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EDUCATION LEVEL AND ADOPTION OF PROCESS INNOVATION IN THE DAIRY SECTOR OF ZIMBABWE

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***Abstract* — This paper, seek to assess factors that are hindering diffusion of process innovation under the Zimbabwean dairy industry. The paper utilized 400 small-medium scale dairy farmers in Zimbabwe who are registered under Zimbabwe Association of Dairy Farmers (ZADF). The rationale behind the research issue is that Zimbabwean dairy sector has failed to adopt process innovations such as e-marketing and e-extension. The paper adopted a binomial logistic regression model and majority of the dairy farmers in Zimbabwe have not acquired any form of education and based on such evidence, level of education has affected the level of adoption of process innovations such as e-marketing and e-extension. The research recommends the dairy sector to introduce non-formal courses and trainings on change management and innovations prior to introduction of new process innovations.**

Keywords— **Process Innovation, dairy farmers, e-marketing, e-extension**

I. INTRODUCTION

According to Max (2016), farming engineering and technology has found its way into the developing nations, SADC community to be specific. Fran (2019) witnessed agro-based nations like South Africa, Namibia, Malawi and Zimbabwe adopting technologies and new ICTs within the production and marketing structures since 1990s. From SADC regional perspective, South Africa being on the lead, markets have become more innovative and significant returns have been realized due to such process innovations (Fran, 2019). It has been noted that climatic change is a critical factor which must be considered when it comes to farming and due to a chronic droughts, the desire for better process innovations such as farming systems and ideas for better agricultural productivity is at peak (Petersen, 2019). South Africa for the since early 1990s they have managed to adopt new farming systems such as e-marketing, e-extension systems and e-procurement of their inputs from other nations like China, and nations around Europe. Based on this process innovation, within their farming enterprises, dairy to be specific have managed to improve their GDP by 20% since 2015-2020 (Hills, 2019). Botswana, another nation which is close to Zimbabwe, but deals on livestock production, they have managed to harness new technologies and farming systems such as backward and forward e-market systems which has worked efficiently for the past 3 years in creating marketing opportunities for their dairy enterprise (Fan, 2020). Although, it is was made easy for other nations like South Africa and Botswana to adopt process innovation since 1980 when Zimbabwe attained independence.

Mavambo (2019), highlighted that United Nations Development Programme (UNDP) introduced e-extension which was initially introduced in South Africa to Zimbabwean dairy farming sector by the adoption rate was as low as 20%. In addition, an e-marketing system was also introduced through a consortium by a name EXTRA which comprised of WHH, Heifer International and LFSP but based on the results adopted from the evaluation reports for the period 2018-2020, the system applications were not successfully accepted in the dairy sector. Despite the successes associated with adoption of process innovation in other nations in SADC, there is a gap that need to be addressed when it comes to Zimbabwe in promotion of the adoption of process innovation within the dairy value chain. Other researches by Gran (2018), Mantra (2019) and Chivabvu (2020) pointed out to factors like cost of technology, access to technology and compatibility of technology as main factors hindering adoption of process innovation, yet little is known on the level of education with regards to low adoption of process innovation in Zimbabwean dairy sector. However, this paper was developed to look into whether level of education attained by dairy farmers plays a critical role in hindering diffusion of process innovation in the Zimbabwean dairy and suggest, model critical for facilitating the diffusion on the process innovation.

This paper is structured in a manner that it provides the purpose of the study. Provide the study conceptual framework of the study, brief methodology. Lastly, the study provides results, conclusions and acknowledgements.

A. Purpose of the Paper

This paper, seek to assess factors that are hindering diffusion of process innovation under the Zimbabwean dairy industry. The

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following conceptual framework was developed in to confirm the hypothesis that adoption of process innovation is primarily affected by level of education of dairy farmers while other factors like cost of technology, access to technology and compatibility of technology identified by Gran (2018), Mantra (2019) and Chivabvu (2020) were assumed to be part of the error term. The hypothesis was inductively tested in the dairy sector in Zimbabwe. However, this paper, draws its theoretical arguments from the Technology Acceptance Model by Rodger (1962) cited in Humron (2020) which is illustrated in the figure below:

