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The effect of innovation practices on agribusiness performance: A structural equation modelling (SEM) approach

Evans Brako Ntiamoah[1]*, Dongmei Li[1] and Daniel Bruce Sarpong[2]

[1]*College of Management, Sichuan Agricultural University, Chengdu City, People's Republic of China*
[2]*Department of Agricultural Economics and Agribusiness, University of Ghana, Accra, Ghana*
**Corresponding author email: kwamebrako@yahoo.com*

This study investigates how innovation practices including product, process, marketing and organizational innovation affect agribusiness performance such as innovative, production, marketing and financial performance in Ghanaian agribusiness companies. Data were collected through survey questionnaires from 1526 respondents mainly from inputs supplies, production and marketing agribusiness companies. Data were analyzed by principal component analysis (PCA), and exploratory and confirmatory factor analysis. We also employed the structural equation modelling (SEM) in determing the relationships between the variables. The results reveal the positive effects of innovation practices on agribusiness performance. Managerial implications are also discussed.

Keywords: innovation practices, agribusiness sector, performance, Ghana

Introduction

Research has proven that innovativeness is a basic growth strategy tool that can enable entry to new markets, increase market share and provide a firm with a competitive advantage (Saxena 2012). Increasing competition among global markets serves as motivation why most companies have adopted innovation, since fast-changing technologies and intense global competition normally diminish the value added by existing products and services. Innovations create an essential module of corporate strategies for different reasons, such as the application of intense productive manufacturing processes, to assess market performance, to gain positive reputation in customers' mind so as to gain sustainability among competing brands (Abou-Zeid and Ben-Akiva 2014). Over the last two decades, innovativeness has attracted the attention of researchers who have tried to define, classify and investigate its performance influences, mainly due to its useful relevance (Wanvoeke et al. 2015). Innovations give firms a strategic positioning to overcome the challenges they encounter while striving to achieve sustainability among competing brands (Al-Sulaiti et al. 2010).

Innovation does not only relate to products and processes; marketing and organizational activities also have relations with innovation. In their research, D'Aleo, D'Aleo, and Bonanno (2017) explained different types of innovation: new approaches of production, new sources of supply, new ways to organize business and new products. OECD 2005, which is considered the fundamental international basis for explaining and assessing innovation activities for use of related data, has been adopted as the basic reference source to describe, identify and categorize innovations at firm level (Hjalager 2010; Camisón and Monfort-Mir 2012).

Four different types of innovation are introduced in the Oslo Manual, OECD 2005. These are product innovation, process innovation, marketing innovation and organizational innovation. The concept of technological developments provides increased connections with product and process innovation. A product innovation has to do with the introduction of a new or slightly improved product with regard to its characteristics, including improvements in its technical specifications (Atalay, Anafarta, and Sarvan 2013). Product innovation can use new technologies and can also be targeted at new uses of existing technologies or a blend of them. Product innovation is being driven by improving technologies, satisfying customers' shortening product life cycles and increasing global competition. Effective interaction within the firm as well as between the firm, its customers and its suppliers gives the firm success (Nicolau and Santa-María 2013).

Process innovation has to do with the implementation of a new or slightly improved production or delivery method. This includes changes in techniques, tools and/or software. Process innovation can be used to reduce unit costs of production or delivery, improve quality, or deliver slightly improved products (Johansson and Sundin 2014). Piroozfar, Halajzadeh, and Ilkhani (2015) discussed that while the introduction of new products is usually expected to have a clear, positive influence on the growth of income and employment, process innovation can have a foggy influence due to its cost-cutting nature.

Marketing innovation is explained as the execution of a new way of marketing, comprising slight changes in product packaging, promotion or pricing. The task of marketing innovation comprises finding better solutions to customers' concerns, enlarging new markets, or placing a firm's product on the market to help increase sales. Marketing innovation has more to do with pricing strategies, product design, product placement and promotion activities which are embedded in the four P's of marketing (Saunila, Pekkola, and Ukko 2014).

Lastly, organizational innovation deals with executing new organizational methods in the firm's business practices, including its internal and external relations. Organizational innovations enable businesses to increase their performance by reducing transaction and administrative costs, increasing labour productivity, or reducing cost of

suppliers (Camisón and Villar-López 2014; Govindan et al. 2015).

Recent innovation literature seeks to find the relationship between innovation and firm performance. Quite a number of conceptual studies have been conducted but there seems to be a limited number of analytical and empirical studies with very in-depth analysis. Only a few studies have closely examined the relationship between innovation and firm performance as Spithoven, Clarysse, and Knockaert (2011) identified. The focus of most empirical studies lies on the relations between the dimensions of innovation and a single performance aspect. The focus of this research is to examine innovation and its impacts on firm performance. A comprehensive innovation-performance analysis based on a structural equation modelling approach, which also indicates the path relationship between all variables used, is the contribution of this study.

