impact of innovation platforms on marketing relationships: The case of Volta Basin integrated crop-livestock value chains in Ghana

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Abstract

Scientific and agricultural development approaches to improve the livelihoods of smallholder agriculturalists in developing countries are shifting from “linear transfer of technology models” towards “systems thinking”. One manifestation of this shift is the recognition of agricultural innovations as multidimensional and co-evolutionary processes that integrate technological, organisational, socio-economic and institutional innovations. This paper attempts to test a new conceptual framework for evaluating innovation platforms for agrifood value chains. The framework is based on the structure-conduct-performance hypothesis of industrial organisation, in combination with concepts of new institutional economics and marketing relationships. Data to test the framework was collected from two innovation platforms in the Volta2 Project in Ghana. Both the qualitative and quantitative data collected validate a possible link between the structure of the platforms, the conduct of their members and the resulting market performance through reducing the transaction costs of search and information.

Key words: Africa, innovation systems, knowledge and information, markets, value chains

1. Introduction

The shift in scientific thinking and development efforts, from linear technology development towards integrated and concerted strategies to improve the livelihoods of smallholder farmers in developing countries, is a recent phenomenon (Nyikahadzoi *et al.* 2012). One manifestation of this shift is the recognition of agricultural innovations as multidimensional and co-evolutionary processes, which require not only technological innovations but also organisational, institutional and socio-economic transformations to achieve synergies (Kilelu *et al.* 2013). In this regard, an innovation systems approach is now widely applied as a promising alternative to both conventional

systems; it is believed also to contribute to sustainability (Nyikahadzoi *et al.* 2012). Establishing innovation platforms (IPs) is the embodiment of this new approach to agricultural development, particularly in the developing world.

IPs have been defined and operationalised as “a group of individuals (who often represent organizations) with different backgrounds and interests: farmers, traders, food processors, researchers, government officials etc.” (Cadilhon *et al.* 2013). There is a large volume of literature and case study reports on IP projects (Gildemacher & Mur 2012) from Sub-Saharan Africa. The role of innovations within agricultural value chains has also been studied (Mcnamara 2009). All confirm that new knowledge can be generated through interactions and information sharing among diverse actors. However, to the best of our knowledge there is no published conceptual framework that reduces the complexity of multi-stakeholder innovation systems to a limited set of operational constructs on which quantitative data can be gathered to assess how the functioning of agricultural innovation platforms impacts on their achieving of objectives.

This article proposes an overarching conceptual framework to study the impact of innovation platforms and seeks to validate it with data gathered in Northern Ghana to identify how the level of interactions among the actors of the IPs set up by the Volta2 project, and the efforts made in improving interaction and communication on price information and other market-related aspects, have resulted in changes in market access for IP members. The contribution made by this study to the literature on innovation platforms for agricultural development lies in the new conceptual framework and research methodology proposed. They reduce the complexity of multi-stakeholder innovation systems to a limited set of operational constructs on which quantitative data can be collected, analysed econometrically and triangulated with qualitative data. This article reports the findings from the first empirical validation trial of this conceptual framework and research method. Although several limitations are identified, it constitutes the first step in a series of articles using data from different country settings with the aim to build up the robustness of the proposed conceptual framework and research method for monitoring and evaluating the impact of innovation platforms for agricultural development.

2. Conceptual framework to study the impact of innovation platforms

One primary contribution of this article is to propose a new conceptual framework that can break down the complexity of multi-stakeholder innovation platforms into a limited set of empirically testable constructs. The literature review to construct this conceptual framework for the impact evaluation of IPs is based on three strands of literature from socio-economic theory. The structure-conduct-performance model provides an overarching logic to study the way IPs function and their impacts on their members and activities. Adding concepts from new institutional economics to the framework makes it explicit that real-life market transactions are embedded in institutions, that market stakeholders will usually organise themselves to reach their aims, and that there are hidden transaction costs to doing business together. Finally, supply chain management and marketing research provide the constructs to operationalise the conduct and performance of IPs; this literature also suggests variables that can be used for the empirical validation of the conceptual framework proposed.

2.1 Elegant logic, flawed assumptions: the SCP model

First, it is worth remembering the elegance of the structure-conduct-performance (SCP) model of markets, which can provide a broad conceptual framework to study multi-stakeholder groups like IPs. Developed by Bain in 1959 for an industrial setting, the SCP framework posited a link between the structure of a market (e.g. the number of players, the market share of stakeholders), the conduct of traders (e.g. competition, collusion, price fixing and raising barriers to entry) and the performance of the market measured by price indicators (e.g. price correlation between different physical markets, price variations and equity of margin distribution among market players) (Moustier *et al.* 2003). The benchmark market in this type of analysis was the perfectly competitive market model, with price indicators used to measure better performance.

