

Irish Potato Value Addition Innovations and Utilization of Value Added Products on Livelihood Improvement Among Utilizers in Kitumba and Bubare Sub-Counties, Kabale District

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Abstract: The study was about Irish potato Value addition Innovations and Utilization of Value added Products on Livelihood Improvement among utilizers. The study specific objectives were to; identify value added products, their utilization and their effect on the livelihood improvement among utilizers, determine the factors affecting value addition of Irish potatoes and utilization of value added products on livelihood improvement and establish the relationship between Irish potato value addition innovations and livelihood improvement among utilizers. The study employed a cross-sectional research design and primary data was collected from 174 respondents. The data was analysed using SPSS version 22.0. The study concluded that that potato chips had a positive significant effect on livelihood improvement at 5% level of significance at $p=.002^*$, Crisps were a strong predictor of utilizer's livelihood improvement at 5% level of significance at $p=.003^*$, a positive and a significant relationship were observed between potato peels/animal feeds and livelihood improvement at 5% level of significance at $p=.002^*$, potato flour was a strong predictor of livelihood improvement 5% level of significance at $p=.005$). The study also concluded that there factors affecting value addition and utilization of value added products on livelihood improvement in Kitumba and Bubare Sub-counties, Kabale district. Such as; income status ($p=.004$), lack of knowledge on value addition technologies ($p=.041$), lack of storage facilities ($p=.000$), limited access to market information ($p=.014$), limited access to credit services ($p=.024$), and electricity shortages and load shading (AOR = 1.121, 95% CI: .226 - 2.566; $p=.004$). The study finally concluded that general correlation of .452 was observed between Irish potato value addition innovations and livelihood improvement through value addition. The study recommends that, policy makers should come up with loan package intended for those interested in value addition. Farmers and individual training sessions in form of workshops, seminars and farmer field days should be encouraged so as to enable farmers exchange ideas on how to add value to their sweet potato and learn from each other while at the same time encouraging them to produce more so as to take advantage of economies of scale.

Keywords: Irish Potato Value Addition, Innovations, Utilization, Value Added Products, Livelihood Improvement Among Utilizers

1. Introduction

1.1. Back Ground of the Study

Irish potato, *Solanum tuberosum* L. is the world's fourth largest food crop after wheat, rice and maize. Irish Potato

farming is an important component of agriculture, rural employment, human nutrition and economic development [3]. Globally, World production reached a record 320 million tonnes in 2017 and Irish potato production in the developing countries has almost doubled with a corresponding increase in consumption [5] Irish Potatoes are an important source of

food, employment and income in developing countries [3]. It is high in energy content and ease of production has also made it an important component of urban agriculture which provides jobs and food security to some 800 million people globally [5].

Value addition can take place by; form value, location value, time value ownership/possession value, information value [12]. Most value addition studies found in the literature have focused on contributions of value addition on the performance of the different sectors and the effects of value addition on economic welfare indicators such as income, savings, asset ownership and other socioeconomic variables such as education level, age, and household enterprise mix.

Potato is mainly processed into crisps and chips. Other potato processed products include long- life fries, pringles and potato flour [11]. Processing of potato flour, starch, weaning food and wine is yet to be commercially exploited. The main potato processors such as Midlands, Deepa, Norda, and Njoro Cannery are operating at 40 percent capacity due to lack of consistent supply of good quality tubers. Inconsistency in supply of raw material is attributed to reliance on rain-fed production system and inadequate storage facilities [10]. Dutch Robijn and Kerr's Pink are the only two potato varieties suitable for crisp processing available to local processors; while RoslinTana, Dutch Robijn and Nyayo are the popular varieties for chip processing [13]. However, most potato processing varieties (Tigoni, Sangi and Desiree) are low yielding and very susceptible to pest and diseases.

In Africa, Hundreds of millions of people are facing food crisis including Uganda as the cost of their staple foods continues to rise and other obnoxious diseases like maize lethal necrotic disease (MLND), streak and rust diseases continue to affect cereals. Currently, there is a rising demand for quality processed Irish potato products like Chips, Crisps, Chevda from the country particularly in Middle East. Potato processing opens a new dimension for development of agro based industries. With the demand for Irish potato value added products rising, the need for farmers to process their Irish potatoes is on the increase [8].