Conceptual issues on innovation

Changes such as technological, social and political have over the last decades taken the global stage. Recent literature now recognizes different phrases such as globalization, global warming, the borderless world, personal computer and the Internet. Changes in organizations are becoming tedious rather than easy, vigorous rather than stable and hostile in form rather than friendly (Gareis 2010). There is also a clear misinterpretation in the meaning of innovation and invention. An invention is a new version of a device, product, process or system whiles innovation is the application of new ideas which come from the core ideas and is in essence branded by change (Parida, Westerberg, and Frishammar 2012). However, businesses in difficult times can adapt some sort of flexibility when they try continuously to reinvent their business model. Success in innovation can be attained via technological facilities, trained workers and support from management (Barrett et al. 2015). The Innovation Union explains innovation as transformation that speeds up and improves the way we conceive, develop, produce, and access new products, industrial processes and services (Hjalager 2015). With the different explanations on innovation given so far, innovation can be seen as a process of equipping and refining products and services to appeal to customers' taste and demand. Innovation is basically about finding and using opportunities to create new products and services (Černe, Jaklič, and Škerlavaj 2013). Worker capability improvement and better wages and salaries are a result of businesses' decisions to expand their innovation activities. The impact of innovations on firm performance differs in scale from sales, market share and profitability to output and efficiency (Olughor 2015).

Agribusiness

Agribusiness in Ghana consists of the overall activities of farms and those businesses that amass, process and convert raw agricultural commodities into final products for distribution within Ghana and other countries (World Bank 2012). These economic activities comprise repair of machinery, production of fertilizer, farming, processing and manufacturing of food, food packaging, wholesale, retail distribution, and market centres. In recent years, the establishment of agribusiness firms has helped to increase employment and income. The term agribusiness in recent studies has been linked mostly to establishments with good corporate structures and international appeal. Historically, transnational enterprises within the food system spread across national boundaries filling a void within the vertical food system from farm provider to final client and carrying on those functions of input technology, farming, grading, gathering, storage, processing, and distribution that either don't seem to be performed in the least or inefficaciously performed by others within the total vertical food system we call agribusiness (Bruni and Santucci 2016).

Firm performance

Innovative performance is regarded as one of the effective drivers of other facets of organizational performance. The formation of corporate learning with constant efforts for improvements has also helped businesses to innovatively perform well in recent times. Gunday et al. (2011) stressed that technical and administrative innovation which falls under innovation performance leads to organizational growth and profitability. They also emphasize that the missing link between organizational strategic orientations and performance is innovative performance. Gunday et al. (2011) found that technologically innovative products have a statistically positive impact on operational performance. Changes within the business environment can be dealt with when businesses integrate administrative and technical functions into their corporate structure. Innovation activities are carried out to help businesses increase their market share, increase production flexibility and create new markets (Epstein and Buhovac 2014). Innovative performance on firms' production, market and financial performances can cause businesses to make a loss or break-even in the short run due to the initiated investments and internal resource usages and then win or gain in the long run. New technology adoption for innovation comes with its consequence. Enough time is needed for a business to assess the positive effects of innovations on firm performance. Businesses for this reason link innovative performance to the non-financial aspects of corporate performance like increasing customer satisfaction and increasing production speed, which will later lead to higher financial returns. When innovative performance improves, production and marketing performances also increase, which later leads to an increase in financial performance. Innovative performance, particularly the kind related to new product success, is connected in the literature to a rise in sales and market share, since it contributes significantly to the satisfaction of existing customers and the gaining of new customers (Ghisetti and Rennings 2014). In addition to new product success, achievement in marketing, process and organizational innovations together lead to an improvement in customer satisfaction. Earlier innovation literature emphasizes that production performance, such as speed, flexibility and quality cost efficiency appears to be closely linked to firm performance. Process exertion and higher performance in

innovation encourage corporate learning and increase the speed and quality of operations. Technological innovations can certainly be adopted by businesses to become faster than their competitors. Businesses that have invested more in quality practices benefit from significantly higher financial rewards. Equally, there is a positive correlation between non-financial manufacturing performance and financial performance (Gunday et al. 2011; He et al. 2014).

Innovation and firms performance

There is a correlation between profitability and the growth of an organization and its performance. Competitive forces from the business environment lead most businesses to adapt to the external environment, thereby integrating competence and usefulness. Performance of firms' innovation activities are influenced by the opportunities provided by their external environment. This explains why businesses in emerging markets give prominence to innovative activities that build their reputation in the market environment. Most businesses undertake innovative activities to improve their business performance and competitive advantage (Easterby-Smith, Thorpe, and Jackson 2012). According to Augusto, Lisboa, and Yasin (2014), there is a direct relationship between innovations and firm performance based on an integrated innovation-performance study conducted on 184 manufacturing firms operating in Turkey.

Crossan and Apaydin's (2010) study on the relationship between learning orientation, firm innovation and firm performance among US firms shows that learning orientation is insignificant for innovation and performance. A study conducted on 600 firms in the manufacturing sector by the Journal (2010) on innovation practices and its effects on performance of SMEs in Australia revealed that innovation strategy is a key driver of performance of SMEs. They concluded that SMEs performance will improve when the alignment between innovation culture and strategy is realized within the innovation process. The examination of 320 SMEs operating in the ICT industry in Malaysia was examined by Crossan and Apaydin (2010). The outcome revealed that organizational learning contributes to innovation capability and, in turn, that innovation is positively related to firm.