The SCP framework has been applied to market studies in developing countries, with recommendations to make market structure and conduct closer to those of the perfectly competitive market model; this would then result in better market performance. However, the SCP model has been vigorously criticised because it posits a perfectly competitive market, which is virtually non-existent in real-life markets involving real people. In particular, it is very rare for smallholder farmers in rural areas of African countries to have all of the following elements that approach the conditions of a perfectly competitive market: information on product characteristics, information on market prices, several potential buyers, or even the capacity to transport the goods to a buyer. Indeed, in the most remote locations, farmers often lack the knowledge to assess the quality of their produce if they wish to sell it; market information systems rely on word-of-mouth or patchy mobile phone networks; remote locations are more likely to be visited by only a few traders, which results in oligopsonistic market conditions; and the necessary road infrastructure and public transport are lacking to allow goods and market actors to circulate freely (Cadilhon 2013a). Thus, the results obtained using this model are often challenged by evidence from the field. Among other deficiencies, the SCP model also negates possible environmental influences on the marketing system (Harriss 1979). A fundamental criticism of the SCP model also lies in its use of price data as principal indicators of performance; they are very difficult to collect from official sources and their reliability is often challenged.

Despite its relatively old age and criticisms of its basic assumptions, the SCP framework nevertheless remains useful as an overarching logic for a conceptual framework to analyse how the structure of IPs (i.e. the organisation between various value-chain actors) can influence the conduct of IP members and, in turn, the performance of the platform in attaining its development objectives.

2.2 Making sense of real-life markets: NIE

The exploration of food marketing systems using new institutional economics (NIE) has become prominent since the 1970s. NIE takes into account the uncertainty that is endemic to the food industry because of the technical and economic characteristics of the products: agricultural production's seasonality, weather instability and food market conditions (Furubotn & Richter 2010). NIE is concerned with transaction costs and the organisation and development of economic activities. Transaction costs are the costs incurred by market agents when searching for a buyer or seller, negotiating terms of trade and monitoring and enforcing contracts. They are a consequence of the uncertainty that arises from the opportunistic behaviour (in plain words, cheating) of market agents, limited or asymmetric information, concentration of market stakeholders, and investments in assets specific to the transaction (Williamson 1991). NIE theory posits that market stakeholders will create a specific institutional background (laws, norms of behaviour) and organisational setting (associations, cooperatives, contracts, firms) to deal with this uncertain market environment. NIE is another relevant overarching framework to understand how the Volta2 IPs in Northern Ghana have been set up as loose organisations to improve the market access of the various stakeholders involved. Insights from NIE help to identify indicators of structure, like modes of formal and informal organisations that are relevant to an IP setting. NIE identifies communication and information sharing as possible sources of transaction costs; this research thus spotlights communication and information sharing as focus constructs to materialise the conduct of IP stakeholders. NIE also helps interpret the conduct and behaviour of market actors.

2.3 Detailed characterization of business relationships: marketing research

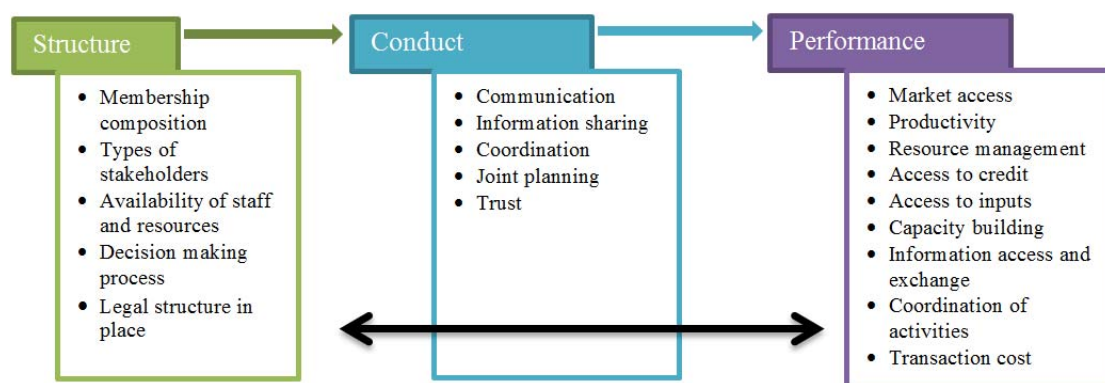
Marketing and business management research has traditionally focused more on identifying various hybrid forms of market organisations and, in line with transaction cost economics, has put the distribution of information along the chains at the core of its analyses. Cadilhon's (2013b) review of marketing research literature led him to reduce the complexity of the interactions within IPs to five

simple marketing constructs: information sharing, communication, co-ordination, joint planning and trust. Although IPs are not predominantly mechanisms for organising market transactions between members, they undertake many functions in facilitating value chain management: they help their members acquire a marketing orientation to their activities; they contribute to information sharing; and they can contribute to regulating some transactions among value chain stakeholders.