Many of the small scale producers in developing countries, and most undernourished households, value the potato because it produces large quantities of dietary energy and maintains relatively stable yields under conditions in which other crops might fail. Those characteristics make the potato suitable for cultivation in many low-income developing countries, where arable land is limited and unemployed labour is abundant. [2] in their study on markets and value addition in selected agricultural value chains showed that, there is clear advantage for farmers to shift from sale of raw produce to processing into higher value products. The study further found that, the rate of return after value addition increases by more than 90% when compared to prices of the raw produce and that processing helps to prevent postharvest losses that are experienced by farmers in general. There exists very good prospects for value addition in Irish potatoes due to the increasing number of urban consumers willing to

diversify their consumption pattern in form of branded and packed fresh Irish potatoes in (super) markets, chips and crisps [7].

Uganda is the third largest producer of potato (*Solanum tuberosum*) in East Africa, after Rwanda and Kenya. In Uganda, annual potato production is estimated at 162,151 metric tonnes which puts the country in a strategic position to benefit from the regional growing demand for processed potato products such as French fries [11]. In Uganda, value addition to potatoes remains limited but is very critical in upgrading the entire potato value. Value addition provides a means to carry over surpluses from one season to another, contributes to increasing the shelf life, facilitates easy handling of the produce and helps reduce product transportation costs [1]. Additionally, it has been noted that value addition bridges agriculture and industry, and creates employment. A study stated that value addition produces 'convenience' foods in response to changing lifestyles and provide products with improved nutritional content in response to the increasing public demand for healthy diets. [2]

1.2. Major Potato Varieties Grown in Uganda

Genetic make-up is one of the main factors influencing processing traits of potatoes. Characteristics like size and shape of tubers, skin and flesh colour, dry matter content, reducing sugars and starch contents are strongly linked to the genotype [2, 4]. Thus, the suitability for processing potatoes into specific products is highly dependent on physical and chemical characteristics which are genotype specific. In their investigation on investment, opportunities and challenges in the potato value chain in Uganda, [7] revealed that more than 11 potato varieties are grown in the Kigezi sub-region where over 60% of potato traded in Uganda are produced. The major varieties grown and ranked based on farmers preference and volumes traded were; Rwangume, Victoria, Kinigi, Rwashaki, Mumba, Sutama, Kimuli, Rutuku, Cruza, Mitare and Kacport 1.

1.3. Statement of the Research Problem

Initially, Value addition and utilization of Irish potato in developing countries and Uganda in particular was limited to boiling and chips but currently, this has been changing to other more value added products from Irish potatoes [2]. Value addition of Irish potato involves processing it into product such as chips, salad, dry chips and crisps, desired by customers, mashed potato, grilled potato and among others which their utilization is limited by customer's awareness and other factors [4] Adding value to Irish potato has the potential to enhance the production of the crop and further can play important place in livelihood improvement in form of enhanced food or nutritional security and income generation among utilizers especially if there is full utilization of value added products from Irish potatoes. The need to add value to Irish potatoes as it is perceived by people could maximize on their revenue and improve their

livelihood. Despite these documented initiative and interests in the need for value addition, livelihood improvement would be realized but preliminary investigations showed that majority of Irish potato value addition actors in Kitumba and Bubare Sub-counties, Kabale district had not fully embraced value addition and utilization of the available value added products were understudied which had affected their livelihood improvement. The present study, therefore, sought to examine the influence of Irish potato value addition innovations and utilization of value added products on livelihood improvement among farming households in Kitumba Sub-county, Kabale district.

The study was guided by the following objectives;

- 1) To identify value added products, their utilization and their effect on the livelihood improvement among utilizers in the study area
- 2) To determine the factors affecting value addition of Irish potatoes and utilization of value added products on livelihood improvement in the study area
- 3) To establish the relationship between Irish potato value addition innovations and livelihood improvement among utilizers in the study area