Impacts of innovations on firm performance

Both empirical and theoretical research confirms the positive relationship between innovation and performance. In a study by Kim Man (2009) that focused on the relationship between innovation and organizational structure of Taiwanese SMEs in the manufacturing and services sector, company performance was measured in terms of company sales. Empirical data were collected through a telephone survey from a population consisting of companies located in the northern part of Taiwan that had less than 200 employees. The research found that 80% of the surveyed companies conducted some sort of innovation. However, administrative innovation was found to be more important than technological innovation in explaining company performance. A study by van Auken, Madrid-Guijarro, and García-Pérez-de-Lema (2008) investigated the relationship between the degree of innovation (measured in innovation in products, processes and administrative systems) and performance among a sample of 1091 Spanish manufacturing SMEs. An important contribution of the study is the empirical evidence on the relationship between three types of innovation (product, process and managerial/systems) and four measures of performance (human relations approach, internal process approach, open systems approach and rational goal approach). Findings of the study provide evidence that innovation positively impacts SMEs performance in low and high technology industries. The study also found that innovation is more important in achieving a competitive advantage in high than low technology firms. These results support the proposition that innovation is crucial to a firm's sustainable competitive advantage. Li (2017) examined the impact of two types of firm innovation activities (exploratory innovation and exploitative innovation) on performance. Data of interest were collected from 397 enterprises in eastern, middle and western China. Using hierarchical regression analyses, the study found that both exploratory innovation and exploitative innovation have a positive effect on firm performance and that the fit between innovation activity and business strategy of the firm has a significant impact on firm performance. In general, these empirical research studies add to the existing body of knowledge which argues that firm-level innovation is a predictor of organizational performance (Figure 1).

Material and methods

Research hypothesis

Product innovation and firm performance

Product innovation has many dimensions. First, from the perspective of the customer, the product is new to the customers. Second, from the perspective of the firm, the product is new to the firm. Third, product modification means bringing product variation to the existing products of the firm. Firms bring product innovation to increase efficiency in the business. New product development and product innovation are important strategies for increasing the market share and performance of the business. Studies showed that new product development has a positive impact on the performance of the firm (Battilana and Lee 2014; Schad et al. 2016). Based on this literature, we derive our first hypothesis as:

H_1: Product innovation leads to firms' performance

Process innovation and firm performance

Firms implement novelties in the production and delivery method to bring efficiency to the business. The new method must be new to the organization. The firm can develop new process either by itself or with the help of another firm. Firms implement process innovation and amendments to produce innovative products. To decrease production costs, firms implement new process innovation. Such process innovation is normally reflected in the cost of the product (Hassan et al. 2013; Karabulut 2015). Based on this literature, we derive our second hypothesis as:

