TRI-COUNCIL REGION

RURAL MUNICIPALITY OF KELSEY

THE TOWN OF THE PAS

AND

OPASKWAYAK CREE NATION

MANITOBA, CANADA

SMART CITIES CHALLENGE

FINALIST PROPOSAL

MARCH 5, 2019

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EXECUTIVE SUMMARY

As finalists in the Smart Cities Challenge, the Tri-Council region in Manitoba is pleased to submit this proposal on behalf of our communities; the Rural Municipality of Kelsey, Opaskwayak Cree Nation, and the Town of The Pas. Our challenge statement is as follows:

Our community will utilize LED Smart Farm technology to support local nutritious food growth and promote food security, create a smart phone distribution system and integrate wearable technology to achieve a 40% reduction in the number of imported vegetables and a 20% reduction in community diabetes rates by 2023.

The goal of this project is to both demonstrate a decrease in diabetes incidence rates within our region, as well as create the infrastructure necessary to inexpensively scale the solution to many other communities in Northern Canada. The two major barriers that currently hinder wide-scale consumption of fresh fruits and vegetables in the Tri-Council region, as well as many other northern communities, is the cost and quality of these products. To decrease transportation costs while increasing the quality of produce, it is necessary to bring production of these goods to the local scale.

Our proposal will flow in a logical manner as outlined by the finalist guideline. In Chapter 1 we discuss our vision and our transformative approach to solving it, utilizing connected technology and innovative solutions in our approach to develop critical levers that will positively and uniquely impact our goals. Establishing these levers is the focus of our Smart Cities project.

In Chapter 2 we developed our performance measurement outcomes, creating a logic model and ensuing narrative that describes the activities required to complete our project, outcomes statements, indicators to measure the outcome statements and data source identifiers that inform indicator measurement. We have also included a payment schedule in this chapter. The content of this chapter informs the content of an outcomes-based contribution agreement.

Chapter 3 contains the elements required for successful project management including a work breakdown structure, which identifies tasks associated with completion of each activity as presented in Chapter 2. This information is also presented graphically in a Gantt chart which illustrates the project's critical path and corelates financial reporting periods and project activities. Furthermore, this chapter identifies required resources, risks, stakeholders, and considerations for long term project sustainability.

The technology that will be utilized for the success of our project is described in Chapter 4.

The first formalized governance structure of the Tri-Council will be the not for profit corporation that has been established for this project. The Board of Directors that will have equal representation from each of the three governments and the articles of incorporation are such that each of the members will have equal voice at decisions made. This has been described in Chapter 5, in which we also indicate who our partners are and their readiness to participate in this project.

In Chapter 6 we discuss our engagement strategy and tools used for gathering the thoughts and ideas from our community members. The population of our communities and our long-established history of living

together has allowed us to create pathways of communication that supported the development of this proposal and will allow us to continue to receive the feedback we need to ensure that we are aware of and addressing the needs of our community members as we proceed with the project.

Chapter 7 is an overview of the initial steps we have taken to understand the legislative authorities that guide all aspects of our project that are associated with personal information or personal health information. Because we have both provincial and federally regulated entities within out partnership, we have both provincial and federal authorities to consider when implementing our project. We have completed preliminary impact assessments with both and will complete more comprehensive assessments upon implementation.

Our financial plan is detailed in Chapter 8 and corresponds to the performance measurement outcomes and project management requirements that were detailed earlier in the proposal.

Chapter 9 identifies our plans for meeting policy requirements pertaining to Duty to Consult with Indigenous groups, modern treaty obligations and community employment benefits required under the Investing in Canada plan.

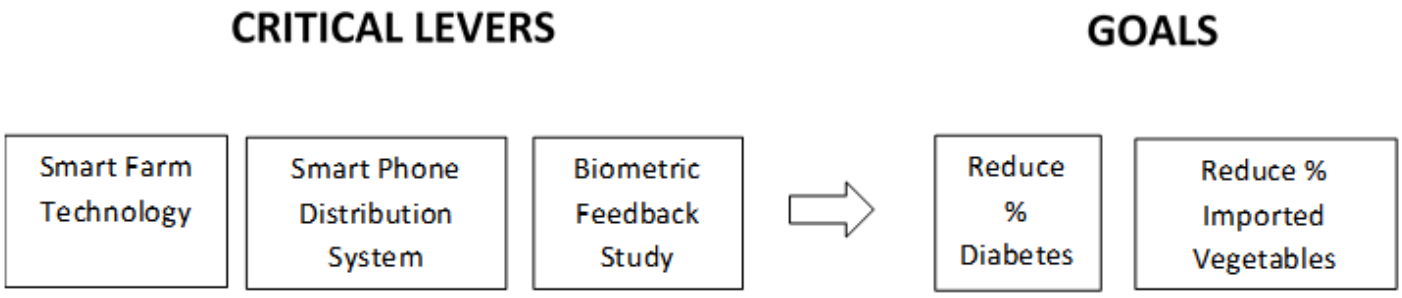
Beyond the benefits to our own community, we recognize the potential of our project to be adaptable and scalable to any community in Canada. We trust that our contribution to addressing food sovereignty in our own community, similarly, contributes to the national food security issue. We also trust that our innovative approach to addressing diabetes will be widely used across Canada as we know that too many of our fellow citizens suffer with the same affliction.

We recognize that our efforts in developing this proposal have created new synergies among our communities and welcome the opportunity to build upon these in the future.

1 CHAPTER 1: VISION

The Smart Cities journey for the Tri-council communities began by identifying that good health is a priority for our community members. Diabetes is the single greatest health issue in our region and so decreasing diabetes rates was identified as a goal that could be achieved through a Smart Cities approach. Further, we understand the link between healthy, nutritious food and combating diabetes. Our definition of nutritious food means food that is grown, is fresh, does not contain harmful chemicals or pesticides and is not preserved or modified. Food security means that this nutritious food must be accessible and affordable; not impacted by factors such as weather, distance, fuel costs and international trade. Accessibility and affordability have been an ongoing issue for our remote geographical location, as it is to many Canadians. During the process of engaging stakeholders, we identified our goals as a 40% reduction in the number of imported vegetables and a 20% reduction in community diabetes rates. Further, we created a list of critical levers that could be developed to achieve these identified goals. Establishing these levers, as listed below, is the focus of our Smart Cities project.

- Utilize Smart Farm Technology to facilitate year-round local food growth
- Create a smart phone enabled distribution system, leveraging electric vehicles for low cost operation, and
- Integrate wearable continuous glucose monitoring (CGM) device technology to cultivate community knowledge and demonstrate the impact of healthy food on physical biometrics



Our approach is transformative, utilizing connected technology and innovative solutions in our approach to develop critical levers that will positively and uniquely impact our goals.

1.1 Critical Levers

1.1.1 Smart Farm

The Smart Farm Technology, known in the community as the Smart Farm, is a technology that addresses many of the factors currently impacting our accessibility to healthy fruits and vegetables. This technology allows us to have year-round product availability with output that can readily be expanded to meet demand. With a three-week growth cycle, the technology allows for nimble response to demand and alternate growing cycles for product reliability. As this growth is indoors, it is climate agnostic and

geography independent: food can be grown in this manner in the tundra, above the tree line, on bedrock or anywhere that people find themselves living in an environment that does not lend itself to outdoor gardening. This technology is also environmentally friendly, reducing the need for transportation of our food from the southern states, reducing refrigeration costs, and reducing land and water resources. Additionally, we create employment for our own community members to grow our food rather than paying people we will never see to do this for us. Using this technology, we obtain food sovereignty – a right that we choose as important to us.

The Smart Farm Technology is a critical lever to the success of our outcomes for these reasons:

- Enables local year-round food growth
  - Freshness of food and the impact of fresh food on diabetes
  - High food cost and early food spoilage are associated with long transport routes which can be mitigated through local food growth
  - Year-round local food growth necessitates indoor production due to harsh climate
  - Existing Korean technology is a preferred option because of their proven production rates and a previously established collaborative relationship on technology, research, and learning from their advancements.

The transformative impact to the community has a broad reach. Fresh, affordable, accessible food has not been part of the everyday life of most community members for decades. However, the transformation goes beyond that. This technology allows community members to raise food for their families, neighbours and friends, as well as create jobs within the community.

The Smart Farm technology is both scalable and replicable in any community, regardless of size, as it can be deployed in a space as small as a shipping container or as large as an airplane hangar. The input requirements for operation of Smart Farm technology include water, electricity, heat, nutrients, and seeds.

1.1.2 Smart Phone Distribution System

The smart phone distribution system consists of two parts. One is the **smart phone application** (app), which serves as an online marketplace, and the other is the physical distribution of food, utilizing an **electric vehicle distribution** system, that is dispatched through the smart phone app.

The smart phone app provides community members with a means to connect to the distribution system by providing an interface to access to goods. The app will resemble any other online marketplace, providing customers with information such as product availability, price, a purchasing platform, and incentives. The app will have a complementary second function which provides knowledge and support for the use of products grown by providing information such as recipes and nutritional information. Additionally, a bulletin board indicating times and locations of local community cooking classes or food sharing experiences will also be available. Popular lunch and learn sessions on issues pertaining to health and nutrition will be advertised in this manner. Options for payment will include use of popular credit cards and for cash deposits to a user's account.

Through extensive community engagement, we have determined that direct to door distribution will increase the possibility that community members will begin to consume more healthy food. Additionally, an identified barrier to accessibility is that many community members do not have access to a vehicle, have small children to care for, or are unable to get to the grocery store in a timely manner. In order to keep operating costs as low as possible, physical distribution of food will be done through the utilization of electric vehicles; an order generated through the smart phone app triggers dispatch of the delivery vehicle.

Our decision to use electric vehicles has been encouraged by the clear signal from automakers and government policies that electric vehicles are here to stay and the way of the future. As a Tri-council, we know that a smart cities approach is to look to the future and to consider how we can leverage resources for more than one purpose. As such, we look to the potential of tying into the growing provincial infrastructure of electric vehicles, as outlined in Manitoba's Electric Vehicle Roadmap document, offering our community members the infrastructure support required to operate electric vehicles within the region.

