

DETERMINANTS OF IMPLEMENTATION OF HAZARD ANALYSIS AND CRITICAL CONTROL POINT PROJECT IN FOUR SELECTED GOUDA CHEESE PROCESSING FIRMS IN RWANDA.

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ABSTRACT

Hazard Analysis and Critical Control Point system implementation has been made mandatory among other compulsory standards in Rwanda since July 2013 as per Ministerial instructions N° 21/2013 of 03/07/2013. However there are still some challenges for cheese processors to implement the said food safety system and those challenges are attributed to poor infrastructure, lack of skilled personnel and poor implementation of government regulations and National standards. This research aimed at identifying determinants of implementation of HACCP Project and came up with information that will help cheese processors and related government regulators to find solution for existing food safety problems. The research carried out in four selected Gouda cheese processing firms in Rubavu namely Fromagerie La Reine, Fromagerie Ingabo, Muhe Farm and Gishwati Farm. The specific objectives for this research were to determine effect of infrastructures development on implementation of HACCP Project, to measure effect of workforce skills involved in cheese processing firms on implementation of HACCP Project and to examine effect of documentation requirements on implementation of HACCP project. Descriptive research design was used for this study. The target population of this study was 67 employees from four selected Gouda Cheese processing units from Rubavu District. The study used census in data collection as the whole population used since it is was small. Data were collected using questionnaires. Data for the years 2015-2017 were used for this research. Collected Data were processed using SPSS software. Multiple regression model was used to analyze data. Based on the information drawn from findings the researcher concluded that the effects of all three variables under study (infrastructure development, skills of HACCP workforce, and documentations requirements) on the implementation of HACCP are significant. He found out that the model is responsible of 57.7% variation in Implementation of HACCP. The remaining 42.3% are due to other factors not supported by this model. Therefore, based on research findings, it is important that all stakeholders involved in HACCP project implementation should work hand in hand to ensure that infrastructure development improved, skills of HACCP workforce are enhanced, and documentations requirements for HACCP implementation are met.

Key words: *Determinants, Hazard Analysis and Critical Control Point Project, Gouda cheese processing firms*

1. Introduction

The concept of HACCP originated from USA and stands for “Hazard Analysis Critical Control Point”. HACCP was first coined by National Aeronautics and Space of the USA in 1958, and in 1959, it was advanced as a way of assuring 100 per cent safety of food used in space (Airey, 2004). Later HACCP was officially published and documented as a food safety management system in USA in 1971. Its recommendations for usage by the National Academy of Science (NAS) dates back in 1985 and it thereafter became a global food safety management tool (Codex, 2009). The dairy subsector is crucial for rural development, poverty reduction and food and nutrition security for the country. It offers a pathway out of poverty for the large number of households keeping livestock, and for those who provide services and value addition throughout the supply chain. The current "farm gate" value of annual milk production is approximately Rwandan francs 117.0 billion (USD 162.4 million). The dairy subsector is the largest segment of the livestock sector in Rwanda, which accounts for 10.5% of agricultural GDP and is the fastest growing sub-sector within agriculture (Rwanda Dairy Development Project Report, 2016). In recognition of the strategic importance of the sector, the Government has over the past decade made significant investments in the industry aimed at transforming it from subsistence orientation to a business-oriented, modern sector capable of meeting the country's demand for dairy products and producing surpluses for the regional market (Rwanda Dairy Development Project Report, 2016).

As a highly perishable commodity, milk quality and market access are highly dependent on the condition of feeder roads from the production areas to Milk Collection Centers (MCCs) which have cooling facilities. Although Rwanda has one of the highest road densities in the region, the general characterization of road infrastructure in rural areas is that roads connecting villages and farming areas to one another and to markets are inadequate and poorly maintained. Official estimates by the Rwanda Transport Development Agency (RTDA) show that 85% of feeder roads (District Class II roads) are in unacceptable conditions (Rwanda Dairy Development Project Report, 2016). Transport capacity is limited and in some cases lack of infrastructure for milk channeling also compromises milk quality hence affecting the quality of other milk products such as cheese. Therefore, there is a need to uplift existing infrastructure. More to that, to enable enterprises to move up the value chain into processing, the export market will require evidence of the existence of a fully functioning and effective risk management system commonly referred to as HACCP. This, in turn, requires traceability along the value chain. If the private sector in Rwanda is to increase its competitiveness and increase overseas exports, compliance with international regulations will be vital (TMEA REPORT, 2012).

