

Technology Impact Assessment of Banana Slicing Machine

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ABSTRACT— Technology Impact Assessment (TIA) was conducted in barangay New Mahayag, Catbalogan City. The assessment was participated by the Mahayagnon Women's Association Daan sa Pag-asenso (way to Progress) association. The TIA focused on the use of Fruit Slicing Machine for slicing raw peeled banana to be processed into banana chips. There is an increase in output of banana chips produced by the machine, the association produced from 1 "kabolig" per day using the manual stripper to 4 "kabolig" per day using the slicing machine. The association increases its income from PhP100 to 1,000 every profit sharing. Other products were also produced by the association like calamansi puree, sweet potato, and cassava chips. The machine is effective since women increase their production of banana chips sold in their identified markets. The machine is user friendly, the woman can easily operate and use the machine for banana slicing. The time saved by the individual involved in banana slicing can already be devoted to other banana chips processing-related activities and other productive work.

KEYWORDS: technology, impact, assessment, machine

1. INTRODUCTION

Samar State University invented a fruit the slicing machine, this technology is to make faster of the slicing of banana (Aldaba) for banana chips which is one of the samarenio products sold in the streets. A manual banana slicer based on how the wood planer functions are presently used in Samar. The structure is an inverted wooden planer-like tool with a wooden platform and the fabricated flattened sharp iron permanently attached to the said wooden platform. The technology was evaluated to be economical, inefficient, risky, and unsanitary. An alternative, therefore, is a Fruit Slicing Machine with qualities that eliminates the above problems in peeled raw banana longitudinal slicing. The machine was turnover to Mahayagnon Women's Association Daan sa Pag-asenso, barangay New Mahayag, Catbalogan City, Samar. The association comprises of 24 members. Association was organized in 2018 and registered in the Department of Labor and Employment. The association started making banana chips using a manual stripper bought in the store. Bananas are tropical fruits belonging to the genus *Musa* and the family *Musaceae*. Bananas are popular and nutritious fruit, with a pleasant flavor. They are high energy fruit rich in carbohydrates and also a good source of potassium, iron, phosphorous, vitamin C, and B6. Generally, bananas are eaten raw but ripe banana is perishable and deteriorates rapidly after harvesting hence there is a need to apply appropriate post-harvest technology to prolong the shelf life of the fruit. To minimize huge economic losses, banana can be preserved and processed by frying that name is banana chips. Banana chips are snacks made from slices of bananas, commonly fried in oil. It can be covered with sugar or honey and have a sweet, salty, or spicy taste. Deep fat frying is a conventional frying method for banana chip production it includes the immersion of banana slices in vegetable oil at a temperature of around 110-160°C that causes drying through frying. The high temperature causes evaporation of the water, which moves away from food and through the surrounding oil. Oil is absorbed by food, replacing some of the lost water. The community of women involved in community empowerment activities is a joint group that makes banana chips, [10]. Value chain analysis can be critically important in

gaining and sustaining a competitive advantage by being especially efficient along with the various parts of the value chain. Several logistics issues have been identified that exert a strong influence on the overall performance of the chain affecting the movement of the product from farmers to the relevant market. No established organizations, inadequate capital, and poor service facilities have been the primary problem of stakeholders in the banana industry. Additionally, low yield due to bunchy top "bugtok" virus infestation accounts for almost 30% of harvest losses. Poor production knowledge and resistance to adopt modern technologies were also identified as major problems affecting farm operations that in effect reduce the supply of bananas. Although there are seminars and training conducted to enhance the farming orientation, some of the farmers are still hesitant to adopt the recommended practices. External issues identified such as high transportation cost, unstable weather, lack of extension support and poor road conditions are common among farmers and traders in the area. Difficult farm-to-market roads, for instance, changes from bad to worse, especially during the rainy season. These roads are not passable and are disruptions in the flow of more severe farm products. Processors also have seen a lack of extension support from government and private sectors in terms of provision of processing facilities, [2].