1.4. Justification of the Study

Change in weather patterns and the need to diversify away from over reliance on maize and other crops as staple food has seen Irish potato gain prominence among smallholder farmers. In essence, Irish potato has inevitably become an important food crop for both domestic and commercial use. [9]. Considering the prominent role Irish potato is gaining in the national diet, it is necessary for farmers to engage in value addition activities which will increase the utility of the Irish potato [9]. It is therefore hoped that the findings of this study will provide impetus on policy discussions about Irish potato value addition especially with regard to rural smallholder Irish potato farmer and utilizers of the value added products. Nutritionally, Irish potatoes are good source of vitamins C and B6, manganese, phosphorus, niacin and pantothenic acid [5, 6]. Non-food uses of Irish potato include: glue, animal feed and fuel-graded ethanol [7]. Irish potato starch is also widely used by the pharmaceutical, textile, wood and paper industries as an adhesive, binder, texture agent and filler, and by oil drilling firms to wash boreholes. Irish potato starch is a 100% bio-degradable substitute for polystyrene and other plastics. It is used, for example, in

disposable plates, dishes and knives, while the peel and other "zero value" wastes from potato processing are rich in starch that can be liquefied and fermented to produce fuel-grade ethanol [5].

2. Materials and Methods

Table 1. Different Bi-products Made from Irish Potatoes.

	Value added products	Frequency	Percent	Cumulative Percent
Valid	Potato chips	51	29.3	29.3
	Animal feeds	38	21.8	51.1
	Crisps	25	14.4	65.5
	Potato flour	19	10.9	76.4
	Grilled potatoes	22	12.6	89.1
	Canned potatoes	13	7.5	96.6
	Others	6	3.4	100.0
	Total	174	100.0	

Source: Primary data, 2023

Table 1 above, majority (29.3%) of the respondents mentioned potato chips, 21.8% talked of animal feeds, 14.4% revealed crisps, 12.6% revealed grilled potatoes, 10.9% revealed potato flour, 7.5% revealed canned potatoes while 3.4% talked of other products. Majority of respondents revealed chips because it's the mostly consumed and utilized value added products.

Surveyed respondents were also asked the common consumers or utilizers of the value added products; responses were captured, analysed and presented Table 2 below;

Table 2. Common consumers or utilizers of the value added products.

Responses	Frequency	Percent	Cumulative Percent
Restaurants	35	20.3	20.3
Supermarkets	39	22.4	42.7
School canteens	44	25.3	68
Whole and retail shops	37	21.1	89.1
Local markets	19	10.9	100
Total	174	100.0	

According to the results in Table 2 above, a quarter (25.3%) of the respondents quoted reported school canteens, 22.4% revealed supermarkets, 21.3% talked of whole and retail shops, 20.3% mentioned restaurants, 10.9% mentioned local markets.

Table 3. Regression Output on Value-Added Products and Livelihood Improvement..

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	7977.381	217038.607		6.361	.000
Potato chips	7963.031	2571.941	.206	3.097	.002*
grilled potatoes	-4592.418	2749.321	-.113	-1.670	.096
Canned potatoes	1673.124	3143.252	.037	.532	.595
Crisps	6071.260	2651.615	.158	2.290	.003*
Irish Potato peels	9635.799	3075.170	.227	3.133	.002*
Potato flour	2722.320	2648.326	0.69	1.028	0.005

* Significant at p>0.05

Results in Table 3 above indicated that out of the six value-added products indicators, only four (4) had a significant effect on livelihood improvement. The analysis in Table 3 above indicated that potato chips had a positive significant effect on livelihood improvement at 5% level of significance. The coefficient $\beta = 7963.031$ significant at $p=.002^*$ implied that a unit increment in value-added potato chips, increased utilizers livelihood improvement by 7963 shillings.

Crisps were a strong predictor of utilizer's livelihood improvement at 5% level of significance. An observed coefficient $\beta = 6071.26$ significant at $p=.003^*$ was an indication that a unit increase in produced crisps, improved utilizer's livelihood improvement by 6071.3 shillings.

Furthermore, a positive and a significant relationship were observed between potato peels/animal feeds and livelihood improvement at 5% level of significance. A coefficient ($\beta = 9635.799$ at $p \leq .002^*$) implied that a unit increase in animal feeds affected livelihood by 9635.799.

Lastly, the study further discovered that value addition through potato flour was a strong predictor of livelihood improvement 5% level of significance. A positive and significant coefficient ($\beta = 2722.320$ at $p=.005$) was an

indication that a unit increase in value-added Irish potato flour affected livelihood improvement levels.

