

## DETERMINANTS OF THE ADOPTION OF DRYING TECHNOLOGY FOR TOMATO PRODUCTS BY SMES IN NIGERIA: OWNER CHARACTERISTICS AND SMES INNOVATIVENESS

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### Abstract

Nigeria is making effort at reviving tomato processing industries including suggestions by scholars for the alternative use of drying technology as against the current practice of sun-drying by farmers with the resultant consequence of poor quality products. Adoption of drying technology at industrial level require knowledge of it's possible determining factors. The objective of the study is to investigate whether SMEs owner characteristics and organizational innovativeness influence and therefore predict adoption of drying technology for tomato products from the perspectives of owners/managers of tomato processing and allied industries. The results which show high contribution of SMEs innovativeness in predicting adoption would provide useful information to government policies and guide would-be entrepreneurs on policies and investment strategies in the sector. The study which is explorative adopted descriptive survey research design using stratified random sampling and structured questionnaire measured on Likert scale and analyzed by SPSS Package Version 20 with multiple regressions.

*Keywords: Determinants, SMEs innovativeness, Owner characteristics, Adoption of drying technology and Tomato products.*

### Background to the Study

Nigeria is a major player in the production of tomatoes in the World with 1,860,600 metric tonnes in year 2010, thus ranking her as the 13th in the World and 2nd to Egypt in Africa (FAO Stat, 2011). However, up to 50% of harvested tomatoes get spoilt annually causing seasonal shortage and fluctuation in supply and prices (Musa-Makama et al,2005). The above situation creates acute shortage to meet its demand that compels importation of an estimated \$162 million of processed tomato paste in year 2008 (NBS, 2010). The CBN (203) reported a whopping current importation figure of N11.7 billion which according to Aganga (20013) is hurting the economy on what it can produce in abundance locally.

Nigeria is making effort to promote domestic growth in processed tomato market from indigenous commodities which has since collapsed with scholars suggesting affordable alternative processing technique such as drying technology (Aminu et al, 2013). Incidentally too, the government Transformation Agenda has identified the need to exploit and utilize available agricultural resources and enhance the development and dissemination of appropriate and efficient technologies for rapid adoption in value addition through the processing chain.

The current use of sun drying for tomatoes excesses by farmers produce un-wholesome products (Oyebanji et al 2011). Consumers of dried tomatoes demand many of their original characteristics be retained which is only possible by use of technologically controlled drying mechanisms (Brooks et al, 2008).

At present, none of the over 100 registered local tomato processing SMEs process from fresh indigenous tomatoes but are all engaged in re-packaging tomatoes paste imported from China (Uba, 2010). Should Nigerian government decide to reduce or ban importation of tomato paste today, many of these SMEs may collapse hence the need to look ahead for possible affordable alternative. This therefore provides a research gap for study in predicting the determinants for adoption of drying technology at the level of manufacturing SMEs for tomato products as against the current use of sun-drying by farmers. The objective of the study is to investigate SMEs innovativeness and owner characteristics on adoption of drying technology, from several other determinants identified in literature. The results will guide would-be entrepreneurs and provide useful information in formulating suitable policies to support business success in the sector.

### Statement of the Problem

The Transformation Agenda of government 2011-2015 desires to utilize it's abundant agricultural resources by adoption of efficient technologies in the value-added processing chain of indigenous commodities. The situation is even more desirous with indigenous tomatoes where current efforts are geared towards fueling domestic growth of processed tomato products to replace imported paste as well as seek affordable alternative processing technique like use of drying technology. Since none of the registered tomato processing SMEs participate in industrial dehydration of tomatoes, thus leaving farmers alone to continue to depend on sun-drying for their excesses despite its inadequacies (Oyebanji et al, 2011). Hence, thoughts of adoption at that level as an alternative processing method become inevitable.

To achieve this higher height requires knowledge of the influence of SME Owner characteristics and innovativeness of the SMEs as influencing factors of adoption hence the gap for this study.

