Discoveries in Agriculture and Food Sciences - Vol. 13, No. 01
Publication Date: February 25, 2025
DOI:10.14738/tnc.1301.17721.
Tchoumboue, N. (2025). Small Scales Food Milling Industries in Dschang-Cameroon: Socio-Economic and Technical Characteristics Assessment. Discoveries in Agriculture and Food Sciences, 13(01). 01-16.

Small Scales Food Milling Industries in Dschang-Cameroon: Socio-Economic and Technical Characteristics Assessment

Nsah-ko Tchoumboue
ORCID: 0009-0007-8536-184X
University of Buea

ABSTRACT

Food security in Africa mostly depends on Food milling industries. Until now lack of institutional rules and hygiene are some of the main causes responsible of low performances of food milling industries in Africa. The purpose of this work is then to analyze the socio-economic and technical characteristics of local mills in order to improve their performance. At this effect, a survey was conducted on 99 food milling industries randomly selected in Dschang city town. Direct measurements and observations were also carried out using specified tools. The collected data were codified using Microsoft Excel 2021. The descriptive analyses were performed using SPSS 21.0. The main results of this work were as follows: women are more involved in the food milling activities. Almost all the food milling industries (92.6%) possess Hammer mill and Flattener mill machine to grind dry foodstuffs and wet foodstuffs respectively. Machine capacities are still low which vary from the highest values of 30 kg per hour to the lowest value of 10 kg per hour. Based on number of working machines, 9 categories of industries were identified. The lifespan of those machines ranges from 5 to 7 years. None of the machines (0%) in industries possess the manual operation to carry out maintenance and provide healthy practices in food milling. Around 90% of the milling machines are made from metals and iron materials with industrial paints that could have negative effects on food quality. Law regulation related to lifespan and Machine's design should be put in place in order to Protect consumers from food spoilage and intoxication by bacterial and ferrous contamination.

Keywords: Food milling industry, Inventory, Machine characteristics, Survey, Healthy practices.

INTRODUCTION

Food security is still remaining a major problem for Africans countries. In order to increase the food access for all Africans, the development of small-scale food milling industries is increasing every day in Africa cities. Small milling industries are dealing only on foodstuffs grinding activities at the household level (Nzudie et *al.,* 2021); (Sneyd, 2014). Economically, the growth rate of those activities is between 20 to 30% annually in Cameroon (FAO, 2019 and Sneyd, 2014) meaning that the local milling activity have a considerable impact in terms of job creation, income distribution and reduction of social inequalities (Mathieu et *al*., 2021); (Knorr and Watzke, 2019). In well-developed Industry, the raw material should be treated as an economical commodity, so the improvement related to the raw material is never ignored by the whole supply chain stakeholder (Nurprihatin et *al., 2021*). Although populations of Africa are used to process the raw food in small scale food milling industries due to the quality of foods and the high number of people per households, the processes should be carried out following

the industrial procedures. Some raw foods like Maize grains or Cassava are grinded into flourish to obtain fufu corn or fufu cassava as the final product (Yar et *al.,* 2023). Due to population growth and food increasing demand as mentioned earlier, the food milling industries in Cameroon are dramatically increasing without legal laws controls and healthy practices. The milling activities are sensible due to the fact that some healthy and technical principles should be respected in order to keep food from infestations (Yar et *al.,* 2023); (Balali et *al.,* 2020); (Sabillón et *al.,* 2020). Such an activity also requires a certain mastery of the processes which range from the design, use and operation of food processing machines to respect for hygiene. Keeping food waste to a minimum will provide competitive advantages to food businesses in the sector and will provide direct environmental and sustainable contributions to the food ecosystem (Aka and Akyùz, 2023). From that, an important interest in milling processes is to maintain the nutritional composition and organoleptic quality of the finished product and to prevent also wastes (Viaux et *al*., 2009); (Aguilera, 2018).

In fact, the cost of food waste was estimated at 1 trillion USD in 2014 making the need to address food waste a financial affair (FAO, 2021). Furthermore, the environmental impact of food waste includes each resource consumed and all pollutants emitted to produce, process, transport and ultimately dispose of food fit for consumption (Dean *et al.,*). Food quality is still a problem for African populations. In fact lack of hygiene and contamination during food processing could be one of the main causes of increasing cancer disease in African countries (Bankole et *al.,* 2013); *(*Ludwig, 2011); (Ankar-Brewoo et *al*., 2020). In order to reduce those diseases and improve decision making, food processing inventory should be available concerning local food processing industries. As from now previous studies on food survey (Sop et *al.,* 2008); (Nzudie et *al.,* 2021); (Silapeux et *al.,* 2021) have been carried out mostly in food losses and health. As socio-economic and technical analysis of food processing in Cameroon as concerned, little informations are available to perform a good decision making to improve milling activities in Cameroon. From (Kolawole *et al.,* 2019*)*, Inventory management has become a vital operational weapon for firms that intend to survive competitive pressures in their manufacturing industries. Inventory errors associated with processed foods could negatively influence firm performance and invariably affect end-consumers' health, studies on inventory management strategies focusing on developing economies (Opoku *et al.,* 2021). The good manufacturing performance means to produce items with satisfactory and superior quality, accelerate delivery time and offer excellent aftersales service (Ke *et al.,* 2020). Related to food milling industry, Standards and controls, food processing procedures, machinery quality and quantity, Machinery design and lifespan should then be studied in order to optimize the performance of small scales food processing industries and increase food security (Moerman, 2017); (Musiari *et al., 2024)*; (Pessôa and Becker, 2020). The main purpose of this research is to characterize milling industry, study the effect of inventory management on the food mills performance and put in place a process flow chart in order to improve the performance of local milling activities in Cameroon.

MATERIALS AND METHODS

Study Area

The study was carried out in the city of Dschang with 800 thousand populations distributed around through 25 quarters. The data were collected using a survey done randomly.

Survey Sheet

A survey was submitted to the managerial team of the industry. The survey sheet was made up of 73 questions as follows: the first section contains 12 questions; the second one was made up of 11 questions, 22 questions for section 3, 10 questions for section 4, 13 questions for section 5 and 6 questions for section 6. About 100 food milling industries were evaluated for the study.