The factors affecting value addition and utilization of value added products on livelihood improvement in Kitumba and Bubare Sub-counties, Kabale district.

Surveyed respondents were questioned whether there could be factors affecting value addition and utilization of value added products on livelihood improvement; responses were captured, analyzed and presented in Table 4.

Table 4. Whether there could be factors affecting value addition and utilization of value added products on livelihood improvement.

Response	Frequency	Percentage	Cumulative percentage
Yes	200	100	100
No	00	00	100
Total	200	100	

According to study results in Table 4, majority of respondents 100% revealed that there were factors affecting value addition and utilization of value added products on livelihood improvement and none of the respondents criticized the statement.

Table 5. Parameter estimates for factors affecting value addition and utilization of value added products on livelihood improvement.

	B	Sig.	Exp. (B)	95% Confidence Interval for Exp (B)	
				Lower Bound	Upper Bound
Intercept	1.186	.383			
Age	-.013	.435	.987	.955	1.020
Educational level	.009	.831	1.009	.932	1.091
Income status	.352	.004*	1.422	1.118	3.807
Lack of knowledge on value addition technologies	-1.061	.041*	1.941	.805	4.099
Transportation issues	.378	.140	1.459	.883	2.412
Lack of storage facilities	3.107	.000*	2.898	.687	4.174
Limited access to market information	1.072	.014*	1.342	.145	2.808
Limited extension training coverage	.025	.742	1.025	.885	1.187
Limited access to credit services	1.033	.024*	2.808	1.319	5.978
Lack of organized markets	-.714	.339	.489	.113	2.116
Inadequate infrastructure	-.138	.839	.871	.229	3.309
Electricity shortages and load shading	2.114	.004*	1.121	.226	2.566

* Significant at $p > 0.05$.

a. The reference category is: No.

b. This parameter is set to zero because it is redundant.

Twelve variables were used as factors affecting value addition and utilization of value added products on livelihood improvement. Adjusted odds ratios were calculated to assess the influence of each factor on the dependent variable than the others. Only six (6) factors remained significant and these included; income status (AOR = 1.422, 95% CI: 1.118 - 3.807; $p = .004$), lack of knowledge on value addition technologies (AOR = 1.941, 95% CI: .805 - 4.099; $p = .041$), lack of storage facilities (AOR = 2.898, 95% CI: .687 - 4.174; $p = .000$), limited access to market information (AOR = 1.342, 95% CI: .145 - 2.808; $p = .014$), limited access to credit services (AOR = 2.808, 95% CI: 1.319 - 5.978; $p = .024$), and electricity shortages and load shading (AOR = 1.121, 95% CI: .226 - 2.566; $p = .004$).

The relationship between Irish potato value addition innovations and livelihood improvement among utilizers in Kitumba and Bubare Sub-counties, Kabale district.

Table 6. Value addition innovations used by actors to add value to Irish potatoes.

Response	Frequency	Percentage	Cumulative percentage
Chipping	80	46	46
Frying	37	21.3	67.3
Grading	22	12.5	79.8
Grinding into flour	10	5.7	85.5
Packaging	25	14.5	100
Total	174	100	

Source: Survey data, 2023

According to the findings in Table 6, majority 46.0% of the respondents reported that chipping is mostly used to a value, 21.3% revealed frying, 14.5% revealed packaging, 12.5% revealed grading while 5.7% revealed grinding into flour. The results implied that majority use chipping as an innovation to add value due to its inexpensiveness because cooking oil is cheap.

Respondents were further questioned whether potato value addition innovations are related to livelihood improvement, responses were captured, analyzed and presented in Table 7 below;

Table 7 Whether potato value addition innovations are related to livelihood improvement.

Response	Frequency	Percentage	Cumulative percentage
Yes	174	100	100
No	00	00	100
Total	174	100	

According to study results in Table 7, majority of respondents 100% revealed that potato value addition innovations are related to livelihood improvement and none of the respondents criticized the statement.

