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Factors Associated with Effectiveness of Improved Cassava Production Technologies in Osun State, Nigeria

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ABSTRACT

Crucial factors which influenced the effectiveness of the improved cassava production technologies were isolated through factor analytical technique. Multistage sampling procedure was employed. 40% of the Local Government Areas (LGAs) in the state were selected based on the number of LGAs in each agricultural zone making 12 LGAs. At the second stage, 2 communities with higher concentration of cassava growers were selected from each of the twelve LGAs, giving a total of twenty-four communities. At the third stage, from each of the twenty-four communities, 25% of the population of registered ADP full-time cassava farmers was randomly selected for interview giving a total of 312 cassava farmers. Factors analytical technique was employed to isolate the critical factors.

The results show that the improved cassava production technologies disseminated to farmers were moderately effective. Nine group of factors were isolated with 54.50% contribution to effectiveness of the improved cassava production technologies. However, economic factor had the highest contribution to effectiveness (11.5%). Other factors were: capacity building factor, group orientation factor, innovation factor, social factor, human resource factor, capital factor, leadership factor and community factor. These findings suggest that there is an urgent need for extension service stakeholders to consider these factors seriously if significant yield increases of cassava will be achieved in the study area.

Keywords: Capacity building, dissemination, extension service, effectiveness, technologies, innovation,

INTRODUCTION

Nigeria is presently the largest producer of cassava in the world with an estimated 49 million tonnes [1]. As a major staple food in Nigeria, it has benefited from the agricultural policies and initiatives of government because of its numerous uses and bye products. It is a major food crop in Nigeria. Presently, there are over 200 possible uses of cassava worldwide [2]. Each component of the plant is useful; the leaves can be consumed as vegetable, cooked as soup ingredient or dried and fed to livestock as protein supplement. The stem is used for plant propagation and grafting while the roots are processed for human and industrial consumption [1]. As a result of its numerous uses especially to reduce extreme poverty and hunger, research has concentrated on improving cassava for increased production per hectare of land. The central aim of any improved technology is to bring an improvement in agricultural productivity and thereby ensure increased standard of living of the farmers and hence overall development of the rural landscape. This aim can only be achieved when the improved technology have gained mass adoption by farmers.

Effectiveness is the measure of the extent to which the improved technologies has produced the expected results or met the objective of disseminating them. Crucial factors are group of factors isolated from large number of underlying variables which determine the effectiveness of a particular programme [3]. Agricultural programmes operated in Nigeria in the past such as Operation Feed the Nation (OFN), Green Revolution (GR), Agricultural Development Programme (ADP), Farm Settlement Scheme were all focused towards increased use of improved technologies by farmers. The Institute of Agricultural Research and Training (IAR & T) is one of the national research institutes under the aegis of the Federal Ministry of Science and Technology which has recommended improved cassava production technologies. It has the mandate of serving the interests of farmers in the South Western Nigeria on the development and dissemination of improved varieties of cassava that are superior to old varieties and resistant to diseases like Cassava Bacteria Blight (CBB) and African Cassava Mosaic Virus(ACMV). The improved varieties: TMS 30572, TMS 30555 and TMS (4) 21425 have been disseminated to farmers for years now through the Agricultural Development Project (ADPs). In recent times, improved cassava varieties NR 8082 and NR 8033 were also being introduced and demonstrated to farmers. These new varieties were superior in terms of disease and pest resistance and tuberization [4].

Inspite of the fact that Nigeria is currently the world's largest producer of cassava, the current level of production is low relative to the targeted 150million metric tons, thus limiting Nigeria's market share and revenue from cassava export [1]. It is also obvious that the small scale farmers who constituted the majority of farmers are living below poverty line. Available statistics also prove that the yield increase of cassava has not been significant over the years [1], coupled with reported reduced cultivated hectarage over the years [5]. [2],

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also reported that in spite of the ongoing cassava revolution in Nigeria, high level of awareness of associated technologies notwithstanding, lower levels of use of cassava technologies still predominate .Moreover [6] reported that the main problem is not the lack of technologies and scientific findings needed for economic and social change. Added to these are the problems of marketing of cassava during boom seasons and high production costs attributable, due largely to infrastructural inadequacies, which limit the competitiveness of Nigeria's cassava at the international market [1].