As it pertains to our goals, we considered how the use of electric cars could ensure adopting healthy food choices in the daily lives of our citizens. Our considerations focus on the reality that our electricity rates are the lowest in North America and that this is a cheaper source of energy than the imported liquid fuel we currently rely on. Using electric vehicles, we can reduce operating costs and, in this way, pass the savings on to the customer thereby eliminating one of the identified barriers to healthy eating: astronomical costs for low quality produce.

The Smart Phone Distribution System is a critical lever to the success of our goals because it increases the distribution system's capacity and efficiency. Most community members utilize their smart phone to communicate with each other and their broader social networks, so it is anticipated that this approach will be effective in connecting customers with the products they want.

Although electric vehicles have been chosen as the vehicle platform for the project, the distribution system can utilize any form of transportation, coupled with the smartphone platform, to functionally accomplish distribution. For example, delivery can be made by foot, bicycle, canoe, drone, or even conventional vehicles. Furthermore, the use of smartphone technology is convenient for reaching larger populations, however, in smaller communities, or communities without reliable access to wireless internet, product selection and ordering could be accomplished through alternative means.

1.1.3 Biometric Feedback Study

Wearable CGM devices, used to measure blood glucose levels in real time, will be worn by a **voluntary study group** as part of an academically led research project that will link the impact of healthy eating on physical biometrics including blood glucose. Furthermore, we see this group as creating the beginnings of a critical mass of community members who recognize the impact of healthy eating and, with this knowledge, influence change for the entire community. A study group provides a quantifiable metric for the impact of our project, allowing us to evaluate the effectiveness of dietary choices on human health; particularly the onset of diabetes. The study group will be guided and supported by health professionals at one of our two

local primary care centers. Nurses will input biometric data from the participants into the electronic medical record (EMR) system. In this way, the data of the participant will be confidential, and allow for simplified feedback over time as the EMR generates graphs and reports that participants can observe. This feedback has proven to be a useful tool to incentivize and encourage individuals in their health journey. Participants will also have professionals to assist them with any health concerns including mental wellness support, group counselling support, or other medical needs.

Throughout this research project, we will support Individuals from all of our communities who wish to participate. One of the Tri-Council members, Opaskwayak Cree Nation (OCN), has adopted an integrated care team (ICT) model of care based on the Alaskan South-Central NUKA model of care. The ICT is nurse led and supported by a physician and/or nurse practitioner, a social worker and clinical assistants. The team is further supported by learning circles which support groups of community members that are facing similar issues to meet and support each other. The seven sacred teachings have been incorporated into all programming at OCN's Beatrice Wilson Health Centre, which offers traditional and non-traditional spiritual care to support the choice of the individual. Our non-First Nation partners also utilize the knowledge of Beatrice Wilson Health Centre staff for Indigenous Cultural training for their non-Indigenous health staff. Through our collaborative Statement of Intent, discussed later, the provincial Northern Health Region and OCN have agreed to share health resources and work together to learn how to best meet the needs of community members who seek health care in any of our local health facilities, including the local hospital.

The biometric feedback study is a critical lever to the success of our outcomes for these reasons:

- Real-time biometric readings provide a strong feedback mechanism corelating dietary decisions and blood sugar levels, thus cultivating participant and community knowledge of the importance of a healthy diet
- Providing a powerful data collection mechanism for academic analysis and healthcare best practice knowledge

The value of the wearable CGM device is in its use for real-time blood sugar monitoring to facilitate personal health knowledge acquisition. However, real-time monitoring is not critical in gaining this knowledge; conventional point measurement approaches to blood sugar monitoring, although less powerful in providing feedback, also serves the purpose of providing feedback on dietary choices.

1.2 Goals

We will measure our goals utilizing a variety of data collection methods.

1.2.1 Reduction in diabetes rates

Although we have been aware that the lives of many of our community members are impacted by diabetes, it is through the collection of data that we have been able to quantify this. Every five years, the Northern Health Region, under the direction of the provincial government, completes a community health needs assessment that captures many of the health issues, health care utilization rates, morbidity and mortality rates and other factors that measure the overall health care needs of the population. While some of the

data of the population of Opaskwayak Cree Nation is captured in this assessment, it is only as it pertains to such factors as hospitalization, cancer care and dialysis usage. To capture the data for the entire Tri-Council region in a uniform manner, OCN utilized the same data collection methodology and reporting structure to complete a community health needs assessment for OCN that can be directly compared to the provincial data. In this way, we have managed to complete an overall picture for the region and this data serves as a baseline that can be utilized as a comparator for future assessments. Given that this is recent data, we will complete community health needs assessments in a similar manner in five years and ensure that we are evaluating the impact of our project on diabetes rates in the region.

The data for residents of The Pas and RM of Kelsey, as captured in the provincial Northern Health Region (NHR) 2016 aggregated data, indicates that in Manitoba 28.1% of the population was recorded to suffer from diabetes and prediabetes with a projected rate of 31.3% by 2026.

Data for Opaskwayak Cree Nation was collected in the identical manner as the NHR, utilizing the same epidemiologist so that data could be compared and aggregated geographically rather than jurisdictionally. In 2017, 46% of those living in OCN had been diagnosed with diabetes according to OCN's Community Health need's assessment report. In 2017, two primary care physicians began practicing at Beatrice Wilson Health Centre. In February 2019, data from the medical records indicate that 60% of their patient population of 1800 people have Type 2 diabetes. The increase of 14% over two years could indicate that community members are now receiving better primary care so previously undiagnosed individuals are now diagnosed and are receiving treatment.

The high rates of diabetes in the Tri-Council region and the monetary and human costs associated with the disease has resulted in the citizens and leadership of the region to determine that real solutions to the escalating problem need to be developed and has therefore become a priority in planning. This was confirmed through our community engagement process detailed in Chapter 6.

The primary care clinics in both The Pas and Opaskwayak utilize the same electronic medical record and patient records can be accessed from either clinic. This data sharing has been secured through a privacy impact agreement signed by leadership in both communities. The patient data in the electronic medical record can be anonymized and collated into reports that assist us in evaluating diabetes rates and reductions in diabetes indicators such as blood glucose levels, Hemoglobin A1C levels, and other biometric measurements. The consistency of data resulting from this shared electronic medical record is an evaluation tool that is useful for us to look at regional population health as we evaluate the impact of our project on the health of our community members.

1.2.2 Reduced in % of Imported Vegetables

In the initial months of our implementation phase, we will monitor current fruit and vegetable import rates into the community. This will serve as our baseline measurement against which we will monitor the success of our project over time. As reflected in the responses from businesses and community members in our community engagement strategies detailed in Chapter 6, we anticipate that fruit and vegetable

consumption rates will increase, particularly as it pertains to the utilization of local food, given that our project will be addressing the two main barriers to fresh fruit and vegetable consumption: cost and quality.

Current fruit and vegetable import rates can be measured by:

- Communication with existing distributors
- Partnership with existing grocery stores

Accurate assessments of import reduction can be done by comparing baseline data to the ratio of locally produced to imported produce at the end of the project. These two factors provide us with an overall accurate reflection of percentage of food import and community utilization over time.

1.3 Progress towards outcomes during the finalist phase

During the finalist phase we have made the following progress towards outcomes:

- Increased community awareness of the project
- Solidified the vision with the Tri-Council
- Steps towards localizing consumables required for growing food
- Development of requirements document for software
- Laid foundations for a biometric study with the University of Manitoba
- Identified partners for our project
- Identified suppliers for all materials
- Secured real estate and preliminary designs for the smart farm
- Establishment of a governance model for the project

1.4 Reasons to be selected as winner

Our project is unique in many respects and aligns with the Smart Cities Challenge guidelines as well as other priorities for Canadians. These include:

- Tri-Council governance model – a unique model that includes Opaskwayak Cree Nation, The Town of the Pas, and the Rural Municipality of Kelsey
- Scalable and adaptable to any community in Canada – food production can adapt to population size and consumption rates and can be established within existing infrastructure; deployment of food can be adapted using a range of deployment methods
- Local food sovereignty – communities can grow food according to community preferences and scaled to meet community consumption rates
- National Food Security – reduced reliance on imported goods
- Carbon Reduction – decreased transport energy consumption
- Health care costs – reduction in hospitalizations, amputations for diabetics
- Community job creation – more northern/local employment opportunities

- Northern development – vendor agnostic modular approach
- First Nation partnership – enhanced community independence
- Multi-jurisdictional health partnerships – reduction in service delivery gaps caused by jurisdictional issues

Our project is transformative in that we are using connected technology to facilitate the growth of food, connect community members with that source of food as well as utilizing wearable technology to provide insight into the correlation between dietary choices and health outcomes.

Throughout this project, we have considered and prioritized a design that is both scalable, to accommodate future expansion as well as easily replicable in other regions of Canada to accommodate local available resources and existing infrastructure.

2 CHAPTER 2: PERFORMANCE MEASUREMENT

2.1 Project Activities and Outcomes

The overarching philosophy of this project is that increasing access to fresh fruits and vegetables, as well as promoting knowledge of the correlation between dietary choices and diabetes, is the pathway to achieving the community identified goals of decreasing diabetes rates and decreasing imported food rates. Community feedback through surveys, interviews, and conversations clearly indicates that fresh fruit and vegetables are currently inaccessible due to either excessive costs, low quality, or absence from grocery store shelves. Therefore, the activities necessary to increase access to fresh fruits and vegetables have been identified as building and operating the three critical levers introduced in Chapter 1; a Smart Farm, smartphone distribution system, and biometric feedback study. Ongoing community engagement, as described in Chapter 6, is necessary to ensure operation of these tools is efficiently and effectively achieving the desired outcomes.

The first lever that will be developed is the Smart Farm. The function of the Smart Farm is to enable, using indoor food growth technology, the year-round localization of economical fruit and vegetable production. Localization of production of these foods mitigates the transportation time and cost from the current procurement model, which are identified as key drivers of cost and early spoilage (products are 1-2 weeks old by the time they reach shelves).