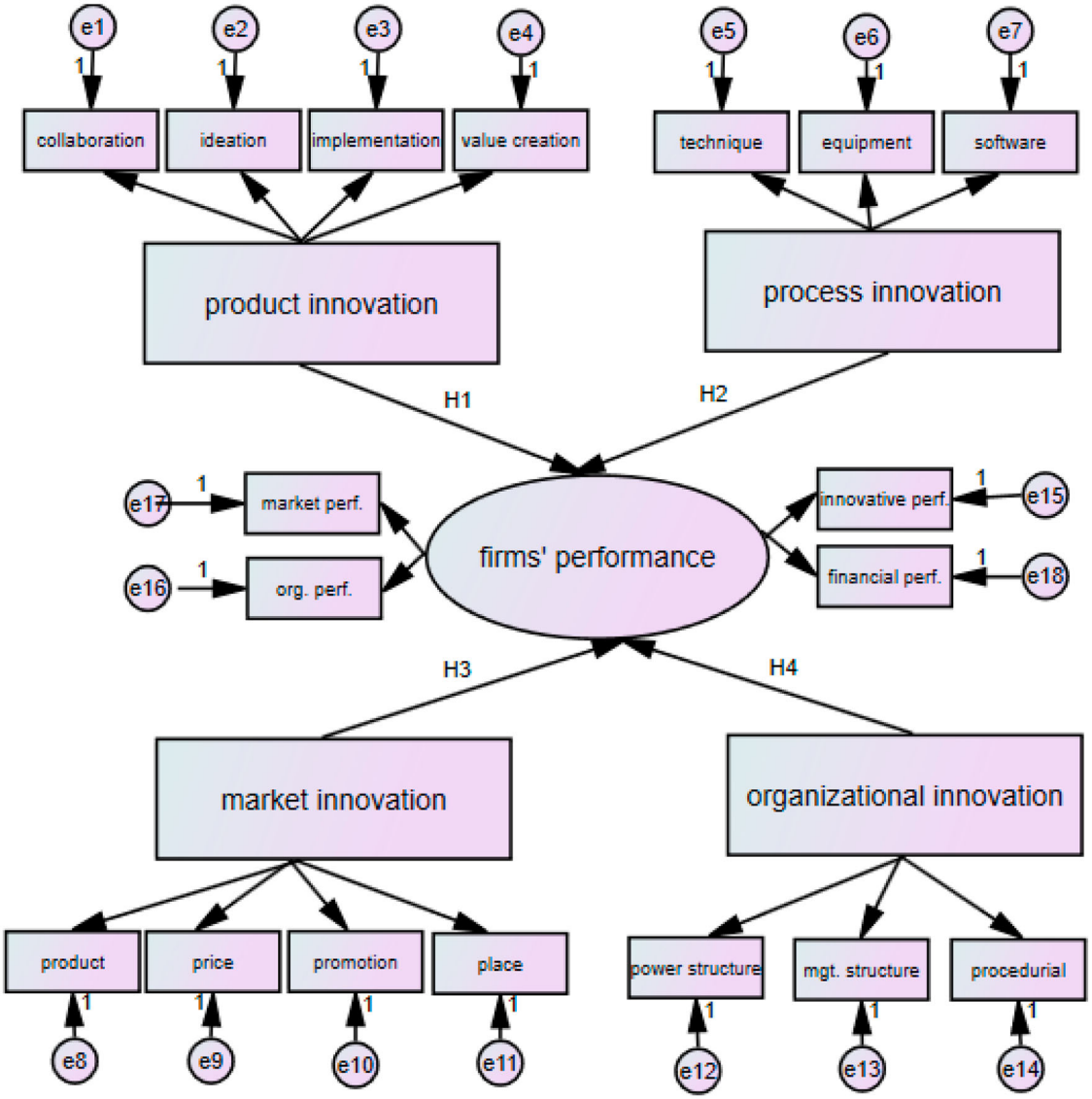

Figure 1: A conceptual framework.

H_2: Process innovation causes firms' performance

Marketing innovation and firm performance

The objective of marketing innovation is to increase sales and market share and to open up new markets. The distinctive feature of marketing innovation that differentiates it from the other types of innovation is the implementation of new marketing methods that the firm has never implemented before. Firms implement innovation in their marketing methods to bring efficiency to their business. Marketing innovation involves developing new marketing techniques and methods. Developing new techniques, methods and tools for marketing can have a significant role in the success of the organizations (Hallstedt, Thompson, and Lindahl 2013; Paillé et al. 2014). This led to our third hypothesis:

H_3: Market innovation induces firms' performance

Organizational innovation and firm performance

For organizational innovation, firms change their method of organizing and implemented ones not used before. Organizational innovation can increase the performance of an organization by decreasing transaction and administrative s Firms implement organizational innovation to bring efficiency to the business. Organizational innovations bring changes to firms' organizational setup. They change the ways of organizing things to compete with their competitors and satisfy their customers (Hassan et al. 2013; Maziriri and Chinomona 2016). This literature led to our final hypothesis:

H_4: Organizational innovation stimulates firms' performance

Data sample

In exploring the factors positively affecting or stimulating firms' performance, a questionnaire was developed, and the survey included 2500 individuals in each of the 10 regions in Ghana. Two-hundred-and-fifty copies of the questionnaire were given to agribusiness firms in each of the regional capitals in Ghana. Due to technicalities with some of the questions asked in the questionnaire, respondents were asked to complete the questionnaire in consultation with managers and line supervisors of these agribusiness firms as well as in consultations with one of the authors present. Also, interviews were conducted for

employees who have little or no educational background. Out of the 2500 invitations extended, a total of 1526 copies of questionnaire were retrieved constituting 61.04% of the total questionnaires given to respondents. In checking non-respondent bias we employed the t-test approach and no significant difference was found between the interviews conducted and actual copies of questionnaire filled in by the respondents. In the analysis, variables such as size, age and ownership status were deemed control variables.

Measurement of variables

Each of the constructs was measured by original measurement items designed by the authors. Product innovation was measured on collaboration, ideation, implementation and value creation. Process innovation was measured on mastering of techniques, equipment and software. Market innovation was measured by the improvement of firms' 4Ps (product, pricing, promotion and place). Finally, organizational innovation was measured on power structure, management structure and procedural processes. We measured our dependent variable firms' performances on innovative performance, market performance, organizational performance and market performance. The questions were asked on a 5-point Likert scale in which 1 indicates strongly disagree, 2 indicates disagree, 3 represents neutral, 4 represents agree, and 5 indicates strongly disagree. The reason for using this Likert scale items was due to the fact that most firms were reluctant to disclose actual performance records.

Research tools

In exploring the relationship in each of our latent variable constructs, multivariate data analysis was deemed necessary in two stages. With the first stage, we extracted the factor structure of our conceptual framework by using principal component analysis (PCA). PCA was used to minimize sets of variables into a convenient set of scales. In considering the underlying dimensions of performance and innovation, the PCA with varimax rotation was conducted. Still in this stage, we explored the convergent validity (AVE) and reliability via the Cronbach alpha test. The second stage of this analysis constituted exploring the relationships between our factors. We employed structural equation modelling (SEM) together with AMOS SPSS software to determine these relationships.