Banana, locally known as "saging", is considered as one of the important food sources in the Philippines. It is commonly grown as a backyard crop by farmers both as a source of food and income. Since the crop is suited for processing because of its high starch content, value-adding and processing of banana are important industries to maximize banana utilization in the country. Mango- and pineapple-flavored banana juice were the first processed products made out of a banana. The hands-on demonstration also showed proper product labeling for commercial production purposes especially if the farmers' association or cooperative would venture into banana processing. The Technological Impact Analysis (TIA) is a learning and teaching technique that requires learners to investigate and understand general technological advancement while studying the history, evolution, and impact of specific past or contemporary technology, [6] Ideally, any impact assessment should occur at the pre-feasibility stage before the final design and engineering are completed and an array of alternatives can still be considered. Nevertheless, consideration of impacts should never be discouraged. Substantive and responsive dialogue should be continued with the local communities to incorporate important indigenous knowledge and values in the development and management of the project. Dialogue with the affected community facilitated an important two-way learning process wherein local information and values were expressed by the community and included in the assessment, and information regarding the potential effects of the machine, [12]. Taking advantage of available resources, and using simple procedures such as checklists, matrices, and unstructured interviews can help to focus the dialogue surrounding a proposed project by providing a more informed decision-making environment that helps avoid shallow polarized debate. Ideally, any impact assessment should occur at the pre-feasibility stage before the final design and engineering are completed and an array of alternatives can still be considered. Nevertheless, consideration of impacts should never be discouraged. Assessment is a formalized set of procedures that seeks to identify, predict, and evaluate the socio-cultural, biophysical, and economic impacts resulting from a proposed project, program, or policy. Recommendations are then made for appropriate mitigation, and communicated to the appropriate decision-makers, [12]. Among the basic sectors, agriculture has the slowest output growth from the 1980s to the 2000s. The poor performance of agriculture affects the welfare of many impoverished households. The government has not attained its goals of poverty reduction and improvement of the welfare of rural households despite the increasing public expenditures on agricultural development. Aside from insufficient funding, another possible reason causing this is the faulty selection, design, and implementation of programs. If such is the case, then the solution lies in finding the right program and in proper implementation. The policy thrust should take into account the inherent dynamics of agricultural development. Agricultural development is generally accompanied by diversification; as an economy grows, it tends to move out of subsistence food-crop production to a diversified market-oriented production system.

The rural workers and farmers have no resources to conduct researches. Even their cooperatives and organizations cannot afford to invest in agricultural R&D. Another reason is the extent of the benefits of agricultural R&D. Farmers can only get a small fraction of the benefits so they cannot be expected to exert much effort in undertaking R&D. Once a new technology is introduced, farmers do not wholly accept or adopt it. They are skeptical about it and would tend to focus only on a specific practice that they find suitable to their daily farm work, [1]. Banana chips are very common snacks like potato chips, all over the world. These are produced by deep frying in edible oil which is then either plain salted or spiced before packaging. The primary packaging of the chips depends on the desired shelf life of the products. If these are sold fast, then normally these are packed in polyethylene bags or polypropylene bags, heat-sealed and sold. The oxygen from the trapped air does not generate fatty acid peroxides to the extent, which could be harmful to human health, nor does the moisture in the trapped air alter the texture of the chips inside. However, the free fatty acid content of the cooking oil also plays an important role, in making the products safe at the same time extending the shelf life a bit longer than usual. In this study, the 2 edible oils used were refined sunflower oil and palmolein. The chips were crispier for 45 days (total shelf life checked was 60 days) when fried in sunflower oil than in palm oil when packed in low-density polyethylene film. The chips were rancid and with significant loss of texture when packed in polypropylene films [5]. A manual slicer was designed and fabricated at the workshop of the Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur during 2013-14. Several factors were considered in the design of the slicing machine which includes the physical and mechanical properties of the construction materials. The slicing component of the slicer is usually expected to be thin and sharp enough to penetrate the tubers easily. Further, the materials needed for the construction of the device must neither contaminate the tubers nor be itself corroded when in contact with water. Stainless steel materials were therefore used for fabricating components. Other considerations in designing the machine included the cutting resistance of the tubers, moisture content, the thickness of the slice, speed of cut, maximum power requirement, power source, and contamination. Design sketches were drawn with SolidWorks software. The orthographic views of the slicer. The slicer was fabricated with MS angle bar, MS flat bar, MS rod, MS sheet, MS shaft, SS sheet, SS pipe, rubber sheet, ball-bearing, and small spares. The functional parts of the machine are (1) Stand; (2) Rotating handle; (3) Feeding cylinder; (4) Base disc and (5) Cutting blades, [4]. The slicing machine is consisting of an upper feeding chute tilted perpendicularly with the machine base, delivery chute tilted at a 21-degree vertical angle with the machine base and a cutting wheel is perpendicular to the machine base that movement which is hand driven. The upper feeding chute has four holes; it can be taken off for cleaning. The number of banana/yam can be cut at the same time depends on the size of the banana/yam. For the big size of banana/yam, a maximum of 3 pieces of bananas/yams can be cut at the same time. No tools or excessive force required to make adjustments on the banana and yam cutting machine, and during adjustment, there will be no binding or jamming of moving parts. The cutting machine also can be used to cut hard vegetables like a carrot. The cutting blade can work without jamming or stalling, and without tearing or crushing the banana/yam. When the machine is being pedal, the cutting blade (slicer) shall rotate such that, below the chute, the cutting edge travels away from the inlet. The cutting edge or serrations, as applicable, have their cutting edge facing the orthogonal direction as the wheel rotation, [11].

