Acceptability and Cost Benefits Analysis of Papaya Pickled Atchara Extractor Machine

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ABSTRACT

This research evaluates the end-user acceptability and cost-benefit analysis of a fabricated prototype papaya pickled atchara extractor machine. The objective is to assess the feasibility of using these machines in papaya pickled Atchara production by evaluating their potential to enhance compatibility, functional suitability, maintainability, reliability, and usability, and improve overall cost benefits. The findings highlight the importance of key factors like simplicity, compatibility, and ease of use in driving user acceptance of the prototype machine. A user-friendly design was shown to reduce errors and improve overall user experience, increasing the likelihood of widespread adoption. Additionally, the cost-benefit analysis revealed a favorable outcome, with the total machine cost of Php 7,469.00 offset by a projected benefit of Php 25,200.00 in product sales, yielding a cost-benefit ratio of 3.37. This positive result indicates that the machine is financially feasible within the first year of use. Recommendations include the use of stainless steel for the plunger mechanism, cylinder housing, and funnel juice collector to enhance safety and hygiene.

Keywords: Acceptability, extractor machine, Atchara, cost benefit analysis, descriptive

INTRODUCTION

In recent years, the demand for papaya atchara has been steadily increasing due to its unique taste and health benefits. However, the traditional method of extracting juice from papaya for Atchara production has become increasingly challenging, as it is time-consuming and labor-intensive, especially in light of the growing demand for papaya Atchara driven by its unique taste and health benefits. There were a multitude of machinery being imported and adopted by the country, but failed since machines favor's large hectares of land that were utilized by big farm enterprises leaving behind the small- scale farmers. As a result, improvements across various fields in diverse settings are examined. Both academic and practicing engineers are compelled to incorporate recent innovations while considering future trends [1]. This encompasses comprehensive optimization scenarios, geometric specifications, and target setting [2]. Moreover, the use of machines for agriculture should be suitable for use in small farms, easily repairable and maintainable, inexpensive, and environmentally friendly. In the agricultural sector, there is a pressing need to create affordable, context-specific, and gender-inclusive tools for small farmers that are also sensitive to socio-cultural factors [3]. As noted by Pai et al., the design process requires understanding the unique needs of the context, adopting a user-centric approach, and using an iterative method that includes prototyping and testing [4]. This design approach can facilitate the development of effective interventions tailored to the needs of small farmers. Hence, this This led to the development of the Papaya Atchara Extractor Machine, which promises to streamline the extraction process and increase efficiency. The primary objective of this research is to evaluate the acceptability and cost-effectiveness of this machine in comparison to traditional methods. By conducting a thorough analysis of production costs, quality of extracted juice, and user feedback, this study aims to provide valuable insights into the feasibility of integrating the Papaya Atchara Extractor Machine into commercial atchara production. Through this research, we hope to contribute to the innovation and sustainability of the atchara industry.