Results

Descriptive analysis

Table 1 shows data retrieval presentation of the questionnaires extended to managers and employees of agribusiness firms in Ghana. Brong Ahafo Region recorded the highest with 83.6%. Volta region recorded the lowest with 41.6%. In all, 1526 questionnaires were retrieved out of the 2500 questionnaires submitted.

Table 2 indicates average responses to our latent variables. The average mean value is more than 4, indicating that respondents agreed to questions under each of the constructs.

Checking internal consistency and validity

The KMO value of 0.813 indicates a good sampling adequacy in our data. BTS value of 25378.506 reveals accurate sampling adequacy in employing factor analysis (Table 3).

The composite Cronbach alpha on each of our five (5) latent variables indicates a suitable level of internal consistency amongst the scale items because all the values were above the lower threshold of 0.70. Also, our AVE values above the 0.50 threshold show that our data satisfy the principle of convergent validity (Table 4).

Table 1: Data retrieval (Regional analysis).

Region	Regional capital	Data submitted	Data retrieval	Percentage
Greater Accra region	Accra	250	198	79.2%
Central region	Cape Coast	250	156	62.4%
Western region	Takoradi	250	201	80.4%
Ashanti region	Kumasi	250	184	73.6%
Volta region	Ho	250	104	41.6%
Brong Ahafo region	Sunyani	250	209	83.6%
Northern region	Tamale	250	193	77.2%
Eastern region	Koforidua	250	182	72.8%
Upper East region	Bolgatanga	250	147	58.8%
Upper West region	Wa	250	153	61.2%

Source: Authors' Construct, 2017

Table 2: Summary statistics of Likert scale variables.

Variables	*N*	Min.	Max.	Avg.	Std. Dev
Product innovation	1526	1	5	4.1982	1.0054
Process innovation	1526	3	5	4.7219	1.1768
Market innovation	1526	2	5	4.0853	0.8583
Organizational innovation	1526	3	5	3.9884	0.9134
Firms performance	1526	2	5	3.8694	1.2495

Source: Authors' Construct, 2017

Table 3: KMO and Bartlett's test of Sphericity.

Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)		0.813
Bartlett's Test of Sphericity (BTS)	Approx. Chi-square	25378.506
	df	153
	Sig.	0.000

Source: Authors' Construct, 2017

Table 4: Reliability and validity test.

Variables	Cronbach alpha	Convergent validity (AVE)
Product innovation	0.856	0.528
Process innovation	0.923	0.632
Market innovation	0.784	0.598
Organizational innovation	0.778	0.624
Firm's performance	0.942	0.514

Source: Authors' Construct, 2017

Table 6: Factor loadings.

	Factor				
	1	2	3	4	5
Collaboration				.589	
Ideation				.913	
Implementation				.897	
Value creation				.683	
Technique	.854				
Equipment	.832				
Software	.764				
Product			.764		
Pricing			.845		
Promotion			.839		
Place			.735		
Power structure		.779			
Management system		.896			
Procedural innovation		.717			
Innovation performance					.743
Organizational performance					.549
Market performance					.536
Financial performance					.542

Source: Authors' Construct, 2017

Exploratory factor analysis

With this table, orthogonal extraction with varimax was considered appropriate in the analysis because it was deemed necessary for a large number of variables with a minimum set of uncorrelated variables. Specifically, varimax rotation was employed to minimize variables with high factor loadings to augment the interpretation of factors. Five (5) factors in the principal component analysis had eigenvalue >1.0, explaining a total variance of 78.958% (Table 5).

This table depicts that all factors are significant, ranging from .536 to .913 with *p*-values <0.05 (Table 6).

Figure 2 represents the confirmatory factor analysis (CFA) derived from our AMOS software. The factor loading from each of our constructs depicted high and low loadings. Financial performance, market performance, organizational performance and collaboration showed low factor loadings. As a result of this, the values derived from our modification indices showed evidence that it is unnecessary to keep these factors. By so doing, these factors were deleted in our final structural equation modelling to obtained appropriate model fit values (Table 7).

Our unstandardized regression weights indicate that all values in our construct were significant with *p*-values <0.04.

Our model showed that our standardized residual covariance has a standard normal distribution with most of the values <2 in absolute value (Table 8).

Table 9 depict goodness-of-fit indices performed using the maximum likelihood estimation. These goodness-of-fit indices were conducted using the variance-covariance matrix obtained by ensuring correspondence with the sample. The λ^2/degree of freedom value of 3.714 corresponds with the general rule of 1< λ^2/df< with the value indicating a better fit. The CFI (comparative fit index),

Table 5: Total variance explained.