### Objectives of the Study

- 1) To establish whether SME owner characteristics influence adoption of drying technology for tomato products by SMEs in Nigeria.
- 2) To determine whether SMEs innovativeness influence the adoption of drying technology for tomato products in Nigeria.

### Research Hypotheses

- Ho1: SMEs owner characteristics do not significantly influence the adoption of drying technology for tomato products by SMEs in Nigeria.
- Ho2: There is no significant influence of SMEs innovativeness on the adoption of drying technology for tomato products by SMEs in Nigeria.

### Literature Review

Jaides and Beaumont (2003) identified the dominance of owners/managers which largely contribute to SMEs final decision to adopt technology. Firm owner characteristics such as age, ethnic background, education, personal technology experience and perceived competitive pressure, influence their decision in adoption of technology. Cabral et al (2009) in using the theory of technology acceptance in empirical studies, found good evidence for the role of moderating influences such as voluntariness of use, experience, gender and age in technology adoption, while the contribution of Suebsin & Gerdson (2009) on Technology Acceptance Model (TAM) attributed attitude of decision makers as contributing to actual system use which influence adoption.

Innovativeness is the ability or propensity to generate, accept and implement new ideas, processes, products or services (Thompson, 1967). Rogers in 1995 (Beaumont & Jaidec, 2003) proposed models for innovation-decision process and stressed that managerial attitude and innovativeness are key factors in the innovation-decision process. The study model of Allan et al (2003) have shown the influencing factors of ICT adoption that includes technological innovativeness, environmental factors, organizational factors and individual factors. The classical model in the antecedent to innovation literature includes several types of predictors for innovativeness viz: characteristics of organizational members, characteristics of the organization and environmental factors (Hadjimanalis, 2000). The review guided the conceptual framework for the study as shown in Fig. 1.

