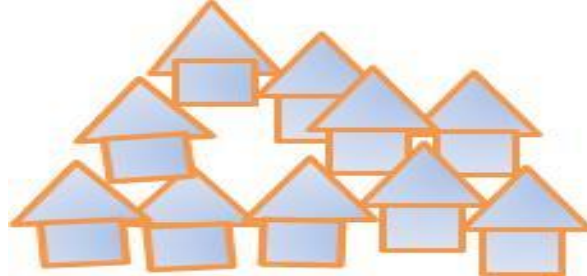
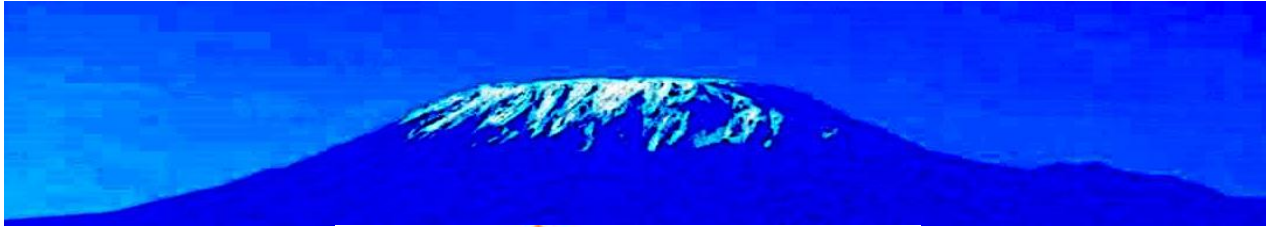


**Volume 2 Number 1
2022**

Tanzania Journal of Community Development (TAJOCODE)



**Online: ISSN 2773-675X
Copyright @ TAJOCODE**

**The Journal that advances the profession and practice of
Community Development**



JOURNAL INFORMATION

The Department of Agricultural Extension and Community Development owns as well as offers its expertise and oversees the management and the review process of the journal. Even though, editorial decisions are based on the quality of submissions and appropriate peer review, rather than on any political, financial, or personal influences from the department, Sokoine University of Agriculture (SUA), and other stakeholders. TAJOCODE follows Committee on Publication Ethics (COPE) guidelines (visit www.publicationethics.org for details) to manage its peer-review process. All authors are welcome to submit complaints and appeals to the editor's decisions. Please contact the Chief Editors for any queries.

EDITORIAL BOARD

Chief Editors:

- Dr. Rasel Mpuya Madaha (PhD), *Sokoine University of Agriculture, Tanzania*,
Email: rasel.madaha@sua.ac.tz
- Dr. Regina Malima (PhD), *the Open University of Tanzania*
Email: reginamalima@out.ac.tz or regina.malima@yahoo.co.uk

Associate Editors

- Dr. Ponsian Sewando (Tengeru Institute of Community Development-TICD: ponsiansewando@gmail.com)
- Novatus Justinian Kaijage (Community Health and Social Welfare Africa, COMHESWA: kaijagecd@yahoo.com)

Other Members of the Editorial Board

- Prof. James O. Bukenya, Professor of Agricultural and Applied Economics and Director of the Office of Research Compliance at Alabama Agricultural and Mechanical University (AAMU)
- Dr. Krijn Peters (Associate Professor in Post-war Reconstruction, Rural Development and Transport Services, Department of Political & Cultural Studies, Swansea University)
- Dr. Robin Neustaeter, PhD, Assistant Professor, Department of Adult Education, Program Teaching Staff
- Brianne Peters. Brianne is an expert on Asset Based and Citizenled Development (ABCD) and Program Teaching Staff at Coady International Institute St. Francis Xavier University
- Dr. Solomon Muhango (Agricultural innovations and Gender, Tengeru Institute of Community Development-TICD)
- Dr. Elimeleck Parmena Akyoo (Tanzania Institute of Accountancy-TIA: eparmena@gmail.com)
- Dr. Respikius Martin (Sokoine University of Agriculture-SUA: rmartin@sua.ac.tz)
- Dr. Godfrey Martin Mubyazi, Chief Research Scientist (Head), Department of Library, Medical Museums & Publications, National Institute for Medical Research (NIMR)
- Dr. Zena M. Mabeyo (PhD), Senior Lecturer, Ag.Deputy Rector, Planning Finance and Administration, Institute of Social Work, East African Regional Representative - Association of Schools of Social Work in Africa (ASSWA)
- Dr. Gabriel K.Nzalayaimisi(Ph.D) Sokoine University of Agriculture
- Juma Almas Mhina, (Ph.D ongoing), Tengeru Institute of Community Development-TICD
- Amon Exavery, Statistics, Epidemiology, and economics. Senior Research & Learning Advisor at Pact/Tanzania
- Rose Mtei (Tengeru Institute of Community Development-TICD)

Information on submission

TAJOCODE is a peer reviewed journal. Visit journal's website for details <https://www.coa.sua.ac.tz/extension/tanzania-journal-of-community-development-tajocode>

DISCLAIMER

The Editorial Board, TAJOCODE, Department of Agricultural Extension and Community Development of SUA and our publishers (referred to as the organs of the journal) make every effort to ensure the accuracy of all the information (the "content") contained in our publication. However, the mentioned organs, our agents, and our licensors make no representation or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the content. Any views and opinions expressed in this publication are the opinion and views of the authors, and are not the views of or endorsed by the organs of the journal. The accuracy of the contents should not be relied upon and should be independently verified with primary sources of information. The organs of the journal should not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, or other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the content. Other details about the journal can be accessed at <https://www.coa.sua.ac.tz/extension/tanzania-journal-of-community-development-tajocode>

Towards Food Security in Semi-Arid Regions: The Role of Small-Scale Food Processing Industries in Dodoma City, Tanzania