The second lever that will be developed is a smartphone distribution system. The smartphone distribution system is comprised of both a smartphone application software component as well as a vehicle-based delivery service component. The function of the smartphone software application is twofold. The first function is to provide an online marketplace to enable selection of desired products, facilitate purchase, and dispatch packaging and delivery activities. The second function is to provide recipe ideas and cooking guides on community recommended applications for food products as well as community cooking events. The function of the vehicle-based delivery service is to provide direct-to-door delivery of food products so that additional barriers to accessing grocery stores, such as not owning a vehicle or having young children to care for, are overcome.

The third lever that will be developed is a biometric feedback study. This study involves the use of real-time blood sugar monitoring technology to provide feedback, to the study participant who is wearing the device, on the correlation between dietary choices and diabetes. The participant may also share this information with their primary care provider for health management support. This feedback is expected to enhance awareness of the link between diet and diabetes in the study participants, and in turn, enhance community awareness of this link. Furthermore, by partnering with the University of Manitoba, publication of the study results can further assist in enhancing awareness throughout the community.

2.2 Project Implementation: timelines, deliverables, milestones

The implementation phase of our project is constructed to have four milestones over five years. Within these four milestones, we have a list of project activities. These activities centre on the three critical levers discussed above. The implementation process for this project takes each of these three critical levers and

divides them into two stages of development: **building** and **operating**. As such, our implementation activities, outcomes and indicators capture the two stages of each of the levers: **building** of these critical levers and **operation** of the critical levers. The milestones and activities are depicted on the logic model below. They are further discussed from a project management perspective in Chapter 3 and illustrated in chronological order on the accompanying Gantt in that chapter.

2.3 Logic Model Overview

The logic model, shown in Figure 1, provides a summary overview of the activities and outcomes associated with the project. A more detailed logic model, including indicators, milestones and data sources is shown in Figure 2 on the next page. A legend, identifying the information that is conveyed on the detailed logic model is shown in Figure 3.

Table 1 includes a list of outcome indicator data sources and the data source number that is used in Figure 3.

Figure 1 summary logic model

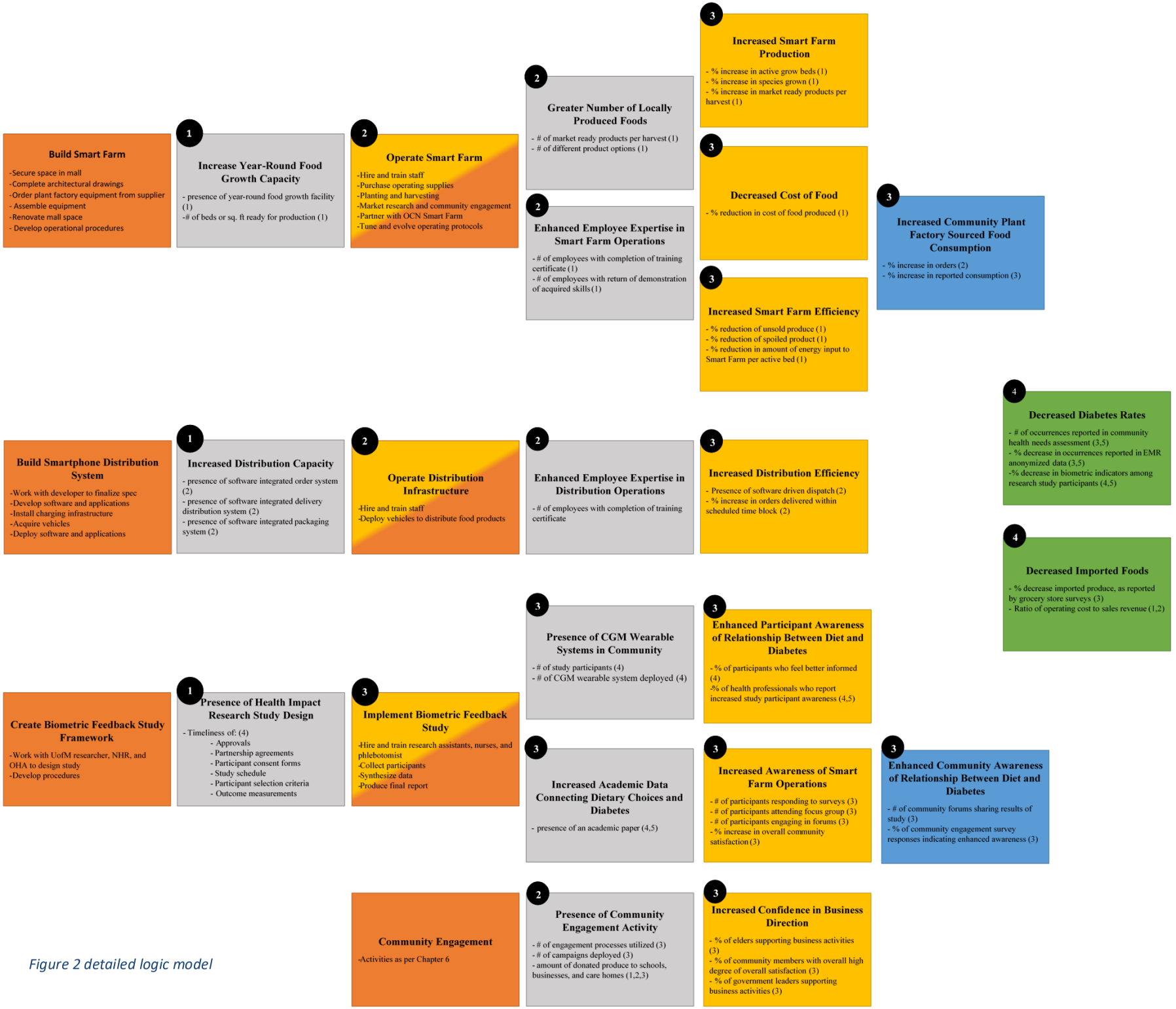


Figure 2 detailed logic model

Table 1 summary of performance indicator data sources

DATA SOURCE #	INDICATOR DATA SOURCE
1	Smart Farm operational data
2	Smartphone distribution system operational data
3	Community engagement activities (described in Chapter 6)
4	Study participant group data
5	Knowledge translation partners

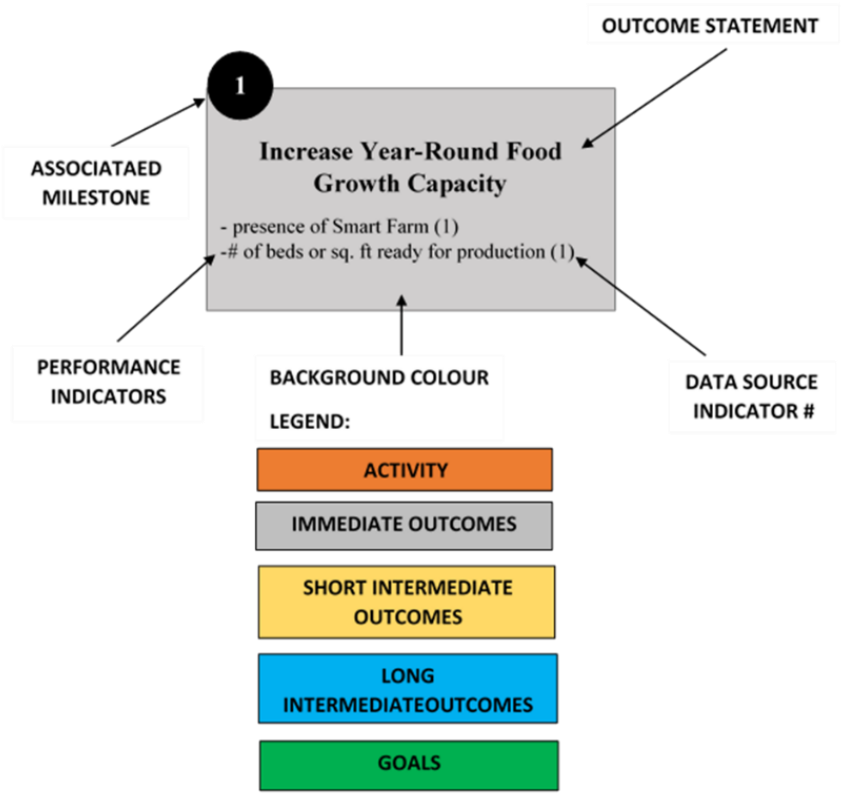


Figure 3 detailed logic model legend

2.3.1 Description Of Detailed Logic Model

MILESTONE 1:

The activities associated with achievement of MILESTONE 1 will involve:

- **Build** the Smart Farm
- **Build** the smartphone distribution system
- **Build**, or create, the biometric feedback study framework.

This phase is anticipated to take roughly 21 months as outlined in the Gantt chart.

Outcomes associated with MILESTONE 1, bulleted below, with sub-bulleted indicators, and indicator data source number as per the table above (in parenthesis), include:

- Increase year-round food growth capacity
    - Presence of year-round food growth facility (1)
    - # of beds or sq. ft ready for production (1)
- Increased distribution capacity
    - Presence of a software integrated order system (2)
    - Presence of a software integrated packaging system (2)
    - Presence of a software integrated delivery distribution system (2)
- Presence of a health impact research study design
    - Timeliness of: (4)
        - Approvals
        - Partnership agreements
        - Participant consent forms
        - Study schedule
        - Participant selection criteria
        - Outcome measurements

MILESTONE 2:

The activities associated with achievement of MILESTONE 2 will involve:

- Initiate **Operating** the Smart Farm
- Initiate **Operating** the distribution infrastructure system
- **Perform** Community Engagement activities

It is anticipated that achieving this level of operational maturity will take approximately 9 months, and with the inclusion of a 3-month allowance time for milestone report and review, this milestone is achieved at roughly month 33 of project implementation.