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According to Almaiah & Alyoussef [5] state that social influences, facilitating conditions, business expectations, and performance expectations significantly impact behavioral intentions to use a system. Interest in individual behavior is reflected in the extent of technology usage, which can be predicted based on attitudes and intentions [6]. For this new technology utilized by people, it should first gain acceptance from the intended users [7]. However, studies have shown a high level of acceptance and usage of agricultural machinery due to its significant impact on agricultural production [8], which can be summarized in two key areas: cost savings and improvements in quality and efficiency. Rising labor costs are a major factor contributing to the decline in agricultural profitability [9], and the service fees for agricultural machinery are generally lower than labor costs. By using agricultural machinery, farmers can substantially reduce labor expenses. Additionally, agricultural machinery plays a key role in land leveling and preparation, which enhances resource utilization and decreases the need for weed and pest control [10]. On the other hand, enhancing the quality and efficiency of agricultural development also requires boosting the confidence and motivation of agricultural workers by raising their incomes, a fundamental goal of China's rural revitalization strategy [11]. Smith et al. noted that farmers are likely to adopt a machine only if it addresses a problem that is deeply felt by the farm family. This means the machine must align with their farming system and meet their needs, while considering technical, social, and economic factors [12]. In addition, conducting a socio-economic acceptability test introduces the harvester to the wide onion farming community. The socio-economic acceptability of agricultural machinery is a critical factor in the successful adoption and integration of new technologies in farming systems [13]. Adopting such mechanization technologies can contribute to the structural transformation of agrarian economies [14]. In particular, machines like the extractor, designed to streamline processes such as harvesting or resource extraction, must demonstrate clear advantages over traditional methods to be embraced by the farming community. Cost-benefit analysis is a key tool for measuring the economic viability of such machinery. It assesses both the upfront costs and long-term benefits in terms of cost savings, labor reduction, and productivity gains. Recent studies have emphasized the importance of understanding both the direct and indirect economic impacts of machinery adoption. For instance, Luo and Qiu highlight that the use of modern agricultural machinery can significantly reduce labor costs while enhancing production efficiency [15]. Similarly, Tian et al., point out that the service costs for agricultural machinery are often lower than the equivalent labor expenses, making them a more affordable alternative [16]. Despite the clear benefits, there are still research gaps in understanding the broader socio-economic and environmental impacts of adopting machines like the extractor. For example, while several studies focus on cost savings [15,16 17], fewer address long-term maintenance costs, training requirements, or the potential for technological obsolescence. Furthermore, the impact on smaller farms, which may lack the capital to invest in such technology, is often underexplored. Thus, this study aims to assess the acceptability of the extractor machine and perform a comprehensive cost-benefit analysis, filling in these gaps and providing a more holistic view of its potential in modern agricultural systems.

METHODOLOGY

The study utilized quantitative methods to explore the acceptability of the machine and to measure the cost benefits analysis of the extractor machine. The objective of the study is to determine the level of acceptability of the fabricated papaya pickled Atchara extractor machine for micro business in terms of (ISO/ISEC 25010) in terms of compatibility, functional suitability, maintainability, reliability, and usability. Likewise, is to determine the cost benefits analysis of the fabricated prototype papaya pickled atchara extractor machine. The study was conducted at Eastern Visayas State University (EVSU) Tacloban Campus in the College of Education and College of Technology during the school year 2023-2024. In this study, 10 participants are selected through purposive judgmental sampling method used to facilitate the relatively small sample size. In selecting the participants, they meet some criteria for relevant expertise, experience, or knowledge related to the machine and its performance. The questionnaire used in the study is a modified ISO 25010 software quality standards evaluation tool. The modifications was made to suit the needs of the present study. The questionnaire evaluates the overall effectiveness of the fabricated prototype papaya pickled atchara extractor machine. The said tool consists of 15 items which are divided into five categories which are compability (3 items), functional suitability (3 items), maintainability (3 items), reliability (3 items) and usability (3 items), and with the following scale: 5=Very Acceptable; 4=Somewhat Acceptable; 3=Neutral; 2=Somewhat Unacceptable; and 1=Very Unacceptable. Furthermore, the questionnaire, before its administration to target respondents will be

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checked and validated. Cronbach's Alpha was utilized to measure the internal consistency and reliability of the instruments. The data collected was tabulated and analyzed through the SPSS 20.0 version. To test the level of acceptability and the cost benefits analysis they used descriptive statistics such as percentage, frequency means score, and weighted mean. The data privacy act of 2012 was also strictly adhered to regarding the handling, treatment, use, and storage of research data collected from respondents.

RESULTS

Level of Acceptability of the Fabricated Prototype Papaya Pickled Atchara Extractor Machine

Fabricated prototype papaya pickled atchara extractor machine that has been developed through a testing process to see the level of acceptability in terms of, compatibility, functional suitability, maintainability, reliability, and usability.