2. Objectives

1. Measure the effectiveness of banana slicing machine to the association
2. Evaluate the appropriateness of the machine
3. Determine the contribution of banana slicing machine to the economic status of the association
4. How has the project brought an impact on the lives of the people

3. Methodology

The assessment was started in the investigation of the history of the machine, its structure, operation, and capacity. Planning for the assessment was done and the communication to the barangay officials and the association for the schedule of the activity. The assessment was done through Focus Group Discussion were a couple of questions were ask to the members of the association. Next was an individual interview where an individual was asked questions more from her perspective. Ocular observation of the machine and the project site was also conducted.

4. Results and Discussion

The primary object of this invention is to provide a mechanized Fruit Slicing Machine for efficient performance in longitudinal slicing raw peeled banana to be processed into banana chips. A plurality of bunches of raw peeled banana can be sliced at uniform thickness within a few minutes in this invention instead of 1 hour in the manually operated banana slicer. The time saved by the individual involved in banana slicing can already be devoted to other banana chips processing-related activities and/or other productive work. Another object of this invention is to provide a Fruit Slicing Machine that eliminates the risk faced by workers using the manual banana slicing technique. This said the machine can be both manually and/or motor operated. Instead of the frequent contact of worker's hand palm in pushing raw peeled banana against the sharp slicing blade, this same machine will automatically slice the banana when turned on by continuously filling the removable feeding hopper mounted on the top platform with raw peeled banana, [3]. The Protection and Promotion of Health and Safety. Health and safety are paramount. All planned interventions should be assessed for their health impacts and their accident risks, especially in terms of assessing and managing the risks from hazardous substances, technologies or processes, so that their harmful effects are minimized, including not bringing them into use or phasing them out as soon as possible. Health impacts cover the physical, mental and social wellbeing and safety of all people, paying particular attention to those groups of the population who are more vulnerable and more likely to be harmed, such as the economically deprived, indigenous groups, children and women, the elderly, the disabled, as well as to the population most exposed to risks arising from the planned intervention, [13]. Problems faced by Partners is the process of slicing and frying process banana chips are still manual and takes a long time. Besides, 42 the temperature used during the frying process is uncertain because it still relies on the traditional fuel of firewood. So the maturity level of banana chips is uneven, the thickness of banana chips that are less evenly distributed, less hygienic, and result in the workers get tired quickly. The purpose of this activity is to increase the effectiveness of banana chips production with indicator: the frying process is done by semi-automatic banana chips machine equipped with temperature controller and alternative fuel, [8].