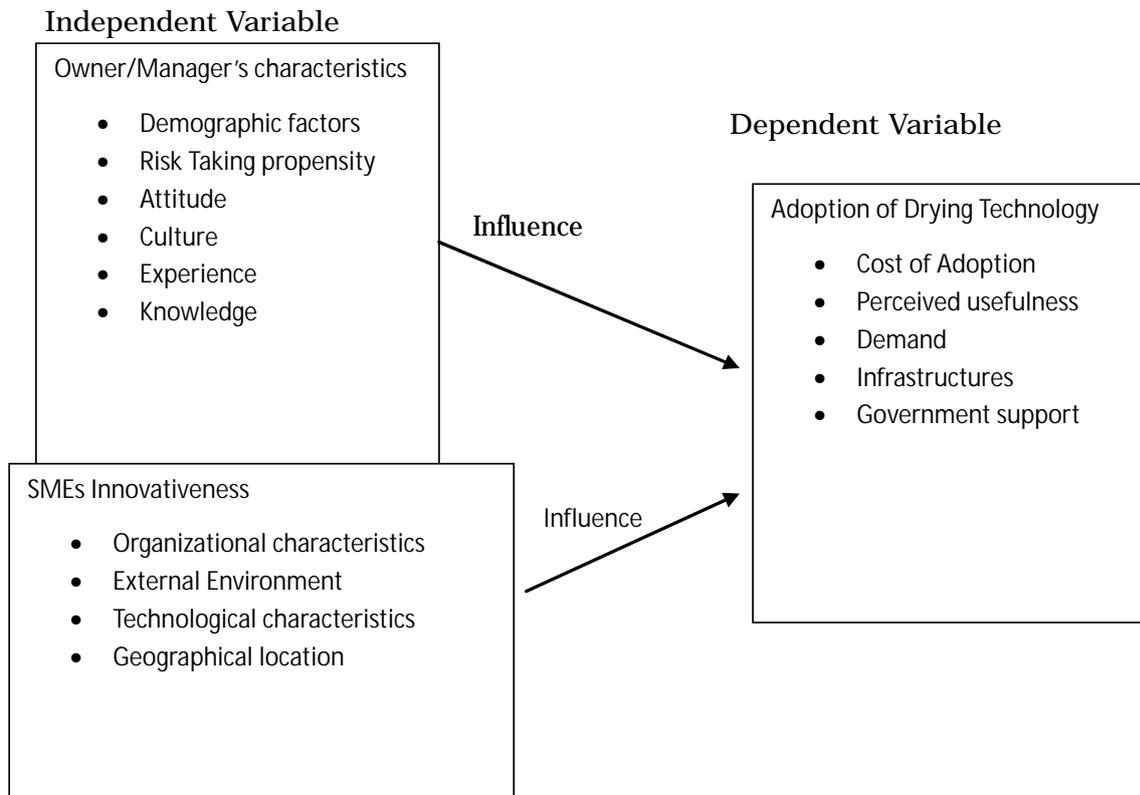


Fig. 1 Conceptual Framework for Adoption of drying technology for tomato products by SMEs

### The Research Design

In this study, an exploratory descriptive survey research design was adopted to investigate the two objectives. The design was used to explore and help picture current conditions of the SMEs and to yield preliminary qualitative and quantitative information on current situation as expressed by respondents which were used to explain or predict probable determinants (predictors) with respect to resources and market development being investigated. The use of the research design is justified by the exploratory nature of research since there are few or no studies in the study area. The focus is on gaining insights and familiarity for later investigation in this preliminary stage (Bassey et al, 2014).

### Target Population

In this study, the target population is the Chief Executive/Owners, Managers or designated staff of the 118 registered tomato processing and allied SMEs in Nigeria (NAFDAC, 2010). The main reason being that they are the decision makers and therefore the only one that can authorize response from the perspectives of their enterprise or organizations especially on adoption decisions/issues as required by the studies.

### Sampling Technique

Pilot test of content validity was through consultation with 3 experts in measurement and evaluation, statistics and management whose comments were used to adjust the questionnaire before sending out to 8 CEO/Managers of tomato processing SMEs where feedback were adjudged satisfactory. In the main survey, the Cochran's formular (1977) was used to obtain the most efficient, representative sample size. Thus:

Thus:

$$n = \frac{1}{4} \frac{(Z \alpha/2)^2}{\rho^2}$$

where n is the minimum sample size required,  
 $Z \alpha/2$  is the value of the standard normal ordinate  
 $\rho$  is the level of significance and  
 $e$  is the predetermined margin of error.

Since N = 118 comprising all tomatoes and allied SMEs in Nigeria, the predetermined margin of error is 15%,  $\rho = 0.15$  and at the 5% level of significance,  $Z \alpha/2 = Z 0.025 = 1.96$   
 The following computation give the sample size determination:

$$n = \frac{1}{4} \frac{(Z \alpha/2)^2}{\rho^2} = \frac{1}{4} \frac{[1.96]^2}{0.15^2} = 42.68 \sim 43$$

Therefore the sample size of 43 was used with a sampling error of at most 15% for the study.

The proportionate stratified random sampling was adopted to select sample size already determined across states as shown:

Table 1: Sampling Procedure

	Population	Proportion	Sample Size (n = 43)
South West	89	0.754	33
South East	16	0.136	6
North	<u>13</u>	<u>0.110</u>	<u>4</u>
TOTAL	118	1.00	43

### Data Collection Procedure

A structured questionnaire was used which has three sections. Section A consists of background information of Enterprise, while Sections B and C are structured questionnaires arranged in two parts in line with the research objectives. Measurements was by Likert Scale with range of 4 to 1.