Outcomes associated with MILESTONE 2, with sub-bulleted indicators, and indicator data source number as per the table above (in parenthesis), include:

- Greater number of locally produced foods
    - # of market ready products per harvest (1)
    - # of different product options (1)
- Enhanced employee expertise in Smart Farm operations
    - # of employees with completion of training certificate (1)
    - # of employees with return of demonstration of acquired skills (1)
- Enhanced employee expertise in Smart Farm distribution operations
    - # of employees with completion of training certificate (1)

- Presence of community engagement activities
    - # of engagement processes utilized (3)
    - # of campaigns deployed (3)
    - Amount of donated produce to schools, businesses and care homes (1,2,3)

MILESTONE 3:

The activities associated with achievement of MILESTONE 3 will involve:

- Optimize **Operation** of the Smart Farm
- Optimize **Operation** of the smartphone distribution system
- Implementing (**operating**) the biometric feedback study
- Perform Community Engagement Activities

The primary outcome for achievement of MILESTONE 3 is the implementation of the biometric feedback study. Implementation of the study as well as synthesis of the produced data and creation of a final report is expected to take 18 months, with completion occurring at roughly month 51 of the project implementation. We are also continuing to increase production at the Smart Farm during the implementation of the biometric feedback study.

Outcomes associated with MILESTONE 3, with sub-bulleted indicators, and indicator data source number as per the table above (in parenthesis), include:

- Increased Smart Farm production
    - % increase in active grow beds (1)
    - % increase in species grown (1)
    - % increase in market ready products per harvest (1)
- Decreased cost of food
    - % reduction in cost of food produced (1)
- Increased Smart Farm Efficiency
    - % reduction in unsold produce (1)
    - % reduction of spoiled product (1)
    - % reduction in amount of energy input to Smart Farm per active bed (1)
- Increased distribution efficiency
    - Presence of software driven dispatch (2)
    - % increase in orders delivered within scheduled time block (2)
- Presence of CGM wearable systems
    - # of study participants (4)
    - # of CGM wearable systems deployed (4)
- Increased presence of academically verified data connecting dietary choices and diabetes
    - Presence of academic paper (4,5)
- Enhanced participant awareness of the relationship between diet and diabetes
    - % of participants who feel better informed (4)

- % of health professionals who report increased study participant awareness (4,5)

- Increased awareness of Smart Farm operations
  - # of participants responding to surveys (3)
  - # of participants attending focus groups (3)
  - # of participants engaging in forums (3)
  - % increase in overall community satisfaction (3)
- Increased community plant factory sourced food consumption
  - % increase in orders (2)
  - Increase in reported consumption (3)
- Enhanced community awareness of relationship between diet and diabetes
  - # of community forums sharing results of study (3)
  - % of community engagement survey responses indicating enhanced awareness (3)
- Increased confidence in business direction
  - % of elders supporting business activities (3)
  - % of community members with high degree of overall satisfaction (3)
  - % of government leadership supporting business activities (3)

MILESTONE 4:

The activities associated with achievement of MILESTONE 4 will involve:

- Collaborate with knowledge translation partners in producing reports on outcome/goal achievement indicators
- Optimize operation of the Smart Farm
- Optimize operation of the smartphone distribution system
- Perform Community Engagement activities

Working with our knowledge translation partners, the Northern Health Region, Opaskwayak Health Authority and the University of Manitoba on identified aspects of creating the final report, our expected timeline of these activities is 6 months, with expected completion occurring in five years (60 months).

Outcomes associated with MILESTONE 4, with sub-bulleted indicators, and indicator data source number as per the table above (in parenthesis), include:

- Decrease in diabetes rate
  - # of occurrences reported in community health needs assessment (3,5)
  - % decrease in occurrences reported through EMR anonymized data (3,5)
  - % decrease in biometric indicators among research study participants (4,5)
- Decrease in imported food
  - % decrease imported produce, as reported by grocery store surveys (3)
  - Ratio of operating cost to sales revenue (1,2)

This final milestone will include completion of the final report which will include information from three different sources to evaluate the impact of our project on diabetes rates in the Tri-Council region. Theses

sources include the NHR and OCN Community Health Needs Assessment reports with a comparison of diabetes rates benchmarked in 2017/18 to those in 2024, anonymized data from the EMR, and the results of the research study. Furthermore, a comparison of benchmarked community food import quantities from 2018 will be compared against those values in 2024 to determine the percent change in imported foods. Optimization of the smart farm and smartphone distribution system is anticipated to have reached a level of economic self-sustainability, where revenue from produce sold exceeds the operating costs and profits can be redirected to further improve the health of community members.

Payment Schedule and performance indicators

Achievement of each project milestone, identified above, will be associated with financial resource release from the project's funding partner, Infrastructure Canada. The milestones are again listed in Table 2 below along with reporting project outcomes used to identify achievement of the milestones.

Table 2 Payment Schedule

Project Milestone	Installment ($)	Project Outcomes Reporting Schedule
Initial	6.22 million	
1	1.11 million	➢ Increase year-round food growth capacity ➢ Increased distribution capacity ➢ Presence of a health impact research study design
2	2.41 million	➢ Greater number of locally produced foods ➢ Enhanced employee expertise in Smart Farm operations ➢ Enhanced employee expertise in distribution operations ➢ Presence of Community Engagement activity
3	0.26 million	➢ Presence of CGM wearable systems ➢ Increased academic data connecting dietary choices and diabetes ➢ Increased Smart Farm production ➢ Decreased cost of food ➢ Increased Smart Farm efficiency ➢ Increased distribution efficiency ➢ Enhanced participant awareness of the relationship between diet and diabetes ➢ Increased awareness of Smart Farm operations ➢ Increased confidence in business direction ➢ Increased plant factory sourced food consumption ➢ Enhanced community awareness between diet and diabetes
4		➢ Decrease in diabetes rate ➢ Decrease in imported food

2.4 Risk Identification and Mitigation

One of the main risks associated with any strategy for impacting health outcomes is that the ownness for action lies with the individual. The three-lever approach presented in this project is designed to efficiently remove as many barriers as possible between community members and fresh fruits and vegetables with the goal of decreasing diabetes rates and decreasing imported foods. However, the assumption then is that each of the three levers are operational. Therefore, risk mitigation must extend into operation of each of the three levers. These risks are identified and presented with mitigation strategies in Chapter 1.

The Smart Farm, just like any other farm, has inherent risks such as pests or farmer error such as inappropriate nutrient supply or premature/late harvest. There is likely to be a learning curve that, throughout the first year or so of operation, results in some degree of crop failure. Mitigating measures include partnership with the OCN pilot Smart Farm in order to acquire as much knowledge from local experts as possible, thereby increasing the probability of success. Furthermore, segregation of vertical farming beds into quarantine or containment rooms to minimize the spread of pests, should they arise, and the use of air showers at entrances to ensure no foreign species are introduced can also minimize the risk of pests.

Software solutions are powerful in their ability to reach many people, but also present risks. The use of a smartphone application to facilitate online ordering of fresh food products presents the risk of excluding those who are less familiar with technology, or do not own a smartphone, from participating in the purchase of goods. In order to mitigate this issue, the ordering platform will also be accessible through a web browser, or orders can be placed in person at the Smart Farm location in the local mall. Furthermore, although direct-to-door delivery is designed to be the primary dispatch pathway, the Smart Farm is also intending on working with local grocery stores to make products available through the more conventional distribution pathways.

Offering a direct-to-door delivery service is risky due to the potential unreliability of vehicles, weather conditions, and variable costs associated with vehicle maintenance. In order to mitigate these risks, electric vehicles have been selected as the desirable platform for performing delivery. These vehicles have a significantly lower operating cost and decreased maintenance requirements. Cold weather driving range of electric vehicles is the primary drawback. In order to overcome this issue, installation of level 3 charging stations which can recharge an electric vehicle in as little as 15-20 minutes will be installed both at the Smart Farm and at the furthest operational location; Kelsey's Cranberry Portage. Secondly, by selecting a vehicle that has a suitably large battery back, the deteriorated cold weather range can be managed.

The biometric feedback study is intended to serve two purposes; provide an opportunity to showcase the effects of fresh produce on diabetes indicators in an academic setting, and to nucleate first hand community knowledge of the correlation between dietary choices and diabetes using real-time blood sugar monitoring technology. As with any study, participant drop-out is a risk to the integrity of the study (too few study subjects indicate the study is not statistically significant). Two measures have been considered to deal with this; providing a financial incentive for study participation as well as increasing the study design size so that if some participants drop out, the study does not become invalidated. The second risk that has

been identified is the participants emotional response to being presented with their body's real-time blood sugar data. Stress and frustration are possible outcomes that may arise with this data. In order to address these risks, the study will be designed to occur in a series of small groups that include several study participants, a nurse and a dietician. This design is anticipated to offer the required support throughout the study process.

3 CHAPTER 3: PROJECT MANAGEMENT

The scope of this project includes the development and operation of the three critical levers; Smart Farm technology, smartphone distribution system, and biometric feedback study. Operation of each of these business units is required in order to successfully leverage the desired community outcomes; achieve a decrease in imported fruits and vegetables and a decrease in diabetes rates.

It is important to bring each one of these business units to an operational state at the correct time and in the correct order to ensure both economical and effective project execution. The project work breakdown structure (WBS), which identified tasks associated with each activity, their resource type, duration, and predecessor, is presented in Figure 4 at the end of this chapter. Each task in the WBS is identified with a unique WBS#. These numbers are then called out in predecessor column to identify the tasks which must be completed prior to the task in that row; its predecessor task. The information contained in the WBS is presented in graphical form through the Gantt chart show in Figure 5 at the end of this chapter. The Gantt chart also illustrates the project's critical path. The critical path is defined as the shortest possible sequence of activities that achieves completion of an activity or project, considering duration and predecessor tasks. Financial milestones are overlaid on the Gantt chart to identify corelating trigger points for progress reporting (red diamonds) and subsequent funding installation release dates (green diamonds).

The project management critical path for this project is defined by 4 activities corelating to Chapter 2:

1. Build the plant factory
2. Initiate operation of the plant factory
3. Perform the biometric feedback study with community members
4. Distribute fresh food products to the community while tuning operational protocols to increase efficiency

Each of these four major activities can be broken down into tasks, some of which are serial and some of which are parallelizable. Scheduling of tasks must prioritize serial tasks on the critical path while ensuring timely completion of parallel non-critical path tasks.

Smart Farm operation and smartphone distribution system operation can be thought of as two pillars that support operation of the biometric feedback study; the biometric feedback study requires products from the plant factory to be delivered through the smartphone distribution system to participants to produce measurable biometric effects.