4.1 Project design

The slicing machine comprises a frame having upper and lower portions, a base being provided at the upper portion an of the frame. The base is being defined by a pair of oppositely disposed of parallel bars defining a space between said bars. A slicing part is slidably inserted in a space of the parallel bars. A holding member is removably mounted on the slicing member, and a driving means is being attached to a side of said slicing member utilizing a shaft. The slicing member is being defined by a plate having a blade elevated disposed thereof. The blade has both ends provided with screws adapted for attachment to the said plate to adjust the desired elevation of the blade from the plate. The parallel bars are being defined by angle bars provided with a plurality of spaced-apart rollers adapted to come into contact with the sides and peripheral edges of the slicing member, [3].

4.2 Management structure/organization

The association is buying raw banana from other barangays since the members have no banana plantation that could supply the needs of the association. The turnover of the banana slicing machine project to the association

had strengthened their cooperation, cohesiveness, and become empowered. The association was supported by the Department of Trade and Industry, Social Action Center, and the Department of Agriculture. Women's diverted their vices into a productive way by planning their activities, production of banana chips and other products. Impact assessment in livelihood has received more attention than in any other area of enterprise development. It is now generally accepted that impact assessment is a critical element in further improving livelihood activity and promoting innovation. Existing impact assessments have made an important contribution to understanding some of the complex interactions between microfinance interventions, livelihoods, and different dimensions of poverty reduction and empowerment. There remains nevertheless a considerable gap between the potential contribution of impact assessment and the practical usefulness of existing findings, [7]. The women entrepreneurs have their own identity in the world of entrepreneurship. Most of them are capable of fully identifying themselves in their new economic role in society. Women as a force of development can change the shape of the global economy. Women entrepreneurs experience many problems in terms of growing challenges to balance family and career obligations. For the woman entrepreneur, the process of starting and operating a new enterprise can be immensely difficult in both formal and informal sectors because she often lacks the skills, education, and societal support system to facilitate her efforts. This paper provides a framework for some innovative additions in the agricultural sector through the intervention of women entrepreneurs, [9].

4.3 Project Significant Change

The machine was being used by the Mahayagnon Women's Association Daan sa Pag- asenso association. There is an increase in output of banana chips produced by the machine, the association produced from 1 bunches per day using the manual stripper to 4 bunches per day using the slicing machine. The association increases its income from PHP100 to 1,000 every profit sharing. Other products were also produced by the association like calamansi puree, sweet potato, and cassava chips. The main impacts of the project rely on the increased productivity of producing banana chips and in turn increased their income. The short time input due to the use of technology is an advantage since producers can devote their time to other livelihood activities such as selling and manning their sari-sari stores. The time saved by the individual involved in banana slicing can already be devoted to other banana chips processing-related activities and/or other productive work.

4.4 Project Sustainability

Mahayagnon Women's Association Daan sa Pag-asenso (Way to Progress), New Mahayag village, Catbalogan City, Samar. The association comprises of 24 members. Association was organized in 2018 and registered in the Department of Labor and Employment. Training of small-scale farmers on the basics of cultivating bananas, which takes just two years to mature. The program, officially the Enhancing Sustainable Income in the Philippines. Similar specialized training, with the assistance of the Department of Agriculture, was provided to the association – Because of these interventions, local banana farmers are no longer limited to selling their produce to middlemen or in the so-called "wet market," where prices are so low that the product might as well be given away for free. Now, growers can sell bananas to the cluster, which in turn assists in harvesting and transportation. This added value is critical for those whose farms are in the remote highland barangays, where the distance to market adds significantly to farmers' overhead. But the partnership is most beneficial for another reason: it helps smaller growers secure a fair price for their produce. For instance, a supply agreement was recently facilitated between the banana cluster and buyers, an agribusiness start-up that processes bananas into chips. The deal ensured that regional banana farmers have a regular buyer, a major challenge for most growers in the country. The machine is effective since women increase their production of banana chips sold in the identified markets. The machine is user friendly, the woman can easily operate and use the machine for banana slicing. Members of the association had attended training on Food processing specifically on banana and cassava chips. Women's identified their market of banana chips. Training on

Products Development was also attended by the members wherein they learned making banana dehydration and calamansi juice and puree. Women have identified their problems and take actions in solving it, the association was able to access technical and financial assistance from different Government Organizations and Non- Government Organizations.