Evaluation Criteria of Food Industries

The criteria of evaluation were based on social, technical and economic items. For social items, the number and age of workers, the area position, gender, healthy conditions of workers were evaluated. Concerning technical parameters evaluation, machines characteristics as volume hopper, the daily mass of food processed, the lifespan, the duration of grinding, the type of food processed etc.., were evaluated also. Finally, the economic factors were determined like passive and active costs.

Survey Realization

The survey method used was the experimental survey (Ampah *et al.,* 2021). The food milling industries were chosen randomly over 22 quarters of Dschang city. One the questionnaires was put in place, it was test to 10 randomly selected Industries as pretest. Once the pretest ended to adjust the questionnaires, the method consists of addressing the questionnaires directly to the managerial team of the industries. Interviews and observations were also carried out to complete the survey. In fact, some characteristics of the milling machines as physical parameters (volume of the hopper, duration of milling, color of the final products, healthy practices and cleaning) were also determined during the survey.

Data Analysis

Once the surveys were completed, the data collected were codified using Excel 2021 software. Descriptive statistics were performed using SPSS 21.0 software.

Cartography of the Industries

A cartographic view of food milling industries in Dschang city town was realized using ArcGIS software. A category of industries was put in place per quarter and per number of grinding machines

RESULTS AND DISCUSSION

Mapping of Food Milling Industries in Dschang-Cameroon

The food milling industries are distributed all along the Dschang city town. It can be seen in Figure 1

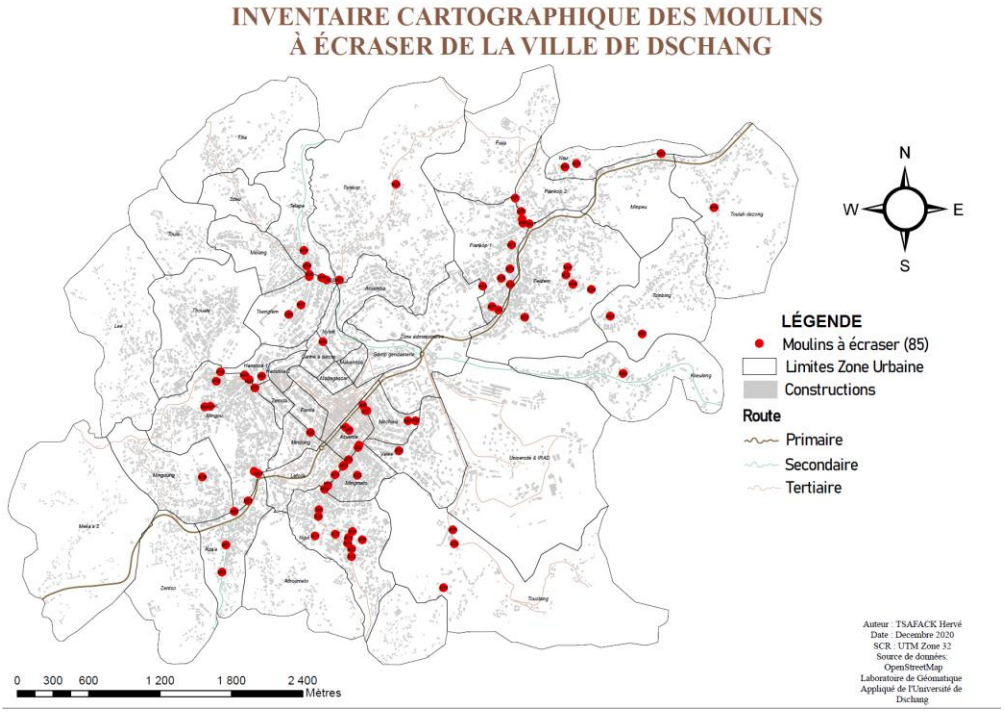

Figure 1: Food milling industries distributed around the city

From the Figure 1, 3 major groups of industries are identified. The first group of food industry is distributed around 5 quarters oriented through the North-East of the town. The second group is distributed around 12 quarters in the south direction of Dschang town. The last group belongs to 5 quarters in the north-west direction of the town. The group 2 has the highest number of millers (28) followed by the group 1 (21) and the group 3 has the lowest number of millers (15). In fact the population density is bigger in the group 3 area. Most of industries of group 2 are based around the local market. Group 1 and 3 belong to quarters situated in rural areas of Dschang city town. In fact the food milling industry are installed according to population density.

Socio-demographic Evaluation of Food Milling Industries

The food milling industries are characterized by the following socio-demographic parameters presented in Table 1. In fact, more women are involved in food milling industries. Although milling requires a lot of physical effort, it is directly associated with cooking, which is the prerogative of women in African society (Mathieu *et al*., 2021); (Sop *et al*., 2008).

Table 1: Socio demographic evaluation of milling industries

Designation	Characteristics	Percentage (%)
Gender	Male	17.3
	Female	82.7
Age range	15-25 years	6.1
	25-35 years	48.0
	35 years and more	45.9
Principal activity	Yes	56.7

	No	43.3
Study level	Primary	14.7
	High school	52.6
	University graduate	20.0
	Never being at school	12.6

Regardless of gender, people from 25 to 35 years old are more involved in food milling industries; the milling activity requires some experience in the use and operation of milling machines, which is difficult for young people under 25 years old. Most of the workers (82.7%) in food milling industries are marred against 16.3% who are single. According to usual thoughts (Mathieu *et al*., 2021), Millers have not being in school (Ndangui, 2015). The results show the contrary where only 12.6% would never have been at school compared to 52% who have reached secondary school. Among the respondents, 20% have a university degree. This precisely shows that it is no longer sub-business and this activity should deserve special attention for any improvement on the organizational or technical level.

Technical Characteristics of Food Milling Industries in Dschang City

Type of Machine Available in Milling Industries:

The machine's type based on their percentage of appearance is presented in Figure 2.