Table 8. Regression estimates on value addition innovations relates to livelihood improvement.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	32.540	3.935		8.269	.000
Increasing people's incomes	4.292	1.865	-.068	2.277	.001**
Decreasing the market intermediaries	3.047	1.012	.134	2.046	.396
Increase on and off farm rural employment	2.260	3.096	.132	.997	.048*
Reduce food crisis	2.931	1.746	.146	-8.51	.024*
Reduce vulnerability to poverty	2.867	1.124	.147	1.661	.005*

*, **, *** statistically significant at 10%, 5% and 1% significance level

Increasing people's incomes was positive and significant contribution at 5% level of significance. A value addition innovation has an influence of livelihood improvement where by quality innovations have high chances of improving product output as this makes an increment on product sales which thus increase income at household level which is an indicator of livelihood improvement.

As predicated increased on and off farm rural employment were a positive and significantly related to value addition innovations at 10% level of significance. A coefficient discovered implied that an increase in value addition innovations played a pivotal role value adder's decision to invest in value addition and increased employment by 2 chances.

More so, reduction on food crisis was a positive and significantly related to value addition innovations at 10% level of significance with $p=0.024^*$. Value addition innovations leads to shelf life of products and this would help stakeholders involved in value addition to solve the problem of food crisis during food scarcity times.

Reduction of vulnerability to poverty was a positive and significant as a result of value addition innovations at 10% level of significance at 0.005^* . This implied that a unit increase quality value addition innovation directly affected value adder's decision to invest more in Irish potato value addition to increase on output as well as products sales that would thus help to increase on 2.86 chances of getting out of poverty.

Table 9. Regression model summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.452 ^a	.204	.155	299429.316

The analysis in Table 9 above, presented a summary of the regression model used in the analysis. A correlation of .452 was observed between Irish potato value addition innovations and livelihood improvement through value addition. The R Square of .204 was an indication that value-added products through use of innovations contribute to 20.4% of the total income as one of the indicators in livelihood improvement. An Adjusted R Square of .155 implied that value-added products accounted for 15.5% variation in total income earned from Irish potato value addition.

3. Discussion of Findings

Value added products, their utilization and effect on the livelihood improvement among utilizers in Kitumba and Bubare Sub-counties, Kabale district.

Results revealed that potato chips had a positive significant effect on livelihood improvement at 5% level of significance at $p=.002^*$ implied that a unit increment in potato chips, increased utilizers livelihood improvement by 7963 shillings. Respondents further reported that chips are simple to make and requires small capital. This finding can be compared with [6] Who explained that the process of making chips remains simple. Kenyan entrepreneurs will be glad to learn that chips can in fact be made at industrial scale for final consumers or restaurants. It involves processes of washing, sorting, pressuring, slicing and freezing. The same authors reported that a consumer would only need to boil the pack of chips, picked from a supermarket shelf, to reminisce the simpler day.

The study results also revealed that crisps were a strong predictor of utilizer's livelihood improvement at 5% level of

significance at $p=.003^*$ with an indication that a unit increase in produced crisps, improved utilizer's livelihood improvement with income of 6071.3 shillings. This finding concurs with [2] who reported that crisps have been dubbed as the "King of Snack Food." Now, there are already many companies or factories that make crisps in Kenya because they are cheap and easy to carry from one area to the other. This finding concurs with research findings, by the International Potato Center, whose their report explained that Kenya still lacks in the areas of packaging and marketing of crisps.

Furthermore, a positive and a significant relationship were observed between potato peels/animal feeds and livelihood improvement at 5% level of significance. Respondents reported that potato peels are fed to their livestock animals which builds their animal and improves animal production capacity that would thus lead to improved income when products got from animals are sold. This finding concurs with of disposable utensils [11] who reported that besides potato itself, the waste products from processing of the crop like peels can be used to feed livestock and further said that potato animal feed is a supplement to what farmers feed their animals.

Lastly, the study further discovered that value addition through potato flour was a strong predictor of livelihood improvement 5% level of significance. It was an indication that a unit increase in value-added Irish potato flour affected livelihood improvement levels through improved sales. Respondents explained that potatoe flour can be used to make porridge, chapatis and among others. This finding is in agreement with Ray and Tomlins, [3] who in their study revealed that potato flour is made by crushing and grinding finely whole cooked or raw potatoes. The same authors explained that unga alternative comes with that potato flavor Kenyans which seem unable to resist. It can be used to make (bake) bread, cake, chapati and other meals food connoisseurs can come up with.