4.5 Physical aspect

The production area where the processing of banana chips is done inside the women association office and at the same time they utilized as a kitchen for cooking and area for the packaging of the product.



Figure 1. The banana slicing machine



Figure 2. Packaging of banana chips



Figure 3. The product-banana chips



Figure 4. Banana chips in pack

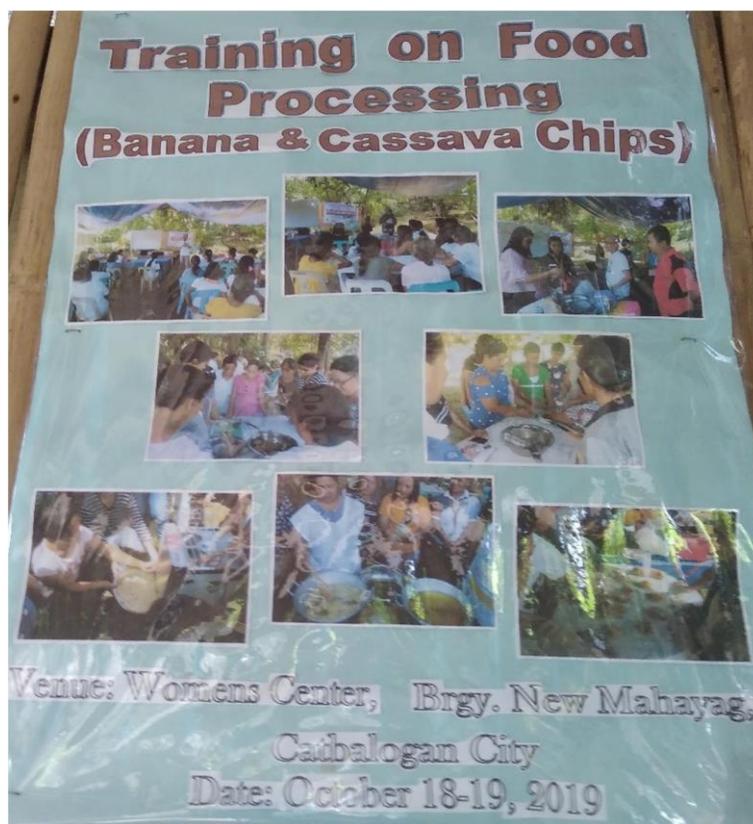


Figure 5. Training on food processing

5. Conclusion

The Technological Impact Analysis has proven to be a useful tool for the study of technological impact. It is a direct and logical approach to this arena of learning. It is easy to use and applies a structured approach that is logical and sequential as well as holistic in focus. Generally, it's too early to determine whether the fruit slicing machine project led to significant changes in the lives of the people specifically their economic status. As of the moment, the project does not substantially alter their livelihood situation. However, the project has strengths, it has helped diversify their income sources and it represents a fairly significant source of income for most of the beneficiaries. The results have already a positive indicator that the members of the association are earning money, change their attitude and sometimes they can decide what to do, identify and resolve their problems.

6. Recommendation

- The machine compartment intended for the peeled banana is big than the regular sizes of banana, the area where the peeled banana should be adjusted into a similar minimum size of the banana finger;
- There are small banana strip which does not command a higher price, the blade of the should be adjusted into the desired strip;
- There should have a planting of banana by the members to supply their needs for raw material for the banana chips making;
- Improve the packaging and labeling of the banana chips;
- Needs to concrete the flooring of their working building and addition of equipment.

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