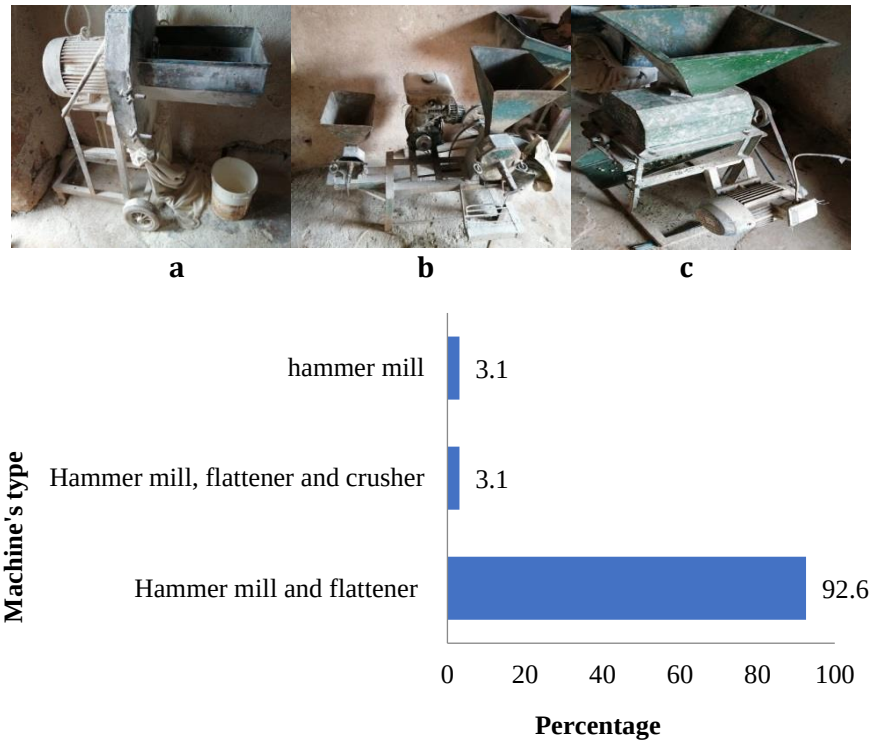

Figure 2: Representation and percentage of appearance of milling machines in Industries

From Figure 2, 3 types of grinding machines were individually identified in industries based on the working operation: hammer mills (Figure 2a), flatteners (Figure 2b) and crushers (Figure 2c). Based on the utility, the survey showed that whatever the food milling industry, the

Tandem Hammer and flattener machines appear the most in food processing with 92.6%. Only 3.1 % the food milling industry possess hammer mill machines and the three at once respectively (Doblado-Maldonaldo *et al.,* 2012). The highest occurrence of the couple Hammer-flattener machines are due to the quality of service in cooking process. In fact hammers machine (Figure 2a) and flattener machine (Figure 2b) are used to grind dry foods like maize and cassava seeds and fresh legumes like tomatoes, beans, grass peas, alfalfa respectively. All those foods are used in cooking different type of sauces. Also for economical purpose, it is more lucrative to have the both machines instead of having just one (Chiron and Fischer, 2008).

Brand of Milling Machine:

Most of the milling machines did have any brand whatever the industries as observed in Figure 3.

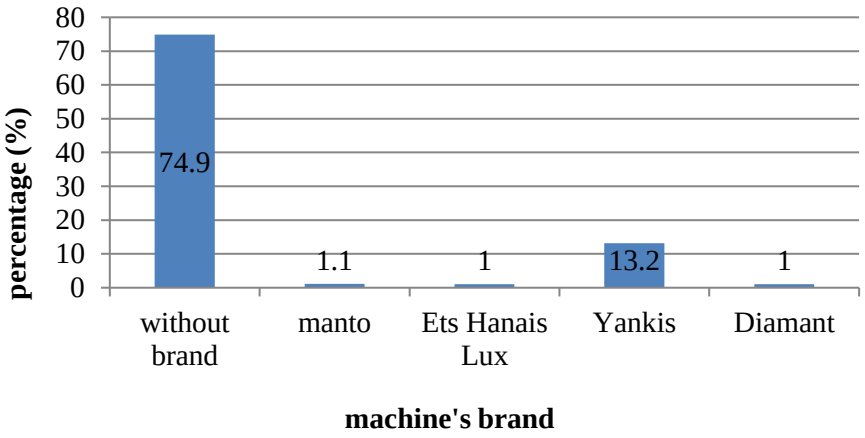

Figure 3: Percentage of machine with brand

From Figure 3, four types of brand were observed in industries. Just one is coming from abroad (Diamant). The others are local brand. Although the grinding machine's design technology is mastered (Ampah *et al*., 2021), there are still to improve like testing and providing the characteristics of milling machines in order to increase the economical aspect of local milling industries. With no identification on the machines, it is difficult to follow the constructors based on the quality of the materials used for design. Also with no brand on machines it shows less of professionalism in the quality of the work carried out.

This observation goes in line with the fact that all the milling machines (with and without Brand) lack operation sheet to carryout maintenance and for use procedures.

Age of Grinding Machine Available in Food Milling Industries:

The age of use for grinding machine are presented in the Figure 4. It appears that the highest age of use is 3 to 7 years followed by 5 to 7 years of age.

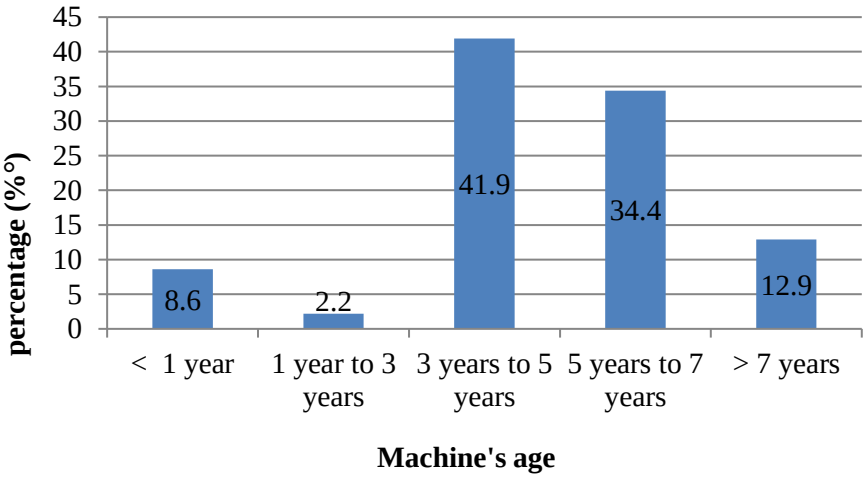

Figure 4: Percentage of machine's age

From those observations, food milling indutries in Dschang rarely renew the machines with time. In relation to depreciation and lifespan, local Manufacturers have not specified the maximum duration of use of these machines. Due to Erumban (2008), the lifespan of food machines should not be exceeding 10 years. The exceeding lifespan could produce a lot of risk in terms of ferrous and bacterial contamination of food which might be responsible of human cancers (Tchana *et al*., 2018); (Gyamea, 2018); (Guo *et al.,* 2017). Then regulation from state should be put in place in order to control manufacturers and millers to improve the milling process and protect consumers.