### Data Analysis

The data were processed using SPSS Version 2.0 with the following regression model:

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Where y = Adoption of drying technology

- $\beta_0$  = constant
- $\beta_1$  = corresponding coefficient for SMEs innovativeness as influencing adoption of drying technology
- $X_1$  = SMEs innovativeness as predictors of adoption of drying technology
- $\beta_2$  = Corresponding coefficient for SMEs owner characteristics as predictors of adoption or drying technology
- $X_2$  = SMEs owner characteristics as predictors of adoption of drying technology
- $\varepsilon$  = Error term
- = 0.05

### Assumptions

1. Coefficients must be linear in nature
2. Response error should follow a normal distribution
3. Error should have a common distribution
4. There is equal variance assumption
5. The values for the 2 variables are independent

### Regression Analysis and Discussion

Table 2: Contribution of SMEs Innovativeness and Owner characteristics in influencing Adoption of Drying Technology for Tomato products by manufacturing SMEs in Nigeria.

Model	Unstandardized coefficient		Standardized coefficient	t	S:g
	B` `	Standard error	Beta		
1 (Constant)	.212	12.615		.017	.987
Innovativeness	.791	.514	.554	1.539	.199
Owner characteristics	-.613	.333	-.663	-1.841	.139

Table 2 above shows the contribution of SMEs innovativeness to be 0.791 and owner characteristics to be -.613 in influencing adoption of drying technology with the following regression model:

$$Y = .212 + .791x_1 - .613X_2$$

Where

- Y = Adoption of drying technology
- X1 = SMEs innovativeness
- X2 = SME owner characteristics

1. Holding X2 constant, it shows that a unit increase in SMEs innovativeness will cause an increase of .791 units of influence in adoption of drying technology.
2. Holding X1 constant, it shows that a unit increase in SMEs owner characteristics will cause a decrease of .613 units of influence in adoption of drying technology.

To check if the predictors are significant, since P – values i.e (Sig) which are .199 and .139 i.e. for SMEs innovativeness and SME owner characteristics are greater than  $\alpha = 0.05$ , it shows they are statistically significant. Hence, both innovativeness and owner characteristics of SMEs have significant influence on adoption of drying technology.

Table 3: Model Summary of Independent Variables on dependent variables

Model	R	R Square	Adjusted square	R	Std. Error of the Estimate
1	.726a	.528	.291		6.84615

- a. Predictors: (Constant), SME Innovativeness, SME Owner characteristics

Table 3 above shows a strong positive correlation of 0.726 of both SMEs innovativeness and owner characteristics to drying technology adoption. Also, with regression coefficient (R<sup>2</sup>) = 0.528 x 100 = 52.8%, it shows that the variability of Y on SMEs innovativeness and owner characteristics is explained by 52.8%, while the remaining (100 – 52.8 = 47.2%) is explained by other variables not measured by the model.

Table 4: ANOVA table of the variation of independent variable on dependent variable.

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	209.378	2	104.689	2.234	.223 <sup>b</sup>
Residual	187.479	4	46.870		
Total	396.857	6			

- a. Dependent Variable: Adoption of Drying Technology
- b. Predictors (constant): SMEs innovativeness, SMEs Owner characteristics

### Conclusion

The study was conducted to investigate the influence of SMEs innovativeness and SMEs owner characteristics on adoption of drying technology for tomato products by SMEs in Nigeria. It was found that both innovativeness and owner characteristics influence adoption of drying technology. Furthermore, both independent variables are significant contribution in predicting adoption of drying technology for tomato products by manufacturing SMEs in Nigeria. The information provide knowledge on factors of innovativeness and owner characteristics in determining adoption of drying technology at industrial level which would be helpful for policy formulation and assist would-be-entrepreneurs in the sector.

## Recommendations

1. Due consideration should be given to factors of SMEs innovativeness (ability to generate and implement new ideas) in an attempt to revive domestic processing of tomatoes that may include adoption of drying technology at manufacturing level. These include intensifying research and development in the area, making information on the subject matters available, improve technological competence of SMEs, net-working, government support with appropriate policy and regulations.
2. Since both innovativeness and owner characteristics contribute 52.8% to adoption of drying technology, further research is needed to uncover other independent variables that may explain for the remaining 47.2%.