It thus is relevant to use some insights from the marketing literature to analyse how IPs foster communication and information sharing to gain better market access. The contribution of the business management marketing literature also comes from its range of indicators for the conduct of transaction partners and the performance of their marketing arrangements. Originally tested in the industrial contexts of OECD countries, these indicators have increasingly been validated through empirical research using the agrifood value chains of developing countries (Han *et al.* 2011).

This study therefore aims to propose and test a new conceptual framework for monitoring and evaluating IPs involved in agrifood value chain development. It is constructed by following an overarching SCP hypothesis augmented with concepts from NIE to ground the framework in the reality of market transactions, and with marketing relationships to operationalise the framework with a limited number of measurable constructs and variables. The new framework's main hypothesis (see Figure 1) is that the performance of an IP (measured by indicators adapted from the objectives set by the IP members for their platform) is influenced by the conduct or behaviour of its members (brought down to five main constructs of information sharing, communication, co-ordination, joint planning and trust), which in turn is determined by the structure of the platform.

In this paper we focus on assessing the role of improved communication and information sharing within IPs in improving value chain actors' market access, as hypothesised by the literature studying dyadic business relationships between two actors involved in a market transaction: a supplier and a customer (Noble *et al.* 2002).



Source: Adapted from Cadilhon (2013)

Figure 1: Graphical representation of the conceptual framework to assess the impact of value chain development innovation platforms, and possible links among its elements

3. Methodology

To explain the impact pathways of IPs, previous studies were based on either quantitative approaches, such as cost-benefit analyses (Gildemacher & Mur 2012), qualitative analyses based on field experiences (CORAF/WECARD 2012), or discussions with stakeholders on the success stories in conjunction with simple descriptive statistics (Devaux *et al.* 2009). Although qualitative and descriptive methods are crucial to explore the impacts of IPs, the significance of such impacts could be better validated if a complementary econometric analysis is conducted. To the best of our

knowledge there is only one study that has employed econometric approaches different from the one presented here to assess the impact of IPs, namely that of Badibanga *et al.* (2013).

Resorting to either quantitative research or qualitative research methods has been very common in the past. Recent trends suggest the superiority of mixed methods research: while quantitative methods are important to measure the significance of relationships between certain variables, qualitative methods help describe social relations and explain unquantifiable situations (Morgan 2007). This study attempts to use mixed methods to assess the structure of the IPs and interactions between various actors in general, and to investigate their linkages with improved communication and information sharing on market access.

Cross-section data were collected from four communities in Northern Ghana. The Volta2 IP project in Ghana only formed two village-level IPs, each comprising a pair of communities: the Orbilli and Naburinye communities in the Lawra district of the Ghanaian Upper West region assembled within one IP. Similarly, Digu and Golinga communities, located in the Tolon-Kumbungu district of the Ghanaian Northern region, constitute the other IP. Since the study's practical objective was to contribute to the impact assessment of the IPs set up by the Volta2 project, the two Ghanaian village-level IPs set up by Volta2 constituted natural objects of study for this research. Finally, because each platform only comprised about 20 participants, the survey covered all the IP members who were identified from the attendance sheet in IP reports. They were surveyed at their home or in a convenient location of their choice during field work from May to July 2013. It is important to note that the study did not cover members of the four communities who were not IP participants.

Both qualitative and quantitative data were collected through two focus group discussions, nine semi-structured interviews of key stakeholders, including facilitators, as well as individual surveys of *all* the 43 IP members. Basic information on the composition of the IP members (age, gender, and household wealth) and other socio-economic, socio-cultural and institutional factors were used to represent structure. In line with the NIE component of the conceptual framework, project inception documents and workshop and survey reports were used to obtain detailed information on the establishment, processes, organisations and objectives of the IPs. In this research, the location of the IP was used as a proxy for the organisational arrangements in two different IP sites, on-site observations having established that the two IP sites were not organised similarly, despite being part of the same project. Previous relationship marketing and market development literature was consulted to identify statements that could be used and adapted to capture the different components of IP performance as related to the objectives set by the platform members. For this study, the literature reviewed made it possible for us to identify previously validated statements that represent indicators relevant to capture communication, information sharing and market access (Téno 2013). These indicators were measured by the psychometric responses by IP members to five-scale Likert-type statements (Tables 1 and 2).¹

The data were collected from farmers, input suppliers and traders, processors, IP facilitators and other stakeholders. The traders, processors and other stakeholders were from nearby towns or small-scale rural-based operators.