2. Statement of the Problem

Today, about 90% of the population worldwide consumes processed foods. Therefore, to avoid food poisoning incidences and food borne diseases; all forms of foods processed should be generally safe and suitable for human consumption (FAO, 2004). Codex Alimentarius recommends HACCP based approach wherever possible to enhance food safety as desired. Codex alimentarius guidelines and HACCP approach forms the core of the entire food safety program. Rwanda has set ambitious targets for growth and poverty reduction in her Vision 2020 and Economic Development, Poverty Reduction Strategy (EDPRS). The government is engaged in liberalization of the country's economy and integrating into the East African Community and has adopted measures for a market oriented economy supported by an increase in industrial and agricultural productivity, value addition and export promotion, (National Industrial Policy, 2011). The country has achieved significant positive growth since 2001 with 7 to 8 percent average annual rates of

growth in GDP. Vision 2020 has six pillars and three cross-cutting issues, and dairy supports each pillar and cross-cutting issue directly or indirectly with its contribution to GDP, household income and job creation, (Rwanda National Dairy Strategy Final Report, 2013). Rwanda's economy has been steadily growing at an annual average of 7% for the past 5 years. In 2009, agriculture contribution to the GDP was 37%, industry 25% while construction and real estate sectors represented (8%) and food processing (3%). Against this backdrop one of the major challenges facing the country is the growing trade deficit and the limited number of competitive companies that can meet the regional and international standards requirements for export (National Industrial Policy, 2011). To enable enterprises to move up the value chain into processing, the export market will require evidence of the existence of a fully functioning and effective risk management system commonly referred to as HACCP. This, in turn, requires traceability along the value chain. If the private sector in Rwanda is to increase its competitiveness and increase overseas exports, compliance with international regulations will be vital (TMEA REPORT, 2012).

It is in this background that RSB through support of TMEA conducted a project on HACCP that aimed at helping Industries to get certified with HACCP through auditing selected industries for the project. International and local consultants facilitated in auditing selected firms (TMEA REPORT, 2012). Even though the HACCP project is being implemented, milk products quality is still an issue of concern through Alternative Milk Sector and this limits domestic and export opportunities, (Rwanda National Dairy Strategy Final Report, 2013), on the other hand, According to Rwanda Standards Test reports (2015), there is a recurrent failure in quality and safety parameters of milk products such as cheese for the last decade. The Rwanda Dairy Development Project Report 2016 also states that major Challenges faced by processors of milk products especially cheese are attributed to poor Infrastructure, employment of non-trained staff and poor implementation of Government Regulations and National standards. Therefore, there is a need to assess above mentioned determinants in order to come up with information that would help processors to produce cheese with quality and safety in line with standards as well as customer requirements. This in turn will help to come up with solution of existing food safety problems in cheese sector.

3. Research Objectives

3.1 General Objective

The general objective of this study was to identify the determinants of implementation of HACCP Project by Gouda cheese processing firms in Rwanda.

3.2 Specific Objectives

1. To determine effect of infrastructures development on Implementation of HACCP Project
2. To measure effect of workforce skills involved in cheese processing on Implementation of HACCP Project
3. To examine effect of documentation requirements on Implementation of HACCP project

4. Research questions

1. What is the effect of infrastructures Development on Implementation of HACCP Project?
2. To what extent skills of workforce involved in cheese processing influence Implementation of HACCP Project?
3. How documentation requirements affect Implementation of HACCP project?

5. Research Methodology

The study adopted descriptive research design. The target population of this study was 20 employees of Fromagerie la Reine, 15 employees of Fromagerie Ingabo, 14 employees of Muhe farm and 18 employees of Gishwati farm. This shows that in total, the target population was equal to 67 employees of four selected Gouda cheese. The study used census since the population was quite small. To collect primary data, questionnaires were used. A questionnaire is a document containing all respondent's answers or reactions. A questionnaire was developed and distributed to the employees of 4 selected cheese processing units and it was suitable because with it, it was easier to collect information from the respondents. The questionnaire is less expensive since it saves time as well as human and financial resources. It offers greater anonymity and in some situations where sensitive questions are asked, it helps to increase the likelihood of obtaining accurate information. Statistical Package for Social Sciences (SPSS) software was used to process data. Data presentation was in form of tables in order to produce meaningful results. During this study, the researcher protected all participants involved in it, as it will not cause indirect or direct harm to them or researcher. The participation was voluntary. All the information was anonymous, which protected the participant's confidentiality. The respondents' role in this research was to complete questionnaires. Respondents were not asked to provide data or otherwise do anything beyond the questionnaire completion.