The factors affecting value addition and utilization of value added products on livelihood improvement in Kitumba and Bubare Sub-counties, Kabale district.

The study results revealed lack of storage facilities as a significant predictor at $p=.000$. Respondents said that since, processed or unprocessed potatoes is one of the biggest nightmares faced by those involved in value addition and marketing which was a big challenge to them. This finding is consistent with [1] who in their study explained that all sorts of vermin exist in poor storage centers that tend to partake of the produce. The same authors revealed that the products are so sensitive to the environmental conditions that one has to take extra care to ensure that they don't make losses by putting up standard storage facilities. The same authors explained that poor decision on storage combined with lengthy storage times could easily expose farmers to total marketing losses in case the store isn't of a good grade.

The study results established that limited access to credit services was a significant factor affecting Irish potato value addition and utilization of value added products at $p=.024$.

Respondents explained that access to credit facilities offer them the opportunity to obtain the resources necessary to adopt and use value addition technologies. This finding is in line with [5] whose their results revealed that credit access increases the participation in value addition of sweet potatoes at one percent level of significance. The same authors reported that access to credit help farmers and processing centres to finance the acquisition of value addition equipment that could enhance adoption and continued use of the value addition technology. However, access to credit by itself is not enough and should be provided in such ways that clients will be able to repay in time without staying indebted for long, thus ending up abandoning the livelihood improving technology.

The study established that electricity shortages and load shading was a significant factor affecting Irish potato value addition and utilization of value added products at ($p=.004$). Respondents explained that power shortage and their unreliability affects their value addition process it's very crucial especially during processing activities. This finding is consistent with [2] who reported that value adders cannot talk about value addition without considering the central and crucial role energy plays. The problem with Uganda's cost of electricity versus affordability is skewed, a Ugandan processor would have a challenge competing with a counterpart say from Ethiopia where the average rate is 7 US Cents in speeding up value addition. The same authors revealed that the unreliable power supply affects the value addition process immensely.

The study results also revealed limited access to market information which was a significant factor affecting Irish potato value addition and utilization of value added products at ($p=.014$). Rural Irish potato value adders have little information about the market demand, which is costly to obtain. Market information allows value adders to make informed marketing decisions that are related to supplying necessary goods, searching for potential buyers, negotiating, enforcing contracts and monitoring. This finding can be compared [5] who in their study explained that [3] who explained that smallholder farmers lack information about product prices at the local level, about quality requirements, about the best places and times to sell their products, and about potential buyers. The same authors reported that this, in turn, reduces their ability to trade their products efficiently and to derive the full benefit from the marketable part of their production. Market information is vital to market participation behavior of smallholder farmers.

The relationship between Irish potato value addition innovations and livelihood improvement among utilizers in Kitumba and Bubare Sub-counties, Kabale district.

Increasing people's incomes was positive and significant contribution at 5% level of significance. A value addition innovation has an influence on livelihood improvement where by quality innovations have high chances of improving product output as this makes an increment on product sales which thus increase income at household level which is an indicator of livelihood improvement. This finding can be

compared with [8] who employed multiple-regression model in evaluation of effects of value addition in Irish potatoes on farmer's income in Homabay County, Kenya and found out that found that, the more value a farmer added to raw tuber, the better the income obtained from the market. The study also noted that farmer marketing groups had a stronger bargaining power in the market compared to farmers selling individually. This finding can still be compared with [10], who revealed that farmers should attain income levels similar to the industry workers (and others) They also pointed out that the ability to attain the same income level should be based on the assumption of effective labour use and other factors of production, all of which are possible through farm diversification and value addition.

It was established that increased on and off farm rural employment were a positive and significantly related to value addition innovations at 10% level of significance. The study results implied that an increase in value addition innovations played a pivotal role value adder's decision to invest in value addition and increased employment by 2 chances. This finding can be compared with [12] found that value adding activities accounted for 350 % increase in household incomes and said value adding could prove to be a useful tool as it leads to increase in 'on and off' farm rural employment where labour is needed in running value addition activities like packaging, chipping, marketing and among others.