Deodata V. Mtenga¹ and Asha S. Ripanda²

Article history

Received: 23/12/21

Revised: 20/07/22

Accepted: 04/10/22

Published: 05/10/22

Keywords: Food processing; Enterprise; Food security; semi-arid; self-sufficient ratio (SSR); Population growth

Abstract

The power of small-scale food processing industries is based on their ability to improve food security by ensuring availability throughout the year. This study used primary and secondary data to obtain information on small-scale food processing industries in semi-arid regions of Tanzania and associated implications for improving food security. About 30 food processors and 6 key informants were available to answer interview questions. It was revealed that men dominated food-processing industries by 93.3%. In addition, food processors comprised medium, small and micro-scale food processors by 20%, 29.23% and 50.7%, respectively. However, the food processing industry faces many challenges such as inadequate funding, stringent government rules and rigid bureaucratic procedures, shortage of raw materials, poor technology and unreliable electric power supply. Supporting the improvement of food processing industries in Dodoma will aid in decreasing post-harvest losses by increasing the shelf life of the agricultural product. In turn, the support will help in overcoming food insecurity in the area. Therefore, it is recommended that the government should provide more support to the food processors to enable them to overcome the challenges for improved livelihood.

Introduction

Food security is a global challenge and a prerequisite for a healthy and peaceful society (Augustin et al., 2016; Prosekov & Ivanova, 2018). The concept of food security has passed through several modifications. World Food Summit gave the most useful definition of food security in 1996. The definition states that food security refers to the ability of all individuals to have physical and economic access to adequate, nutritious and safe food that meet their dietary needs and food preference for an active and healthy life (FAO, 1996). The definition shows four pillars to attaining food security: availability, accessibility, utilization and stability. Sustainable Development Goal (SDG) -2 targets and indicators also align with the four pillars. In this regard, food security is guided by the SDGs (Gill, 2019). Specifically, SDG-2 calls to “End hunger, achieve food security and enhanced nutrition, and promote sustainable agriculture” (Cafiero, Viviani, & Nord, 2018). However, it is already halfway through its implementation, and global food security improvement signs are sceptical. Land-use preferences, population increase and global climate change may significantly contribute to food insecurity, as reported by other researchers (Molotoks, Smith, Pete, & Dawson, 2021).

FAO reports that more than 820 million people are still hungry, and 2 billion people experienced moderate to severe food insecurity globally (FAO, 2019). In this case, achieving a zero-hunger target by 2030 becomes an immense challenge. Africa is the most affected continent by the prevalence of food insecurity (Niywul, 2021; Tumushabe, 2018), as it has a more than 50% of the food-insecure population (Gebre & Rahut, 2021). Despite surplus food in some regions, Tanzania experiences food insecurity in some parts of the country. For example, between November 2019 and April 2020, nearly one million people, out of 4.8 million in 16 analysed

¹ Institute of Development Studies, The University of Dodoma, Deodata.mtenga@udom.ac.tz

² Department of Chemistry, College of Natural and Mathematical Sciences, The University of Dodoma, ashariipanda7@gmail.com

districts of Tanzania experienced severe food insecurity (URT 2020). The problem is higher in semiarid regions due to climatic characteristics of low and erratic rainfall. The area is characterized by low rainfall and temperature, limiting plant and animal populations and human activities such as agriculture. Dodoma city is in a semi-arid region with a growing population due to the shifting capital city of Tanzania from Dar es Salaam to Dodoma in 2016. Consequently, the food requirement hiked to meet the growing population's demand. For example, in 2018/2019, the Dodoma region food requirement for cereal -the main staple food- was 422,114 tons. However, the production was only 37, 5196 tons indicating a deficit of 46,917 tons (URT 2019).

Food processing may be among the best methods for improving food security, particularly in urban areas where the main food source is from rural areas (Gebre et al., 2021; Hanjra & Williams, 2020; Petersen & Charman, 2018). Food processing has multiple effects, such as the availability of food options, reducing food losses along the value chain, preserving nutrient content, and increasing food safety and shelf life (Augustin et al., 2016; Manual, 2004). The contribution of food processing in improving food security in semiarid areas like Dodoma city, where the study was conducted, needs to be fully utilized. Overall, the utilization of small-scale food processing industries as a vehicle for improving food security in semi-arid regions is not well documented. Hence, this study intended to assess the role of small-scale food processing industries in improving food security in semi-arid regions. The data obtained will provide useful information to the general public, policymakers, Non-Governmental Organizations (NGOs) and researchers on the importance of food processing to ensure food security at the household and national levels.

Literature Review and theoretical framework

Two theories guided this study; Malthusian Theory and Antimalthusian Contentions. The selection of these theories was influenced by their ability to inform the relation between population, technology and food security. Thomas Robert Malthus developed Malthusian Theory to describe the relationship between population and food security. Malthusian contends that the population ratio to food production shapes food security. His main argument in 1798 was that "population when unchecked increases in geometrical ratio while subsistence food production increases only in an arithmetical ratio". The theory further added that there must be an equal relationship between population and food production to achieve subsistence food production. The theory is useful due climatic nature of the area and the increasing population. Further, the study area has been affected by harsh climatic conditions. In this regards, the increase in population intensifies the problem. Malthus' central argument is that food is vital for human survival, even if the human population grows faster than the earth's ability to generate subsistence.

However, the Malthusian argument was criticized by antimalthusian contention developed by Ester Boserup in 1960. The theory, also known as the optimistic theory by Boserup (1993), was optimistic on three aspects regarding population growth. The theory had a conflicting argument with that of Malthus and propounded that population growth is an opportunity for development as through population there might occur development of new technology that might enhance food production enough to keep up with population growth for many years. Primarily, she considered population growth the source of labour to enhance food production. Next, she considered the invention of mechanization as the result of population growth which boosts food production; thirdly, Boserup was optimistic that population growth is a major factor determining agricultural development and food security. Thus, the increasing population would enhance fertiliser use, producing more food for the growing population.