Compatibility. Table 1.1 below discloses the evaluation results of the acceptability of fabricated papaya pickled atchara extractor machine in terms of compatibility. Participants rated the compatibility of the fabricated prototype papaya pickled atchara extractor machine for the evaluation using the evaluation instruments. Results showed that the statement, " the machine can run and display results without affecting other installed applications" obtained the highest mean (M=4.87, SD=.411) and was verbally interpreted as "Very Acceptable". On the contrary, the lowest rating was on the statement, "The machine can perform its required functions efficiently while sharing a common environment and reverses with other products, without detrimental impact on any other product" with a mean (M=4.46, SD=.523) and was verbally interpreted as "Somewhat Acceptable". The fact that the atchara makers find the machine simple and easy to use suggests that it is well-designed and intuitive in its operation. This can help reduce the learning curve for new users and minimize the risk of errors or accidents during operation.

Table 1.1. Level of Acceptability of the Fabricated Papaya Pickled Atchara Extractor Machine in terms of, Compatibility

Compability	**Mean**	**SD**	**Interpretation**
The machine can perform its required functions efficiently while sharing a common environment and reverses with other products, without detrimental impact on any other product.	4.46	0.523	Somewhat Acceptable
The machine can run and display results without affecting other installed applications.	4.87	.411	Very Acceptable
The machine is simple and easy to use.	4.72	467	Very Acceptable
Grand Mean	**4.68**		**Very Acceptable**

Functional Suitability. Table 1.2 below discloses the evaluation results of the acceptability of fabricated papaya pickled atchara extractor machine in terms of functional suitability. Results showed that the statement, " The machine efficiently accomplishes its purpose at the specific area provided" obtained the highest mean (M=4.87, SD=.411) and was verbally interpreted as "Very Acceptable". Moreover, the lowest rating was on the statement, "The machine facilitates the accomplishment of a specified tasks and objectives" with a mean (M=4.83, SD=.407) and was verbally interpreted as "Very Acceptable". This notion translates into the broader context of implementing a machine capable of extracting atchara efficiently, where the user's expertise and perspectives play a pivotal role in the machine's successful integration within a production setting. Furthermore, the acceptability of fabricated papaya pickled atchara extractor machine in terms of functional suitability, obtained an overall rating of (M=4.29) and was verbally interpreted as "Very Acceptable". By harnessing the latest advancements in food processing technology, this machine can revolutionize the Atchara production industry, meeting the increasing consumer demand for high-quality and convenient food products.

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Table 1.2. Level of Acceptability of the Fabricated Papaya Pickled Atchara Extractor Machine in terms of, Functional Suitability

Functional Suitability	**Mean**	**SD**	**Interpretation**
The machine effectively accomplishes its directed tasks and objectives.	4.84	.408	Very Acceptable
The machine efficiently accomplishes its purpose at the specific area provided.	4.87	.411	Very Acceptable
The machine facilitates the accomplishment of a specified tasks and objectives.	4.83	.407	Very Acceptable
Grand Mean	**4.84**		**Very Acceptable**

Maintain ability. Table 1. 3 revealed the level of acceptability of fabricated papaya pickled atchara extractor machine in terms of maintainability. The level of acceptability of fabricated prototype papaya pickled atchara extractor machine in terms of maintainability content as very acceptable supported by the grand mean of 4.52. This means that the evaluators perceived that the machine was beyond acceptable standards. The validators were Very Acceptable that the parts of the machine can be modified without the risk of defects or degrading the existing product quality which gained the highest (M=4.87, SD=0.411). Contrary, the machine can be placed indoor and outdoor areas. which obtained the lowest (M=4.25, SD=0.711), interpreted as somewhat acceptable. The results further imply that the successful operation of the machine not only guarantees a continuous supply of high-quality atchara products but also contributes to cost-saving measures by minimizing downtime and repair costs. This means that maintaining the machine demonstrates a commitment to quality and reliability, which can enhance the overall reputation of the business.