This finding also concurs with [4] who also highlighted the potential of post-harvest and value added activities emphasized on gains in rural income and employment are complemented by reductions in food prices for urban dwellers and improvements in processing and market chains.

The study results further revealed that reduction on food crisis was a positive and significantly related to value addition innovations at 10% level of significance with $p=0.024^*$. Value addition innovations leads to shelf life of products and this would help stakeholders involved in value addition to solve the problem of food crisis during food scarcity times. This finding is in agreement with [2] who revealed that utilization of Irish potato-based confectionary was used as a step to reducing food crisis among women farmers in Imo state Nigeria because of the health benefits, environmental friendliness and ability to make a home food secured with little investments. The same authors reported that different methods are intended to increase utilization hence, increasing Irish potato production leading to improve incomes and food security among the poorer segments of the rural population.

The study results that value addition innovations lead to reduction of vulnerability to poverty was a positive and significant as a result of value addition innovations at 10% level of significance at 0.005^* . This implied that a unit increase quality value addition innovation directly affected value adder's decision to invest more in Irish potato value addition to increase on output as well as products sales that would thus help to increase chances of getting out of poverty. This finding can be compared with [5] who reported that potato cultivation and value addition can help reduce

overcome poverty and strengthens livelihoods through the generation of a fast yielding and nutritious source of food and a reliable source of income. Same authors reported that, since it does not require access to land, mushroom cultivation is a viable and attractive activity for both rural farmers and peri-urban dwellers.

4. Study Conclusion

The study concluded that that potato chips had a positive significant effect on livelihood improvement at 5% level of significance at $p=.002^*$, Crisps were a strong predictor of utilizer's livelihood improvement at 5% level of significance at $p=.003^*$, a positive and a significant relationship were observed between potato peels/animal feeds and livelihood improvement at 5% level of significance at $p=.002^*$, potato flour was a strong predictor of livelihood improvement 5% level of significance at $p=.005$.

The study also concluded that there factors affecting value addition and utilization of value added products on livelihood improvement in Kitumba and Bubare Sub-counties, Kabale district. Such as; income status (AOR = 1.422, 95% CI: 1.118 - 3.807; $p=.004$), lack of knowledge on value addition technologies (AOR = 1.941, 95% CI: .805 - 4.099; $p=.041$), lack of storage facilities (AOR = 2.898, 95% CI: .687 - 4.174; $p=.000$), limited access to market information (AOR = 1.342, 95% CI: .145 - 2.808; $p=.014$), limited access to credit services (AOR = 2.808, 95% CI: 1.319 - 5.978; $p=.024$), and electricity shortages and load shading (AOR = 1.121, 95% CI: .226 - 2.566; $p=.004$).

The study finally concluded that general correlation of .452 was observed between Irish potato value addition innovations and livelihood improvement through value addition. The R Square of .204 was an indication that value-added products through use of innovations contribute to 20.4% of the total income as one of the indicators in livelihood improvement. An Adjusted R Square of .155 implied that value-added products through use of value addition innovations accounted for 15.5% variation in total income earned from value added products.

5. Study Recommendations

Policy makers should come up with loan package intended for those interested in value addition. Mechanisms should also be put in place and follow up on how the funds borrowed are used. This is because those who accessed loans only devoted a small portion to value addition.

The government extension system needs to address the factors which affect the decision to use a technology continuously. An effective and efficient extension system can render an innovation sustainable and useful for economically and spatially disadvantaged groups, thus, contributing towards alleviating poverty and reducing inequality among rural communities.

Irish potato value addition has the potential of increasing people's income and as such the poor smallholder farmers

should be encouraged to take up the value addition technology so as to get better prices for their produce which translates to increased income thereby increasing their purchasing power and improving their livelihood.

Marketing of the processed Irish potato products still remain a challenge which calls for proper marketing strategies such as linking farmers with supermarkets. Inadequate product development, proper packaging and labeling are other challenges that require urgent attention through acquiring certification from Uganda's Bureau of Standards.

Farmers and individual training sessions in form of workshops, seminars and farmer field days should be encouraged so as to enable farmers exchange ideas on how to add value to their sweet potato and learn from each other while at the same time encouraging them to produce more so as to take advantage of economies of scale.

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Conflicts of Interest

The authors declare that there is no conflict of interest.

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