

Low-Cost Maize Shellers for Nepal

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Abstract

As a country that depends on maize as a staple crop, Nepal could significantly benefit from hand-held maize shellers. Shellers are designed to reduce time and female drudgery in the post-harvest processing of maize. The target consumer group is millions of poor Nepalese farmers; the large population that requires the maize shellers should result in a strong demand for the product. Canada does not currently produce this item, but it is a good supplier candidate due to its large aluminum industry and the relatively low competition from other countries.

Background Information on Nepal

In the small country of Nepal, located between China and India, poverty is prevalent. The country is considered to be one of the poorest countries across the globe by international standards (IFAD, 2013). From a population of nearly 29 000 000 (World Population Review, 2014), approximately 80% of citizens rely on subsistence agriculture for their livelihood (IFAD, 2013). Their currency is the Nepalese rupee. Men make up 90% of the Nepalese who seek employment opportunities outside of their communities, which leaves women and children to grow and harvest crops for the household (IRIN, 2012). Women contribute over 60% of Nepal's agricultural workforce, but have little access to resources and technology (IFAD, 2013).

The country is divided into 3 ecological zones: the mountainous Himalayas in the North, the Terai plains in the South, and the hilly region in the centre. In Nepal's hill region, a large percentage of impoverished people depend on maize as a staple crop. It is grown by many subsistence farmers on hillside terraces (La Rovere et al. 2009). Maize is grown only second to rice (CIMMYT, 2010). While it is used mainly for consumption within households, a surplus of the crop will give the farmer the chance to sell it at markets for extra income. The demand for improved maize-related technology is quickly growing, and the crop is becoming increasingly significant for improving livelihoods of the poor (Nwakaire et al. 2011).

Background Information on Maize Processing

One post-harvest issue surrounding maize is the threshing methods, which affects storage, quality, and value (Nwakaire et al. 2011). Shelling maize from the cob is an essential step in processing the crop for utilization (FAO, 2014). Dry maize kernels are often removed from the cob by placing them in a bag and beating them with a stick (FAO, 2014). This is done

primarily by women. The current method of threshing is time consuming, but the biggest risk is the damage it can pose to kernels (Heng et al. 2005). Low-quality maize kernels typically have half the market value of maize in better condition (La Rovere et al. 2009). Damaged kernels are also more susceptible to disease and spoilage during storage, meaning that more maize must be grown and kept to compensate (Nwakaire et al. 2011).

A second way of threshing maize is done by removing the kernels by hand, by applying pressure to the kernels so they loosen and fall from the cob. While there is less damage done to the product, it is much more time consuming (Heng et al. 2009). Whether there is any cultural significance, beliefs or stigmas attached to the current threshing methods is unknown. By introducing a new threshing method, households can generate more money to spend on the education of their children and small domestic expenses (La Rovere et al. 2009). This can be achieved through selling extra product and having more time for other income-generating activities (Heng et al. 2005).

Product Nomination and Description

A low-cost, hand held maize sheller will reduce drudgery and reduce time required for threshing. The target consumer population is poor female maize farmers in the hill region. It can save a farmer hundreds of hours threshing each year (MIT, publishing date not given). It is capable of shelling 22-30 kg of kernels per hour, and there is very little to no damage done to the kernels (University of the Philippines, 2013). The sheller is constructed from cast aluminum and is small enough to fit comfortably in a woman's hand. The measurements of different shellers vary, but are approximately 3x3x3" and they weigh around 0.25 kg (AgPoint Precision, 2014). One end of the tube is circular, and the other is toothed to remove the kernels by abrasion.



Fig. 1

A cob of maize is inserted in the round end and twisted through to the notched side. The twisting motion causes the notches pull off kernels without damaging them, and they fall into a basket below. The hand held design has been used in other developing countries, such as rural Mexico and Guatemala, with success (Delgado 2008). It is an affordable solution that Nepalese farmers could purchase for the equivalence of a few dollars (Heng et al. 2005). The tool's simple technology and durable construction means it is very difficult to break, therefore reducing the risk of requiring repairs (Gempler's Commercial-Grade Outdoor Work Gear, 2014).

Canadian Export Potential

The aluminum corn sheller provides Canada with an export opportunity for aluminum, and the opportunity of the creation of a company to manage the sheller's production and distribution. Nepal is one of South Asia's most open economies, and there are no barriers preventing the import of maize shellers (World Bank, 2014). The country's import tariff for agriculture related imports is 10% (Encyclopedia of Nations, 2014). Canada is a major aluminum producer globally, behind only China and Russia (GC, 2009). Aluminum is a lightweight and durable metal that is safe for contact with food (Bhatt et al. 2006). While Canada does not currently produce these, they can be commissioned through aluminum casting companies.

Custom Castings, located in Winnipeg, Manitoba, has been a Canadian-owned company since 1972 and employs 85 Canadians (Industry Canada, 2014). According to the company's business development manager Vic Janzen, maize shellers weighing half a pound could be produced for \$3.50 CAD each. He notes that thousands of these would need to be purchased on a regular basis in order for the company to supply them (Personal communications with Janzen, November 2014). Considering that roughly 22 million Nepalese depend on subsistence agriculture, there would likely be enough demand for the shellers to fill the supply requirements.

