

Export Potential to Nepal
Thermophilic Cheese Starter Culture
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PART 1: PRODUCT INFORMATION

INTRODUCTION TO CHEESE CULTURE

Cheese making is an art and includes many steps that would need to be followed closely to prevent unsuitable cheese. To make cheese milked is first heated up, then cheese cultures would sit for two to three minutes on the surface of the heated milk to be rehydrated and to prevent clumping. This culture would then thoroughly be mixed into the milk, and after this step rennet must be added. At this point the curds produced would be stretched and kneaded by hand and formed into balls. (Skovmose, 2011). Type B thermophilic cheese starter culture would be used in the process of making soft Italian style cheeses like mozzarella.

Cheese cultures have specific functions necessary for the first step processes of creating cheese as it is used to ripen milk (Skovmose, 2011). Type B Thermophilic cheese starter culture (*Streptococcus thermophiles*) would consist of combined single strains of bacteria used to make softer cheeses such as mozzarella. Culture is needed to adjust the pH as it would rapidly raise the acidity of milk by consuming the milk sugar lactose and converting it into lactic acid (Skovmose, 2011). This would disable bacteria present in milk and aid the rennet to set the cheese. The starter culture would also help in the development and preservation of the flavour and body of the cheese as well as the functional properties like melting, texture, and appearance of the cheese (Ober, 1998). Thermophilic culture means that this type of culture would be added to heated milk as it thrives in temperatures of 40 to 45 degrees Celsius (Cultures for Health, 2016). Cheese starter cultures are necessary to successfully make Italian style cheese.

PRODUCT PRODUCTION

This cheese starter culture is generally manufactured and bought from laboratories. The Canadian company of Glengarry Cheese located at 5926 County Road 34, Lancaster Ontario produces large amounts of cheese and is the recipient for large amounts of culture as well as selling and shipping this cheese starter culture. Wilma Klein-Swormink at wilma@glengarrycheesemaking.on.ca takes orders and can be contacted for orders and inquiries of the cheese cultures (Glengarry, 2016).

CHEESE PRODUCTION ISSUES

Soft Italian style cheese is one of the least labour intensive cheese products to make however there are many steps and materials necessary to produce cheese. When done properly this cheese would take an average of 40 minutes to make as it is a soft Italian cheese (Barz, R. 1997). However, this would mean it must be consumed within a week after it was made before it spoils as this type of cheese is not set to age. To successfully make cheese one would need proper equipment, setup, and knowledge. A sanitary area would be necessary to create cheese as the only bacteria growing should be in the cheese itself (Barz, R. 1997). Thus, labour would include cleaning equipment and space used, as well as obtaining supplies that sufficiently clean the area. Large pots would be needed to contain milk and heat it up to pasteurize it. Therefore, it must be able to be set over a fire or some form of heat. To heat up the milk wood would be needed, adding to the labour of collecting and cutting the wood. Then at the step of adding the culture by sprinkling it on top, this causes the curds to form and would then be kneaded, heated and stretched by hand, adding to overall labour. (Barz, R. 1997) There are many steps to follow and procedures to know when making mozzarella cheese in the home.

There has been an explosion in the growth of Mozzarella production within the past twenty years and this has led to another issue. This issues includes the bacteriophage attack on *S. thermophiles*. However, this problem mainly affects the large mozzarella cheese producers. (Oberg, 1998) The shelf life of this cheese is also an issue and is directly affected by the type of raw milk used. Soft Italian cheese could last up to four days without losing any characteristics but overtime the quality and flavour of the cheese deteriorates. There has been large demand for cheese and therefore the quality of the cheese is very important.

REQUIRED INPUTS

There are several main inputs required to produce cheese. Milk is one of the inputs necessary for cheese making therefore herds of dairy cattle or preferably buffalo are needed to produce enough milk for the creation of cheese. The following table outlines the amount of culture needed to inoculate certain amounts of milk and the estimated amount of cheese produced. The quantity of cheese produced is not certain as the percent of protein and fat highly contribute to the cheese yield.