There is therefore the need to boost productivity through the use of improved cassava production technologies and this cannot be achieved in terms of yield per hectare without a proper understanding of the factors influencing the effectiveness of the improved technologies. Therefore, the purpose of this study was to appraise the effectiveness of the improved cassava production technologies disseminated to farmers and to isolate the crucial factors that are associated with it.

The objectives of the study therefore were to;

i. determine the level of effectiveness of the improved cassava production technologies.
ii. investigate the factors associated with effectiveness of the improved cassava production technologies.

MATERIALS AND METHODS

Multistage sampling procedure was employed to select the cassava farmers. In the first stage, 40% of the Local Government Areas (LGAs) in the state were selected based on the number of LGAs in each of the 3 agricultural zones making 12 LGAs. At the second stage, two communities with higher concentration of cassava growers were selected from each of the twelve LGAs, giving a total of twenty-four communities. At the third stage, from each of the twenty-four communities, 25% of the population of a registered ADP farmers group was randomly selected giving a total of three hundred and twelve cassava farmers.

Effectiveness which is the dependent variable of the study was measured following [7] and [8]. Farmers were given a 23- item statements on the improved cassava production technologies disseminated to farmers based on the objectives of the technologies and measured on a 5-point likert scale, thus; very effective (5 points), effective (4 points); fairly effective (3 points), rarely effective (2 point) and not effective (1 point). The improved cassava production technologies were: choice of land, land preparation, recommended varieties, planting time, planting techniques, planting spacing, weeding technique, pesticide application, supplying, herbicides application, fertilizer rate, fertilizer application, and timely harvesting.

Effectiveness index was the sum of the scores on all 23 statements per farmer. The maximum score was 115, while the minimum was 23. Total score for each respondent was grouped into 3 categories: high, low and medium. The high was placed within mean plus standard deviations, the low within mean minus standard deviation, while the medium within mean ± standard deviation. Factor analytical technique was adopted to isolate the more crucial and unique factors that are associated with the effectiveness of improved cassava technologies. Kaisers criterion was employed which according to [9], was to select those factors which have Eigen value of greater than one and variables with correlation coefficient of greater than 0.30 and the factors in each group were labeled or named based on the following criteria as employed by Farinde [3]:

1. Picking synonyms of the higher loaded variables on each factor
2. Joint explanation or interpretation of the highly loaded variables on each factor
3. Retaining the name based on the similarity of the factors reposed in the variables contributive to the factors.

RESULTS AND DISCUSSION

Effectiveness of Improved Cassava Production Technologies.

Table 1 showed that 22.1 percent of the technologies had high level of effectiveness, 68.3 percent had medium level of effectiveness, while 9.6 percent had low level of effectiveness. The mean was 82.7, while the standard deviation was 12.07. This finding agree with [10], who reported a medium level of effectiveness (40 – 76.9%) for the various non – indigenous storage practices for maize, cowpea and yam in Oyo State while Farinde [3] reported that majority (72.62%) of farmers in the T & V extension system of the Lagos State ADP had their effectiveness scores within the medium level. In summary, it could be said that the improved cassava production technologies disseminated to farmers through the Osun State ADP were effective.

Table 1
Distribution of level of effectiveness of improved cassava production technologies

n=312

Level	Scores	Frequency	Percentage
High	Above 95	69	22.1
Medium	70 – 94	213	68.3
Low	Below 70	30	9.6

Mean = 82.7
Standard deviation = 12.07
Source*: Field Survey* 2010

Factors associated with effectiveness of improved cassava production technologies

Results in Table 2 show that the factors loaded explained 64.8% of variance, while unknown factors explained the remaining 35.2 percent of variance. Economic factor 11.5%, capacity building factors 9.6%, group orientation factor 7.4%, innovation factor 7.3%, social factor 6.4%, human resources factor 6%, capital resource factor 5.8%, leadership factor 5.6% and community factor 5.1% are the named factors that have eigen value greater than 1.

Table 2
Principal component analysis of factors associated with effectiveness of improved cassava production technologies.