Table 1.3. Level of Acceptability of the Fabricated Papaya Pickled Atchara Extractor Machine in terms of, Maintainability

Maintainability	**Mean**	**SD**	**Interpretation**
The parts of the machine can be modified without the risk of defects or degrading the existing product quality.	4.87	.411	Very Acceptable
The machine can be placed indoor and outdoor areas.	4.25	.711	Somewhat Acceptable
The machine parts can be easy to assemble and disassemble	4.44	.521	Somewhat Acceptable
Grand Mean	**4.52**		**Very Acceptable**

Reliability. Table 1.4 revealed the level of acceptability of fabricated papaya pickled atchara extractor machine in terms of reliability. The level of acceptability of fabricated papaya pickled atchara extractor machine in terms of reliability as very acceptable supported by the grand mean of 4.59. This means that the evaluators perceived that the evaluation of fabricated prototype papaya pickled atchara extractor machine was beyond the acceptable standards. The validators strongly agree that the evaluation is relevant to the machine can be operated and accessible when required which obtained the highest (M=4.84, SD=0.408). Likewise, they rated it very acceptable that the statement “I think the machine can consistently perform its function during a long period of time” got the lowest (M=4.27, SD=0.786). This implies that integrating these technological developments can lead to more reliable and efficient food processing systems, benefiting both manufacturers and consumers alike. Consequently, prioritizing reliability in the design and operation of food processing machinery is crucial for sustaining industry standards and ensuring customer satisfaction.

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Table 1.4. Level of Acceptability of the Fabricated Papaya Pickled Atchara Extractor Machine in terms of, Reliability

Reliability	**Mean**	**SD**	**Interpretation**
I think the machine can consistently perform its function during a long period of time.	4.27	.786	Somewhat Acceptable
The machine can be operated and accessible when required for use.	4.84	.408	Very Acceptable
Does the degree of the mechanism, meets the needs for reliability under normal operation?	4.67	.516	Very Acceptable
Grand Mean	**4.59**		**Very Acceptable**

Usability. Table 1.5 revealed the level of acceptability of fabricated papaya pickled atchara extractor machine in terms of usability. The level of acceptability of fabricated papaya pickled atchara extractor machine in terms of usability as very acceptable supported by the grand mean of 4.84. This means that the evaluators perceived that the evaluation of the extractor machine was beyond the acceptable standards. The validators strongly agree that the machine is helpful in assisting its target users in their extracting process of papaya pickled. which obtained the highest (M=4.87, SD=0.411). Likewise, they rated it very acceptable that machine specified users to achieve specified goals of learning to use the product with effectiveness, efficiency, freedom from risk, and satisfaction in a specified context of use got the lowest (M=4.83, SD=0.407). This implies that the user-friendly design and intuitive interface have contributed to its high level of usability, with users reporting ease of operation and satisfaction with the results.

Table 1.5. Level of Acceptability of the Fabricated Papaya Pickled Atchara Extractor Machine in terms of Usability

Usability	**Mean**	**SD**	**Interpretation**
The machine can carry out the exact and accurate result in extracting the pickled papaya for atchara.	4.84	.408	Very Acceptable
The machine is helpful in assisting its target users in their extracting process of papaya pickled.	4.87	.411	Very Acceptable
Does the machine specified users to achieve specified goals of learning to use the product with effectiveness, efficiency, freedom from risk, and satisfaction in a specified context of use.	4.83	.407	Very Acceptable
Grand Mean	**4.84**		**Very Acceptable**

This section shows the summary of the level of acceptability of the fabricated papaya pickled atchara extractor machine. Table 1.6 below shows that based on the agreement given by the respondents, all the indicators obtained a very acceptable rating. The findings show that in terms of acceptability, respondents have an agreement that conforms with the standard. Overall, usability and functional suitability has obtained the highest grand mean rating indicating that this has the highest acceptability among the five factors.

Table 1.6. Summary of the level of acceptability of the fabricated papaya pickled atchara extractor machine.

Indicators	**Grand Mean**	**Interpretation**
Compatibility	4.68	Very Acceptable

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Functional Suitability	4.84	Very Acceptable
Maintainability	4.52	Very Acceptable
Reliability	4.59	Very Acceptable
Usability	4.84	Very Acceptable
Over-all Grand Mean	**4.69**	**Very Acceptable**

Cost Benefits Analysis of the Fabricated Prototype Papaya Pickled Atchara Extractor Machine

The cost benefits analysis of fabricated prototype papaya pickled atchara extractor machine was determining the initial investment, incremental annual cash flow, return of investment, payback period, and benefit cost ratio.