	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
Component	Total	% of Variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.849	49.160	49.160	8.849	49.160	49.160	3.825	21.248	21.248
2	2.128	11.822	60.982	2.128	11.822	60.982	3.533	19.630	40.878
3	1.344	7.468	68.450	1.344	7.468	68.450	2.475	13.751	54.630
4	1.062	5.900	74.350	1.062	5.900	74.350	2.463	13.682	68.312
5	.830	4.609	78.958	.830	4.609	78.958	1.916	10.646	78.958
6	.653	3.630	82.589						
7	.569	3.161	85.750						
8	.557	3.094	88.844						
9	.470	2.613	91.457						
10	.324	1.802	93.259						
11	.273	1.516	94.775						
12	.259	1.441	96.216						
13	.210	1.167	97.383						
14	.146	.809	98.191						
15	.120	.668	98.860						
16	.089	.494	99.354						
17	.062	.343	99.697						
18	.055	.303	100.000						

Source: Authors' Construct, 2017

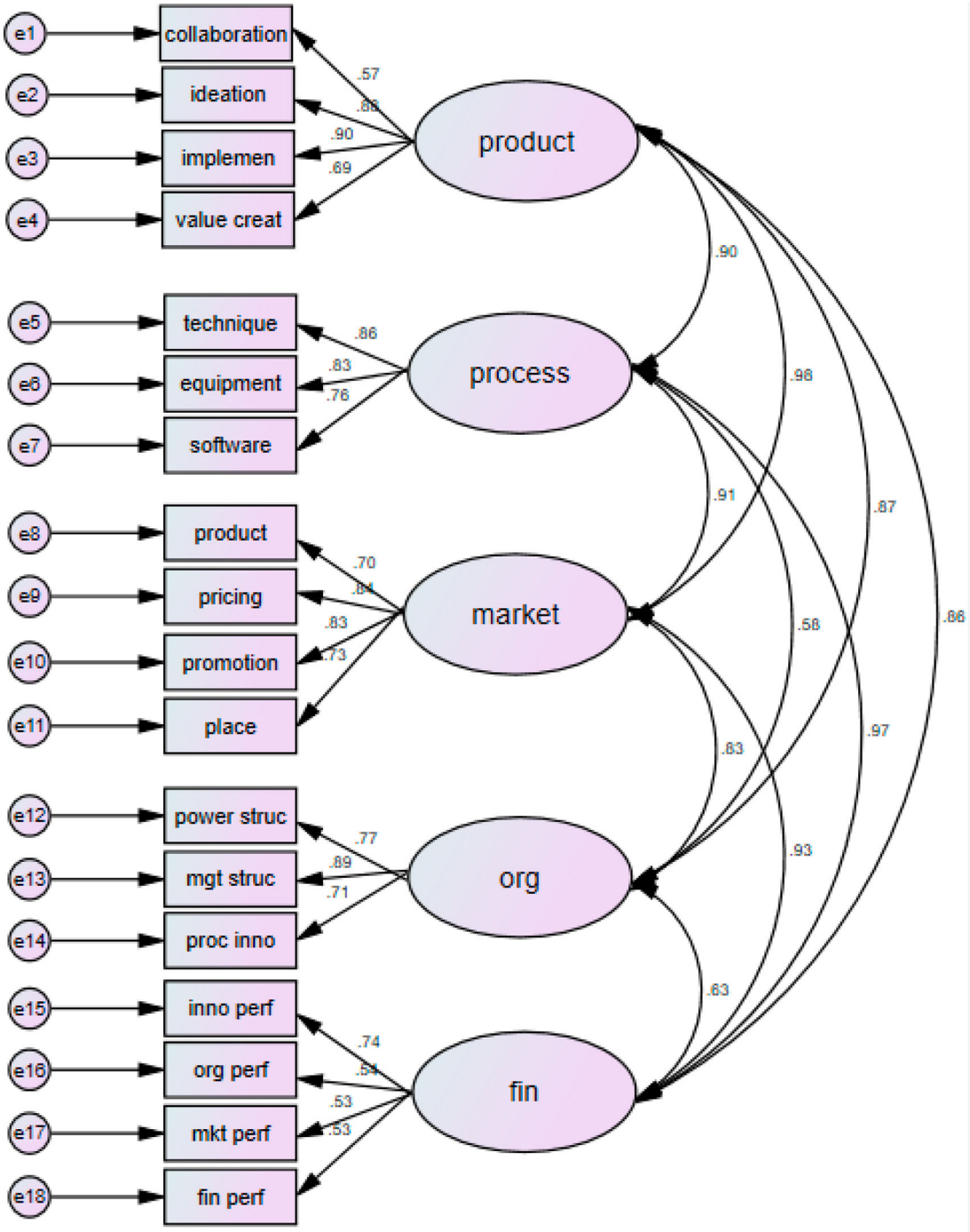

Figure 2: Confirmatory factor analysis (CFA).

NFI (normed fit index), RFI (relative fit index), IFI (incremental fit index) and TLI (tucker-Lewis fit index) all reported a very good fit because the values were all close to 1. Finally, the RMSEA value of 0.0034<0.08 also depicts a good model fit.

This structured model measures the effects of innovation (product, process, market and organizational) on firms' performance. This theoretical scheme (research model) is presented in Figure 3. Table 10 shows the standardized and unstandardized path estimates as well as the *p*-values for our structural model. Each of our hypotheses with *p*-values<0.05 was supported. This further supports the fact that product, process, market and organizational innovation has a positive impact on firms' performance. According to the regression estimates, process innovation is seen as the most influential driver of firms' performance. Also, it was observed that product innovation has an indirect positive impact on firms' performance. Finally, it was observed that the *r*-squared value of 0.575 shows that 57.5% of preceptor variance is explained by the predictor variables.