## References

- Aganga, O. (2013) "Government's Drive towards Development in Nigeria" A paper delivered at the UK-Nigeria SME networking event 7th March, 2013 retrieved on August 22, 2013. [www.scribd.com/mobile/doc/141434143](http://www.scribd.com/mobile/doc/141434143)
- Allan, C. & Annear, J. (2003). "A framework for the Adoption of ICT & Security Technologies by SME's. A paper for the Small Enterprise Association of Australia & New Zealand 16th Annual Conference, Ballarat.
- Aminu, A. and Musa, S.A. (2013). "Tomato commodity chain analysis in Kano River Irrigation Project Nigeria" (ADENI), French Embassy/NAERLS ABU, Zaria. Retrieved May 9th, 2013 [www.hubrural.org/IMG/pdf/nigeria\\_tomato\\_report.pdf](http://www.hubrural.org/IMG/pdf/nigeria_tomato_report.pdf).
- Bassey, A., Ankai, A. S., Diji, C. J., Babajide V.F.T., Yariyo, K.P., Bashir, F. U., Ekei, J.O. (2014). "Standards for writing Research proposal" Grants & Field Reports. African Research Council on Sustainable Development.
- Cabral, C., Lucas, P. & Gordon, D. (2009) "Technology adoption in developing country contexts" testing water for microbial contamination, school of policy studies, University of Bristol Aquatest working paper No. 03.
- Central Bank of Nigeria Annual Report (2011/12).  
[www.cenbank.org/out/2012/publication\\_reports](http://www.cenbank.org/out/2012/publication_reports).
- Cochram, W. G. (1972). Sampling size Determination in Farmers sampling size. Publisher Wiley pages: 428. Published 1977-01-ISBN-10
- FAOSTAT. (2011) "List of countries by tomato production accessed in August 2011" [en.wikipedia.org/wiki/list](http://en.wikipedia.org/wiki/list).
- Hadjimandis, A. (1990) "Barriers to innovation for SMEs in a small less developed country (Cyprus)" *Technovation* 19(9). 561-570.
- Jaidee, S. & Beaument, N. (2003). "Factors Affecting SMEs Owners / managers in Adoption of Business – to – Business Techniques" A Research frame work (Monash University, faculty of Business and economies). Working papers retrieved on 9/9/2012. [www.busecs.monash.edu.au/mgt/research](http://www.busecs.monash.edu.au/mgt/research)
- Malti Stendahl and Anders Roos (2008). "Antecedents & Barriers to product Innovation" A comparison between innovating and non-innovating strategic business units in the Industry. Swedish University of Agricultural Sciences. Available at <http://www.metla.fi/silvafennica/full/sf42/sf424659.pdf>

- Musa-Makama, A.L. (2006). "Kinetics of convective drying of sliced tomatoes (*Lycopersicum esculentum*)" Proceedings of the 7th Internal Conference & 28th Annual General Meeting of the Nigerian Institution of Agricultural Engineers. ABU, Zaria 28:289-294.
- National Agency for Food & Drug Administration & Control (2010). NAFDAC Green Pages 1st Edition.
- National Bureau of Statistics (NBS). "Review of the Nigerian Economy in 2011" National Centre for Technology Innovation (NCTI-2012) Advancing Technology Innovation for all students. [www.nationaltechcentre.org](http://www.nationaltechcentre.org). Retrieved on 13/09/2012.
- Oyebanji, A. O., Ibrahim, M. H., Okanlawon, S. O., Okunade, S. O. & Awagu, E. Z. (2011) "Journal of Science and Post-harvest Research" Vol. 2(10) Pp. 200-207
- Suebsin, C. & Gerdri, O. (2009). "Key Factors v Driving Success of Technology Adoption" Case Examples of ERP Adoption PICMET Proceedings, Portland, Oregon USA.
- Thompson, J. (1967). Organizational in action. McGraw-Hill New York. 192p.
- Uba, G. (2010). Investing in tomato puree & paste production in Nigeria. [www.business day on linc.com/Archive](http://www.business day on linc.com/Archive) retrieved on 8/9/2012.