State of Milling Machines:

Figure 5 shows a view of milling machine's state percentage. It appears that 90,7% of food milling industries buy their machines new while 5,2% buy second hand machines. Otherwise, 4,1% of the millers in Dschang city town possess their coming from both sides (new and second hand).

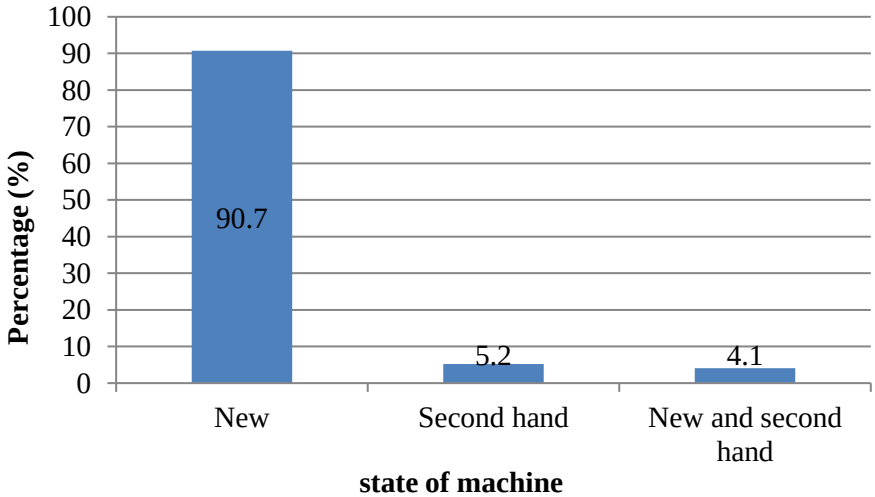

Figure 5: State of milling machine

Machines used for food transformation are sensitives. It is then very important to provide new machine for operations. Controls and regulations should verify the real behavior of the machine. From our survey and obervations, we might think that milling machines from second hand might have attained their lifespan. The consequence could be the ferrous contamination of food (Ankar-Brewoo *et al.,* 2020).

Miller's Category of Dschang:

In order to access the technical capacity of industries in Dschang, a Categorization of food milling industries as a function of milling machines number is presented in the Figure 6.

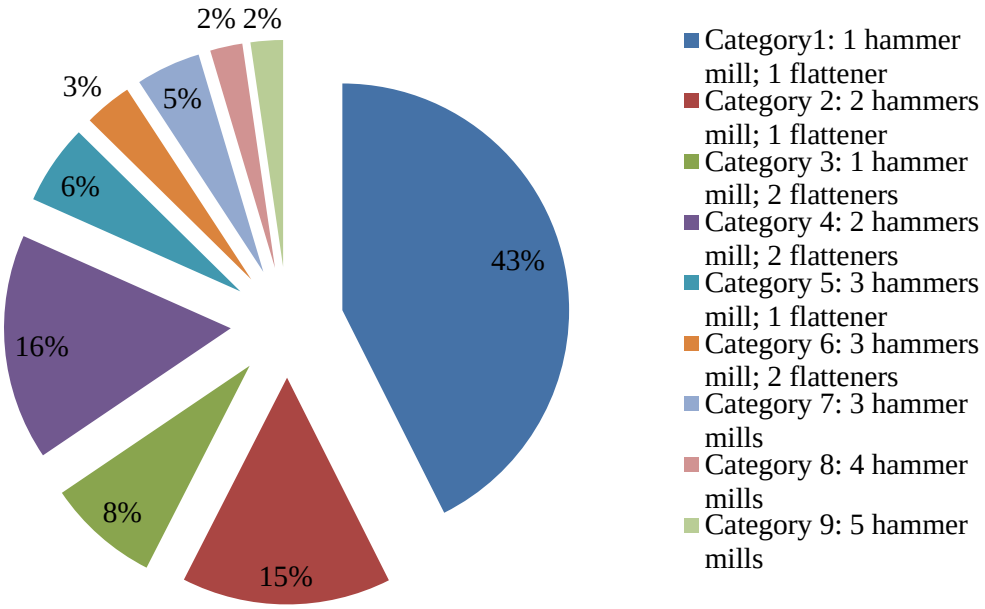

Figure 6: Category of food milling industries in Dschang city

It appears that 9 categories of industries are available in Dschang town based on the number of machines owned for grinding services. The category 1, with one hammer machine and flattener machine, has the highest percentage of appearance (42.5%). This could be explained by the low financial ability of industries to acquire more machines. At the contrary, the category 8 and 9 with the lowest percentage (2.3%), possess 4 and 5 machines respectively. Based on the grinding service, the categories 4 and 6 are the most efficient based on the energy consumption and economical aspects. Although the food processing costs with hammer machines are twice greater compared to those with flattener machines at the same weight, the second one is daily more used due the type of foods made in the city.

Energy Consumption:

Electricity Bill Consumption:

Electricity bill consumption was assessed during the investigation. From Figure 7, it appears the highest bill cost range from 1000 to 70 000 frcs.