Related Empirical literature

Food security in terms of availability and accessibility is imperative to ensure the human right to food is achieved. Several strategies must be done to sustain the availability and accessibility of food to everybody throughout the year. The strategies may range from technologies, enabling policies and providing support such as credit and training.

Several scholars have reported different issues related to food processing as a vehicle for improving food security. Adeyeye (2017) acknowledges a need to promote a simple and effective agro-processing technology that adds value to products and increase their shelf-life to attain food security (Adeyeye, 2017). Similarly, Ibnouf (2011) acknowledges the role of women's indigenous knowledge in food processing as a vehicle for improving food security in Sudan. In addition, Precoppe and Coallegues (2017) are of opinion providing suitable cassava processing equipment to small-scale processors could reduce post-harvest losses thus, increase the shelf life of the products (Precoppe, Chapius, Muller, & Abass, 2017).

The advantages of food processing as means to improve food security has also been reported by several scholars (Alamu & Mooya, 2017; Amit, Uddin, Rahman, Islam, & Khan, 2017; Augustin et al., 2016; De Vries et al., 2018). Some advantages of food processing including using fewer resources, greater quantities, longer shelf lives, ease transportable, and innovative new foods. Food processing can be part of a food system that aims at maintaining biodiversity and ecosystems, be culturally acceptable and accessible, be economically equitable and affordable, and be nutritionally adequate, safe, and healthy (De Vries et al., 2018; Mikolajczak and Coallegues, 2018; Augustin and Colleagues, 2016). Owing to its involvement in food security issues, nutritional deficiency demands, and preventive health methods on environment protection and energy serving, food processing can enhance the ability of humans to live long and stay healthy (De Vries et al., 2018). Similarly, food processing is a food preservation technique which maintains food quality at desired capacity to obtain maximum benefit and nutritional value (Amit et al., 2017).

The policy issue in the food processor also has received attention and been reported from different perspectives by different scholars. Tschirley and Colleagues (2021) discovered that despite food processing having immerse benefits in improving the quality and quantity of food, it might lead to a dilemma for policy makers due to its ability to bring unhealthy products to the market as a result of ultra-processed food (Reardon et al., 2021). Notwithstanding, the policy to enhance food security should ensure the achievement of the four dimensions -availability, accessibility, utilization and stability (Qureshi, Dixon, & Wood, 2015). Effective public policies may influence consumer demands, accessibility and producer supply by supporting in enhancing food production.

The challenges facing small-scale food processing industries are a drawback to food processing, thus impairing the effort to improve food security. Further, inadequate capital is the major constraint facing the growth of small-scale food processing (Nwajiuba, Amazu, Nwosu, & Onyeneke, 2013). According to Shehrawat (2007), there are several challenges facing food processing industries such as deficiency of physical facilities, limited stock of raw materials, inadequate managerial competence, and poor attention to advertisement and publicity of the products. Other challenges are technological gap, inadequate working capital, inadequate supply of export information, shortage of power supply, licensing and registration, inadequate market, poor government support, and long and complicated procedures to avail institutional conditions (Shehrawat, 2007).

Materials and methods

Study area

Dodoma is the capital city of Tanzania that is located at the central zone of the country. The city is characterized by a semiarid climate. The city has been experiencing a population increase following the upgrading of Dodoma to the capital city of the country. The population prompts a need for an adequate food supply. Dodoma city covers an area of 2,669 square kilometres characterized by both Urban and rural qualities. It stands on the broad upland plateau with an altitude ranging between 900-1000 meters above sea level. Due to unreliable rainfall caused by semiarid nature, the area has scanty vegetation such as herbs, grasses, conspicuous baobab and acacias trees. In the 2012 National Population and Housing Census, the population of Dodoma was 410,956 people, of whom 199,487 or 48.5 per cent, were male and 211,469, or 51.5 per cent, were female, with 74,914 households having an average size of 4.3 people. Dodoma city is divided into 4 divisions, 41wards and 188 streets/villages, as shown in Table 2. In the urban area, commerce, urban farming, and civil service jobs are the primary sources of income, but in rural areas, crop farming and animal keeping are the primary sources of income.

Table 1: Dodoma city; divisions and villages/streets

Division	Number of wards	Number of Village/streets
Urban	23	120
Hombolo	7	27
Kikombo	4	28
Zuzu	7	13
Total	41	188

Source: Dodoma city profile 2012

Research design, Sampling Techniques, Sources of Data and Data Collection

A cross-sectional research design was employed. Dodoma City was purposively selected due to its arid nature. Thirty (30) participants from small-scale food processors were purposively selected from Dodoma city using a snowball approach involving three waves. In the first wave, five participants were contacted after nomination from the SIDO Dodoma region. The five participants agreed to participate in the study and nominated ten participants for the second wave. The participants in the second wave were contacted and agreed to participate in the study and also nominated fifteen participants for the third wave whom were also contacted and agreed to participate in the study, thus making a total of 30 participants. Among the food processors selected for an interview, fifteen were for maize processing, and fifteen were for sunflower processing. The 30 participants selected were out of 65 food processors recorded by SIDO, accounting to 46.15% of all food processors. Among them, male were 28 equivalents to (93.33%) and female were 2 equivalents to (6.67%), indicating that males dominate food processing industries in Dodoma city. The interview was conducted with 30 participants, as they were available and willing to participate in the interview process. Male dominance in food processing was also reported by researchers such as Essel et al., 2019 and Ojiweno et al., 2015).

Also, one focus group discussion (FGDs) was conducted, involving six (6) key informants (two (2) from the Ministry of Agriculture, Livestock and Fisheries (MALF) and four (4) from the Small Industries Development Organisation (SIDO). Ethics were adhered to throughout the study, including the confidentiality of all participants. This study generally involved a combination of methods to obtain primary and secondary data. Primary data specifically focused on obtaining information about the type and source of food processed, challenges facing food processors, and the opportunity of food processing as a source of food security in Dodoma city. Secondary data include a documentary review to supplement information abstained from the primary

sources and included; census reports, journals, research reports and government policy documents.