There are four categories of resources that are required in the development of this project:

1. Material
    a. Standard building materials (for example lumber, ventilation, electrical, etc)
    b. Real-estate (space to house the plant factory)
    c. Vehicles and supporting charging infrastructure
    d. Plant factory equipment (vertical farm, refrigerators, computers)
    e. Continuous Glucose Monitoring devices

2. Contract labour
    a. Project coordinator / manager
    b. Engineer/architect
    c. Construction contractor for plant factory renovations
    d. Software developers / maintenance experts
    e. Nurse / researchers for biometric feedback study implementation
3. Operation labour
    a. Plant factory manager / supervisor / seeders / harvesters
    b. Delivery drivers
    c. Bookkeeper
4. Financial

One of the primary goals throughout the design of this project has been to maintain a vendor agnostic design so that this project can be replicated in any geographic location without being hindered by dependency on a particular supplier. Furthermore, this design serves to de-risk schedule delays and cost overruns that can arise with sole service / material providers.

3.1 Impacts on Stakeholders

The following list identifies the stakeholders that are impacted by our project or conversely, impact our project. We have also identified these groups in our engagement strategy in Chapter 6. Characteristics that make each of these stakeholders unique are:

1. Community members
    - Community members are the primary stakeholders in this project as its success impacts their access to more fresh fruit and vegetables options and thus may impact their health over time. Additionally, there will be employment opportunities created at the Smart Farm.
2. Businesses
    - Opportunity for synergies and supply of local fresh produce for their own enterprises.
3. Schools/youth
    - Opportunity for lunch program options, employment, and influencing family choices.
4. Citizens with disabilities
    - Increase access through direct to door delivery, food choice options
5. Elders/seniors
    - Increase access through direct to door delivery, food choice options, education
6. Government leadership
    - Increased community health, business opportunities, funding synergies, electorate satisfaction
7. Health partners
    - Health professionals can provide nutrition counselling to patients, knowing that there is access to healthy foods - a criteria for treatment of many chronic diseases including diabetes; data collection to support practice

Response to feedback from these stakeholders is paramount in ensuring success of the project. Feedback is anticipated to come in the form of monitoring the relative popularity of the various food products, customer feedback via delivery driver interactions, surveys, and other forms of community engagement as outlined in Chapter 6.

3.2 Long-term Sustainability Considerations

The five-year project through Smart Cities Challenge is viewed as an incubator period, during which time external financial resources are leveraged to build capital assets, the Smart Farm and smartphone distribution system, and establish a sustainable business for long term operation and community impact. Upon commencing food production and distribution, it will be necessary to establish:

a) suitable pricing models that make these products more widely available

b) high value export markets in the form of product contracts to support revenue

c) administrative protocols that are efficient and effective

d) community awareness of the dietary decisions on health outcomes to promote increased community health

Following completion of the biometric feedback study, the three remaining business units will continue tuning these four variables with the goal of achieving financial self-sustainability so as to ensure the goals of decreased fruit and vegetable imports and decreased diabetes rates are sustained beyond the five-year lifecycle of the project.

3.3 Risk Identification and Mitigation

Except for the CGM devices, of which there is presently only one Health Canada certified device available, the Dexcom G5, the material resources required for this project can be provided from many different vendors. There are presently two known additional companies working to bring Continuous Glucose Monitoring devices to the Canadian market. Given that these devices are not required until partway through year 2 (approximately fall 2021) as outlined in Chapter 2, there may be alternative hardware available on the market by then. Furthermore, although much less insightful as to the relationship between dietary choices and diabetes indicators, point measurement blood sugar monitoring technology is readily available and could be performed more frequently amongst study members of the biometric feedback study.

Contract labour is used for those tasks which are not part of the ongoing operation of the plant factory. All tasks to be assigned to contract labour require specialized skills but are not locked in to any particular vendor. Construction contractors, nurses and researchers, as well as project coordinators are available either locally or within Manitoba. Some software developers are available in Manitoba, but these services may be solicited from elsewhere in Canada based on project scheduling.

Operational labour is readily available within the tri-community. Several of the OCN community members responsible for operation of the Smart Farm pilot project are already skilled with the operation of the Smart

Farm technology and are acting as partners in the project to provide required training and knowledge transfer to the incoming staff.

The two greatest risks of the project are expanding lead times and cost over-runs related to resource procurement.

We have mitigated risks related to **procurement** through the preparation of requirements documents in advance during the finalist phase of the project, which were used to acquire more accurate quotes and lead times from several potential suppliers. Furthermore, many of the required material resources for this project are off-the-shelf items, for which quotes and lead times have also been secured. Consequently, the assignment of resources, human resources, material resources and financial resources, has been performed with a high degree of confidence. Further discussion on the financial resources required are discussed in Chapter 8.

The project schedule, as outlined in the Gantt chart below, is a comfortable, yet aggressive timeline identifying a step-by-step approach to timely project completion. Should resource procurement timelines slip, mitigating actions such as re-sourcing resource procurement or increasing labour resources will be taken to bring the project back on schedule. Financial resources have been assigned with a buffer in order to facilitate these types of de-risking measures. A dedicated project manager that monitors project progress is necessary to identify risks, should they arise, and take the required remedial action.

Procurement of materials and contract labour will generally be performed following acquisition of three quotes for materials that meet the project requirements and selection of the quote that offers the best combination of economy and lead time (de-risking schedule delays through selection of higher cost, lower lead time equipment may be desired as project delays also carry an embedded cost). Exceptions to this system are anticipated in those instances, such as real-estate, where selection will be performed based on greatest value add to the project and necessary duty to consult.

WBS #	Task Description	Resource Type	Duration (months)	Predecessor(s)
	Financial Milestones			
1	Installment 1			
1.1	Receive Installment 1			
1.2	Progress Report 1 writing		0.5	5 7 9
1.3	Progress Report 1 Review GC		2.5	1.2
2	Installment 2			
2.1	Receive Installment 2			1.3
2.2	Progress Report 2 writing		0.5	6.6 8.3 (approx. 10% completion)
2.3	Progress Report 2 Review GC		2.5	2.2
3	Installment 3			
3.1	Receive Installment 3			2.3
3.2	Progress Report 3 writing		0.5	10.8
3.3	Progress Report 3 Review GC		2.5	3.2
4	Installment 4			
4.1	Receive Installment 4			3.3
4.2	Write final report		0.5	11.4
4.3	Submit final report for GC review		2.5	4.2
	Smart Farm Activities			
5	Build Smart Farm		19	
5.1	Secure space in Otineka mall	1	0.5	1.1
5.2	Work with architect/engineer to complete drawings	2	1	5.1
5.3	Order Smart Farm equipment from supplier	1	15	5.2
5.4	Assembly / Installation of Smart Farm	2	3	5.3
5.5	Renovations (Space preaparation)		17.5	
5.5.1	Hire general contractor	2	0.5	1.1
5.5.2	Order renovation materials, vacuum system, and fixtures	1	6	5.5.1
5.5.3	Build walls, install electrical, install fixtures	2	6	5.5.2
5.5.4	Order office equipment, harvesting carts, packing station	1	1	5.5.3
5.5.5	Setup Office space, carts, packing stations, staff room	2	4	5.5.4
6.1	Operate Smart Farm			
6.2	Hire custodian, planting staff	3	2	2.1
6.3	Staff training	2,3	2	6.2
6.4	Purchase cleaning supplies, mops, buckets, paper towel	1,3	1.5	2.1
6.5	Purchase seeds, rafts, sponges, etc	1,2	1.5	2.1
6.6	Planting and Harvesting	1,3	34	6.5
6.7	Partner with OCN Plant Factory to develop new protocols	2,3	33	6.6
6.8	Tune and evolve operating protocols	2,3	32	6.6
	Smartphone Distribution Infrastructure Activities			
7	Build Smartphone Distribution Infrastructure			
7.1	Setup contract with software company	2	0.25	1.1
7.2	Formulate complete specifications document	2	1.25	7.1
7.3	Programming	2	6	7.2
7.4	Acceptance testing	2	1	7.3
7.5	Deployment to server and tablets	1,2	2	7.4 5.5.5
7.6	Order charging stations, cable, and transformers	1,2	3	1.1
7.7	Install charging stations	1,2	2	7.6 5.1
7.8	Purchase 2 vehicles	1,2	6	1.1
8	Operate Smartphone Distribution Infrastructure			
8.1	Hire 2 drivers	2,3	1	2.1
8.2	Driver Training	2,3	1	8.1
8.3	Active product distribution	3	33	8.2 6.6 7.5
8.4	Purchase 2 additional vehicles	1,3	6	6.8
8.5	Hire 2 additional drivers	1,3	1	8.4
8.6	Driver Training	3	1	8.5
	Biometric Study Activities			
9	Create Biometric Feedback Study Framework			
9.1	Work with UofM, NHR, and OHA to design study	2	4	
9.2	Develop required procedures, forms and schedules	2	8	9.1
10	Implement Biometric Feedback Study			
10.1	Provide research contribution to partners	2	0.25	3.1
10.2	Collect study participants	2	1	9.2 3.1
10.3	Hire nurse(s) and phlebotomist	2	1.25	3.1
10.4	Order Continuous Glucose Monitoring equipment	1,2	1	3.1 9.2
10.5	Train nurse(s) on study requirements	2	1	10.3
10.6	Run study	2	13	10.5 10.4 10.2 10.1 8.3 6.6
10.7	Synthesize data	2	8	10.6
10.8	Produce final report	2	5	10.7
	General Activities			
11	Work with knowledge translation partners			
11.1	Establish partnership agreements with UofM, NHR, and OHA	2	1	
11.2	Uofm, NHR, OHA on study needs integration	2	18	11.1 10.6 4.1
11.3	NHR and OHA on Health Needs Assessment	2	4	10.6 4.1
11.4	Final report creation	2	4	11.3
12	Community Engagement			
12.1	Social media campaign to promote awareness of Smart Farm	3	6	2.1
12.2	Biometric feedback study entry/exit surveys	3	13	10.6
12.3	Survey 1 to community members on satisfaction	3	1	3.1
12.4	Survey 2 to community members on satisfaction	3	1	6.8 8.6
12.5	Facilitate periodic community cooking classes	3	27	3.1