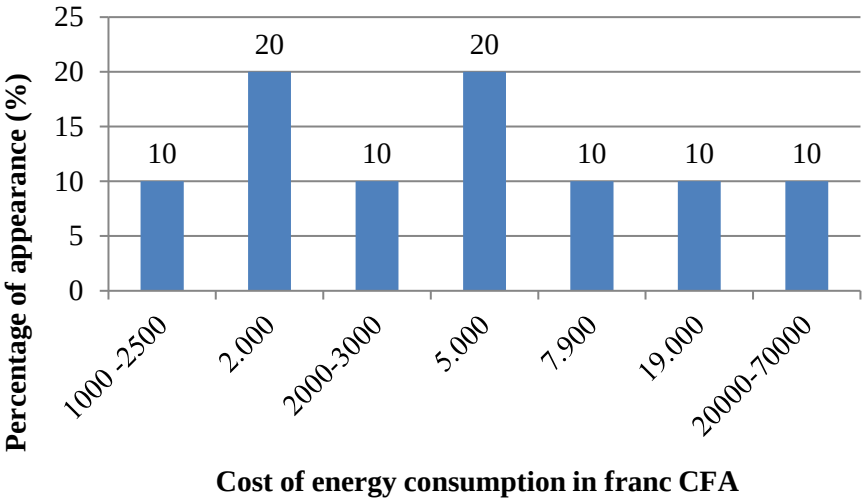

Figure 7: Electricity bill consumption

In terms of percentage of appearance, 20% and 10% of millers provide exactly 2000 frcs, 5000 frcs and 7.900 frcs. The other 10% of millers respectively pay in between 1000-2500 frcs, 2000-3000 frcs, and 20000-70000frcs. A positive correlation was observed between machine types and electricity bill. Indeed, most hammer machines are supplied with high powerful three-phase motors due to the operating mechanism requiring a high torque to easily perform the task. Naturally, more number of machines is available, more energy consumption is increasing. This might explain the highest cost observed.

Fuel Consumption:

During our survey, the fuel analysis was also carried out and it is presented on Figure 8.

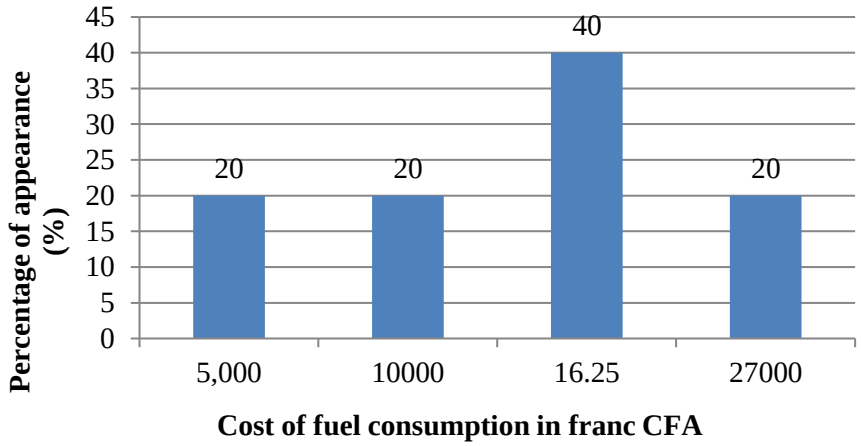

Figure 8: Fuel consumption cost per month

From our observation during survey, petrol engine from low power (5.5 hp to 6 hp) was used to assist flattener grinding machine when there was electricity shot down. The fuel consumption cost vary from 5000 frs to 27000 frcs. In terms of percentage of appearance, the

highest percentage of appearance (40%) was observed for a consumption fuel of 16.250 frcs a month. In order way, the percentage of appearance (20%) appears for 5000 frcs, 10000 frcs and 27000 frcs respectively. The highest percentage of appearance link to 16.250 shows that the electricity access is low or there is more periods of electricity shot down in Dschang as in Africa in general. It is true that the cost of grinding is double when there is electricity shot down.

Major Faults, Repairs and Maintenance on Milling Machines

Major Faults:

In order to study the behavior of grinding machines during their usage, the Table 2 presents the parts suggested to faults on grinding machines.

Table 2: faults observed on grinding machines as a percentage

Parts suggested to faults		Percentage of appearance (%)	
	Hammer	Flattener	both
Grinding disc	0	11.9	0
Belt Cut	10	13	23
Pulley wear	0	5.3	0
Motor windings	20	20.1	40.1
Clamping screw point	0	7.6	0
Bearings	0	4.3	0
Sieves mesh	2.1	0	0

From our survey, The motor windings with the highest percentage (40.1%) is the main fault which is common on both machines (hammer machine and flattener machine). Whatever the type of faults, the flattener mill machines are the ones presenting all the faults. These observations could be due to the facts that the flattener mill machines are designed for wetted products as compared to hammer mill machines which are designed for dry products (. Another observations is that most of the faults appear on rotative parts like the belt, clambing ball, pulley and bearings. the sieves mesh (Figure 9) are the part that are only appearing on the hammer mill machines and that have the least percentage of fault appearance (2.1%). On the same way, faults on electrical motor coiling, that are common to both machines, could due to the high voltage drops in Dschang city like in other places in cameroon (Onanena *et al*., 2021). Failures on the flatteners would be mainly due to either depreciation or lack of maintenance. In fact, these machines do not have any maintenance manual that could help the user to carry out those tasks.

Figure 9: some parts of milling machines to be maintained (a: grinding disc; b: sieve mesh; c: axle; d: clamping screw point

Maintenance:

In this study, the maintenance analysis was also carried out based on the parts regularly following the maintenance. The Figure 10 show the percentage of parts maintenance.