Data Analysis

Descriptive statistics such as frequencies, means and percentages were used to describe the relationship between variables under study. Data collected from small-scale food processors were analyzed by content analysis where the theme was established from phrases, and issues raised from the discussion were analysed.

Results and discussions

This section will present the result and discussion of the study.

Status of small-scale food processor in Dodoma City

The report from SIDO technical officer showed that only 65 food processors were recorded with the organisation in Dodoma city. About 13 (20%) were medium processors, 19 (29.23%) were small-scale processors, and 33(50.7%) were microprocessors. The production capacity was reported to be 0.5 to 1.5 tons, 1 to 2 tons and 2.5 to 5 tons, respectively. This data indicates that food processing in Tanzania is mostly done by micro-enterprises and on a small scale. Nevertheless, it has value to the food chain, thus improving food security. The role of food processing in improving food security was also reported by other researchers (Adeyeye, 2017; Augustin et al., 2016; Ibnouf, 2012). Overall, the findings indicate male dominance in food processing. This has also been recorded by other researchers (Essel, Adams, & Amankwah, 2019; Ojiewo et al., 2015).

Contribution of Food Processing to Food Security in Dodoma city

Food processing plays a key role in each step of the food system, from production to consumption (Cichoski et al., 2015; Costa, de Oliveira Rios, Flôres, & Products, 2015; Dwyer, Fulgoni III, Clemens, Schmidt, & Freedman, 2012). It is important in overcoming the challenges of feeding the growing world population estimated to reach 9 billion by 2050 (Despain, 2013). The study focused mainly on secondary food processing. Secondary food processing falls on a long-term basis mainly to cereal products like maize and sunflower seed. The crops are main crops grown and processed in the Dodoma region. Food processing, in this case, is practised on a small scale using the small machine and on medium scale using medium size industries and, in most cases, is done manually by food processors. According to Crush and Frayne (2011), 70% of food is processed by micro, small and medium private enterprise. This corresponds to the current study, where most small-scale food processors fall under micro, small and medium private enterprise. The government's action is to facilitate regulatory and public support functions, as reported by Mmasa (Mmasa, 2013).

Regardless of being in a semi-arid region, Dodoma city has a great opportunity to enhance food processing for better livelihood and food security. Food processing covers several items such as horticulture products, animals' products, fisheries and grain products. Dodoma city has the opportunity to produce all of the products mentioned above. Several cereals are also grown in other districts of Dodoma region. They include Bahi, Chamwino, Kondoa, Mpwapwa and Chemba. As such, reliable transportation from the districts to the city can enhance the availability of raw materials for processing industries. Despite its semi-arid nature, Dodoma is located at the centre of Tanzania. The city is well connected to other regions by a good transportation network such as railway and tarmac roads. The findings from the FGD showed that small-scale food processors could manage to obtain raw materials from other regions of Tanzania including Mbeya, Morogoro, Arusha, Songea, Tanga and other places whenever the chance happens.

Nevertheless, food processing has not gained much attention, particularly from the government; the task is left to the private sector. Government is there to regulate and monitor the standard and quality of the process. In-depth interview with eight (8) key informants showed that the food processing industry in Dodoma city range from larger, medium, small and micro-enterprises. The Small and Medium Enterprise Development Policy of 2002 in Tanzania also well elaborated on these categories. Thus, micro-enterprises are those engaging up to 4 people, family members or employing capital amounting to Tshs.5.0 million. The informal sector accounts for the majority of micro-businesses. Small businesses are usually formalized with 5 to 49 workers or a capital investment of Tshs. 5 million to Tshs. 200 million. Medium-sized businesses employ 50 to 99 employees and invest between Tshs.200 million and Tshs.800 million in the capital (Makorere, 2014).

Maize was the most processed carbohydrate energy food and was done on a micro-scale using a small machine and manually by several people. The response from the interview and FGD indicated that the machine's capacity and inadequate funding challenge small-scale maize flour processors; therefore, they could process only 0.5 to 1 tons of maize a day. They relied upon a small machine to process flour on the microscale and localized customers. Inadequate financial resources were supported by other researchers (Nwajiuba et al., 2013; Sasidharan & Rajesh Raj, 2014; Shehrawat, 2007). Limited access to finance and lack of capital have been identified as constraints to the growth of small enterprises in Africa and elsewhere (Sasidharan & Rajesh Raj, 2014). As noted in Dodoma city, financial constraints also limit the market as producers will produce enough for the localised market.

Sunflower is another crop in Dodoma that is processed to produce cooking oil and animal feeds. Unlike maize, sunflower processing has small-scale and medium-size processors whereby small-scale processors can process up to 2 tons, and medium-scale sizes can process up to 5 tons. Despite being on a small scale the products offer the opportunity for improving food security to the community of Dodoma city and the neighbouring districts. This lowers postharvest food losses, increases food shelf life, and facilitates transportation (Dwyer et al., 2012; Weaver et al., 2014). Also, it facilitates food availability throughout the year though at varying prices. During the harvest, the season price is likely to be very low, and it hikes after and later in the season. It also provides employment opportunities and hence provides income, which ultimately enable accessibility of the food.

Moreover, processed food is more likely to be safe for better health as, in most cases, the packaging is done hygienically due to safety regulations by the Tanzania Bureau of Standard (TBS) (Tanzania, 2009; TBS). This is also supported by Food Business Africa (2013), within the food value chain. Overall, improvements to the food processing industry have the most significant multiplier effects. The health of the food processing industry goes a long way to determining the production of abundant good quality, nutritious and safe foods, which are readily available and affordable for consumers.