Discussions

Stimulating the growth of agribusiness firms goes beyond laying appropriate marketing strategies and rather hinges on innovation practices. The ability to adopt and

Table 7: Regression weights (Group number 1-Default model)

			Estimate	S.E.	C.R.	*P*
Col	←	product	0.474	0.019	24.736	***
Ide	←	product	0.895	0.017	51.737	***
imp	←	product	1			
vc	←	product	0.623	0.019	33.016	***
tcq	←	process	1			
equ	←	process	0.994	0.024	40.842	***
sof	←	process	0.866	0.024	35.666	***
pro	←	market	0.814	0.026	30.851	***
pri	←	market	0.951	0.024	40.153	***
prom	←	market	1			
pla	←	market	0.937	0.028	32.992	***
ps	←	org	0.831	0.023	35.576	***
ms	←	org	1			
pi	←	org	0.818	0.026	31.588	***
ip	←	fin	1			
op	←	fin	0.741	0.036	20.42	***
mp	←	fin	0.706	0.035	20.011	***
fp	←	fin	0.708	0.036	19.944	***

Source: Authors' Construct, 2017

Table 8: Standardized correlation results

	Ip	Pi	Ms	Ps	Pla	Prom	Pri	Pro	Sof	Equ	Tcq	Vc	Imp	Ide
Ip	0													
Pi	0.152	0												
Ms	0.083	−0.063	0											
Ps	0.178	−0.209	0.112	0										
Pla	−0.264	0.546	0.015	0.002	0									
prom	0.124	0.344	0.03	0.084	0.148	0								
Pri	−0.041	−0.139	−0.134	−0.019	−0.061	−0.106	0							
Pro	0.036	−0.151	−0.091	−0.019	−0.13	−0.047	0.233	0						
Sof	−0.165	−0.051	−0.002	0.019	−0.02	−0.009	0.16	0.148	0					
Equ	0.066	−0.099	0.017	−0.008	0.013	−0.057	−0.025	−0.036	−0.003	0				
Tcq	0.215	−0.079	0.049	−0.009	0.043	−0.062	−0.017	−0.003	−0.045	0.034	0			
Vc	0.269	0.027	−0.071	−0.069	−0.21	0.04	0.023	0.061	0.084	0.059	0.069	0		
Imp	−0.011	0.087	−0.058	−0.188	0.13	−0.028	−0.084	−0.172	0.028	0.073	0.141	0.066	0	
Ide	−0.036	0.028	0.032	−0.012	−0.065	−0.089	0.141	0.042	−0.003	−0.084	−0.092	−0.04	0.051	0

Source: Authors' Construct, 2017

implement workable innovation practices by an agribusiness firm gives it more competitive advantage than its competitors. Agribusiness firms in advanced countries are growing at a speedier pace than agribusiness firms in developing and emerging countries (Horbach, Rammer, and Rennings 2012). Based on this background, we analyzed the effects of innovation practices on agribusiness firms' performance.

Tackling the structural equation model used for our confirmatory analysis, it was evident from our standardized correlation matrix that those variables with low factor loadings were not included. This hinges on the fact that those variables (collaboration, organization performance, market performance and financial performance) have factor loadings below 0.70. Our standardized correlation weight table showed evidence of standard normal distribution because all the values satisfied the threshold of being less than two (2) in absolute value. After satisfying the existence of normal distribution in our correlation matrix, it was therefore viable to look into our model fit data in AMOS to check for our model fit indices. The λ^2/degree of freedom, CFI (comparative fit index), NFI (normed fit index), RFI (relative fit index), IFI (incremental fit index), TLI (tucker-Lewis fit index) and RMSEA (root mean square error) all showed the existence of good or better fit when compared to the reference value in Table 9.

In confirming the relationship between innovation practices to firms' performance (production innovation to firms' performance, process innovation to firms' performance, market innovation to firms' performance and organizational innovation to firms' performance) we resorted to regression in AMOS to depict these relationships. Regression weights were found for all the variables under each of the constructs and recoded into one variable for all five (5) observed variables (product innovation,

Table 9: Goodness-of-fit indices

Goodness of Fit	Construct	Reference Value
λ^2/degree of freedom	3.714	$1< \lambda^2/df<5$
CFI (comparative fit index)	0.962	0.95<CFI<1
NFI (normed fit index)	0.947	0.90<NFI<1
RFI (relative fit index)	0.938	0.90<RFI<1
IFI (incremental fit index)	0.962	0.95<IFI<1
TLI (tucker-Lewis fit index)	0.959	0.95<TLI<1
RMSEA (root mean square error)	0.034	RMSEA<0.08