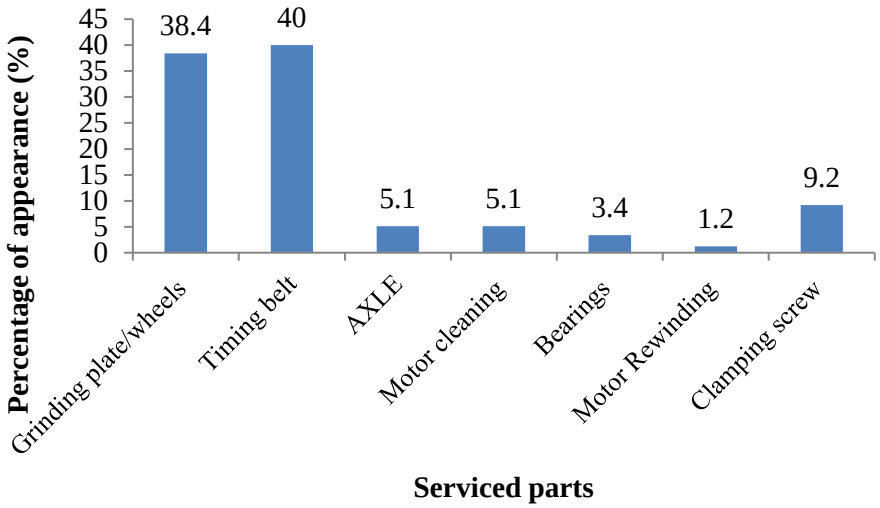

Figure 10: serviced parts and their percentage of appearance

From the figure above, the parts submitted to maintenance are mostly rotative parts. The timing belt with 40% of percentage appearance, is the part in which maintenance is the highest followed by the grinding disc and clamping screw with 38,4% and 9,2% of appearance respectively. Most of the time the preventive maintenance is been carried out on those previous parts due to the fact that they are accessible and visible so it becomes easy to carryout the maintenance. On the otherhand, bearings, motor coil and sometimes axle are parts which need some knowledge in maintenance technics (Farid et *al.,* 2020). That is why for those specific parts, the curative maintenance is the one carriedout. Generally, preventive maintenance are carriedout by millers while technicians are the one doing the curative maintenance (Yeleliere, *et al*., 2017); *(*Yar *et al*., 2023). From our observation due to the lack of maintenance sheets that should be provided by the manufacturer, it is then difficult to prevent faults based on maintenance procedures established by the litterature (Moerman, 2017). Most of the millers are not doing maintenance in a proper way which can explain also faults repetivity.

Improvement Procedures in Food Milling Industries

The design of food milling procedures was done and it is presented on the Figure 11.

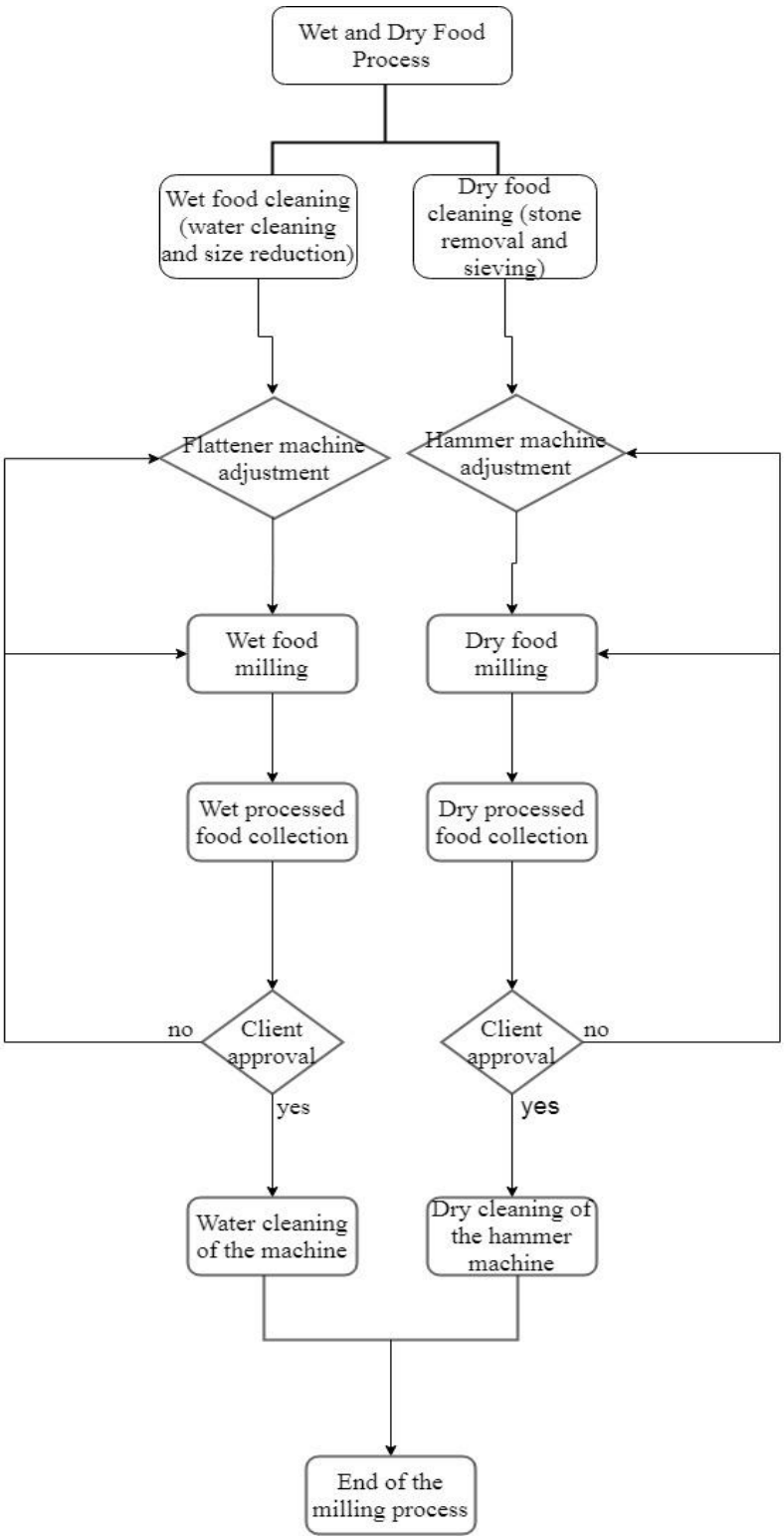

Figure 11: Flow chart for food processing in Dschang city town

From the survey, the flow chart of food processing for small scale mills in Dschang was designed in order to improve the process. In fact seven steps have been identified whatever the quality

of food to be processed (dry or wet). The first step is the food reception, the cleaning and sieving of products if needed, followed by the machine adjustment. The next step is the processing followed by food collection. Once the food is collected, the client needs to approve the quality of the processing. If the client approved the client do not approve the quality of the process, the processed food should come back either to the reprocessing or machine should be readjusted before reprocessing. This procedure is totally different from the literature (Nurprihatin *et al.,* 2021); (Fischer *et al.,* 2007)