Challenges facing food processors in Dodoma City

Despite abundant opportunities available for food processors in Dodoma city, they encounter many challenges that hamper their ability to produce the desired standards. Based on the research findings, food processors encounter somewhat similar challenges in their business. In this study, respondents mentioned several challenges: inadequate funding, high price and scarcity of raw materials during off-seasons, unreliable electricity supply, outdated technology, and government regulation. Ekblom reported similar challenges in 2006 (Ekblom, 2006).

Insufficient funding

Financial constraints of various business models in African countries and elsewhere have been largely studied, and it was reported that limited access to finance and lack of capital are key constraints (Chu, 2007; Mukantwali, Laswai, Tiisekwa, & Wiehler, 2012; Sasidharan & Rajesh Raj, 2014). Similarly, this was frequently mentioned by almost all respondents in Dodoma city. The respondents reiterate that inadequate funding affects many vital activities for business growth. Shortage of funds resulted in several constraints such as using outdated technologies, manual work resulting in many hours of work and inadequate raw materials for processing. These challenges hamper the quality and quantity of processed food. In addition to the above challenges, respondents mentioned having low access to the loan. Here, the majority of financial institutions have stringent rules that the majority of food processors in Dodoma city cannot comply with. The challenge greatly affects small and micro-scale processors. Although there is increased credit availability, they are not easily accessible to many micro-enterprises. The aspect of funding was raised during FGD. One of the key informant said that: -

“SIDO provides loans to small-scale entrepreneurs including food processors, but similar conditions apply. Therefore, in most cases, many food processors fail to meet the conditions”.

It was also supported by Nichter&Goldmark (2009) (Nichter & Goldmark, 2009) that SMEs (Small and Medium Enterprises) tend to face greater financial constraints than firms of a larger scale. For most financial institutions, collateral is needed for one to get a loan. This rule is a bit hard to fulfil. Also, the interest rate of many financial institutions is relatively very high. The financial constrain affect nearly all SMEs in most developing countries, as reported by scholars.

Government rules and regulations

Food processing as a business has a slew of laws that must be followed before obtaining a license. To become a food processor in Tanzania, one must pass through numerous departments. These include obtaining a TIN (Tax Identification Number), obtaining approval from the Health Department, obtaining a business license from the relevant District/Department city of Business, and registering with the Tanzania Bureau of Standards (TBS). The present study revealed that going through all of the regulatory procedures is difficult for the food processors since they involve lengthy bureaucratic procedures that take a long time to complete. Some charges must be repeated, such as the annual registration price. Therefore, the mentioned constrain hinder the growth of their business, as supported by other researchers (Nichter & Goldmark, 2009). The strict regulations to obtain licenses affect the growth of many SMEs, limiting profit and available capital, especially in developing countries. It was further pointed out that the regulatory environment is hampering small enterprise growth in developing countries, and indeed, a negative and statistically significant relationship has been found between regulations and growth in sales (Edwards & Balchin, 2008).

Nevertheless, adhering to government rules and regulations has advantages for food processors as it increases business freedom and profits. Registered by the regulatory authority can enhance the chance to obtain loans from several financial institutions, as supported by Sasidharan & Rajesh (2014). Government regulation for business was raised during FGD; one of the key informants said that:-

“There is no option, and food processors must adhere to government regulations for better performance of their business.”

Adhering to the regulatory authority and getting the license can grant business owners legitimacy in obtaining bank loans.

Raw Materials Scarcity

Raw materials include agricultural products such as oilseeds (sunflowers) and maize. The food processing business depends on the good performance of agricultural raw materials. As

mentioned earlier, Dodoma is a semiarid region in which all six districts that supply food to Dodoma urban are vulnerable to weather conditions. Very few of these commodities are available in the required quantity throughout the year to sustain processing industries. The problem is worse for small and micro-scale processors with inadequate capital to purchase raw materials outside the Dodoma region (URT, 2019). Food security Department's Ministry of Agriculture and fisheries report in Tanzania showed that Tanzania had surplus food production in four years and sufficient food in one year for five consecutive years. Generally, Tanzania produces surplus food.

Nevertheless, Dodoma has experienced a food shortage for the same years, as translated from Self Sufficient Ration (SSR), indicated in Table 2. The self-sufficiency ratio measures how much food is spent and produced locally. It determines if a country's agricultural commodity production is sufficient to meet domestic demand. As a result, the larger the ratio, the higher the level of self-sufficiency. If SSR is below 100, there is a food deficit; if SSR is 100 to 119, is food sufficient, and 120 and above, food is surplus. Self Sufficiency is defined as meeting consumption needs (particularly for staple food crops) from own production rather than buying or importing (Minot & Pelijor, 2010). In this regard, countries' policy has a vital role in ensuring self-sufficiency, as reported by Ghose (Ghose, 2014). However, international networking is also important to archive as it may enhance networks for outsourcing food supply beyond national borders (Ghose, 2014).

Generally, inadequate raw materials were reported by 23 (76.67%) respondents, mostly small and micro-processors. Small and microprocessors are vulnerable due to low capital and the unavailability of soft loans. Shortage of raw material was also raised during FGD; one key informant said that: -

“The shortage of raw materials in Dodoma city is the critical problem due to semiarid climatic conditions; however, the neighbouring regions such as Mbeya, Iringa, Arusha, and Morogoro produce surplus food which can be purchased during the lean season”.

Table 2: Tanzania Food Supply Analysis and Self Sufficiency Ratio (SSR) for 2012/2013 to 2016/2017 based on Total food production

Year	Production	Requirement	Gap/surplus	SSR
2012/2013	14,680,047	12,197,302	2,482,747	120
2013/2014	16,015,238	12,767,879	3,247,359	125
2014/2015	15,413,169	12,975,252	2,437,917	119
2015/2016	16,172,841	13,300,034	2,600,831	123
2016/2017	15,900864	13,300034	2,600,831	120

Source URT (2018)

From Table 3, it is obvious that raw materials for food processing in Dodoma are not sufficient as the region experiences food shortages frequently, as translated from SSR. Food processors in Dodoma city can sustain the processing business due to the availability of raw materials to other regions of Tanzania. The opportunity is that Dodoma city is located in the central part of Tanzania and well connected by tarmac roads and railway. This factor makes transporting raw

materials from another region to Dodoma city easier. Nevertheless, the price of purchasing outside the region is higher than when the material is available within the region. This challenge affects small-scale processors more than the medium and larger ones.