The qualitative data and first-hand observation of a scheduled quarterly IP meeting in Lawra district on 27 June 2013 were used to understand and explain the actual interactions among the stakeholders during IP meetings, as well as their overall relationships. Consistent with the best practices of mixed methods research, this helped to back the results of the quantitative analysis when the latter analysis generated unexpected results. Despite having conducted individual surveys with all the

¹ The questionnaires used for this research and the databases generated are freely available from <https://cgspace.cgiar.org/handle/10568/33744>

members of the IP, the quantitative analysis was used mainly to supplement the claims of the qualitative results because of the small number of platform members involved in this exhaustive census.

For the quantitative analysis, after constructing the framework based on qualitative information, a factor analysis was conducted followed by a semi-logarithmic multiple linear regression to test the relationships between structure, conduct and performance, and hence to assess the impact of the IP project in helping members to achieve their development objectives.

After checking the appropriateness of undertaking factor analysis using the Kaiser-Meyer-Olkin measure of sampling adequacy (> 0.6) and Bartlett's test of sphericity (p-values $< 5\%$ significance level), a principal components factor analysis was applied to the elements of conduct and performance separately to generate reduced numbers of uncorrelated underlying factors that best represent these sets of elements. Community (> 0.5) was used to judge the relevance of including each variable in the factor models, while eigenvalue and scree plots were used to determine the final number of factors to be retained. Varimax rotation was used to obtain a rotated correlation matrix for easier interpretation. Internal consistency of the factor models was checked using Cronbach's alpha (≥ 0.7). The factor analysis of communication and information sharing resulted in three factors, which were labelled according to their constitutive variables: "Factor1-Information sharing", "Factor2-Using media to acquire quality information" and "Factor3-Frequent communication for information" (Table 1 and Annex 1). Likewise, the factor analysis using market access variables led to a solution with four factors, which were labelled "Factor11-Improved access to input and output markets", "Factor12-Better access to market information", "Factor13-Improved negotiation for better prices", and "Factor14-Bypassing intermediaries" (Table 2 and Annex 2).

An ordinary least squares regression was conducted to check if a statistically significant relationship existed between certain elements of IP structure and the factors obtained previously representing conduct and performance. The regression's validity was checked using common tests for residual normality, heteroscedasticity and omitted variables bias conducted after the estimation of parameters using Stata 11.0 on Windows 7. One potential challenge was that, given the small size of the data, model residuals as well as individual variables may not follow normal distributions, although the latter is not a requirement unless it causes serious problems in the former. Wu (2007) shows that combining the various Likert-type items using transformation algorithms or any mechanism following a factor analysis makes the data set conform to normality better.

The econometric model for validating the new conceptual framework (Figure 1) follows an *ad hoc* equation to find out if there is any possible link between the structure, conduct and performance of IPs. Some variables representing IP structure and conduct were used as explanatory variables, while the performance variable, market access, was used as dependent variable:

$$marketaccess_j = \beta_{0j} + \beta_{1j}IP_j + \beta_{2j}gender_j + \beta_{3j}age_j + \beta_{4j}lnnbhous_j + \beta_{5j}income_j + \sum_{i=1}^n \beta_{6ij}communication_{ij} + \epsilon_j$$

where $marketaccess_j$ represents the factor that explains the j^{th} dependent variable of market access. IP is a dummy variable that assumes 1 if the IP member is from Tolon-Kumbungu and 0 if he/she is from Lawra. $Gender$ is also a dummy variable that takes 1 for male and 0 for female. The variable age is the age of the IP member. $lnnbhous$ is the natural logarithm of the household size of the respondent and is used because focus group discussions have shown that it refers to the social and economic status of the IP member within the community. $Income$ is the annual income of the participants based on their own estimates. Estimated annual income is used as a proxy for wealth,

while household size is also taken in a separate exercise to compare the results. *Communication_i* is the i^{th} variable or combination of variables that represents the level of communication and information sharing of a member, while i and j depend on the outcome of the factor analysis.

4. Results and discussion

According to the IP participants interviewed, the Volta2 IP project has had a positive impact on the level of interaction and market access of IP participants. They explained that training sessions and quarterly meetings have improved the knowledge of the members. The qualitative data gathered also helped validate a possible link between the structure of the platforms, the conduct of their members – in terms of interaction to obtain and share market information – and the resulting market performance through reduced transaction costs, as described below. The IP project has in fact been instrumental in improving links between the various stakeholders to improve marketing relationships between actors in the value chain. From July 2011 until the survey period, the IPs had been conducting quarterly meetings to discuss their constraints and to exchange ideas on better solutions to the various bottlenecks along the value chains. The IPs also organised workshops and training sessions on issues such as improving crop and livestock production, post-harvest management and marketing.

During the meetings and workshops, professional urban-based traders and processors, along with other knowledgeable stakeholders, gave advice to farmers on better animal feed and outputs management so that they could sell the animals at good value. Almost all of the players in the agricultural value chains in the IPs reported that they had received at least one such training session or advisory services, in addition to experience sharing during the meetings. When asked about what they considered as the benefit of these platforms, the respondents mentioned several aspects. Among other things, they received training in crop and livestock production, price standardisation, commercialisation and the use of weighing scales for the products they sell. Participants in the IP meeting in Lawra also mentioned that attending the meetings, training sessions and workshops had helped them not only to acquire knowledge, but also to meet new value chain actors, such as an input seller or an output buyer whom they could call to get market information when in actual need of such transactions.

The claim of the value chain actors regarding the impact of the IP project is also supported by other stakeholders. One platform facilitator explained how the platform was “creating additional options for members to access market information and even get new trading partners”. This has the potential of reducing information search transaction costs. One prominent urban-based processor participates in the Volta2 platform meetings primarily to give advice to the predominantly farmer members on how to benefit from price standardisation and using weighing scales. She also mentioned that the IP was “an eye opener for farmers” because it had made them start using weighing scales, as well as enquiring about price information prior to selling their products: they could make price comparisons and sell for a better price.

4.1 Results from factor analyses

A principal components factor analysis on nine selected statements representing *communication and information sharing* yielded three underlying factors (Table 1). Annex 1 shows the rotated factor loadings for this analysis. The same procedure on ten statements relating to *market access* generated four factors (Table 2). Annex 2 shows the rotated factor loadings for this second analysis.

Table 1: Construction of underlying factors for communication and information sharing

Name of factor	Statements contributing to the variances in the respective factors representing communication and information sharing ^a	Assigning name to the factors
Factor1	I exchange information with my value chain partners about my on-going activities	Information sharing
	My value chain partners exchange information about their on-going activities with me	
Factor2	I listen to weekly radio announcements to get market information	Using media to acquire quality information ^b
	I am satisfied with the quality of communication I was having with my business partners in the last two years	
Factor3	I am satisfied with the communication frequency I had with value chain actors in recent business relationships	Frequent communication for information
	I ask relatives and friends in the village for market information	

^a Three of the original variables do not appear in this table because they did not load well enough on the factors chosen or they did not show a clear enough pattern to be retained in the factor analysis.

^b Factor2 was labelled “Using media to acquire quality information” so as to encompass the two variables, one dealing with the media the other with the satisfaction of the quality of the information received, which loaded onto this factor.

Source: Own research

Table 2: Construction of the underlying factors for market access

Name of factor	Statements contributing to the variances in the respective factors representing market access ^a	Assigning name to the factors
Factor11	My access to input markets has improved in the past two years	Improved access to input and output markets
	My access to output market has improved in the past two years	
	The number of marketing companies buying products from the villagers has increased in the past two years	
Factor12	Information on the market is easily accessible to value chain actors	Better access to market information
	Farmers in the IP negotiate with buyers as a group	
Factor13	I can now better negotiate market prices than two years ago	Improved negotiation for better prices
	I am satisfied by the prices I get from my customers for my products	
Factor14	I sell my output directly to processors or consumers	Bypassing intermediaries
	There is a ready market for farm produce during harvesting seasons in my area ^b	

^a One of the original variables does not appear in this table because it did not show a clear enough pattern to be retained in the factor analysis.

^b The presence of a ready market for farm produce could help farmers find other customers in retailers and consumers, thus contributing to bypassing market intermediaries.

Source: Own research

The three factors of the conduct model jointly explain about 70.73% of the total variation in the corresponding variables, and the four factors of the performance model account for 70.70% of the total variation in the original variables. All variables maintained in both factor models have communalities of above 0.5. This implies that at least half of the variations in each variable have been explained by the factor model and the rest are unique to the variable. Some statements that were relevant but had communalities of less than 0.5 were removed from the factor analysis and used directly as separate variables in the regression models.