CONCLUSION

The main objective of this study was to assess the socio economical and technical characteristics of small scales food processing in Cameroon using survey technics. From this study, small food processing mills are of great importance for households in Cameroon and in Dschang city in particular. In 95% of quarters of Dschang, there exist minimum of one foods mills processing that is why it is then important to improve the workability. The milling activity is controlled by the female gender. Two main types of machinery are used in local milling in Cameroon, the hammer mills machines and flattener's mills machines to process dry and wet foods respectively. most of the milling machines are manufactured locally while the electrical motors are imported from abroad. There is no guide for using those machines and due to that some technical problems are encountered regularly like motor breakage, axle breakage, belt breakage. Added to that, state regulation related to lifespan and machine's design should be put in place in order to avoid potential food spoilage and intoxication by ferrous and bacterial contamination.

ACKNOWLEDGMENT

We wish to acknowledge the millers of the Dschang city town who accepted to follow the survey and kindly answer the questions.

References

Aguilera, J. M. (2018). Relating food engineering to cooking and gastronomy. Compr Rev Food Sci Food Safety, 17(4), 1021-1039. http://doi.org/10.1111/1541-4337.12361

Aka, S., Akyüz, G. 2020. An inventory and production model with fuzzy parameters for the food sector, Sustainable Production and Consumption, Volume 26, 2021, Pages 627-637, ISSN 2352-5509, https://doi.org/10.1016/j.spc.2020.12.033

Ankar-Brewoo, G. M., Darko, G., Abaidoo, R. C., Dalsgaard, A., Johnson, P., Ellis, W. O., & Brimer, L. (2020). Health risks of toxic metals (Al, Fe and Pb) in two common street vended foods, fufu and fried-rice, in Kumasi, Ghana. Scientific African, 7. https://doi.org/10.1016/j.sciaf.2020.e00289

Ampah, J., Ribeiro, J. X. F., Bugyei, K. A., Kumi, F., Akowuah, J. O., Ofori, H., & Otchere, C. (2021). Status, challenges and prospects of food processing equipment fabricators in Ghana. Scientific African, 12. https://doi.org/10.1016/j.sciaf.2021.e00843

Balali, G. I., Yar, D. D., Dela, V. G. A., & Adjei-Kusi, P. (2020). Microbial Contamination, an Increasing Threat to the Consumption of Fresh Fruits and Vegetables in Today's World. Int J Microbiol, 2020. http://doi.10.1155/2020/3029295

Bankole, Y. O., Taninola, O. A., Adesina, B. S., & Samuel, D. O. (2013). Quality Assesment of Pepper Paste Using Different Milling Methods. Academic Journal of Interdisciplinary Studies, 2(10). 187. https://doi.10.5901/ajis.2013.v2n10p187

Chiron, H., & Fischer, J. (2008). Etat des lieux des pratiques de meunieres et boulangères biologiques en France. 3eme partie: Différentiation de la boulangerie bio. Industries des céréales, 157, 10-21. https://orgprints.org/id/eprint/15457/1/25-Viaux.pdf

Dean, C., Badurdeen, F., OoNorasak, K. (2023). Enabling Sustainable Consumption: Development of an Inventory Management Tool for Food Recovery. In: Kohl, H., Seliger, G., Dietrich, F. (eds) Manufacturing Driving Circular Economy. GCSM 2022. Lecture Notes in Mechanical Engineering. Springer, Cham. https://doi.org/10.1007/978-3-031-28839-5_45

Doblado-Maldonado, A. F., Pike, O. A., Sweley, J. C., & Rose, D. J. (2012). Key issues and challenges in whole wheat flour milling and storage. Journal of Cereal Science, 56(2), 119-126. http://dx.doi.org/10.1016/j.jcs.2012.02.015

Erumban, A. A. (2008). Lifetimes of machinery and equipment: Evidence from dutch manufacturing. Review on income and wealth, 54(2), 237-268. https://doi.org/10.1111/j.1475-4991.2008.00272.x

FAO. Food Wastage Footprint (2022). https://www.fao.org/nr/sustainability/food-loss-and-waste (14.07.2024)

FAO. The state of food security and nutrition in the world (2019). Safeguarding against economic slowdowns and downturns. FAO, Rome.

Farid, D. A., Budiasih, E., & Alhilman, J. (2020). Proposed optimal maintenance intervals for milling machine using risk based maintenance and analytical hierarchy process at manufacturing plant. IOP Conference Series: Material Science and Engineering, 1003, 1-8. https://doi.org/10.1088/1757-899X/1003/1/012041

Fischer, J., Bar-L'Helgouach, C., Rathier, F., & Chiron, H. (2007). Etat des lieux des pratiques meunières et boulangères biologiques en France. 1ere partie: La meunerie bio. Industries des céréales, 155, 07-14. https://www.researchgate.net/publication/341769007_Comment_gerer_la_necessaire_approche_pluridisciplinaire_et_transversale_des_programmes_de_recherche_en_agriculture_biologique_L'exemple_du_programme_pain_bio

Flach, F., Breitung-Faes, S., & Kwade, A. (2017). Scaling Wet Fine Grinding Processes of Organic Particles Using Stirred Media Mills. Chemik Ingenieur Technik, 89(8), 1051-1059. https://doi.org/10.1002/cite.201600148

Guo, C., Zhou, Z., Wen, Z., Liu, Y., Zeng, C., Xiao, D., ..., & Ye, X. (2017). Global epidemiology of dengue outbreaks in 1990–2015. a systematic review and meta-analysis. Frontiers in cellular and infection microbiology, 7. https://doi.org/10.3389/fcimb.2017.00317

Gyamea, H. (2018). Assessing dietary pattern and its association with hypertension among the elderly in the Tano North District in the Brong Ahafo Region, Ghana [Doctoral dissertation]. https://ir.knust.edu.gh/items/05bc47bf-190e-4a74-b68f-e2a4a64123a5