6. Research Findings and Discussions

6.1 Descriptive Statistics per variables

Table 1 below summarizes how respondents rated answers for every variable. Therefore based on descriptive statistics results, this indicates that respondents strongly agree with statements made according to the variables.

Table 1: Descriptive Statistics per variable

Descriptive Statistics per variable					
	N	Minimum	Maximum	Mean	Std. Deviation
skills_of_HACCP_workforce	67	2.00	5.00	4.0597	.69371
Documentation_requirement	67	3.00	5.00	4.4179	.63124
Infrastructure_development	67	1.00	5.00	3.9403	.77617
Implementation_of_HACCP	67	4.00	5.00	4.7313	.44661
Valid N (listwise)	67				

Source: Field Data (2017)

6.2 Correlation analysis

To assess the degree of association between variables the Pearson correlation coefficient has been calculated. Results are shown in table 2.

Table 2: Correlations Analysis

Correlations Analysis					
		Infrastructur e_developm ent	skills_of_HAC CP_workforce	Documentati on_requireme nt	Implementat ion_of_HA CCP
Implementation_of_HA CCP	Pearson Correlation	.521 **	.542 **	.512 **	1
	Sig. (2-tailed)	.000	.000	.000	
	N	67	67	67	67
**. Correlation is significant at the 0.01 level			(2 tailed).		

Source: Field Data (2017)

Based on findings Table 2 the result of Correlation of infrastructures and implementation of HACCP is at the rate of 0.521 meaning that the infrastructure development and the implementation of HACCP have a significant moderate positive correlation at 0.01 levels. This means that development of infrastructures such as well-maintained road, availability of electricity, availability of well-established processing units equipped with in house laboratories would boost HACCP project. The Pearson correlation coefficient between skills of HACCP workforce and implementation of HACCP is 0.542 at 0.01 confidence level. This is also a moderate positive correlation. The table 3 above shows also the Pearson correlation coefficient between documentation requirement and HACCP is 0.512 at 0.01 confidence level. This is shows that there is a positive moderate association between these variables.

6.3 Regression analysis

6.3.1 Model summary

The table 3 below shows that R^2 equal to 0.577; this means that implementation of HACCP is being explained by the model at 57.7% and the rest equivalent to 42.3% are due to other factors that may be subjected to further research.. Now the question is how much each independent variable contributes to prediction of dependent variable. This is revealed in the following section. The costs of implementing the HACCP system can be divided into three groups by order of importance. The most important type of cost was investment in new equipment. Costs related to contracting external consultants and staff time spent on documentation were classified in the second group. The third group comprised the costs of personnel training. The results suggest that the circumstances of the individual enterprises and the standards in place before adopting HACCP have significantly affected the costs associated with plant improvement, consulting, and the time spent on documentation. This therefore demonstrates that there is relationship between Infrastructure development, skills of workforce involved in cheese processing and meeting documentation requirements and HACCP Project.

Table 3: Model summary

Table 4 Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.759 ^a	.577	.557	.29736
a. Predictors: (Constant), Documentation_requirement, skills_of_HACCP_workforce, Infrastructure_development				
b. Dependent Variable: Implementation_of_HACCP				

Source: Field Data (2017)

6.4 Regression coefficients

The table 5 below shows the regression coefficients in order to construct the regression model.

This table gives the coefficients (B1, B2, B3) that correspond respectively to the independent variables (infrastructure development, Skills of HACCP, documentation requirement). Using them the model is constructed as follow: $Im = C + B1In + B2Sk + B3Do$, hence $Im = 1.799 + 0.198(In) + 0.255(Sk) + 0.253(Do)$ (1), Im =Implementation of HACCP, In = Infrastructure development, Sk =Skills of HACCP workforce, Do =Documentation required

From equation (1) we notice that all estimates (Bi) are positive. So we expect any change in Xi (independent variables) to affect positively changes in Y (dependent variable). For instance a change of a unit in infrastructure will increase implementation by 0.198 units, keeping all other variables constant. In the table 4 above, one can notice that p-values for all of three independent variables are .000 at 5% confidence level, which means that there are almost 0 chances in 1000 that each parameter could be zero, which implies that the term of the regression equation containing each parameter cannot be eliminated without significantly affecting the accuracy of the prediction.