Figure 4 work breakdown structure

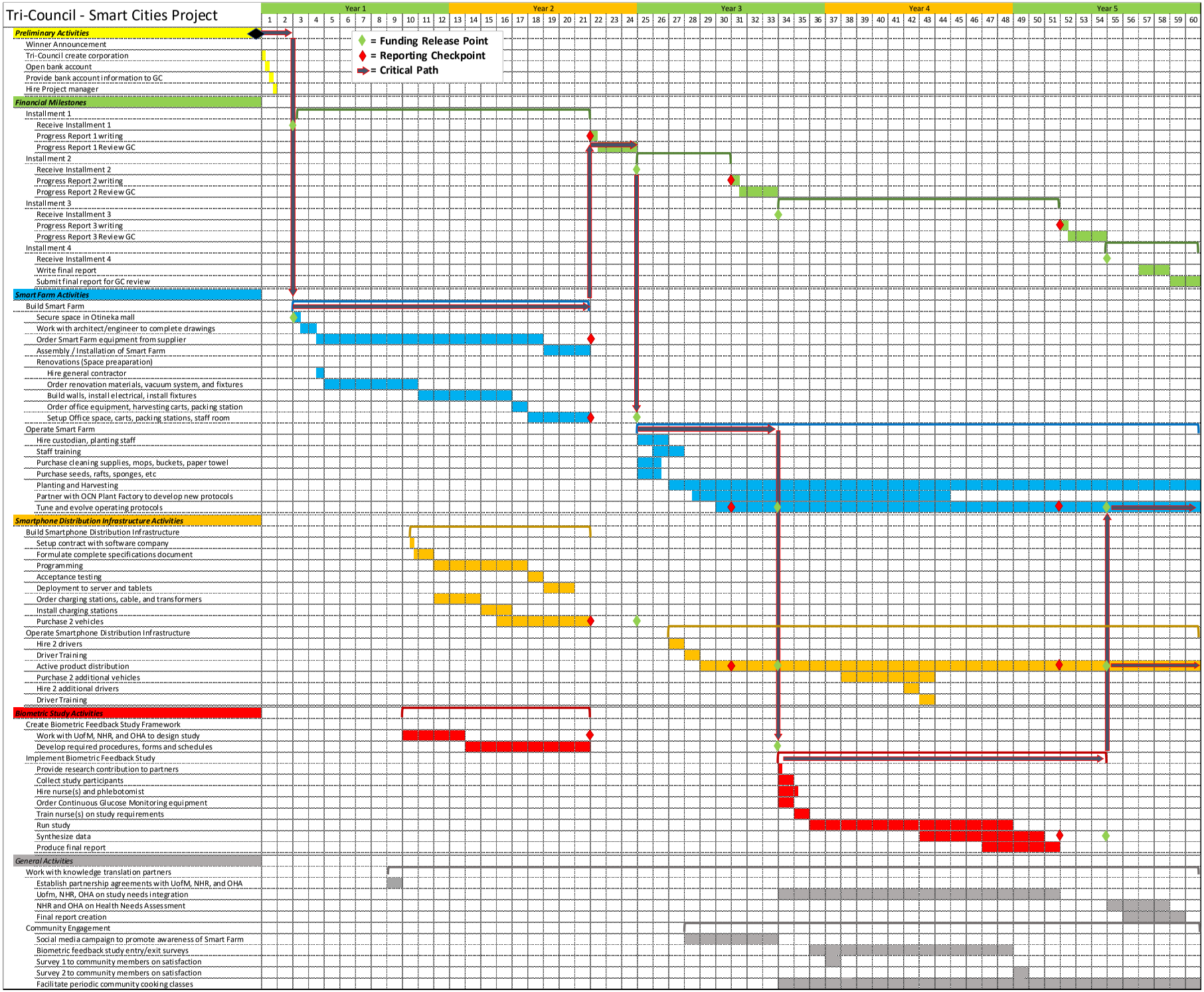


Figure 5 project Gantt chart

4 CHAPTER 4: TECHNOLOGY

Development of internet connected smart devices has grown exponentially over the past 5-10 years. The impact of this development has revolutionized many industries by providing technology solutions to overcome barriers that were otherwise insurmountable. This project will leverage several of these powerful, cutting edge technologies to address the challenges identified by our community.

Technologies leveraged by this project, further described below, include Smart Farm technology, a smartphone distribution system, and wearable biometric feedback devices.

A Smart Farm is the merger of vertical farming and the internet of things (IOT) connected technology, combined with cutting edge LED lighting control algorithms used for the year-round cultivation of food.

A smartphone distribution system connects community members with the Smart Farm and its products by leveraging the combination of an online marketplace smartphone application for the placement of orders, and a direct-to-door delivery system that utilizes electric vehicle powered distribution infrastructure to complete orders cultivated and packaged at the Smart Farm.

Wearable biometric feedback devices, specifically continuous glucose monitoring devices, provide a real-time window into the wearers blood sugar levels as well as a data logging solution so that this information can be shared with healthcare providers.

These technologies work together to provide a complete system which provides both the tools and feedback systems to improved health outcomes and local food security to the community. These technologies have been selected as they are familiar and have each been previously demonstrated to be effective at achieving their desired outcomes. A diagram illustrating the connection between each of the technologies used in this system and their location in the overall system operation is shown at the end of this chapter in Figure 6 below.

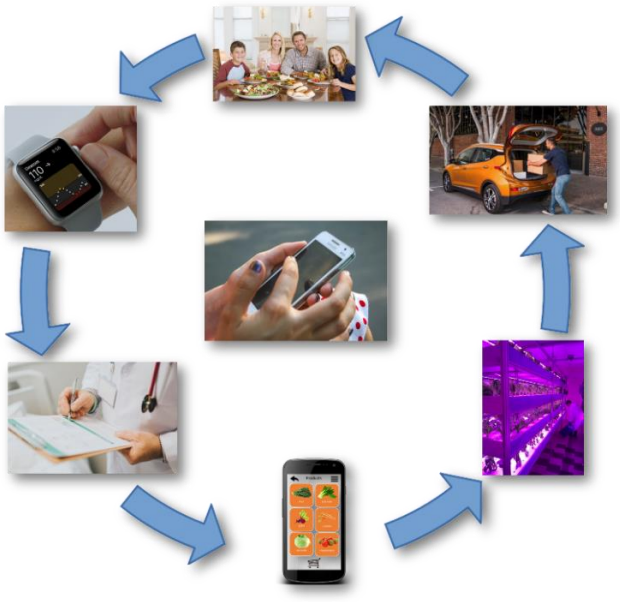


Figure 6 system flow diagram

4.1 Replicability and Scalability

Although certain suppliers have been selected for the execution of this project based on the particular geography of this project site, their availability, price, and the established business relationships of the community, it should be clear that the framework laid out in this project, namely food production, food distribution, food ordering interface, and biometric feedback, are technology agnostic; many different types of technology can be used to fill the function of each block. This allows for utilization of alternative suppliers or technological approaches, depending on the availability and requirements for deployment of this project to other locations in Canada. This ensures that the project is both replicable and scalable. For example, the use of electric cars is recommended for this project; however, any vehicle ranging from conventional cars to drones to hovercrafts to helicopter could be used if this technology was more suitable for operation in another geographical region. Similarly, the Smart Farm technology supplier has been selected from Korea based on a multi-year business relationship that has previously been established with OCN and the fact that many staff are already quite familiar with this system. However, any vertical farm technology from an alternative supplier, and even similar technologies such as aquaponic systems, could be substituted for this role; so long as they facilitate year-round food growth.

4.2 Detailed Discussion

4.2.1 Smart Vertical Farm

Vertical farming technology leverages hydroponic technology, combined with "bunk-bed" style layered grow beds, to increase food growth capacity per unit area of indoor floor space. Hydroponic technology, the practice of growing plants without the use of soil, has been practiced in various forms since the early 1600's. OCN, in partnership with the Korean Agricultural Systems and Technology (KAST), installed one of KAST's Smart Farms as part of a demonstration project that commenced in 2016. The Smart Farm, or more generally a vertical farm, has successfully demonstrated the ability to produce 98 different species of plants ranging from leafy greens and herbs to calorie dense root vegetables and fruit. Demonstrating the ability of an agricultural technology's ability to grow calorie dense vegetables and fruits year-round is critical to address issues of food security in Northern Canada.

KAST is one supplier amongst a multitude of suppliers for vertical farming hydroponic equipment, so procurement from this supplier is not critical for project success. However, KAST has poured extensive research into development of their now patented lighting control system which increases energy efficiency while accelerating plant growth.

The KAST Smart Farm technology is far from experimental. KAST has deployed system that are successfully operating all over the world, with key markets including Japan, China, Korea, and USA.

Through implementation of the demonstration project, KAST was required to establish cUL certifications for all their equipment to ensure its conformance with electrical safety standards in Canada. This was successfully established and now they are fully prepared to provide equipment for this project and more projects into the future. There are no regulations surrounding the use of vertical farming technology for the cultivation of food; however safe food handling regulations will need to be followed and periodic

testing will be required to ensure quality of the plants. Clean and safe work environment practices will also need to be followed to ensure staff and customer safety. As part of the demonstration project in OCN, all staff have received safe food handling certification, a practice which will continue on to new staff throughout this project, supported by the management staff of OCN's Smart Farm pilot project.

All seeders, harvesters, and packagers will be trained on the operation and maintenance of the equipment as required. Only trained staff will be permitted to operate or become involved in the Smart Farm operations. This will ensure contamination free high-quality product.

One of the risks to using foreign technology is bottlenecks in the supply chain for consumable items. This has already been experienced through the demonstration project and local suppliers are being sought out to mitigate future supply chain issues. Since the Smart Farm is remotely controllable, another risk could be remote high jacking of the control systems. This is primarily mitigated through the use of encrypted communication protocols and high security login credentials.