Ke, G., Chen, R. S., Chen, Y. C., Wang, S., & Zhang, X. (2020). Using ant colony optimisation for improving the execution of material requirements planning for smart manufacturing. Enterprise information systems, 1-23. https://doi.org/10.1080/17517575.2019.1700552

Knorr, D., & Watzke, H. (2019). Food Processing at a crossroad. Sec. Nutrition and Food Science Technology, 6(2019). https://doi.org/10.3389/fnut.2019.00085

Kolawole A.D., Akomolafe A.B., Olusipe B.J., 2019. Inventory Management: An Impetus for Increased Profitability in Manufacturing Firms. International Journal of Accounting, Finance and Risk Management, 4(4), 1-6. https://doi.org/10.11648/j.ijafrm.20190404.12

Ludwig, D. S. (2011). Technology, diet, and the burden of chronic disease. JAMA, 305(13), 1352–1353. http://doi.10.1001/jama.2011.380

Mathieu, B., Zenabou, G., Hamadou, L., Alim, A. Y. Y., Amadou, N. M. (2021). Caracterisation de l'artisanat agro-alimentaire de la ville de Garoua, Nord-Cameroun. Journal of applied biosciences, 159, 16429-16437. https://doi.org/10.35759/JABs.159.7

Moerman, F. 2017: Chapter 8 - Personal Hygiene and Good Maintenance Practices for the Servicing of Food Processing Equipment, Editor(s): S. Kennedy, In Woodhead Publishing Series in Food Science, Technology and Nutrition, Food Protection and Security, Woodhead Publishing, 2017, Pages 267-327, ISBN 9781782422518, https://doi.org/10.1016/B978-1-78242-251-8.00008-4

Musiari, F., Moroni, Fabrizio., Pirondi, A., Favi, C. 2024: Towards computer-aided hygienic design: Definition of a knowledge-based system for food processing equipment, Journal of Food Engineering, Volume 363, 2024, 111776, ISSN 0260-8774. https://doi.org/10.1016/j.jfoodeng.2023.111776

Ndangui, C. B. (2015). Production et Caractérisation de farine de patate douce (Ipomoeabatatas.Lam): optimisation de la technologie de planification. PhD Thesis. Department of food transformation, University of Lorraine, France http://docnum.univ lorraine.fr/public/DDOC_T_2015_0059_NDANGUI.pdf

Nurprihatin, F., Gotami, M., & Rembulan, G. D. (2021). Improving the performance of planning and controlling raw material inventory in food industry. International journal of research in industrial engineering, 10 (4), 332-345

Nzudie, H. L. F., Zhao, X., Liu, G., Tillotson, M. R., Hou, S., & Li, Y. (2021). Driving force analysis for food loss changes in Cameroon. Journal of Cleaner Production, 278. https://doi.org/10.1016/j.jclepro.2020.123892

Onanena, R., Tchuidjan, R., Motto, F. B., & Gatchessi, M. M. (2021). Improvement of the voltage quality in an electrical network via the loopback: case of the southern interconnected Grid (SIG) of Cameroon. Journal of Power and Energy Engineering, 9, 25-41. https://doi.org/10.4236/jpe.2021.93002

Opoku R.K., Abboah C.K.B., Owusu R.T., 2021. Inventory Management Strategies of Food Manufacturing Industries in a developing economy. LogForum 17 (1), 37-48. http://doi.org/10.17270/J.LOG.2021.557

Sabillón, L., Stratton, J., Rose, D., & Blanchini, A. (2020). Microbiological survey of equipment and wheat-milled fractions of a milling operation. Cereal Chemistry, 98(1), https://doi.org/10.1002/cche.10373

Silapeux, A. G. K., Ponka, R., Frazzoli, C., & Fokou, E. (2021). Waste of Fresh Fruits in Yaoundé, Cameroon: Challenges for Retailers and Impacts on Consumer Health. Agriculture, 11(2) 89. https://doi.org/10.3390/agriculture11020089

Sneyd, A. (2014). Cameroon: Perspectives on Food Security and the Emerging Power Footprint. Sustainability, 6(4), 1868-1895. https://doi.org/10.3390/su6041868

Sop, M. M. K., Fotso, M., Gouado, I., Tetanye, E., Zollo, P. H. A. (2008). Nutritional survey, staple foods composition and the uses of savoury condiments in Douala, Cameroon. African Journal of Biotechnology, 7(9), 1339-1343. https://www.ajol.info/index.php/ajb/article/view/58672

Pereira Pessôa, M.V. Jauregui Becker, J.M. 2020: Smart design engineering: a literature review of the impact of the 4th industrial revolution on product design and development. Res. Eng. Des., 31 (2020), pp. 175-195, https://doi.org/10.1007/s00163-020-00330-z

Tchana, A. N., Kamnang, N. D., Maliedje, A. T., Manfo, F. T., Njayou, F. N., Abia, W. A., Nantia, E. A., Moundipa, P. F. (2018). Assessment of dietary exposure and health risk to multiple heavy metals amongst some workers in Yaoundé, Cameroon. Journal of pharmacy and pharmacology, 6(2018), 801-816. https://doi.org/10.17265/2328-2150/2018.09.001

Viaux, P., Taupier-Letage, B., & Abecassis, J. (2009). Comment gérer le nécessaire approche pluridisciplinaire et transversale des programmes de recherche en agriculture biologique? L'exemple du programme pain bio. Innovations Agronomiques, 4, 183-196. https://hal.inrae.fr/hal-02655832

Yar, D. D., Kwenin, W. K. J., Balali, G. I., Assoah, E., Addy, R., & Francis, G. (2023). Food milling machines are hosts to pathogenic bacteria: A cross-sectional study in the Asante Mampong Municipal, Ghana. Scientific African, 20. https://doi.org/10.1016/j.sciaf.2023.e01673

Yeleliere, E., Cobbina, S. J., & Abubakari, Z. I. (2017). Review of microbial food contamination and food hygiene in selected capital cities of Ghana. Cogent Food and Agriculture, 3(1), 1395102. https://doi.org/10.1080/23311932.2017.1395102