Table 4: Regression Coefficients

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.799	.324		5.546	.000
	Infrastructure_development	.198	.050	.345	4.007	.000
	skills_of_HACCP_workforce	.255	.055	.396	4.654	.000
	Documentation_requirement	.253	.060	.357	4.192	.000
a. Dependent Variable: Implementation of HACCP						

Source: Field Data (2017)

From equation (1) above, we expect that any change in Xi (Independent variable) affects positively change in Y(Dependent variable). That is to say, a change of a unit in infrastructure development such as availability of well-maintained road, availability, access to electricity and availability of well-established processing units equipped with in house laboratories increase implementation of HACCP implementation by 0.198 units keeping other variables constant. Therefore, Government Institutions concerned, Private Sector Federation, Owners of Cheese Processing firms should work hand in hand to ensure that required infrastructures are available so that sustainable Implementation of HACCP is achieved. The above findings therefore show that there is positive relationship between infrastructure development and HACCP implementation revealed by the field data.

From equation (1) above, we expect that any change in Xi (Independent variable) to affect positively changes in Y (Dependent variable). That is to say, a change of unit with regard to skills of workforce involved in cheese processing unit for example training of workforce on Food Hygiene, Food Safety, Food Handling and other related standards increase implementation of HACCP by 0,255 units. Therefore, owners of Cheese processing units should seek training from competent authorities to ensure that their staffs are equipped with necessary skills required for effective implementation of HACCP (Yang, 2007). Previous researches had shown that resources, such as human resources as well as time, money, costs (i.e. expense of training), to be the largest barrier in implementation of the system. By studying and classifying the elements, it is evident that the biggest problems for HACCP efficiency are human resources and training. Major barriers detected during implementation of HACCP system were twofold: insufficient training and human resources. The latter includes the broad area of human treatment, where barriers such as awareness, agreement, self-efficacy, outcome expectancy, motivation; staff (gender, educational level, thoughts and experiences, inexperienced employees, turnover, employee commitment, etc.) are included (Henson et al, 2005). The above research findings therefore show that there is relationship between skills of workforce involved in cheese processing and HACCP implementation as per also it has been revealed by findings of this research results.

From equation (1) above, we expect that any change in Xi (Independent variable) to affect positively change in Y (dependent variable). That is to say, a change of unit regarding availing required quality documents such as HACCP manual and related documents increase implementation of HACCP by 0.253 units. Therefore, Cheese processing firms' owners should ensure that HACCP manual and related documents are available to enhance effective implementation of HACCP. The study in China showed that small-sized food enterprises have little incentives to implement HACCP system. It also revealed that small companies may face more difficulties to implement HACCP, such as time cost and documentation required by HACCP (Yeng et al, 2007). The organization shall establish and maintain a HACCP manual that includes: the scope of the HACCP system; documented procedures established for the HACCP system, or reference to them, and PRP procedures or reference to them. This manual may be included in another management system manual or parts of this manual may refer to other relevant management system manual(s). The interrelation shall be described. The organization shall ensure the establishment and implementation of documented procedures for the control of documents and records. The HACCP team shall ensure that a procedure for document control is established the above research findings therefore showed that there is a significant relationship between meeting documentation requirements and HACCP implementation (Roberts, 2008).

7. Conclusion and Recommendations

7.1 Conclusions

According to the interpretation of collected and analyzed data during the course of this study the researcher came up with the following conclusion: Based on the information drawn from findings the researcher concluded that the effects of all three variables under study (infrastructure development, skills of HACCP workforce, and documentations requirements) on the implementation of HACCP are significant. It was found out that the model is responsible of 57.7% variation in Implementation of HACCP. The remaining 42.3% are due to other factors not supported by this model.

7.2 Recommendations

After analyzing and interpretation of data, the researcher came up with the following recommendations:

Cheese processing firms should build competence in employees through providing them short-term training courses. Cheese processing units should put in place necessary procedures and keep records to ensure sustainability of quality system. Cheese processing firms should Understand, develop & implement Standard Operating procedure (SOPs) such as SOP for Document and Record Control, SOP for Internal Audits, SOP for Management Review, SOP for maintenance (Preventive schedule and breakdown), SOP for training (identification, conduct and records), SOP for identification of product, batch numbering & traceability from supplier to customer, SOP for emergency preparedness, SOP for Control of non-conforming product, correction and corrective actions, SOP for market complaint handling, recall and mock recall, SOP for defining the process of manufacturing each product, SOP for testing of incoming, in-process and final product.

Cheese Processors should put in place pre-requisite programs such as cleaning facility - schedules & methods for all areas & machines. Water - source, treatment (if any), testing frequency & cleaning of storage tanks, Waste disposal - types of wastes & how they are handled, frequency of disposals, Availability of Toilets & hand washing facilities.