	Factor label names	Eigen Value	Proportion variance	Percentage variance	Cumulative percentage variance
1.	Economic factor	2.310	0.115	11.5	11.5
2.	Capacity building factor	1.915	0.096	9.6	21.1
3.	Group orientation factor	1.482	0.074	7.4	28.5
4.	Innovation factor	1.457	0.073	7.3	35.8
5.	Social factor	1.288	0.064	6.4	42.3
6.	Human resource factor	1.204	0.060	6.0	48.3
7.	Capital resources factor	1.179	0.058	5.8	54.2
8.	Leadership factor	1.116	0.056	5.6	59.7
9.	Community factor	1.014	0.051	5.1	64.8
10.	Other factor (unknown)			35.2	100.0

Source: *Field Survey***,** 2010
Λ = **Latent root for the factor** ($\sum L^2$)

The descriptions for each of the factors are presented below:

Economic factor (factor 1)

Results in Table 3 show the value of loading in economic factor (factor 1), with source of capital (L = 0.684); amount in savings (L = 0.624); income (L = 0.725); expenditure on adopted technologies (L = 0.170); hired labour (L = 0.356), years of schooling (L = 0.488) and farm size (L = 0.528).

The following variables above contributed to the factor with the following percentages: income (52.6%) and source of capital (46.8%). The income level of any farmer is a major contribution to effectiveness of improved technologies. A farmer with steadfast source of income will be more favourably disposed to the usage of improved technologies than a farmer with low and unsteady income. Therefore, income level of a farmer is associated with effectiveness of improved technologies.

Capacity building factor (Factor 2)

Results Table 3 show the values of the loadings in capacity building factor (factor 2), with years of schooling, (L = 0.972); age (L = 0.852) extension contact (L = 0.729); extension training (L = 0.924); family labour (L = 0.262); source of credit (L = 0.528) and amount in savings (L = 0.317). All these variables have significant contribution to capacity building factor. Data further revealed that each of these variables had the highest contribution with the following percentages: years of schooling (94.5%), extension training (85.4%) and age (72.6%). Level of literacy of the cassava farmers coupled with age and experience and extension training will greatly influence the effectiveness of the improved cassava production. This finding is in agreement with [11], [10] and [12] who reported that majority of arable farmers and fish farmers respectively were literates in Osun State. Therefore, as the literacy level of the farmer increases, the effectiveness of the improved cassava production technologies increases.

Group orientation factor (factor 3)

Data in Table 3 show the value of the loadings in group orientation factor (factor 3), with external orientation (L = 0.604); social organization membership (L = 0.742); years of schooling (L = 0.312); household size (L = 0.369); extension contact (L = 0.370) and extension training (L = 0.444). All these variables have significant contribution towards group orientation factor. The data further revealed that each of the variables contributed to the factor with the following percentages: social organization membership (55%), external orientation (36.4%), and extension training (19.7%). Social organization membership could be a determinant factor of the effectiveness of improved cassava technologies as it improves the social contacts and networks of farmers and exposed them to improved technologies.

Innovation factor (factor 4)

Data in Table 3 show that the following variables significantly contributed to innovation factor. The variables are: cost (L = 0.770); complexity (L = 0.773); accessibility (L = 0.865); compatibility (L = 0.867); communicability (L = 0.845) and relative advantage (L = 0.726). The data further revealed that each of these variables had high contribution towards innovation factor with the following percentages: cost (59%), complexity (59.7%), accessibility (74.8%), compatibility (75%), communicability (71.4%) and relative advantage (52.7%). The results show that the variables compatibility and accessibility had the highest percentage. The compatibility of the improved cassava production technologies would enhance effectiveness of the improved technologies. This finding agrees with Jibowo [13], who reported that innovations that are compatible with the culture and practices of the farmers will be more adopted hence facilitating effectiveness. Therefore, the more the compatibility of the improved technologies, the more the effectiveness of the improved cassava production technologies.

Social factor (factor 5)

The value of the loading for factor 5 in Table 3 shows that the following variables had significant contributions to social factor associated with the effectiveness of improved technologies. The variable are: age (L = 0.625); number of children (L = 0.750); number of wives (L = 0.739); household size (L = 0.766); occupation (L = 0.625); and religion (L = 0.327). The result also shows that the following variables contributed to social factors with the following percentages: household size (58.6%), number of children (56.2%) and number of wives (54.6%). Household size had the highest percentage contribution to social factor. Large households constitute cheap labour force and have an impetus to expansion of a farm which invariably will influence adoption of improved technologies, hence aiding effectiveness of the same. [14] asserted that large family size might be desirable as a source of ready labour for farm work..