4.2.2 Smartphone Distribution System

4.2.2.1 Smartphone Distribution - Software

Online marketplaces have been growing in popularity over the last decade because they are easily accessible to a large group of people (those with smartphones or a computer), they minimize the requirement for a bricks and mortar location for the business, and they are deployable over a much larger customer area. Online banking is an example of how a software application has revolutionized rural locations. Prior to the development of smartphones, it was necessary to travel, sometimes hundreds of kilometers, to deposit a cheque or transfer funds. Online banking, accessible through the smartphone application interface, has made it possible to perform these tasks quickly, regardless of geographic location.

A smartphone ordering application will be used to connect community residents with products from the Smart Farm by providing an online marketplace where users can see available products and order those products for delivery to their door. To ensure community members are provided with up to date product information, regular updates will be required by the Smart Farm manager to ensure the products available so that they are reflected in the online storefront.

Customers can view these items through the ordering application and select which items they would like to purchase. Accompanying the available products display will be a list of recipe suggestions for that particular product. Selecting a recipe will provide a list of required ingredients with the option of filling the shopping cart with all of the items offered by the Smart Farm that are required for that particular recipe. Alternatively, browsing can be done by recipe. Selecting a recipe will display the required ingredients, and, again, the option to fill the shopping cart with products available from the Smart Farm will be available. Through the customer application, there will also be an option for viewing order history and account information.

Drivers will also have an application interface that shows the delivery destination and the order number that needs to be dropped off at that particular address. This will ensure the driver brings the correct package to the correct destination.

Like any online store, there will be a requirement for a central product database to store product information as well as account information of users. Minimizing the amount of information that is stored for each customer is step one. Secondly, security will be maintained using standard SSL encryption techniques on all communications as well as encryption of the data on the server. Payment processing will certainly be a required task for this software solutions, so a secure eCommerce platform such as Magneto, an industry standard Adobe product, will be used. Although the majority of Canadians carry at least one credit card, there are still individuals who do not prefer to own a credit card or use if for online shopping purposes. Therefore, one of the other features that will be incorporated into the smartphone ordering application will be the ability to carry an account balance that can be recharged using cash at the Smart Farm. Privacy considerations for the commercial activity of the Smart Farm fall under the authority of the Office of the Privacy Commissioner of Canada (OPC) and specifically the Privacy Information Protection and Electronic Documents Act (PIPEDA) that is discussed further in Chapter 7. Upon implementation of this project, we will work closes with OPC to ensure that we comply with all necessary legislation and privacy considerations.

Compatibility of the smartphone application will comply with iOS and android operating system standards so as to ensure that, regardless of a user's desired platform, this service will be accessible. Furthermore, updates will be made available as needed to ensure customer feedback can be incorporated into the operation of the software, and that compatibility with future operating systems is supported. Making the application available in the Android Play Store and the Apple App Store will ensure that it is easily distributed to anyone in the community, and with potential future expansion of the distribution infrastructure, scaling services into additional communities can happen seamlessly.

The vertical farm requires several consumable items for its operation and securing a timely supply of those consumables is critical for de-risking successful ongoing operation of the vertical Smart Farm. These include Styrofoam rafts for floating the plants above the nutrient rich water, nutrients for mixing with the water, and foam cubes for germination of the seeds. As the demonstration project between OCN and KAST has progressed, it has been identified that there are often delays when procuring these items from Korea and so local suppliers are currently being sought out.

4.2.2.2 Smartphone Distribution - Vehicles

There are several technologies included with the electric vehicle distribution system including electric vehicles and electric vehicle charging stations. As with each of the four portions of this project, the particular vehicle which is selected is not overly critical for success of the project; although suitable size and range are certainly considerations for effective completion of tasks.

Electric vehicles have been gaining popularity around the world due to their decreased operating cost, zero emission characteristic, and decreased maintenance cost over their liquid fuel powered predecessors. As battery technology advances, the range that an electric vehicle can travel is ever increasing which makes these vehicles increasingly viable for more people living in Canada's sparsely populated Northern regions. Consideration of these characteristics provided the foundation for exploration of the viability of electric vehicles for this project.

The RM of Kelsey's Cranberry Portage is located 80km North of OCN and The Pas. In order to complete a round trip, it was established that a minimum range of 160km with a 30% margin was needed as a minimum; 200km range. Furthermore, since battery chemistry yields decreased energy delivery at cold temperature, accounting for an additional 50% range reduction was determined to be required in order to ensure that 200km could be travelled in cold weather. This left two currently available vehicles as options, the Tesla Model 3 or the Chevrolet Bolt. Based on many Canadian owner reports of cold weather performance, the Chevrolet Bolt will lose up to half of its range when operating below -30C, which means a range of roughly 190 km. In order to further de-risk the possibility of running out of energy on the highway, a rapid electric vehicle charging station will also be placed in Cranberry Portage so that recharging can take place before returning to the Smart Farm.

Installation of 50kw+ rapid DC electric vehicle stations (Level 3 charging stations) are required in Canada in order to enable inter-city and rural travel. Given the 600km journey from The Pas to Winnipeg, and that the best electric vehicles have a range of 400-500km per charge, there is still a requirement for rapid reenergization of vehicles. By contrast to Level 2 recharging stations which are commonly installed for around $2,500 and will recharge an electric vehicle in 6-9 hours, a Level 3 charging station costs roughly $50,000 and enables vehicle recharging in 15-30 minutes; this is currently the only path forward for Canadian highways and rural destinations.

There are several manufacturers of level 3 charging stations around North America and they all offer CSA and/or cUL compliance and compatibility with the two universal charging connector standards; CCS1 and CHAdeMO. One of the leading Canadian suppliers for this technology is a company called FLO which is located in Quebec. FLO offers charging stations that are unparalleled in their cold climate functionality and tolerance, and are also partners with the US giant Chargepoint, which means they have a reciprocal agreement for payment account usage at stations. Use of FLO or Chargepoint hardware is not required for recharging functionality, but since they are leaders in charge station location software and payment logistics, it makes reasonable sense to work with them.

One of the leading electric vehicle manufacturers today is Tesla Motors. Tesla has designed and is deploying their own proprietary supercharger stations which accomplish a similar rapid recharging function as the Level 3 chargers, however Tesla vehicles also use a proprietary connector for interfacing their cars. In order to increase adoption rates of Tesla vehicles by making them more universally usable, Tesla provides an adapter to their proprietary connector which enables compatibility with the CHAdeMO connector. There is no reciprocal connector, however, which would enable a non-Tesla electric vehicle to charge at a Tesla supercharging station. With this in mind, a Level 3 charging station with the universal CCS1 and CHAdeMO connectors ensures compatibility with all future electric vehicles.

Electric vehicle charging stations do not operate in the same way as conventional fuelling stations insofar as an attendant and cashier are waiting to take your payment. Electric vehicle stations operate more like the cardlock system used for long distance trucking organizations, where fueling is done in a self-serve manner and payment is done by card at an unattended kiosk. One of the advantages to this system is that there is

no labour cost to operation of the system so installation of these Level 3 provides a benefit to not only the Smart Farm distribution fleet, but also the community at large with no additional cost to Smart Farm.

4.2.3 Biometric Feedback System

Continuous glucose monitoring (CGM) technology is a wearable device that samples blood glucose continuously throughout the day and provides real-time feedback to the person wearing the device. There is one company currently operating in Canada called Dexcom that provides this CGM device. This device uses a very small subcutaneous needle to monitor glucose levels of the wearer. The device that Dexcom provides also houses a Bluetooth transmitter so that the readings from the glucose sensor can be broadcast to the smartphone of the user for real-time display. The user can then establish correlations between dietary habits and blood glucose levels, choose to optionally share their data with family and friends, or choose to share their data with a healthcare provider for greater insight into their health and health care requirements.

Dexcom G5 CGM devices are currently used successfully by patients all over the world. The Dexcom G5 device became available in Canada in 2016 after certifying that it complied with all required regulations. In 2018, Health Quality Ontario released a report indicating it is strongly in favour of publicly funding the use of CGM devices for those with severe diabetes since the results are very positive. Although Dexcom is currently the only CGM device available in the Canadian market, there are several other companies including PKVitality and Medtronic that promise CGM devices to become available in the coming year or two.

The scope of this project's use of CGM devices is for the monitoring of a study group to assist in increasing community knowledge by providing real-time feedback on the correlation between dietary choices and biometric parameters. As such, training on the device use will be provided by health care professionals to ensure individuals feel secure on the proper use and operation of the device. Individuals in the study group sign a consent form indicating that they choose to share data collected via the CGM device with their health care providers. As per the provincial legislated authority, the Personal Health Information Act (PHIA), the personal health information of the study participant will be maintained in a confidential manner. We have met with the provincial Ombudsman in Manitoba and have discussed, in Chapter 7, our review of this legislation and the necessary steps we will take during the implementation phase to comply with all legislative and regulatory requirements.

One of the risks of using this type of technology is that by providing new information to the study group participants, these individuals may become anxious or overwhelmed. Meetings with health care providers and learning circles, provided at the health centre, provide opportunity for study group participants to receive support throughout this process.

4.3 Purpose for Using Technology

Local production of food using vertical farming technology is seen as an excellent approach to making high quality fresh produce available year-round since it removes the requirement for international trucking to

connect farms located in the southern US, Mexico, Central America, and other various tropical destinations with communities in Northern Canada. This means that food produce:

- Is fresh, as it can be consumed on the same day it is harvested
- Cost has a decreased dependence on liquid fuel and other transport costs
- Security is less dependent on international trade politics, and
- Availability is not impacted by weather and road conditions

The main barrier to year-round food production in Canada is the sub-zero climate. This is experienced for over half the year depending on location; The Pas, OCN, and Kelsey can experience sub-zero temperatures from early October through late April. Vertical farming technology enables local year-round growth of fruits and vegetables regardless of the outdoor climate.

Vertical farming systems are manufactured all over the world, with maturities ranging from home built to commercial grade. OCN, in collaboration with the Korean Agricultural Science and Technology organization (KAST), a Korean manufacturer of advanced commercial vertical farming technology, commissioned a pilot project to demonstrate the effectiveness of KAST's vertical farming technology in Canada. The project was initiated in 2015 and has successfully demonstrated the ability to grow 75 varieties of various fruit and vegetable species.