Table 3: Dodoma Food Supply Analysis and Self Sufficiency Ratio (SSR) for 2014/15 to 2016/2017 based on Total food production

Year	Production	Requirement	Gap/surplus	SSR
2012/2013	567,212	570,876	-3664	99
2013/2014	658,600	594,303	64,297	111
2014/2015	572717	596,714	-23997	96
2015/2016	690,633	616,506	187,868	112
2016/2017	1,479,496	1,262,624	-1,796	100

Source URT (2018)

Unstable power supply and Outdated Technology

The world is endowed with well-advanced technology for industrial business. However, both small and medium food processors in Dodoma claimed to use low and labour-intensive technologies. The major reason was insufficient funds to obtain advanced technology, which was given by 27 (90%) respondents. This is also the case with the packaging materials made locally and not well advanced. The same problem was discovered by (Mukantwali et al., 2012) in their study on Small and Medium Scale Pineapple Processing Enterprises in Rwanda. They discovered that access to equipment and packaging materials is a problem for small-scale food processing enterprises in Rwanda. These enterprises can hardly afford modern equipment and suitable packaging material, which leads to using some recycled packaging materials. The challenge also affects marketing as the Tanzania Bureau of standard (TBS) requires the certification of packaging material before any product is transported outside the Tanzanian border.

On the other hand, unreliable electricity was also echoed by 25 (83.33 %) of respondents in Dodoma city. The processor also mentioned the high electricity tariff price, especially the medium food processor. Therefore, respondents said that electricity for them was too expensive and unreliable. One cannot predict the sustainability of electricity supply all day, leave alone the long process and procedures for installation. Their response is also consistent with previous research that the electricity challenge is twofold: the power supply is expensive and unreliable. Like most challenges identified in this study, money is needed to solve the problem. Using a generator makes it possible to operate during power failures but increases production costs (Ekblom, 2006). So not only do processors need to invest in a generator, but they also need to be able to cope with the consequences of decreased profit.

Conclusions

Food processing in Dodoma city is vital for improving the food security and wellbeing of individuals, households and the whole nation. It increases the shelf life of food products and facilitates easier transportation from one place to another. Also, it facilitates food availability throughout the year though at varying prices. The price is likely to be very low during the harvest

season, and it hikes after and later in the season. It also provides employment opportunities hence providing income that will ultimately enable accessibility of the food. Likewise, processed food is more likely to be safe for better health in this case; it should be promoted and supported to have good results. However, due to different circumstances, food processing industries face several challenges which hamper their proper functionality in improving food security. Inadequate funding, unstable electric supply, shortage of raw materials, outdated technologies, and ineffective government policies and regulations are some of the challenges that affect food processors, especially small-scale processors. However, there is an opportunity for stable continuity of food processing and thus sustainable food availability. The fact that Dodoma city is connected to other regions by tarmac such as Mbeya, Morogoro, and Iringa.

Recommendations

The government should be involved in processing by providing more support to the processor. The government, among other things, should improve technology, infrastructure, and financing of the industry. Further, the government should reduce bureaucratic procedures involved in entering into the food processing business to attract more people. Also, the government should set aside a fund for research and development to innovate new technology and machinery to improve the food processing business. Training is also vital for the success of any business. Hence, the government and other development partners should be willing to provide training or support the same to provide technical know-how in the food processing field.

References

- Adeyeye, S. A. O. (2017). The role of food processing and appropriate storage technologies in ensuring food security and food availability in Africa. *Nutrition & Food Science*, 47(1), 122-139. doi:10.1108/nfs-03-2016-0037
- Alamu, E. O., & Mooya, A. (2017). Food processing technologies and value addition for improved food safety and security. In *Smart technologies for sustainable smallholder agriculture* (pp. 201-210): Elsevier.
- Amit, S. K., Uddin, M. M., Rahman, R., Islam, S. M. R., & Khan, M. S. (2017). A review on mechanisms and commercial aspects of food preservation and processing. *Agriculture & Food Security*, 6(1). doi:10.1186/s40066-017-0130-8
- Augustin, M. A., Riley, M., Stockmann, R., Bennett, L., Kahl, A., Lockett, T., . . . Cobiac, L. (2016). Role of food processing in food and nutrition security. *Trends in Food Science & Technology*, 56, 115-125. doi:10.1016/j.tifs.2016.08.005
- Cafiero, C., Viviani, S., & Nord, M. (2018). Food security measurement in a global context: The food insecurity experience scale. *Measurement*, 116, 146-152.
- Chu, H. M. (2007). Ghanaian and Kenyan Entrepreneurs: A Comparative Analysis of their Motivations, Success Characteristics and Problems. *Journal of Developmental Entrepreneurship*, 12(3), 295–322.
- Cichoski, A. J., Rampelotto, C., Silva, M. S., de Moura, H. C., Terra, N. N., Wagner, R., . . . Technologies, E. (2015). Ultrasound-assisted post-packaging pasteurization of sausages. 30, 132-137.
- Costa, T. M. H., de Oliveira Rios, A., Flôres, S. H. J. I. C., & Products. (2015). Residues of minimally processed carrot and gelatin capsules: Potential materials for packaging films. 76, 1071-1078
- Crush, J. S., & Frayne, G. B. (2011). Urban food insecurity and the new international food security agenda. *J Development Southern Africa*, 28(4), 527-544
- De Vries, H., Mikolajczak, M., Salmon, J.-M., Abecassis, J., Chaunier, L., Guessasma, S., . . . Trystram, G. (2018). Small-scale food process engineering — Challenges and perspectives. *Innovative Food Science & Emerging Technologies*, 46, 122-130. doi:10.1016/j.ifset.2017.09.009