The shellers could be marketed for sale in Canada as well, targeting homesteaders, small farmers, and bird enthusiasts. Shelling maize in Canada would likely be intended for producing small quantities of animal feed (Mother Earth News, 1983). The production of the shellers would directly benefit Canadians by providing the company with another opportunity for export; generating revenue and supporting a Canadian business. Canadians would indirectly benefit as well if a Canadian shipping company were used to transport the products to Nepal.

Transportation and Storage Logistics

Shipping the shellers from Canada to Nepal via airmail is an economical option. A1 Freight Forwarding, a Canadian shipping company with headquarters in Toronto, Ontario, will mail crates from Winnipeg to Kathmandu (A1 Freight Forwarding, 2014). 4096 shellers can theoretically fit into a 4 foot cubic crate. (One sheller is 27 cubic inches, and a 4 foot cubic crate is 110592 cubic inches.) The crate would weigh roughly 2100 pounds. A quote from the company mid-November 2014 estimated the shipping cost per crate to be \$3687.38 CAD (A1 Freight Forwarding, 2014). This means that shipment to Nepal costs \$0.90 CAD per sheller.

Storing the shellers in a Nepalese warehouse is not expensive. The shipping company offers the option of warehouse storage at approximately \$56.50 CAD per crate (A1 Freight

Forwarding, 2014). The storage cost divided among the maize shellers translates to \$0.01 CAD. This brings the total cost per sheller to be \$4.76 CAD. Once the shellers are in Kathmandu, they can be distributed to the major cities of Pokhara, Biratnagar, Kakarvita, and Birgunj through the Nepalese shipping company Shangri-La Freight (Shangri-La Freight, 2014). The cost of transportation within Nepal is currently unknown at the time of the paper submission. From these cities, they can be distributed to rural markets in order to reach the target consumer population.

Optional Inputs and Marketing

One strategy that was used in Guatemala to help assist with the cultural integration of shellers was to cover the outside of them in a traditional textile. The textile coverings held emotional value and were more aesthetically pleasing to consumers. They also made the shellers more comfortable to use and supported local artisans (Heng et al. 2005). This may make adoption of the technology more likely. This idea could potentially be integrated into the idea of maize shellers for Nepal. Large woven textiles could be purchased from Nepalese artists, cut into smaller pieces and attached to the outside of shellers using high-quality glue.

One Nepalese company, Woven Textiles from the Nupri Valley (WTNP), sells various types of textiles including woolen blankets. They are located in Kathmandu. These blankets are made by women of the Nupri Valley and Kathmandu, and purchasing these products would support local artists. The prices range depending on the size of the blanket. For example, a 63 by 63 inch blanket retails for 6000 Nepalese rupees (\$68.05 CAD) (WTNP, 2014). This is enough material to cover 148 shellers that have a circumference of 9.42 inches and a length of 3 inches. The cost of covering each sheller would be \$0.46 CAD.

The cost of the adhesive is unknown, as its unclear how much would be required. This could be purchased from Nepal, China, or India, depending on what makes the most economical

sense. The idea of the textile covering is optional and may not be required, but had proved to be successful in the Guatemala project (Heng et al. 2005).

Promoters and salesmen can be hired to transport the shellers from the major cities to the markets, apply the textile covering (if this option is chosen), and sell them. Offering demonstrations and encouraging people to try the tool themselves is an interactive way to sell. The customers will not only gain a thorough understanding of what the product is, but will experience its simplicity and effectiveness (Heng et al. 2005). Similar approaches in Guatemala have found this to be an extremely effective sales technique (Delgado 2008).

Cost Analysis for Canadian-made Maize Sheller

Inputs required	Estimated cost per sheller (\$CAD)
Hand held aluminum maize sheller	\$3.50
10% Import Tariff	\$0.35
Transportation from Winnipeg to Kathmandu	\$0.90
Storage in Kathmandu	\$0.01
(Optional) Textile covering	\$0.46
(Optional) Adhesive for textile	Unknown; likely under \$0.10
Transportation within Nepal	Unknown; awaiting response from company at time of paper submission
Salary for promoters	Unknown; current minimum wage in Nepal is 8000 NPR/month (\$90.38 CAD)
<i>Total</i>	~\$4.76 to \$5.32+

Table 1.

Competition from Other Countries

Most corn shellers of the hand-held style are manufactured in the United States. They retail for approximately \$6.74 to \$15.73 CAD, and are marketed towards homesteaders and small-scale American farmers (Amazon, 2014). A search on alibaba.com found that the majority of the low-cost manual corn shellers manufactured in China are crank-style, and cost between \$6.75 to \$225 CAD (Alibaba, 2014). Prices vary due to size and weight of the particular sheller, and the size of order placed. No hand held shellers were found to be produced in China currently, but it should be noted that there is a possibility that they may still be manufactured there. Crank-style maize shellers function by the operator placing an ear of maize in a basket and turning a crank handle. The cob is forced through teeth at the bottom of the basket, causing the kernels to be removed and separated from the cob (University of the Philippines, 2013).