Source: Authors' Construct, 2017

Table 10: Structural model path coefficients

Variables	Unstandardized estimates	Standardized estimates	SE	*P*	Results
Product to performance	−0.174	−0.189	0.029	.000	Supported
Process to performance	0.726	0.725	0.027	.000	Supported
Market to performance	0.119	0.117	0.025	.000	Supported
Organizational to performance	0.167	0.177	0.021	.000	Supported
R squared	0.575				

Source: Authors' Construct, 2017

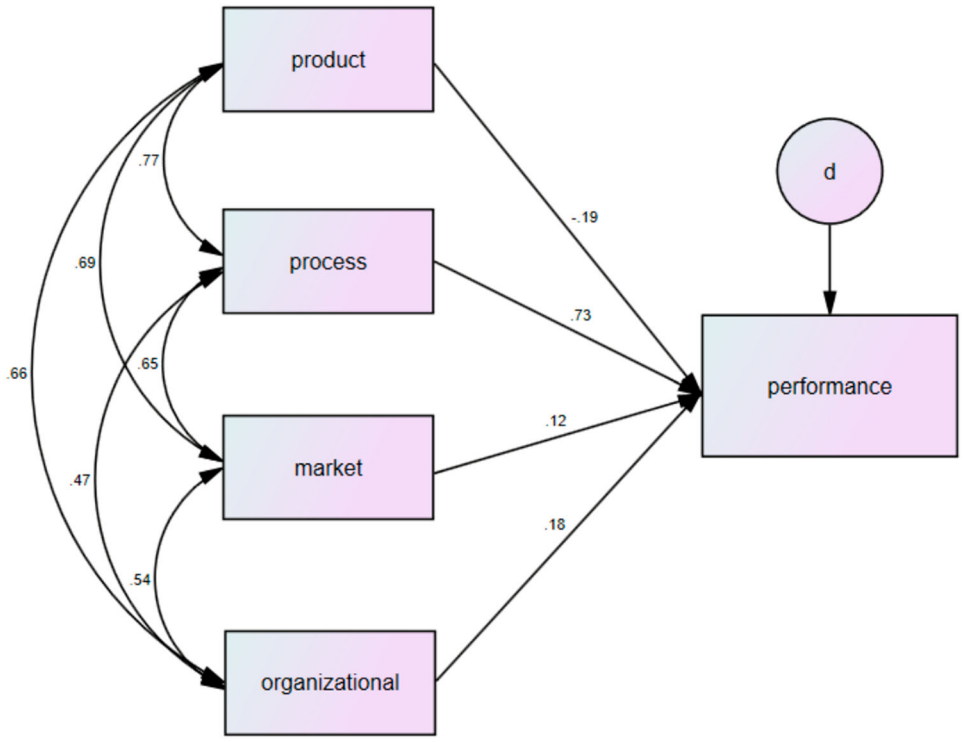

Figure 3: Regression results.

process innovation, market innovation, organizational innovation and firms' performance). Analyzing product innovation to firms' performance, our standard coefficient value of −0.189 depicted the existence of an indirect relationship between product and performance. Nevertheless, we obtained a *p*-value of 0.00 therefore satisfying our first hypothesis (Battilana and Lee 2014; Schad et al. 2016). Our second hypothesis (process and firm performance) had a *p*-value of 0.00 as well as a strong standardized coefficient of 0.725 which further concludes that process innovation has a strong relationship with firms' performance (Hassan et al. 2013; Karabulut 2015). Furthermore, our third hypothesis (market to firms' performance) was also supported with a weak positive coefficient of 0.117 and a *p*-value of 0.00. This indicates that market innovation positively induces firms' performance (Hallstedt, Thompson, and Lindahl 2013; Paillé et al. 2014). Finally, the fourth hypothesis (organizational and firms' performance) was also supported with a weak positive coefficient of 0.177 and a *p*-value of 0.00. As with our third hypothesis, this also confirms that organizational innovation stimulates firms' performance (Hassan et al. 2013; Maziriri and Chinomona 2016).

Conclusion and recommendation

This study reports on innovation practices amongst agribusiness firms across all the ten regions in Ghana by drawing on a sample of 1526. Our theoretical framework was entirely tested in determining whether agribusiness firms' innovation practices have an influence on firms' performance. Our findings from our regression table show that all our hypotheses are supported with the highest influential factor on firms' performance being process innovation. Consequently, it can be observed that product innovation has an indirect positive relationship with firms' performance. Therefore, in ensuring that agribusiness firms adopt innovation practices in the daily operations of their businesses, we propose the following recommendations to augment agribusiness firms' innovation practices.

Agribusiness practitioners should pay more attention to organizational innovation as it not only significantly relates with other innovation types but also has a stronger positive impact on innovative performance. Innovative performance is the main vehicle to convey the positive effects of innovation types to market, production and financial performance.

- Agribusiness policies should be designed in ways that addresses horizontal concerns and which generate better and more viable inducement for innovation activities.
- Practitioners should appreciate investments for bringing innovation capability to sustain the competitive advantage and increase the profitability of the firm.
- Better systems for internal and external information sharing between co-operating agribusiness firms may be a direction to follow.

Disclosure statement

No potential conflict of interest was reported by the authors.

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