Human resource factor (factor 6)

The value of the loading for factor 6 in Table 3 shows that the following variables had a significant contribution to human resource factor associated with the effectiveness of improved cassava technologies. The variables are: family labour (L = 0.756); farm size (L = 0.610); and hired labour (L = 0.543). The result further reveals that the following variables contributed to the factor with the following percentages: family labour (61.5%), mechanized labour (57.2%), farm size (37.2%) and hired labour (29.5%). Family labour had the highest percentage contribution to labour factor. The result implied that the higher the family labour, the higher the effectiveness of improved cassava technologies

Capital resource factor (factor 7)

Data in Table 3 show that four variables had significant contributions to capital resources as factors associated with effectiveness of improved technologies. The variables are source of capital (L = 0.639); amount in savings (L = 0.746); amount of capital borrowed (L = 0.823) and expenditure on innovation (L = 0539). Data further revealed that each of these variables contribute to the factor with the following percentages: source of capital (40.5%), amount in savings (55.6%), amount of capital borrowed (67.7%) and expenditure on innovation (29%). The result could be interpreted that the more the sources of capital available to a farmer, the more the effectiveness of the improved technologies.

Leadership factor (factor 8)

Data in Table 3 show the values of the loading in leadership (factor 8), with level of education (L = 0.843), household size (L = 0.674), farm size (L = 0.589), amount in savings (L = 0.325) and income (L = 0.460). Data further reveal that each of the variables contributes to the factor as a factor associated with effectiveness of improved technologies with the following percentages: level of education (71%), household size (41.8%), farm size (34.6%), amount in savings (10.5%) and income (21%). The result could mean that the more the level of education of the farmer, the more the effectiveness of improved technologies. This finding was supported by Jibowo [13] and [15] who reported that it is often easier for an educated person to be favourably disposed towards improved technologies because he could give a reasonable consideration to its adoption . The more enlightened a person is, the easier it normally is to overcome the complexities of improved technologies and adopt.

Community factor (factor 9)

The value of the loading for factor 9 in Table 3 shows that the following variables have a significant contribution to community factor associated with effectiveness of improved technologies. These variables are: community participation (L = 0.972); ethnic heterogeneity (L = 0.525); source of decision to adopt (L = 0.745); accessibility (L = 0.622) and infrastructural facilities (L = 821). The data further revealed that each of these variables contributes the following percentages to the factor: community participation (94.5%), ethnic heterogeneity (68%), source of decision to adopt (55.5%), accessibility (38.7%) and infrastructural facilities (67.4%). The result implies that community participation had influence on effectiveness. This finding was supported by [15], who reported that communities with religious and ethnic heterogeneity do have higher adoption scores of improved technologies than homogenous ones. This will enhance effectiveness. Availability of infrastructural facilities could also determine the effectiveness of improved cassava technologies. This finding agrees with [1] report that there is need to improve infrastructure in order to reduce the cost of production of cassava.

Table 3
Factor analysis showing variables contributing to effectiveness of improved cassava production technologies.