- Despain, D. (2013). Fruit-focused formulating. *Food Technology*, 67(8), 65-70
- Dwyer, J. T., Fulgoni III, V. L., Clemens, R. A., Schmidt, D. B., & Freedman, M. R. (2012). Is “processed” a four-letter word? The role of processed foods in achieving dietary guidelines and nutrient recommendations. *Advances in Nutrition*, 3(4), 536-548. doi:10.3945/an.111.000901.
- Edwards, L., & Balchin, N. (2008). Trade related business climate and manufacturing export performance in Africa: A firm-level analysis.
- Eklblom, M. (2006). Challenges Facing Food Processing SMEs in Tanzania. In. Essel, B. K. C., Adams, F., & Amankwah, K. (2019). Effect of entrepreneur, firm, and institutional characteristics on small-scale firm performance in Ghana. *Journal of Global Entrepreneurship Research*, 9(1), 1-20
- FAO. (1996). World Food Summit, 1996. Rome: FAO
- FAO. (2019). The State of Food Security and Nutrition in the World (SOFI): Safeguarding against economic slowdowns and downturns. Rome: FAO
- Gebre, G. G., Isoda, H., Amekawa, Y., Rahut, D. B., Nomura, H., & Watanabe, T. (2021). Gender-based decision making in marketing channel choice—evidence of maize supply chains in Southern Ethiopia. *Human Ecology*, 49(4), 443-451
- Gebre, G. G., & Rahut, D. B. (2021). Prevalence of household food insecurity in East Africa: Linking food access with climate vulnerability. *Climate Risk Management*, 33, 100333. doi:https://doi.org/10.1016/j.crm.2021.100333
- Ghose, B. (2014). Food security and food self-sufficiency in China: from past to 2050. *J Food Energy Security*, 3(2), 86-95
- Hanjra, M. A., & Williams, T. O. (2020). Global change and investments in smallholder irrigation for food and nutrition security in Sub-Saharan Africa. In *The role of smallholder farms in food and nutrition security* (pp. 99-131): Springer, Cham
- Ibnouf, F. O. (2012). The Value of Women's Indigenous Knowledge in Food Processing and Preservation for Achieving Household Food Security in Rural Sudan. *Journal of Food Research*, 1(1). doi:10.5539/jfr.v1n1p238
- Makorere, R. (2014). The role of microfinance in promoting small and medium enterprises (SMEs) in Tanzania: empirical evidence from SMEs holder who have received microcredit from financial institutions in Morogoro, Tanzania. *Global Business Economics Research Journal*, 3(4).
- Manual, U. T. (2004). Small-scale Fruit and Vegetable Processing and Products. UNIDO
- Minot, N., & Pelijor, N. (2010). Food security and food self sufficiency in Bhutan _ IFPRI _ International Food Policy Research Institute. Food security and food self sufficiency in Bhutan
- Mmasa, J. J. (2013). Value addition practices to agricultural commodities in Tanzania. *Journal of Agricultural Economics and Development*, 2(2), . 065-076
- Molotoks, A., Smith, Pete, & Dawson, T. P. (2021). Impacts of land use, population, and climate change on global food security. *Food Energy Security* 10(1), e261
- Mukantwali, C., Laswai, H., Tiisekwa, B., & Wiehler, S. (2012). Issues Affecting Small-and Medium-Scale Pineapple Processing Enterprises in Rwanda: A Cross-sectional Study. Compliance of Small Medium Scale Pineapple Processing Enterprises with National International Standards in Rwanda, 28
- Nichter, S., & Goldmark, L. J. W. d. (2009). Small firm growth in developing countries. *World development*, 37(9), 1453-1464
- Nwajiuba, C. U., Amazu, G. O., Nwosu, C. S., & Onyeneke, R. U. (2013). Motivation factors and constraints to the growth of small scale food processing enterprises in Owerri metropolis, Imo State, Nigeria. *Int. J. Entrepreneurship and Small Business*, 19(4)

- Nyiwul, L. (2021). Climate change adaptation and inequality in Africa: Case of water, energy and food insecurity. *Journal of Cleaner Production*, 278, 123393. doi:10.1016/j.jclepro.2020.123393
- Ojiewo, C., Keatinge, D. J., Hughes, J., Tenkouano, A., Nair, R., Varshney, R., . . . Silim, S. (2015). The role of vegetables and legumes in assuring food, nutrition, and income security for vulnerable groups in Sub-Saharan Africa. *World Medical Health Policy*, 7(3), 187-210
- Petersen, L., & Charman, A. J. D. S. A. (2018). The scope and scale of the informal food economy of South African urban residential townships: Results of a small-area micro-enterprise census. 35(1), 1-23.
- Precoppe, M., Chapius, A., Muller, J., & Abass, A. (2017). Tunnel Dryer and Pneumatic Dryer Performance Evaluation to Improve Small-Scale Cassava Processing in Tanzania. *Journal of Food Process Engineering*, 40(1). doi:10.1111/jfpe.12274
- Prosekov, A. Y., & Ivanova, S. A. (2018). Food security: The challenge of the present. *Geoforum*, 91, 73-77
- Qureshi, M. E., Dixon, J., & Wood, M. (2015). Public policies for improving food and nutrition security at different scales. *Food Security*, 7(2), 393-403. doi:10.1007/s12571-015-0443-z
- Reardon, T., Tschirley, D., Liverpool-Tasie, L. S. O., Awokuse, T., Fanzo, J., Minten, B., . . . Popkin, B. M. (2021). The Processed food revolution in African food systems and the Double Burden of Malnutrition. *Glob Food Sec*, 28. doi:10.1016/j.gfs.2020.100466
- Sasidharan, S., & Rajesh Raj, S. J. T. D. E. (2014). The Growth Barriers of Informal Sector Enterprises: Evidence from India. 52(4), 351-375
- Shehrawat, P. S. (2007). Modalities for future prospects of small-scale agro-processing industries in India. *Int. J. Business and Globalisation*, 1(4).
- Tumushabe, J. T. (2018). Climate change, food security and sustainable development in Africa. In *The Palgrave handbook of African politics, governance and development* (pp. 853-868): Springer
- URT (2019). Ministry of Agriculture, Department of Food Security, Dar es Salaam Tanzania.
- Weaver, C. M., Dwyer, J., Fulgoni III, V. L., King, J. C., Leveille, G. A., MacDonald, R. S., . . . Schnakenberg, D. (2014). Processed foods: contributions to nutrition. *Am J Clin Nutr*, 99(6), 1525-1542.