4.2 Results from regression

Among the variables used in the regression models, the Shapiro-Wilk *W* test and the graphical inspection of boxplots showed that three factors related to communication and information sharing deviated from normality. Two variables were transformed: *income2* is *income* with two outliers replaced by mean values; and *lnnbhous* is the natural logarithm of *nbhous*. The variable *focq50i*²

² *Focq50i* is a Likert-scale statement on a conduct variable stating “My level of overall communication has improved in the past two years”. Its distribution was skewed.

could not be transformed because the data behaviour would have changed completely. In addition, log transformation of the other variables, Factor1 and Factor2, which came from the factor model, was not possible because these variables had negative values. On the other hand, the average value of the variance inflation factor (VIF) for the measure of multicollinearity was 1.58, with 2.84 the largest VIF for the individual variables. This suggests the absence of serious collinearity in the set of regressors.³ Most studies use $VIF < 5$ as decision criterion for a good model. The low VIF values here were also the result of conducting a factor analysis that had already reduced correlations between the variables.

The econometric analysis supports the existence of a relationship between improved interaction due to IP formation and the resultant improvements in market access. Based on the statements from which they are constructed (Tables 1 and 2), the predicted factor scores for the four factors of the performance model are used to represent certain aspects of market access.

Four separate regressions were run using all the components of performance as predicted variables and all three components of conduct as explanatory variables, together with other predictor variables related to structure in the conceptual framework (Figure 1). The results of the econometric models are generally complex and it is difficult to provide a clear interpretation of the coefficients. However, the four separate regressions (Table 3) in general revealed that IP (location of the platform), gender, household size (a local indicator of wealth), estimated annual income and certain attributes of communication and information sharing have statistically significant impacts on some elements of the participants' access to the market.

To complete these regression results, when the respondents were asked an additional question on whether the improvements in communication and interaction with value chain actors had resulted from their membership of the IP, more than 95% responded 'yes'. The mobile technology revolution, other projects and natural trends in communication have probably contributed to improvements in market access. Respondents who listened to various media outlets, such as radio, in addition to interactions in the IPs had better access to market information. The better the level and quality of communication on market prices, the better the level of members' access to market information.

The third equation was related to improved capacity to negotiate for higher or more satisfying price levels for the products participants transact. Our data showed this was significantly influenced by gender differences, with men having a lower capacity to negotiate for higher prices. This is in line with the qualitative data, which indicated that women were involved in trading and processing activities, while men conducted farming. In addition, a very likely reason is that women might have more social connections to get the necessary market information before engaging in transactions: they thus have better negotiating positions. In addition, the household buying or selling activities are often conducted by women even when they are not traders. Therefore, their involvement in marketing activities for household and business matters could make women more experienced and better at negotiating higher prices. In West Africa, and especially in Ghana, women are known to have an important role in processing and marketing, so it is not surprising that the regression shows that women are better at negotiating prices than men; they are more used to being in the market, unlike in other countries, where men dominate marketing.

The fourth equation examines whether participants are able to sell their products directly to processors and consumers and the existence of such ready markets, and whether this depends on the location of the platform. The dummy variable *IP*, which refers to the location of the platform in which the respondents are found, shows a statistically significant effect on market access. It

³ Correlation matrices of the explanatory variables used for each model are available from the authors upon request.

suggests that the participants in Tolon-Kumbungu have better access to the market than those in Lawra, other variables being constant. Indeed, the former is surrounded by many market centres, including Tamale metropolis, with many urban consumers and big agro-processors. In addition, the level of annual income of the members was found to have a statistically significant positive impact on the level of market access. This implies that the higher the level of household wealth, proxied by mean annual income, the better the level of a member's market access. It could also be the result of bi-directional causality between these two variables: those who have better market access also have higher income. A very peculiar result in the same equation is that (log) household size, a local indicator of wealth, has a statistically significant negative impact on market access. It implies that IP members with many household members have a lower level of access to markets compared with those with smaller families. This might be due to the formers' high household consumption, leaving little to sell. In contrast, smaller families could focus better on business and hence have better market access. This result also suggests the need to determine household composition.