Initial Investment. Table 2.1 revealed the comparative annual cash flow of the before and after investment of the fabricated prototype papaya pickled atchara extractor machine. Comparing the two scenarios, its shows that both scenarios result in a net annual cash flow of PHP 47,700. However, it's important to note that the investment in the extractor machine significantly increases the gross income, which can have long-term benefits such as increased efficiency, reduced labor costs, and improved product quality.

Table 2.1 Comparative Annual Cash Flow of the Before and After Investment

	Cost of Investment		**Annual Cash Flow New Equipment**	**ACF before investment**
Acquisition Cost	7,469.00	Sales (636 bottles x Php 150)	95,400	45000
Useful Life	10 years	Cost of Goods Sold (636 bottles x Php 75)	(47,700)	22500
		Gross Income	47,700	22500
		Non-Cash Expenses (7,469/10)	746.9	
		Earnings Before Income Tax	46,953.1	
		Tax	0	
		Income after Tax	0	
		Non-cash Expenses	746.9	
		Annual Cash Flow	**47,700**	

Incremental Annual Cash Flow. Table 2.2. shows the incremental annual cash flow analysis that the investment in the fabricated prototype papaya pickled atchara extractor machine. is financially sound and has the potential to improve the business's profitability and efficiency. The increase in sales from 336 bottles to Php 50,000.00 results in a higher gross income of Php 25,200.00. This indicates an improved revenue stream due to the new equipment's efficiency. It is expected that the additional income for the incoming years will increase gross income by 25,200 per year.

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Table 2.2 Incremental Annual Cash Flow

	Annual Cash Flow
Sales (336 bottles x Php 150)	50,400
Cost of Goods Sold (336 bottles x Php 75)	(25,200)
Gross Income	25,200
Non-Cash Expenses (7,469/10)	746.9
Net Income	24,453.1
Non cash Expenses	746.9
Annual Cash Flow	**25,200**

Return on Investment. Table 2.3. shows the return on investment of fabricated prototype papaya pickled atchara extractor machine. The Return on Investment (ROI) is a key financial metric that indicates the profitability of an investment relative to its cost. Likewise, the ROI of 327.39% indicates that for every peso invested in the extractor machine, the business is expected to generate a return of approximately 3.27 pesos. The results suggests that the investment in the extractor machine is financially lucrative and has the potential to significantly benefit the business in terms of profitability.

Table 2.3. Return on Investment

Return on Investment	
Net Income	24,453.1
Divided by: Cost of Investment	7,469
Return on Investment	**327.39%**

Payback Period. Table 2.4. shows the payback period of fabricated prototype papaya pickled atchara extractor machine. The payback period is a financial metric that indicates the time it takes for an investment to generate enough cash flow to recover its initial cost. Based on the data it shows that payback period of 0.296 years or approximately 3.6 months indicates that the investment in the extractor machine is expected to pay back its initial cost in a relatively short period. A shorter payback period is generally considered favorable, as it means the investment generates cash flow quickly, reducing the risk of the investment. It suggests that the investment in the extractor machine is financially viable and has the potential to provide a quick return on investment.

Table 2.4. Payback Period

Payback Period	
Cost of Investment	7,469
Divided by: Annual Cash Flow	25,200
Payback Period	**0.296 years or 3.6 months**

Benefits Cost Ratio. Table 2.5 shows the benefits cost ratio of the fabricated prototype papaya pickled atchara

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extractor machine. This determine if the product is feasible, the projected sales or revenues were also estimated. The calculated cost-benefit ratio is 3.37. Based on these results, the total cash benefits are Php 25,200.00 and represents the total costs as the sum of ingredient expenses, materials used and the total cost of tools and equipment over 12 months. The total benefit of Php 25,200.00 was derived from the potential sales over 12 months. The estimated benefits are based on calculated data, but they are subjective and carry a degree of uncertainty regarding the anticipated increase in sales. However, since the cost-benefit ratio is positive, it can be inferred that the new product developed is "feasible," considering the extent to which the benefits outweigh the costs within the first year.