Table 1

Batch Size	Amount of Culture	Amount of Milk (L)	Approx. Cheese produced (kg)
Small	½ tsp	12-15 L	1.5 (kg)
Large	10 grams	100 L	10 (kg)

Another input required to produce of cheese would be the animal feed into the milk producing buffalo. In Nepal, the buffalo would typically be grazed in the hills, consuming mostly grasses therefore the protein content in their milk would be less than that of buffalo fed

on high protein diets (Han, et al. 2016). The diet of the milk producing animal also affects the flavour and outcome of the cheese.

NUTRITIONAL INFORMATION ASSOCIATED WITH THE PRODUCT

Mozzarella cheese has many health benefits associated with it, however the type of milk plays a large role in nutritional value. It is proven in Table 2 that buffalo milk has lower cholesterol and more calories and fat compared to typical Holstein cows milk. The higher percentage of protein in the milk the higher the percent yield of cheese. The table demonstrates that buffalo milk compared to cow's milk has a higher percentage of all components. (Cinotti, 2003). Therefore, it would be more beneficial to use the milk of a buffalo as it contains more nutrients, minerals, protein, and fat than from other dairy cattle available in Nepal. (Han et al, 2006)

Table 2

	Fat (%)	Protein (%)	Yield (%)	Yeild/Protein
Holstein	3.44	3.10	9.5	3.1
Buffalo	8.30	4.65	25	5.4

(Han, et al. 2016)

MARKET OPPORTUNITY

The cheese industry officially began in 1953 for Nepal where it mainly produced yak cheese with the support of the swiss and is typically sold to western tourists (Elliott, 2008). An input of 140 000 liters of milk and over 100 000 kilograms of wood is used to process the milk into cheese by two factories (Yonzon et. al. 1991). In Nepal, these cheese factories are located in

Langtang National Park, and produce 14 000 kilograms of cheese each year to be sold in Kathmandu mainly to western tourists. As tourism is very common in the mountainous regions there will constantly be a market for soft cheese like mozzarella. These factories could then purchase and buy of large amounts of cheese cultures to produce enough cheese to make a profit.

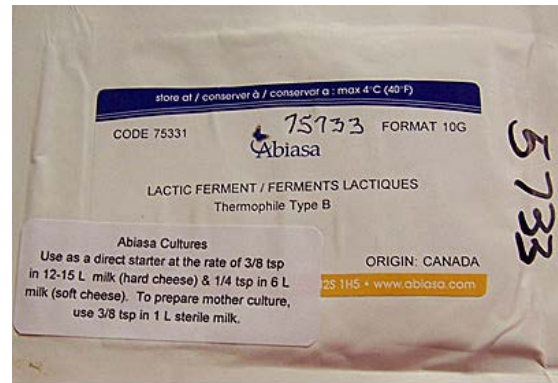
There is increasing demand for water buffalo mozzarella cheese as sales have increased 7% from 2001 to 2002 (Laurienzo et. Al. 2006). This demand positively correlates with the demand for thermophilic cheese starter culture as this culture is necessary to create mozzarella cheese. The Northern countries have been found to consume very little of this product due to lack of cultural knowledge and the limited shelf life. (Laurienzo et. Al. 2006) Cheese culture would aid in the production of mozzarella cheese to be sold for tourists trekking through Nepal and for those who wish Nepalese culture.

SUSTAINABILITY

Issues surrounding the two large cheese factories in Nepal include sustainability as there is an extensive use of wood and overgrazing. This issues has caused and is continuing to cause extreme deforestation as it uses 100 000 kilograms of wood for fuel each year. (Yonzon et. al. 1991) The milk used for this cheese is mainly from chauri, which is a yak-cattle hybrid. Nepalese farmers have received money in the form of loans and payments in advance to encourage them to maintain large herds of chauri (Yonzon et. al, 1991). The enormous production of cheese has resulted in large herds of yaks overgrazing so that the farmers can sell enough milk. Overgrazing and deforestation is a very unsustainable way of creating cheese.