Fig 2.

Due to the increased number of components in this style and the increase in size, it may be a less convenient option for Nepalese farmers. Distributing these shellers to remote locations may be slightly more challenging, and logistics for repairing a broken one may be problematic. Warranties for these products typically exist a year after purchasing. Depending on the size and

style, they weigh approximately between 3 kg and 6.5 kg. There is a large variation in the crank-style shellers available for purchase (Alibaba, 2014).

Comparison of Hand-Held and Crank Style Maize Shellers

	Canadian Hand-Held Sheller	Small Crank Sheller
Price (CAD)	\$4.41 to \$4.97	\$6.75 to \$225
Weight	0.25 kg	3 kg to 6.5 kg
Shelling capacity	22-30 kg/hr	40-400 kg/hr
Benefits	Low cost, durable, extremely difficult to break, ease of use	Can be highly productive, relatively small and lightweight, ease of use
Drawbacks	Lower shelling capacity than crank-style shellers	Heavier than hand-held shellers and may be difficult to repair; some styles are costly
Additional notes	May have a higher chance of adoption if a textile cover is used	Machines with higher shelling capacities may process maize so efficiently the farmer could offer shelling services to others

Table 2

Similar products manufactured in India were for more commercial use, and were significantly more expensive. This places them out of the price-point of most Nepalese farmers. No hand held or crank-style shellers could be found for purchase from India (Trade India, 2014).

Alternative Options

Another option Nepalese farmers have would be creating hand-held maize shellers themselves (Engineering for Change, 2012). By using recycled household materials, the shellers could potentially be free. Aluminum cans could be used for this project by removing both ends

of the can and using needle nosed pliers to bend one end of it, in order for it to be notched. A sheller made this way will not be very durable, but it is a more cost-effective solution. The aluminum tends to break as it is manipulated with pliers, creating weak points, holes, and sharp edges (Engineering for Change, 2012). Since it is free, however, they could be disposed of, and new ones made, when they are no longer functioning.

Needle-nosed pliers can be supplied from China. For example, purchasing large bulk orders of 1000 5" pliers from Zhejiang Everpower Tools Co., Ltd., a Chinese distributor, means that an individual item could be sold for \$1.12 CAD (Zhejiang Everpower Tools Co., Ltd., 2014). Pliers could have countless other uses in a household or on a farm.

Homemade maize shellers could be made more durable by incorporating a second can and cement (Engineering for Change, 2012). Another aluminum can, slightly bigger than the crimped one, could be used as a mould for cement. By placing the smaller can within the larger one, cement could be poured into the gap between the cans and allowed to harden. This would strengthen the sheller and make it a much more durable item (Engineering for Change, 2012). Nepalese could even make this product to sell at markets for extra income.

Critical Analysis

Supplying Canadian hand held aluminum maize shellers to Nepal has many potential benefits for both nations. The hand-held sheller may be more ideal for impoverished farmers, as it is a less expensive option. It may be too expensive for the poorest of farmers, however. It is much more efficient than current threshing methods in Nepal and is highly unlikely to ever break. It is recommended that different sizes of shellers be made available to accommodate different ear sizes; it is also recommended to investigate as to whether the current practises of

threshing maize hold any cultural stigmas or beliefs. This may affect the technological adoption and integration. Application of a textile so that the sheller appears more familiar may assist with this. A simple, low-tech and low-cost maize sheller can benefit both Nepalese households and Canada's large aluminum industry. Its potential should be considered to help improve lives of Nepalese and Canadians.

Despite the fact that China is the world's largest producer of aluminum, and they are geographically much closer to Nepal, China mainly produces crank-style manual shellers. This style of sheller is more expensive but has a higher processing capacity. This may be ideal for wealthier farmers who can afford the initial cost; by offering shelling services, they could make extra income. Their customers may save a great deal of time that they can allocate to income-generating activities, and likely none of their maize kernels would be damaged.

The most cost-effective method for farmers would be to create their own shellers from local recycled materials. This item may be the most beneficial for Nepalese and would have the environmental benefit of the repurposing of "useless" items. While specialized equipment is needed, these pliers could be purchased from China for a low cost by taking advantage of bulk pricing. Locals could start businesses by making shellers and selling them to other farmers in the area. Educating farmers on how to produce hand-held shellers could be very beneficial for Nepalese. This is an option to assist the most poor and even farmers who could afford the Canadian-made sheller, and so may be the most effective and helpful solution.

Conclusion

While exporting shellers from Canada may be viable option, and have many benefits to both countries, it may not be the best option. Producing them in Nepal would result in a lower

cost to the consumer, sales opportunities for Nepalese producing the shellers, and would have environmental benefits as well. Producing them locally recycles waste materials, as well as reducing emissions for transportations. A lower cost would make the technology of a maize sheller more available to the millions of farmers who could benefit.

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