Table 2.5. Benefits Cost Ratio

Benefit Cost Ratio	
Total Cash Benefit	25,200
Divided by: Cash Cost of the Investment	7,469
Benefit Cost Ratio	**3.37**

DISCUSSION

In examining the results for the acceptability of the fabricated prototype papaya pickled atchara extractor machine, it is essential to consider the crucial findings from prior research. The evaluation of a machinery prototype's compatibility plays a vital role in determining its usability and effectiveness. The study emphasizes the importance of simplicity and ease of use in improving user acceptance, as supported by the high mean score for these attributes. This correlates with the results of the fabricated prototype papaya pickled atchara extractor machine evaluation, where participants rated the machine as simple and easy to operate, indicating a high level of acceptability. Additionally, insights from highlight the significance of user-friendly design in reducing potential errors and enhancing overall user experience. By incorporating these perspectives into the discussion, it understands the implications of the prototype's acceptability based on compatibility metrics. Furthermore, drawing parallels with successful teaching methodologies as demonstrated in [18] the application of specific learning models significantly improved student outcomes, underscores the importance of innovative design in achieving positive results. Thus, by considering these factors, it evaluates the impact of compatibility on the acceptability of the prototype papaya pickled atchara extractor machine and its potential for widespread adoption and efficiency. Moreover, the cost-benefit analysis of the product with the highest acceptability involves evaluating all the positive benefits and negative costs associated with a machine. This analysis quantifies these costs and benefits in monetary terms, incorporating people's opinions and their willingness to pay [19]. The aim is to assist entrepreneurs in identifying the highest return on investment considering the costs, resources, and risks involved. To conduct this analysis, a bill of materials, tools, equipment, and projected sales were identified to determine the feasibility of the new product. The items, specifications, quantities, units and total cost for machine and materials needed for production were determined. The total cost for the machine is Php 7,469.00, which is used for the extracting the green papaya pickled product. The machine and green papaya are considered assets for atchara production. Over 12 months, these machines are used in production as part of the costs. Thus, Php 7,469.00 will be deducted from the gross income for the entire year. To determine if the product is feasible, the projected sales or revenues were also estimated. The calculated cost-benefit ratio is 3.37. Based on these results, the total possible cost is Php 7,469 and represents the total costs as the sum of ingredient expenses, materials used and the total cost of tools and equipment over 12 months. The total benefit is Php 25,200 and over 12 months, the total was derived from the possible total amount of product sales. Based on the calculated data, estimates of the benefits are subjective and there is a degree of uncertainty associated with the anticipated sales increase. Since the cost-benefit ratio is positive, it can be concluded that the new product developed is "feasible" given the extent to which the benefits outweigh the costs within the first year. This finding aligns with the study by Abad et al., where farmers perceived an increase in profit and considered acquiring the machine as a viable option [20].

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CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn: This study suggests that the level of acceptability of the fabricated prototype papaya pickled atchara extractor machine is generally very acceptable to the experts and atchara makers. Furthermore, the results of the cost analysis revealed that the initial investment in the machine can be recovered within a reasonable timeframe through increased production efficiency and reduced labor costs. Likewise, cost-benefit analysis discovered that the new product developed is feasible given that the benefits outweigh the costs within the first year of production. Thus, it can be concluded that the product developed would provide a product acceptable to consumers.

RECOMMENDATIONS

The foregoing conclusions served as the basis for the following recommendations: it is recommended that plunger mechanism, cylinder housing, and funnel juice collector shall be stainless steel for anti-bacterial property measures and safety reasons. The small-scale food processing businesses consider investing in a Papaya Pickled Atchara Extractor Machine can used the machine to improve operational efficiency and product quality. Further research could explore the scalability of the machine for larger production volumes and assess its impact on overall business sustainability in the long term.

Conflict Of Interest

No conflicts of interest exist.

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