Table 3: Summary of the four regression models of market access

Regression equation	Dependent variable	Explanatory variables	Coefficient ^a	Beta ^b	t	P> t
1	Factor11	IP	0.0638 (0.6171)	0.032	0.10	0.918
		gender	0.2767 (0.3494)	0.139	0.79	0.436
		lnnbhous	-0.0182 (0.5422)	-0.007	-0.03	0.973
		age	-0.0014 (0.0113)	-0.020	-0.13	0.896
		Income2 ^c	-0.0003 (0.0003)	-0.240	-1.19	0.247
		focq50i ^d	0.5782 (0.2556)	0.365**	2.26	0.032
		factor1	0.1543 (0.2569)	0.156	0.60	0.553
		factor2	-0.0642 (0.2309)	-0.069	-0.28	0.783
		factor3	-0.1543 (0.6197)	-0.157	-0.95	0.349
	constant	-2.1627 (1.4727)	.	-1.47	0.154	
2	Factor12	IP	0.6432 (0.4439)	0.324	1.45	0.159
		gender	-0.2612 (0.2966)	-0.131	-0.88	0.387
		lnnbhous	0.1248 (0.2426)	0.054	0.51	0.611
		age	-0.0122 (0.0127)	-0.169	-0.96	0.344
		Income2 ^c	-0.0001 (0.0002)	-0.026	-0.17	0.867
		focq50i ^d	-0.1968 (0.2583)	-0.124	-0.76	0.453
		factor1	0.2535 (0.2252)	0.257	1.13	0.271
		factor2	0.3339 (0.1175)	0.359*	2.84	0.009
		factor3	-0.0460 (0.1427)	-0.047	-0.32	0.749
	constant	1.068 (1.3416)	.	0.80	0.433	
3	Factor13	IP	-0.3810 (0.5536)	-0.192	-0.69	0.497
		gender	-0.8305 (0.3816)	-0.418**	-2.18	0.039
		lnnbhous	0.0440 (0.4225)	-0.418	0.10	0.918
		age	-0.0228 (0.0147)	0.019	-1.55	0.132
		Income2 ^c	0.0002 (0.0002)	-0.314	0.71	0.486
		focq50i ^d	0.3342 (0.3217)	0.122	1.04	0.308
		factor1	0.3007 (0.2722)	0.305	1.10	0.279
		factor2	0.0222 (0.1625)	0.023	0.14	0.892
		factor3	-0.1405 (0.2229)	-0.143	-0.63	0.534
	constant	0.01651 (1.8646)	.	0.01	0.993	
4	Factor14	IP	1.8330 (0.4026)	0.923*	4.55	0.000
		gender	-0.2039 (0.2973)	-0.102	-0.69	0.499
		lnnbhous	-1.0078 (0.4293)	-0.438**	-2.35	0.027
		age	0.0123 (0.0108)	0.170	1.14	0.265
		Income2 ^c	0.0006 (0.0002)	0.449*	3.02	0.006
		focq50i ^d	-0.0157 (0.2285)	-0.009	-0.07	0.946
		factor1	-0.1235 (0.1657)	-0.125	-0.75	0.463
		factor2	-0.3224 (0.1374)	-0.347**	-2.35	0.027
		factor3	-0.0318 (0.1182)	-0.032	-0.27	0.790
	constant	0.4784 (1.3244)	.	0.36	0.721	

^a Standard errors (*robust*) are shown in brackets

^b Betas are standardised coefficients. * and ** represent statistical significance of the standardised beta coefficients at the 1% and 5% levels of significance respectively

^c Income2 is estimated annual household income of the IP member

^d Foc50i is a variable that says, "my communication level has improved in the past two years"

Source: Own research

The fourth equation generated a seemingly unexpected result: those using various media outlets, such as radio, had a lower chance of bypassing intermediaries. A possible explanation is that those who listen to weekly radio announcements communicating 'credible' market information provided by the districts' ministry of food and agriculture offices may not want to waste time and energy to look for processors and final consumers who would likely pay better prices than those paid by the intermediaries. They may easily sell their products as long as the price offered by the traders does not significantly deviate from what the media have transmitted. This finding can back the new

institutional economics explanation: having more information from the media helps producers reduce their transaction costs because they no longer need to find other buyers. The information they have allows them to deal directly and negotiate a good price with market intermediaries, using radio prices as baseline.

All the four regressions were executed with the robust option, considering the small size of the data and also to correct for any possible bias. The overall specifications of all the models looked appropriate, as suggested by the Ramsey RESET test. Their results also were acceptable because the central limit theorem allows us to believe that the residuals will be normal in large samples, as our data size is more than the minimum threshold of the rule of thumb of 30 observations. However, the results of the Shapiro-Wilk W test indicate that the residuals of equations 2 and 3 are normal only at the 10% significance level. This was the main reason for using the econometric results only as supplementary to the qualitative information and facts. Furthermore, the R-squares of equations 1 and 3 were low, further reducing the confidence in the overall fit of the model. Yet the regression outputs support the hypothesis that IP performance depends on platform structure and members' conduct.