BENEFITS TO CANADA

Exporting this culture will benefit the Canadian company Glengarry cheese making supplies. Glengarry would be able to expand their range of customers and sell more cheese culture and would therefore be increasing profits. If Glengarry's products were sent to Nepal it would strengthen trade relations in addition to selling more product.



(Glengarry, 2016)

Glengarry sells different sized packages depending on the amount of milk available. The Type B Thermophilic culture is priced at \$7.45 per 10-gram package (code: 75733) and \$33.50 for the 100-gram package (code: 75738). To contact Glengarry for this product one could call at 1-888-816-0903 or visit www.glengarrycheesemaking.on.ca and email: info@glengarrycheesemaking.on.ca. (Glengarry 2014). Glengarry would potentially benefit by exporting their product to Nepal.

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PART 2: EXPORT POTENTIAL TO NEPAL

INTRODCUTION TO NEPAL

Agriculture has plays a large role in Nepal's economy as it employs approximately 70% of the total population. The main workers have been women doing the drudgery work as the men go out of the rural areas to find higher paying jobs (2015, Human Development Report). Nepal is one of the least developed countries in the world and contributing to this is the 45% unemployment rate of the 28 million people. Most farms are subsistence farms that struggle with malnutrition, hunger, and low income. Nepal also struggles with illiteracy which has inhibited the process of development for the Nepalese population. (2015, Human Development Report) Nepal greatly relies on agriculture and there is potential do develop their agriculture sector.

Another sector that contributes highly to the economy is tourism. Nepal is a geographically diverse country as it has three different regions; the Himalayan Region located along the border of China, then south of this region is the elevated flatlands and located on the Indian border is the terai region. Nepal's geographical diversity contributes to the flow of tourists which visit Nepal for a variety of activities such as trekking, hiking, paragliding and rafting through the diverse geography of Nepal. Tourism is one of the largest sectors creating a large income for Nepal.

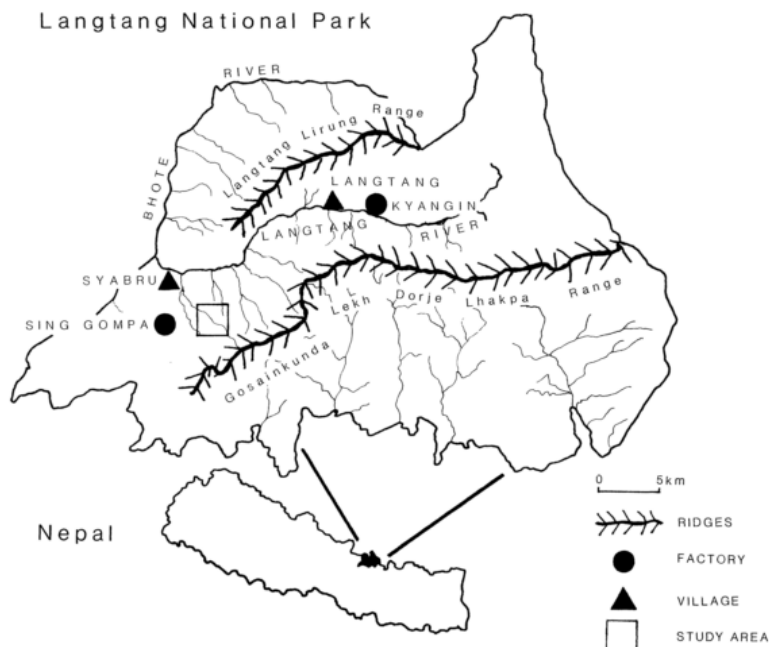
TRANSPORTATION TO DESTINATION

Many steps would be involved in the transportation of shipping cheese culture packages to Nepal. The culture packages would need to be transported via truck from FedEx shipping company located in Cornwall, twenty minutes from Glengarry in Lancaster Ontario (FedEx, 2016). Then FedEx could send ten 10-gram package out of the Toronto airport in one tear and

water resistant envelope at a time to the landing in Kathmandu Nepal (FedEx, 2016). From the Nepalese airport, the packages would be transported to the hill region and the higher populated area's where local farmers would be currently making cheese with herds of buffalo. Several steps would be involved to ship cheese culture packages to Nepal.