Factors and contributing variables	L	L^2	λ
1. Economic factor			
Source of capital	0.684	0.4678	
Amount in savings	0.624	0.3893	
Income	0.725	0.5256	
Expenditure on adopted innovation	0.170	0.0289	2.0551
Hired labour	0.356	0.1267	
Years of schooling	0.488	0.2381	
Farm size	0.528	0.2787	
2. Capacity building factor			
Years of schooling	0.972	0.9447	
Age	0.852	0.7259	
Farm size	0.785	0.6162	
Extension contact	0.729	0.5314	4.1196
Extension training	0.924	0.8537	
Family labour	0.262	0.2787	
3. Group orientation factor			
External orientation	0.726	0.5270	
Social organization	0.742	0.5505	
Household size	0.069	0.0047	
Extension contact	0.037	0.0013	1.1332
Extension training	0.444	0.1971	
4. Innovation factor			
Cost	0.770	0.5929	
Complexity	0.773	0.5975	
Accessibility	0.865	0.7482	3.9312
Compatibility	0.867	0.7516	
Communicability	0.845	0.7140	
Relative advantage	0.726	0.5270	
5. Social factor			
Age	0.625	0.3906	
Number of children	0.750	0.5625	
Number of wives	0.739	0.5461	
Household size	0.766	0.5867	2.5834
Occupation	0.625	0.3906	
Religion	0.327	0.1069	
6. Human resource factor			
Family labour	0.784	0.6146	
Mechanized labour	0.756	0.5715	
Farm size	0.610	0.3721	1.853
Hired labour	0.543	0.2948	
7. Capital resource factor			
Source of capital	0.639	0.4082	
Amount in savings	0.746	0.5565	1.9326
Amount of capital borrowed	0.823	0.6773	
Expenditure on innovation	0.539	0.2905	
8. Leadership factor			
Level of education	0.843	0.7106	
Household size	0.674	0.4186	

Farm size	0.589	0.3469	1.7933
Amount in savings	0.325	0.1056	
Income	0.460	0.2116	
9. Community factor			
Community participation	0.972	0.9447	
Ethnic heterogeneity	0.825	0.6806	3.2411
Source of decision to adopt	0.745	0.5550	
Accessibility	0.622	0.3868	
Infrastructural facilities	0.821	0.6740	

Source: Filed Survey, 2010; * Significantly contributing at $p \leq 0.05$; L = Loading for factor; L^2 = The square of loading factor; Λ = Latent root for the factor ($\sum L^2$)

Conclusions and recommendations

The effectiveness of the improved cassava production technologies was appraised and the crucial factors associated with it were isolated. The level of effectiveness of the improved technologies was moderately high. Economic factor, capacity building factor and group orientation factor has the highest contribution to effectiveness. Other factors associated with effectiveness of the improved technologies were: social factor, leadership factor, group orientation factor, community factor, capital resources factor and innovation factor.

For the improved cassava production technologies to be effective, the following recommendations were made:

1. Credit should be made available to farmers and should be in cash and kind (through provision of improved technologies such as fertilizers, insecticides, herbicides and improved planting materials).
2. The cost of improved technologies should be subsidized so as to make them affordable to peasant farmers who are in the majority.
3. Extension Agents should be motivated to work harder through work incentives and prompt payment of salaries etc.
4. There should be constant and steady monitoring and evaluation of extension programmes.

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APPENDIX I

Result of varimax rotated factor matrix showing correlation coefficient of highly loaded variables associated with effectiveness

Highly loaded X variables	**Factor I**	**Factor II**	**Factor III**	**Factor IV**	**Factor V**	**Factor VI**	**Factor VII**	**Factor VIII**	**Factor IX**
X 1 Age		0.852			0.625				
X 2 Farm size	0.528	0.785				0.610		0.325	
X 3 Income	0.725							0.460	
X 4 Source of capital	0.684	0.528					0.639		
X 5 Household size			0.069		0.766			0.674	
X 6 Extension training		0.924	0.444						
X 7 Hired labour	0.356					0.5439			
X 8 Expenditure on innovation	0.170							0.539	
X 9 Extension contact		0.729	0.037				0.756	0.325	
X 10 Amount in savings	0.624								
X 11 Family labour					0.787				
X 12 Years of schooling	0.488	0.972	0.122						
X 13 External orientation			0.604						
X 14 Social organization			0.742						
X 15 Household size									
X 16 Cost				0.770					
X 17 Complexity				0.773					
X 18 Accessibility				0.865					
X 19 Compatibility				0.867					**0.622**
X 20 Religion					0.327				
X 21 Number of wives					0.739				
X 22 Occupation					0.625				
X 23 Communicability				0.845					
X 24 Relative advantage				0.726					
X 25 Number of children					0.750				
X 26 Mechanized labour						0.756			
X 27 Amount of capital borrowed									
X 28 Level of education							0.823		
X 29 Community participation								0.843	
X 30 Ethnic heterogeneity									**0.972**
X 31 Source of decision									**0.825**
X 32 Infrastructural facilities									**0.745**

All loadings above were significant at 5 percent and 1 percent level of significance: