

Canadian Export to Nepal: Travelling Wheel Line Irrigation System

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Part One: Product Information

Irrigation Systems

At a time in the world in which there is great uncertainty in rainfall, it is necessary that farmers can be guaranteed their crops receive the proper amounts of water to maximize yield. Water is needed in order to maintain an adequate food supply for the human population and for other animals, plants, and microbes worldwide (Pimentel *et al*, 2004). As human populations and

economies continue to grow, global freshwater demand has been increasing rapidly (Hinrichsen *et al*, 1998). Irrigation is the method in which a controlled amount of water is supplied to plants at regular intervals for agriculture. It is used to assist in the growing of agricultural crops. Additionally,

irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growth in grain fields and preventing soil consolidation (William *et al*, 2007). The majority of agriculture relies only on direct rainfall is referred to as rain-fed (Pimmnetal *et al*, 2004). World agriculture consumes approximately 70% of the freshwater withdrawn per year (UNESCO, 2001). 17% of the world's cropland is irrigated, but produces upwards of 40% of all food (FAO, 2002). Around the world the amount of of irrigated land is slowly expanding, even though salinization, waterlogging, and siltation continue to decrease its productivity (Gleick *et al*, 2002). Despite a small



https://i.ytimg.com/vi/s_SvoABY66I/maxresdefault.jpg

annual increase in total irrigated area, the irrigated area per capita has been declining since 1990 because of rapid population growth (Gleick *et al*, 2002). Only 28% of all agricultural land in Nepal is irrigated (Chapagain, In Lecture, 2016)

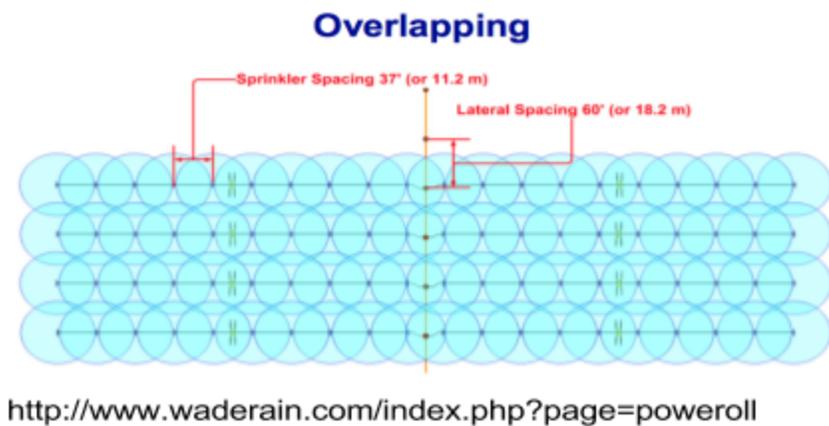
Travelling Wheel Line Irrigation

Using travelling line irrigation, a farmer can be assured their crops will be receiving water while reducing labour, lowering cost compared to other forms of irrigation while still having a simple,

reliable, and easy to maintain system.

Travelling wheel line irrigation is an aluminum sprinkler line mounted on large wheels that sweep

across a field. The irrigation line is propelled forward by a small gasoline engine located in the centre of the line (Vanden Bussche, 2016). The line is then connected to a mainline waterline via a flexible hose (Vanden Bussche, 2016). One round of irrigation generally takes approximately 8 to 12 hours (Smith, Personal Communication, 2016). Once the line has completed the cycle the operator reverses the cycle and the line travels back to the original starting point, where the system is ready for the next irrigation cycle.



VandenBussche Irrigation

The travelling line irrigation is sold through Vanden Bussche Irrigation systems in Delhi, Ontario, along with 4 other Ontario locations.

For over a decade, Vanden Bussche has been providing full service irrigation service to a variety of overseas and Canadian clients(Vandenbussche Irrigation, 2016).

International sales began service in

1999. A sod farm in Moscow

responsible with the task of upkeep of

the lawns of the Kremlin and Red

Square called to rectify the sorry state of

the State green spaces

(Vandenbussche Irrigation, 2016).

Vanden Bussche designed and installed

an irrigation system which has kept

these world-renown lawns at the ready to receive the world's leaders. Since then,

Vandenbussche Irrigation has lead many irrigation projects around the world, including

agricultural irrigation projects(VandenBussche Irrigation, 2016).



pbs.twimg.com/profile_images/582599728333860864.jpg

Benefits of Wheel line Irrigation

Wheel line is considered labour saving technology . The system takes 15 minutes to reset (Vandenbussche, 2016). It is a proven system with over 200,000 wheel line systems in use around the world. With this semi-automatic system, one person can manage up to 15 lines and irrigated fields up to 20-50 acres (8-20 hectares) depending on crop, soil and water consumption, and frequency of moves. Reduces crop damage from walking on crop. Irrigates square and rectangular fields. Irrigates in heavy soils where big guns and pivots fail.



www.waderain.com/images/galleries/powerroll/Powerroll-7.jpg

Exporting Benefits to Canada

Increased Revenue

The sales to Nepal would directly benefit Canada and Canadians by increasing revenue. This increase in revenue would allow for more manufacturing of systems and parts (Smith, 2016). Shops producing the parts for the wheel line irrigation systems would be a direct beneficiary from this increased revenue.

More Canadian Jobs:

Employment would increase as support, marketing, and servicing would be in demand. With an increase in demand for these systems, an increase in production would occur. Irrigation sprinklers are used as part of a sprinkler system, consisting of various plumbing parts, pump unit^l piping and control equipment (FAO, n.d). Along with the increase in workers needed to produce these parts, support services such as repairmen, maintenance, and support for the Nepalese Farmers.

Support Available for Exporting Country

Support is available for Canadians exporting agricultural products (Potter, 2014). The Ontario Chamber of Commerce and the Ontario Ministry of Agriculture, Food, and Rural Affairs that helps create sales opportunities and provide research and marketing education (OMAFRA, 2014).

Process Of Export

Transportation from Canada to Nepal would begin with shipping from Delhi, Ontario to Toronto via transport truck. From there the units would be sent via cargo ship to Calcutta, India. Once received in India the cargo would be unloaded and delivered via truck to the small agricultural inputs retailers around Nepal. The total price would depend upon many variables, but one unit would cost approximately \$1,800-\$2,200 dollars as calculated on A1 Freightforwarding.com. A large order would be placed by select input suppliers in Nepal and would be delivered to lower cost per unit delivered. The Two main irrigation suppliers in Nepal are Agro Engineering Works Ltd.

in the Butwal Industrial District, Butwal-12, Rupandehi, and Prakash Engineering Co. Ward No. 2, Mills Area, Chettrapur, Chitwan District (Nepal Agricultural Machinery and Farm Equipment Directory, 2016).

Part Two: Potential Benefits for Nepal

Nepal-The Country

Nepal is a developing country with many diverse issues and challenges. The estimated population is roughly thirty-one million people (The World Factbook – CIA, 2015). Nepal is landlocked between the borders of India and China (The World Factbook - CIA, 2015). There are three specific ecological regions to Nepal. The Terai region is referred to as the plains of the country, containing the most productive land in the country (The World Factbook – CIA, 2015). Then there is the hills and flatlands region located in between the Terai and the Mountains (The World Factbook – CIA, 2015). Following these, there is the mountainous region of the country that contains the Himalayas (The World Factbook – CIA, 2015).

Irrigation Projects	District	Irrigated Land in Hectare
Sharada	Kailali, Kanchanpur	6800
Bagmati Multipurpose	Bara, Rautahat, Sarlahi	50,200
Rapti	Banke	3000
BanGanga	Kapilvastu	8000
Kanchan Danav	Rupendehi	10000
Kankai	Jhapa	8000
Chitwan	Chitwan	11100
Sikta	Banke	36000
Koshi	Saptari	22000
Gandak	Bara, Parsa, Rautahat, Nawal Parasi	51000
Babai	Bardiya	13000
Marchawar	Rupendehi	56000
Eastern Rapti	Chitwan	56000
Sunsari	Sunsari, Morang	58000

Agriculture in Nepal

Nepal has one of the highest percentages of total country employment in the agricultural sector. Currently, Nepal sits with seventy percent (70%) of the total population in

agriculture. (Nepal | Agriculture and Food Security | U.S. Agency for International Development., 2015). This means that with such a large improvement in the agricultural sector, a vast majority of the population will benefit.

Benefits to Nepal

This is a benefit for Nepal as the only investment is the irrigation system. Only 28% of all agricultural land in Nepal is irrigated (Chapagain, 2016).

Consistency

Introducing this product to Nepalese farmers would bring consistency to their rainfall and cropping systems as a whole.

Versatility

“The science of controlled rain” as quoted by Marc Vanden Bussche (Vanden Bussche,

Crops:

Pasture	★★★★★★
Hay	★★★★★★
Cereal Grains	★★★★★★
Cotton	★★★★★
Potatoes	★★★★★
Alfalfa	★★★★★
Sugar Beets	★★★★★
Soy Beans	★★★★★
Carrots	★★★★★
Strawberries	★★★★★
Row Crops	★★★★★
Vegetables	★★★★★
Corn	☆☆☆☆☆
Not Recommended	
Sugar Cane	☆☆☆☆☆
Not Recommended	
Orchards & Vineyards	☆☆☆☆☆
Not Recommended	

2016), assures farmers that they can sufficiently use the land to grow crops successfully.

Travelling wheel line systems are a proven concept with more than 200,000 systems worldwide (Wade Rain Powerroll, 2016). With the average farm size in Nepal only being 0.94 Ha (Chapagain, 2016), this system is fully capable of ensuring proper watering as it is able to irrigate 8-20 Ha, depending on soil and crop type (Wade

Rain Powerroll, 2016). This irrigation system is able to irrigate a multitude of crops including pasture, cotton, potatoes, strawberries, carrots, and many more (Wade Rain Powerroll, 2016).

Easy Installation

Travelling wheel line irrigation systems are designed to be simple to operate and maintain. It is also simple to install. No special tools or equipment such as a boom truck are required, meaning that Powerroll can be located in rural areas where minimal infrastructure is needed (Wade Rain Powerroll, 2016).

Increased Production of High Value crops:

High value crops such as tobacco, potatoes, and other vegetables can be grown as annual crops as irrigation allows them to be sure that the initial investment will have a high probability of having a reasonable harvest as rainfall will not be a limiting factor (Pimentel et al, 2004). Crop diversity would also be a greater as crops like corn, beans, peas and so on can be



www.nelsonirrigation.com%2Fproducts%2Fapplication%2Fwheel-line&bvm=bv.139782

harvested. This is all possible due to due the reduces fluctuations in the year-to-year yields and the risk of crop failure due to drought.

Transition to Wheel line Irrigation

With increasing amounts of land in Nepal becoming dependent on irrigation due to the fluctuations in rainfall year to year, it is necessary for such irrigation systems to work well (FAO, N.d). The transition would take place over several decades, as the initial cost of purchase is large. Travelling wheel line irrigation would not fully be able to satisfy all of Nepal's irrigation needs, so other forms of irrigation would still be used where necessary (Vandenbussche Irrigation, 2016). Area's such as irregular shaped fields, terrace farms, or other such constrictions would need a more conventional form of irrigation such as a drip-line or sprinkler (Pimentel et al, 2004).

Quality of Life

Nepal is one of the world's most malnourished countries (WFP, 2014). Malnutrition has extreme impacts on economy, decreasing productivity by reducing physical and cognitive health (WFP, 2014). Chronic malnutrition has debilitating effects, such as blindness, brain damage, and infectious diseases, which often can result in lifetime damage (USAID, 2016). An increase in nutrient dense vegetables such as kale, carrots, and other vegetables would decrease the rates of disease that have been caused by lack of nutrients and vitamins in the past (FAO, N.d). An increase in saleable

harvested would also increase the farmer's revenue allowing him to purchase other necessities of life (FAO, N,d).

Quantities and Cost Associated with Export

Cost to Farmer

Many options are available in the wheel line irrigation system. For the purpose of this project, the best option is the base model, as it has the lowest amount of initial input cost. The model is 195 feet in length, has 4" tubing , and four pairs of 76" wheels. This would cost total of \$8,110.07 Canadian which is equal to 664090 Nepalese Rupees (Vanden Bussche Irrigation, 2016), plus shipping and handling. Wheel-line irrigation is considered one of the most cost efficient way of irrigating a field (Vandenbussche

Table 2: Irrigation System Comparisons

Irrigation System	Application Efficiency*	Cost**(irrigation labor not included)	Advantages	Disadvantages
Wild Flood	15 – 40%	\$0 – \$20 (home made plastic or canvas dam)	<ul style="list-style-type: none"> • Low input cost • Low maintenance 	<ul style="list-style-type: none"> • Low efficiency • Increased labor • Poor uniformity
Furrow <ul style="list-style-type: none"> • Gated pipe • Corrugation 	40 – 80% 40 – 55% 50 – 80%	\$2 – \$3/foot -----	<ul style="list-style-type: none"> • Control of delivery time and space 	<ul style="list-style-type: none"> • High labor • Low efficiency
Sprinkler <ul style="list-style-type: none"> • Mini gun • Portable hand lines • Solid set 	55 – 75% 60 – 85% 60 – 85%	\$3,000 ---- \$2,000 – \$4000/acre	<ul style="list-style-type: none"> • High efficiency • Low labor • Suitable for most crops • Good choice for fields with varied soil & topography 	<ul style="list-style-type: none"> • Higher cost • Higher operation & maintenance • Needs continuous supply of water • Requires pressurized water source
Surface Drip	70 – 95%	\$1,000 – \$2,000/acre	<ul style="list-style-type: none"> • Higher efficiency • Less time and labor • Reduced runoff • Reduced pumping costs • Typically used for vegetables, windbreaks, trees, vines, and shrubs 	<ul style="list-style-type: none"> • High initial cost • Higher management time • Needs continuous supply of water • Filtration required

Source: Barta, et. al, 2004

*Application Efficiency refers to the percent of water delivered that ends up in the root zone of the crop. Efficiencies can be much lower due to poor design and management.

** Based on 2012 cost estimates

irrigation, 2016) as a sprinkler as \$500/ha (\$202/acre). Providing year round irrigation for most of the cultivated area and would enables rapid growth in the basic food staples therefore. The direct inputs are farmer must supply for this system includes gasoline, oil, and labour to move the system from field to field (Vandenbussche irrigation, 2016)

Potential Export Quantity and Revenue

As this transitional would occur over several years and decades it would economically advantageous to start off with small shipments and focus on the revenue generated on the service end. With 28% of land in Nepal being irrigated (Chapagain, in lecture, 2016) and 29% of Nepal's land area being arable land we can derive the following calculation:

Nepal's Land Area total (Ha) x % of land irrigated= Total amount of irrigated land
 14.7181 Million ha (FAO, n.d) x .28 (Chapagain, in lecture, 2016) = 4.121 million hectares of irrigated land.

In tens years 10% (412,100 Ha) of the irrigated land would could be done through wheel line irrigation. If each system sold irrigated 8 ha a day, the low end of the possible range, and was used seven days a week it would be possible to irrigate 56 hectares per week. Therefore a total of 7358 systems in the first ten years for a total of 59.7 million dollar investment. Although this seems like a large number is would benefit the Nepalese as it does not require a large amounts of maintenance.

Challenges of Exporting to Nepal

A key part of maintaining and increasing demand for irrigation is creating a successful market for farmers and processors. There are challenges associated with shipping to poor countries, but there are also ways that Canadian companies like Vandebussche Irrigation would be able to assist Nepal with growers and producers.

Lack of Infrastructure.

Infrastructure is the basic physical and organizational structures and facilities (e.g., buildings, roads, and power supplies) needed for the operation of a society or enterprise (Merriam-Webster's, 2016). Some of the key challenges that categorize irrigation development in Nepal are old infrastructure and poor performances of the existing irrigation systems; poor system efficiency and under-utilization of canal water; weak participation of Water Users Associations (WUAs), weak institutional capacity; weak linkages between agriculture and irrigation; continuation of subsistence agriculture practices in command area etc (Ministry of Irrigation, 2016).

The Environment

Due to riparian issues, in Nepal, it has not been possible to tap the major river systems for irrigation development, which discharge substantial amount of water even during the dry season. Most of the irrigation systems use rivers, which almost entirely dependent upon rain.

Poverty

Poverty continues to grow in rural areas which poses a major problem for Canadian exporters, as their target market would be rural farmers (IFAD, n.d.) A large challenge associated with exporting a product to Nepal is that fact that Nepal is

extremely poor, with 1/3 of its population surviving on less than \$14 (US) per month (IFAD, n.d.).

Lack of Genetically Superior Crop Cultivars

Selective breeding is breeding to selectively develop particular phenotypic traits (characteristics) by choosing which typically animal or plant males and females will sexually reproduce and have offspring together (Merriam-Webster's, 2016). Due to the steady amounts of subsistence farming that occurs in Nepal, farmers do not use the best plant genetics available (FAO, N.d). Selective Breeding increase overall yield, plant height, performance under stresses such as weeds, pests, and drought (Batlang et al, 2014). Better selected cultivars also have a higher water use efficiency (Batland et al, 2014). Water use efficiency and agricultural productivity remain low in both the traditional farmer-managed schemes and the large public irrigation systems (FAO, N.d). This problem does not allow crops to be as efficient with the water they are given, and therefore would require more irrigation (FAO, n.d).

Transportation:

The transportation network is very weak, particularly in the hill areas (FAO, n.d). Thus, transportation of irrigation system to the field would be difficult and expensive.. This would be only a problem in the initial stage of the installation process. Livestock and human strength may be needed to complete some of the transportation tasks (FAO, n.d).

Lack of Agricultural Education

Nepalese farmers are often uneducated, making marketing strategies a key part of export (World Bank, 2013). Farmers would potentially learn first hand from the Canadian exporter how to properly utilize, maintain, and efficiently grow their crops with the wheel line irrigation system (Vandenbussche, Personal communication, 2016).

Trade Barriers

Nepal joined the World Trade Organization in 2004, which is helping develop more trade opportunities (World Bank, n.d.) and is considered one of South Asia's "most open and trade dependent" countries (World Bank, n.d.)

Recommendations for Export

To maximize the success of the travelling wheel line irrigation in Nepal and reduce drawbacks created by challenges with marketing, some major changes should be made in the current Nepalese Agricultural industry, specifically within the cropping systems. Challenges associated with lack of knowledge and current farming and irrigation practices are inevitable (FAO, n.d). Sending along a trained professionals to not only help set up the system, but also guide them in what way is most advantageous for the grower is also ideal. A technician would able to help with logistical problems such as mechanics, application questions, and other day-to-day related questions.

Unlike many countries in the world the Nepalese government has a Ministry of Irrigation. Water is an important natural resource of Nepal (MOIR, 2016). The immense quantity of water available in the country and its potentiality to irrigate significant percentage of the total agricultural land, provide us the opportunity of overcoming the barriers of economic development (MOIR, 2016). The responsibility of utilization and management of this resource lies in the Ministry of Irrigation. Preparation plan and policies and their implementation regarding development of irrigation for the efforts to achieve agricultural development targets are the objectives of this ministry (MOIR, 2016). There is tremendous potential for the Ministry of Irrigation to work with both the private and public sector to unlock Nepal's greatest agricultural potential, while continuing to be stewards of the environment.

Marketing

The marketing strategy for exporting the wheel line irrigation system to Nepal from Canada would be to provide the farmer with the correct information and a system that works directly in his favour. Before the product is imported, local farm suppliers will be contacted with information regarding the wheel line style of irrigation. Discounts may also be provided if larger systems were to be bought. Upon the arrival of our product a trained employee will be alongside to provide instruction on how the system works and talk to local farmers one on one. This employee will also be providing individuals with all background information needed.

Future Considerations

If this project is to be pursued, some steps will be necessary to guarantee it is successful. Retail suppliers would have to show interest in importing and carrying a product such as the wheel line irrigation system. Secondly, there would have to be technicians in Nepal willing to learn about the system and work with farmers to apply this technology to their cropping systems. Research into cropping systems would be required to see which crops and style of systems would have the greatest benefit with this form of irrigation.

Competitive Products

Currently there is no major amounts of travelling wheel line irrigation in Nepal. This is partially due to its relative recent release on the market (Smith, Personal Communication, 2016). Another major factor is that the large variety of field type and landscapes (MOIR, 2016). The main form of irrigation currently in Nepal is overhead sprinkler irrigation (Pimentel et al, 2004). Little is known about the exact numbers of types of irrigation systems in Nepal as research and data is not taken from the majority of Nepal's mostly subsistence farmers (Smith, Personal Communication, 2016).

The majority of irrigation systems are called farmer-managed irrigation systems. These are built and maintained by the farmers with minimal help from other companies, countries or agencies (Bhandari and Pokharel, n.d). Their infrastructure is considered simple and lacks provision for water management. The agency-managed systems have largely been abandoned due to flooding, increased maintenance costs and as farmers

had to contribute much labour and resources to run these systems (Bhandari and Pokharel, n.d). The Nepalese government is now aware of the importance and strengths of the farmer-managed irrigation systems for the country's agriculture. There is now a push to improve the systems through their rehabilitation and the extension of irrigated area, which would be possible by minimizing water losses and improving management strategies (Bhandari and Pokharel, n.d).

Irrigation system type	Area (ha)	Share (%)
Farmer-managed	406 986	38.5
Agency-assisted farmer-managed	332 130	31.5
Agency-managed	292 546	27.7
Private	23 955	2.3
Total	1 055 617	100.0

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