Appendix

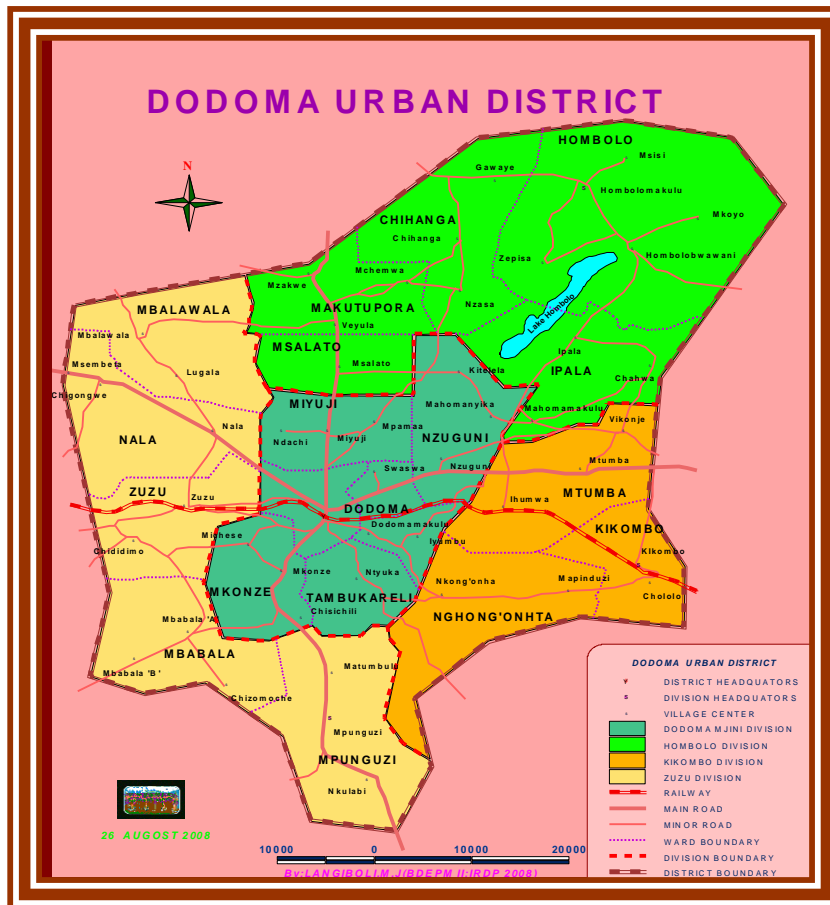


Figure 1: Dodoma Urban District Map (Source: Dodoma Municipality profile 2018)

POLICY BRIEFS

Towards Food Security in Semi-Arid Regions: The Role of Small-Scale Food Processing Industries in Dodoma City, Tanzania

Food security is a livelihood concept that individuals, households, and nations need to achieve at any cost. Several strategies and policies have been put forth to achieve food security. Food processing has been an important strategy that enhances household and national food security. The process can increase the shelf life of food and make it available year-round. Dodoma city is located in the semi-arid region of central Tanzania, and like any other semi-arid region, the climate is a problem for food production. Therefore, food insecurity affects the area more often than in other regions. The area is also experiencing rapid urbanization due to Dar es Salaam's shift from the capital city to this city. Therefore, different actions must be taken to meet the food demand for the ever-growing population in Dodoma city. Food processing could make food security sustainable in Dodoma if taken seriously and in action. Therefore, the study offers information valuable for the government on how food security can be sustained in Dodoma.

The process can be achieved if more experts are engaged in processing; hence, there is an opportunity to train and empower small-scale food processors who can make a great impact on the community and household as compared to larger-scale food processors whose main intention is to make a profit through food processing. Therefore, Tanzania can utilise her several organizations to influence the dissemination of food processing knowledge to the community and the general public. For example, Small Industries Development Organization (SIDO) may

be empowered by the government to train more food processors for a greater impact on the community. Also, the Vocational Education and Training Authority may introduce a tailor-made course to their colleges so that more individuals can obtain food processing knowledge. Food processing can also improve members' livelihood and may act as an income-generating activity, which may provide income for household spending, including food, health, clothing, education and shelters. This process can also supply food to neighbouring regions, particularly rural areas that may have no similar opportunity due to several weaknesses such as inadequate infrastructures such as inaccessibility to electrical power and high illiterate levels, which may lead to the inability to follow food processing procedures.

Dodoma region being at the centre of the country (Tanzania) and connected with big producer regions like Morogoro and Mbeya with tarmac roads is an advantage that may convince the government to add more funds for food processing industries. This will bring great impact not only to Dodoma city but also to the neighbouring districts and regions regarding food security. Food processing also offers a great opportunity for researchers interested in obtaining more information and contributing to the body of knowledge. So, this study and similar studies will provide information to researchers and policymakers on the importance of food processing to food security.