Government of Rwanda should put more emphasis on mobilization of funds for use to facilitate cheese processors in establishment of necessary infrastructures such as roads, electricity, potable water, well-constructed workplaces to ensure that processing of cheese and deliver of milk is done within time frame required by standards hence produce of safe and quality cheese. This will promote made in Rwanda Campaign.

7.3 Areas for further studies

Since this study focused on determinants of Hazard Analysis Critical Control point Project by Cheese processing Firms, taking selected Gouda cheese processing Firms, the research only investigated issues related to the subject matter of the study, however a few areas for further research were identified and these included the following: The role of regulatory institutions in implementation of HACCP project, The Influence of Financial institutions in the support of implementation of HACCP Project and Role of Research and Academic Institutions in Implementation of HACCP project.

References

1. Al Kaabi, A., Al Mazrouei, A., Al Hamadi, S., Al Yousuf, M. & Taylor, E. (2015), "Gathering baseline data on food safety management across the Abu Dhabi Hospitality Industry", *Worldwide Hospitality and Tourism Themes*, Vol. 7 No. 1.
2. Caswell. (2009). *Standards as Barriers Versus Standards as Catalysts: Assessing the Impact of HACCP Implementation on U.S. Seafood Imports*.
3. Chaves, J. (2006). *Contaminacao de alimentos: O melhor e preveni- la. Departamento de Tecnologia de alimentos - FTA. Universidade Federal de Vicosa*.
4. Chege, P., W., (2017). A Critical review of the literature on hazard analysis critical control point. *Prime Journal of Social Science (PJSS)* ISSN: 2315-5051. Vol. 6(4), pp. 1476-1483
5. Commission, E. (2006). *Integrated Pollution Prevention and Control: Food drink and milk*.
6. Corlett, J. D. (1998). *HACCP User's manual*. Aspen Publishers.
7. Cullor, J. (2007). *HACCP (Critical Analysis Control Points) Is it coming to the dairy?*
8. Eagan, R. (2006). *A Review of food safety and food hygiene training studies in the commercial sector*. School of Biomedical and Molecular sciences, University of Guildford.
9. Ehir, J. (2005). *Implementation of HACCP in food businesses: The way ahead*.
10. Evans, J.D. 1996. *Straightforward statistics for the behavioral science*. CA, USA: Brooks/Cole Publishing.
11. Hamidreza T., Seyed A. (2015), "Status of prerequisite programs for the implementation of HACCP system in chain restaurants in Iran", *British Food Journal*, Vol. 117 Iss 6 pp. 1753 – 1763
12. Henson. (2005). *Meta-Analysis As A Tool For Barriers Identification During Haccp Implementation To Improve Food Safety*.
13. Jan, T. (2016). A Study of HACCP implementation in milk plant at Khyer. *Journal of food processsing Technology*, 38-46.
14. Jevsnik. (2006). *Cost-benefit analysis of HACCP implementation in the Mexican meat industry*
15. Mike, L. (2013). *The 4 C's model for good food hygiene*.
16. Peter A., Kofi B., & Ernestine A. (2013). *Policy on Hazard Analysis and Critical Control Point (HACCP) and adherence to food preparation guidelines: a cross sectional survey of stakeholders in food service in Kumasi, Ghana*.
17. Petersons. (2007). *Hazards & Controls Guide for Dairy Food HACCP*. New York: Center for Food Safety .
18. Phils. (2015). *FSIS Compliance HACCP System validation*. USDA.
19. Renan T. Cobanoglu A., (2012). "Defining economic obstacles to the adoption of food safety systems in table olive processing firms", *British Food Journal*, Vol. 114
20. Roberto CD, B. S. (2006). *Cost and Investments of implementing and maintaining HACCP in pasteurized milk plant*. Food Control.
21. Roberts, L. (2008). *Implementation of Hazard Analysis and Critical Control Points System*.
22. RSB. (2013). *Food safety management systems — Requirements for any organization in the food chain*.
23. RSB. (2013). *Requirements for Hazard Analysis and Critical Control points*. Kigali: Rwanda Standards Board.
24. Taylor, E. (2003). *HACCP and SMEs: Problems and Opportunities: Problems and Opportunities*. Woodhead.
25. Taylor, E. (2008). HACCP for the hospitality industry: history in the making. *International Journal of Contemporary Hospitality Management*, 20(5), 480–493.
26. Yang. (2007). *Implementation of HACCP system in China: A survey of food enterprises involved*.