The type B thermophilic cheese starter culture can also be shipped to large cheese making factories in Nepal. This would mean shipping 10 kilograms of the culture to the large cheese factories located in Langtang National Park near the border of China (Yonzon, 1991). The following map reveals the destination of the cheese factories within the National Park. FedEx would be able to ship it in 40.2 cm x 32.7 cm x 25.9 cm box via airplane to Kathmandu, then trucked to Kyangin and Sing Gompa in the national park. It would be more worthwhile to send the culture in bulk to the large cheese operations as the area's where they are located are more developed. There would be better roads for importing the cheese culture and resulting in easier distribution of the cheese produced. The factories located in Langtang National Park could be the recipients of larger amounts of cheese culture shipped from Canada.

Figure 1



(Yonzon, 1991)

CHEESE CULTURE STORAGE ISSUES

Issues would arise when it comes to storing the cheese starter culture. The packages of cheese culture could last up to four months at room temperature, therefore it would not be necessary for the culture to be refrigerated during shipping (Berry Hill Ltd. 2016). The temperatures in Nepal change over the seasons, in June it becomes an average of 23 degrees Celsius, meaning the cultures would need to be used by September or October. However, in the winter, the average temperature is 9 degrees Celsius which is warmer than preferable but the cultures would still last around three months longer than the summer. If starter cultures could be kept in frozen or cool areas they could last an entire year. There is little frozen storage within the Hill regions of Nepal therefore they would most likely be stored in caves. This could potentially cause an issue with moisture if the opened packages of cheese culture were not sealed or protected properly. This would require Canada to supply cheese culture every time Nepal was running low, adding to the shipping costs (Laurienzo et. Al. 2006). The culture packages could be transported in tear and water resistant envelopes from FedEx to protect the contents after opening (FedEx, 2016). Then the Nepalese cheese maker who would only use $\frac{1}{4}$ teaspoon at a time could store their packages of culture within the shipping envelope and keep it in a cool place without losing the contents. There are several factors that affect the preservation of cheese culture packages, and overlooking these factors could result in waste of cheese culture and cheese.

COST ANALYSIS

It would prove to be difficult to make a profit from sending individual cheese culture packages to small holder produces in Nepal. The 10 gram packages charge an extra 41 cents per gram compared to the 100-gram package. Therefore the 100-gram packages would be more economical for the Nepalese cheese producers. The problem with this is that the individual farmers may not use 100 grams before its expires, and this would also depend on the storage situation. On average, it takes ten liters of milk to produce one kilogram of cheese and about $\frac{1}{4}$ rounded teaspoon of type B thermophilic cheese starter culture to properly inoculate this amount of milk. (Yonzon, 1991). The price of the cheese starter culture is not the main issue, but the labour and feed cost of acquiring the milk. The average herd size in Nepal is about three to ten buffalo and each buffalo produces about 6% fat. If milking would need to be done by hand the hours of labour would increase exponentially and the price of cheese sold would not cover these hours of hand milking three buffalo.

The price of cheese sold would be unknown as it depends on supply and demand as well as market prices. In the past, the cheese has been sold for \$4.30 US per kilogram of cheese (Yonzon et al, 1991) and at that time it would have been \$5.11 CAN sold in Nepal to tourists (Exchange rates, 2016). As this information was from twenty-five years ago, the price of cheese has risen, but these numbers still prove that in Nepal cheese was sold at significantly lower costs than in North America. This means that Nepal would also be able to charge more per kilogram of cheese to make a profit closer to that of western profit in cheese making.