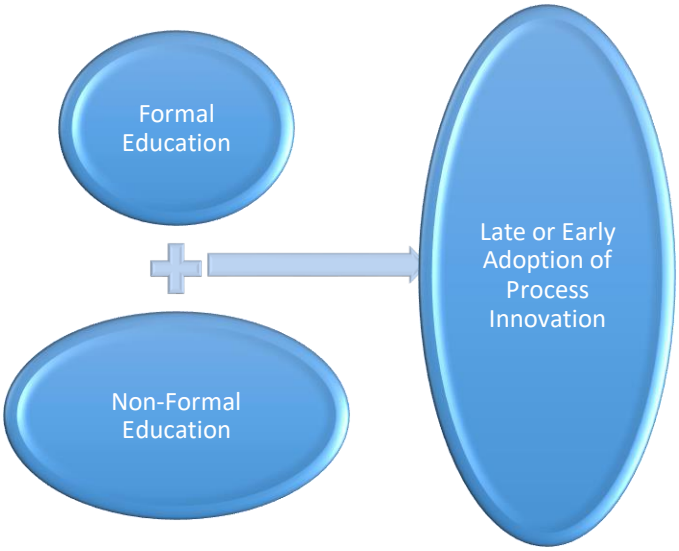


Fig. 1. Conceptual Framework

Based on this model dairy farmers can adopt process innovation earlier, late or might not accept as driven by their level of education. However, the study was based on the following hypothesis:

H_o: There is no association between dairy farmer level of education and adoption of process innovation

H_1: There is an association between dairy farmer level of education and adoption of process innovation

B. Methods and Materials

The data utilized in this study was for 2020 period and it was adopted from 400 small-medium scale dairy farmers under Zimbabwe Association of Dairy Farmers (ZADF). The categorical qualitative cross section data was gathered using a questionnaire and data was analysed using SPSS. Since, the dependent variable was ordered in nature with 5-levels (Early or late adopter) a binomial logistic model was adopted. Level of education being (formal education, non-formal and none) was adopted. Chi-square was adopted to confirm the statistical significance of the model. In terms of the model specification, the following was the theoretical ordered logistic model:

$$Log\left(\frac{P}{1-p}\right) = \beta o + \beta iXi + \cdots + \mu$$

Were, p are odds ratios, B_o is the constant, B_i are the beta coefficients, X_1 are independent variables and μ is the error term.

Fig. 2. Binomial Logistic Regression Model

II. Results

The following were the results from the ordered logistic regression analysis:

Table -1 Association between Level of education and adoption of process innovations in Zimbabwean Dairy Sector

Case Processing Summary

	N	Marginal Percentage
No Education	220	55.0%
Non-formal education	140	35.0%
Attained formal education	40	10.0%
Valid	400	100.0%
Missing	0	
Total	400	

Table 1 has shown that majority of the dairy farmers (55%) had no education whilst 35% acquired a non-formal education and only 10% attained a formal education qualification. The researcher also assessed the association of the level of education on the adoption of process innovation in the Zimbabwean dairy sector and the following were the results analyzed based on a binomial logistic model:

Table -2 Association between Level of education and adoption of process innovations in Zimbabwean Dairy Sector

Parameter Estimates

	Estimate	Std. Error	Wald	df	Sig.
Adoption [early adopt = 0]	2.203	.784	7.890	1	.005
of Innovation [late adopt = 1]	4.299	.809	28.224	1	.000
Level of education	1.048	.268	15.231	1	.000

The results in table 2 has shown that the higher number of dairy farmers who do not possess educational qualification has a greater effect on adoption as reflected by the beta coefficient value of 4.299 which was greater that early adoption. The findings has shown that each variable was statistically significant. The chi-square results were as follows:

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Table -3 Hypothesis Test

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	557.272			
Final	533.091	24.180	3	.000

Link function: Logit.

Table 3 above show that the null hypothesis that there is no association between dairy farmer level of education and adoption of process innovation was rejected since the p-value was less than 0.05 implying a strong association between education level from dairy farmers and poor adoption of process innovation. The findings were in line with Gitinja (2017) who suggested that education plays a critical role in facilitating change and incorporate sense of compliance in the adoption of process innovation.

III. CONCLUSION

The research has established that majority of the dairy farmers in Zimbabwe have not acquired any form of education and based on such evidence this has affected the level of adoption of process innovations such as e-marketing and e-extension. The research recommends the dairy sector to introduce non-formal courses and trainings on change management and innovations prior to introduction of new process innovations.

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