5. Conclusion

This study has shown that a new conceptual framework elaborated by integrating the structure-conduct-performance framework, new institutional economics of markets and marketing relationships for the impact evaluation of agrifood value chain innovation platforms had some degree of relevance to the Volta2 project innovation platforms in Ghana. The methodology proposed to validate the conceptual framework in this real-life context employed mixed methods. The tools to gather the quantitative and qualitative data for measuring the elements of the conceptual framework were not considered as foreign by the stakeholders interviewed, thus providing further backing for the relevance of the conceptual framework proposed. A careful investigation of both the quantitative and qualitative data collected from the project sites in Ghana revealed that the IPs set up by the Volta2 project intervention had enhanced the overall interaction and marketing relationships among IP members. Furthermore, the IPs had led to improved communication and information sharing through meetings and training workshops. These, in turn, resulted in better market access to inputs and outputs by the IP members. In addition to the level of interactions, market access was found to be determined by other elements, such as gender differences and geographic factors, the latter including the proximity of the IPs to alternative market centres.

The findings therefore provide some empirical evidence to validate the overall assumption of the conceptual framework, which posited that IP performance (market access in this case) is influenced by the conduct of the platform members in terms of improved communication and information sharing as well as by the structure of the platform. Furthermore, the qualitative data gathered provide additional illustrations of how IPs can become an institution to foster market access, and can help reduce transaction costs, as posited by NIE. The constructs and indicators selected from marketing research to measure communication and information sharing in IP member conduct, and market access as a proxy for IP performance, have also given satisfaction in the rural Ghanaian context.

However, due to the short life of the project, the small number of beneficiaries and the absence of a control group, it is difficult to come to a strong conclusion on whether the framework employed here is the most appropriate for conducting impact evaluation, and if the results thus far achieved are associated with the project's intervention. Further research is needed to refine and test the framework on other IP projects with a relatively longer life, more respondents and a control group of non-beneficiaries.

Nevertheless, this study can provide insights for managers or facilitators of IPs and other multi-stakeholder groups to foster innovation along agrifood value chains. This research identified that communication and information sharing among IP members contributes to improve market access by members. Thus, sponsors and facilitators of IPs with a marketing objective may want to focus their limited resources on fostering communication and information sharing among IP members.

The findings from this research also confirm that IPs are complex, though loose, organisations of multiple stakeholders. This case from Ghana is further recognition of the multidimensional nature and multi-stakeholder complexity of the agricultural innovation processes already identified by Kilelu *et al.* (2013) in Kenya. Policymakers should try to take part in these innovation platforms to understand the real-life problems of their constituents, which might lead to better targeted regulations for the development of agrifood value chains, as identified in other case studies of innovation platforms (Cadilhon *et al.* 2013).

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Annex 1: Rotated factor loadings (pattern matrix) and unique variances for conduct

Variable	Factor1	Factor2	Factor3	uniqueness
I am satisfied with the communication frequency I had with value chain actors in recent business relationships			0.5546	0.40
I exchange information with my value chain partners about my on-going activities	0.8826			0.19
My value chain partners exchange information about their on-going activities with me	0.8954			0.18
Exchange of market information has improved in the past two years	0.6591		-0.5386	0.22 ^a
I ask relatives and friends in the village for market information			0.8681	0.23
I ask friends and relatives in the city for market information	0.6315			0.40
I listen to weekly radio announcements to get market information		0.8921		0.20
The mode of communication I use with value chain actors is compatible with my living conditions	0.6601			0.35
I am satisfied with the quality of communication I was having with my business partners in the last two years		0.5978		0.45

Cumulative variance explained: 70.73%; Kaiser-Meyer-Olkin measure of sampling adequacy: 0.748; Bartlett's test of sphericity Chi-square: 142.887 and p-value: 0.000; Cronbach's alpha: 0.81

(blanks represent abs(loading) < 0.5)

^a The variable does not show a clear pattern

Annex 2: Rotated factor loadings (pattern matrix) and unique variances for performance

Variable	Factor11	Factor12	Factor13	Factor14	uniqueness
Information on the market is easily accessible to value chain actors		0.8217			0.2438
There is a ready market for farm produce during harvesting seasons in my area				0.8242	0.1905
Farmers in the innovation platform negotiate with buyers as a group		0.6317			0.2793
The number of marketing companies buying products from the villagers has increased in the past two years	0.8263				0.2926
I am satisfied by the prices I get from my customers for my products		0.5289	0.6160		0.2681 ^b
Prices for products are mainly determined by intermediaries and my role is limited	-0.5456				0.4291
I sell my output directly to processors or consumers				-0.7620	0.2391
Market access to inputs has improved in the past two years	0.6906				0.3104
My access to output market has improved in the past two years	0.5316				0.4979
I can now better negotiate market prices than two years ago			0.9004		0.1794

Cumulative variance explained: 70.70%; Kaiser-Meyer-Olkin measure of sampling adequacy: 0.641; Bartlett's test of sphericity Chi-square: 93.161 and p-value: 0.000; Cronbach's alpha: 0.72

(blanks represent abs(loading) < 0.5)

^b The variable does not show a clear pattern