Shipping costs would also need to be covered, either by the farmer purchasing it, or by the importing country. Fed ex can ship ten 10 gram packages of culture in one envelope for 143\$ from Cornwall Ontario to Kathmandu Nepal. (FedEx, 2106) The other option was to ship

10 Kg of thermophilic cheese starter culture in a medium box via air transportation to the factories in Lang Tang National Park. This export would cost \$623.88 to ship through FedEx. Since the cheese would be sold in mass amounts there would be larger profits made from the factories than if it was sold small scale. The factories would be able to afford the shipping paying the shipping costs compared to the small holder's.

BENEFITS TO NEPAL

Nepal would benefit from cheese starter culture as it would contribute to more employment and increase the income per person. Selling cheese starter culture alone would not create more jobs in Nepal, however it is the cheese making process which will need more employees. Nepal cheese factories have only once met target production in 1987 when the target was lowered by 22% which was 2000 kg and there had been a new milk depot set up (Yonzon, 1991). This proves the enormous demand for mozzarella cheese and therefore Nepal would not have issues with marketing the product as the demand is so large. Selling this cheese would potentially help add more jobs for the factories, as the more cheese culture they have available the more cheese they could produce and the more workers needed. Nepal struggles with unemployment currently at a rate of 46%. As Nepal is one of the least developed countries of the world creating more jobs and increasing income could help substantially.

CHEESE AND CHEESE CULTURE COMPETITION

Canada needs to compete for sales of starter culture as it also be imported from China. There is a manufacturing company in Shanghai, China that has 101-200 workers and mainly produced probiotic powder, starter culture, supplement, and formula development (Alibaba, 2016). Their main market is southeast Asia which provides 20% of their total revenue. This

manufacturing company is much closer to Nepal in distance lowering the transport bill compared to FedEx's (Alibaba, 2016). It would be more affordable for the small business cheese makers and large factories in Nepal to import culture from China.

There is also competition in the mozzarella cheese market. The mozzarella cheese is sold from this competitor at a price of \$2 026.39 per tonne (Alibaba, 2016). Their main customers also include western tourists looking for mozzarella cheese on their pizza and with other meals. Therefore, it is not only competing with Canada to export the culture but also with Nepal to sell cheese as part of the tourist industry.

UNKNOWN STATISTICS OF CREATING CHEESE IN NEPAL

To export cheese culture there are many different variables that would need to be considered. The type of milk used to make cheese depends on how much will be produced, therefore it is unknown as to how much cheese culture is needed to produce 1 kg of cheese. No studies have been found to test how much cheese culture is needed to begin the process of making mozzarella cheese with milk from buffalos raised in Nepal. These unknown quantities lead to unknown prices and profit of the product of cheese. Therefore we cannot state the exact amount of money gained per factory or cheesemaker, and cannot determine whether the price of cheese covers labour costs.

SUMMARY

Thermophilic cheese starter cultures would be necessary for the beginning steps of creating Italian style cheeses. Demand for mozzarella cheese has increased globally and therefore more cheese culture is necessary. Nepal would be able to use cheese culture to sell mozzarella cheese to tourists flowing through Nepal increasing incomes and creating more employment.

It would not be a challenge to send thermophilic cheese starter culture from Canada to Nepal however it would be a challenge to make a profit from the cheese. There are many unknown variables when the prices of cheese are determined as it depends greatly on milk availability and demand for cheese. The most likely scenario to truly benefit Nepal from sending cheese culture from Canada would be to ship it to the factories as they already have the proper equipment and labour to properly make and store cheese and cheese culture.

I would recommend shipping the cheese culture only to the factories in Nepal as they have facilities to store cheese culture and cheese as well as ship it. The cost for shipping would be less if China supplied the culture as the factories are located near the Chinese border and therefore significantly less distance travelled in order transport the culture. Shipping from Canada is not economical as it needs to be transported by Air as well as land transportation. Therefore, this product can not truly benefit both Canada and Nepal.

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