KAST's vertical farming technology leverages a unique lighting control system to accelerate plant growth. It is claimed that this control system provides accelerated plant growth over competitor lighting systems. While this is a challenging claim to prove or refute, KAST's vertical farm technology has become familiar to many of the community members in OCN, The Pas, and Kelsey, and the established business relationship is valued by community leaders.

One of the shortcomings that has been identified with many other hydroponic systems that have operated in Northern Canada is that they primarily produce leafy greens and low-calorie products. The demonstration project plant factory that was installed by OCN in 2015 has successfully demonstrated the ability to grow high calorie vegetables such as beets, radishes, kohlrabi, cabbage, broccoli, cauliflower, and carrots. The ability to grow high calorie vegetables with this system proves its viability as a Northern Canadian food security solution.

5 CHAPTER 5: GOVERNANCE

As per our challenge statement, we as the Tri-Council entered the Smart Cities Challenge for the purpose of the health and well being of the community. This goal has led us to determine that the appropriate governance model for the project is a not for profit corporate structure. To this end, each of the three governments has signed a council resolution in which they agreed to proceed jointly in this manner and to create a Board of Directors for the not for profit entity which will see equal representation from each of their respective governments, as depicted on the Figure 7 below.

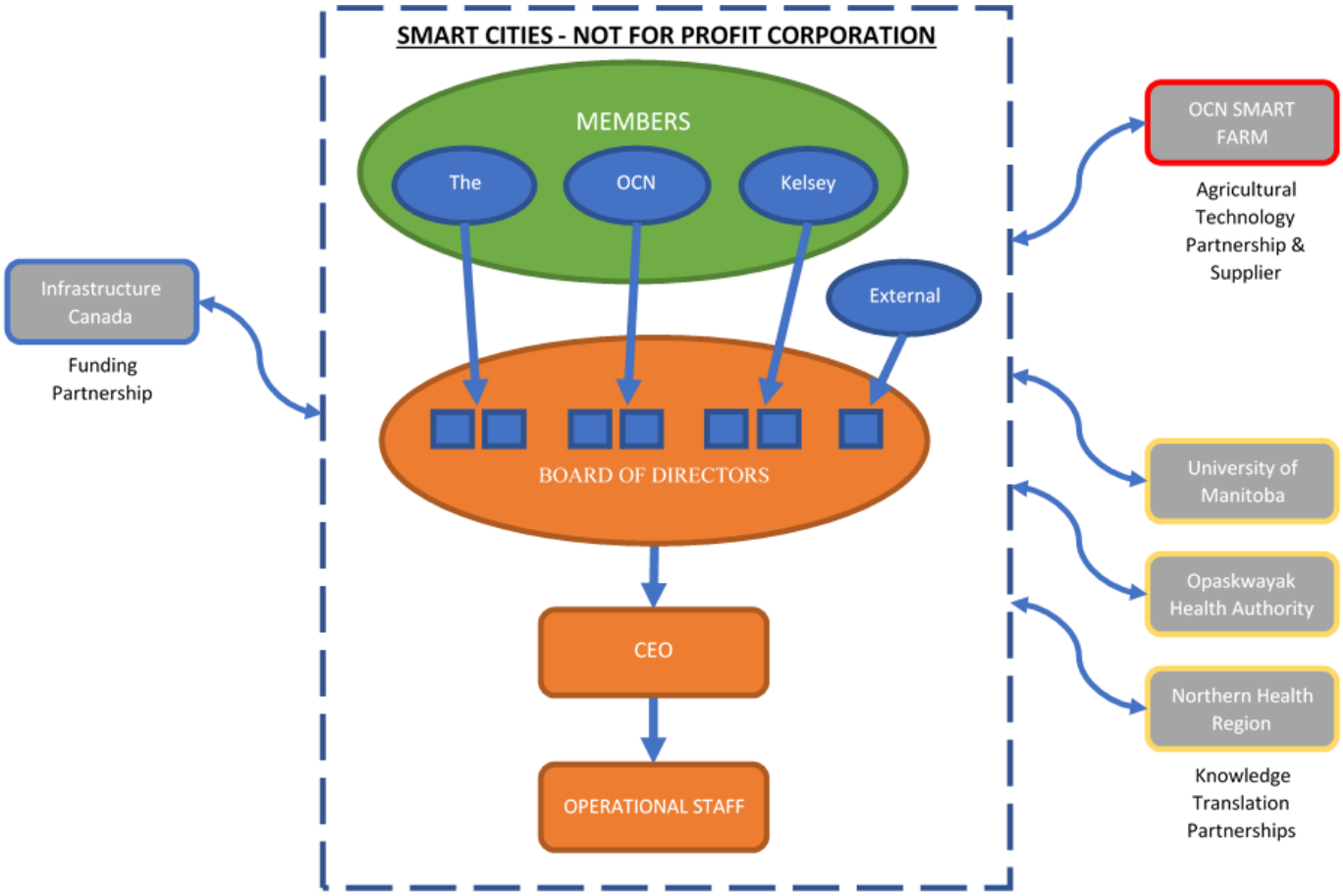


Figure 7 not-for-profit corporate structure diagram

Our not-for-profit corporation will be established under the auspices of The Corporations Act (Manitoba). Figure 7 above depicts our structural organization. In green, we have our membership which will be comprised of the elected officials that make up the three government bodies of the Tri-Council. Each of these governments appoints two representatives to the Board of Directors which will also have an external member, appointed jointly by the Tri-Council. The Board of Directors is responsible for hiring the CEO to provide operational management to the business as per this proposal and oversight to the operational staff working in the business.

The diagram also depicts our partners, colored differently to denote that they have different functions as partners. Our partners include:

- Infrastructure Canada, the **funding partnership** who will release funds as per our outcomes-based agreement and to whom the Board will provide ongoing reports as required
- Opaskwayak Cree Nation LED Smart Farm, is the **agricultural technology partnership**, providing knowledge, training and ongoing technological advancements to the vertical smart farm as well as the supplier of the smart farm technology.
- University of Manitoba and the Northern Health Region, the **knowledge translation partnerships**, work with us to move our research and data into the hands of our health care providers and community members to put the knowledge we gain into practical use to reach our intended outcomes.

Our partnerships have been established over time and each have strong governance structures and resources, such that they make stable partners with whom we can collaborate and build our success.

5.1 Readiness of partners

- OCN LED Smart Farm - has developed and operated the Smart Farm over the past four years with support from their relationship with the Korean Institute of Science and Technology (KIST) and Korean Agriculture System and Technology (KAST). This partnership began with Opaskwayak Cree Nation in 2015 and is ongoing as the vertical smart farm is currently functioning as a test and training site as well research and development of at least 75 food products, feeding approximately 100 people at this time. OCN has obtained distribution rights for the Korean technology and the have an agreement in this regard.
- University of Manitoba – will provide a researcher for our project by the name of Dr. Miyoung Suh. Dr. Suh is an Associate Professor in the department of Human Nutritional Sciences. She has experience in research and translating knowledge to the medical profession as well as the general public. She has experience in the area of practice-based research for dietetics. Having completed prior research in the area of prenatal health in Opaskwayak Cree Nation, she is respected and trusted by community members.
- Northern Health Region - through ongoing collaboration on program development and resource sharing as per our joint steering committee on health, the NHR is a long-time partner and has agreed to continue to work together to support this project. In particular, the NHR will provide the primary health care support for the research participants and any other community members willing to consider health care support and changes to lifestyle to improve the quality of their health. They have provided physicians and the electronic medical record to the Beatrice Wilson Health Centre located in Opaskwayak Cree Nation.

- Opaskwayak Health Authority (OHA) – OHA is responsible for the health services delivered on reserve at the Beatrice Wilson Health Centre. We submitted the required Research Lens in Ethical Decision-Making as directed by the OHA Board of Directors, and they have approved it. Furthermore, they have indicated that this research is very necessary for the community and are grateful for the opportunity.

Over time, we have built relationships based on policies and agreements, but more importantly, on trust, which enables us to move nimbly as we set directions for our Board of Directors and their staff. With our business model, governance model, and overall plan, these strong partnerships also enable us to expect the success we are bound to have with this project.

The role of the Board of Directors is one of policy governance, although will function as an operational Board at the early stages of project implementation. The operational role of the Board will be to hire an Executive Director and determine policies and procedures that will support the Executive Director to carry out the goals and objectives and achieve the outcomes as documented in Chapter 3 of this proposal. When the Executive Director is comfortable in carrying out the functions of the business, he or she will report regularly to the Board. The Board will then shift from an operational focus to one of setting strategic direction, establishing governance policies, and supervising the Executive Director. The Board will have policies outlining the relationship between the Executive Director and Board members.

The governance structure we have created to proceed with our project is based on sound principles of governance. These are as follows:

1. Well defined goals and objectives
    - We have completed extensive community engagement, examined current research and developed a model, created a five-year plan of business milestones and supported this with outcomes-based performance measurement goals
2. Evaluation of resources
    - We are supported by cohesive relationships among governing partners, experience in working with corporate structures, strong workforce, supportive and contributing partners, business knowledge and access to external expertise
3. Planned processes
    - Details of the business have been created within this proposal and lessons have been learned from the three years the smart farm has been in development prior to this project was proposed
    - Financial accountability following best business practices, including an annual audit, is a key process of the Board

4. Governance lead
    - Membership of the not for profit corporation consists of the elected official from the three government bodies that comprise the Tri-Council including:
    - OCN - Onekanew (Chief) and 7 Onuschekewak (Council)
    - RM of Kelsey – Reeve and 6 Councillors
    - Town of The Pas – Mayor and 6 Councillors
    - Membership will lead the Board of Directors with a mandate, through election, from the community members they represent
    - Membership, and the Board, will also be informed of the needs and wishes of community members through ongoing engagement as described in Chapter 6
5. Scalable documentation and processes
    - The utilization of technology such as the server database of the smart farm and distribution business, central to this project, allows for anonymized data and trends to be gathered in a clear and concise manner. This would include details such as logistic costs, consumption patterns, customer preferences, utilization of delivery versus pick-up, etc. This documentation in turns assists the Membership, Board of Directors and Executive Director to make ongoing business and business process decisions based on information that can be compartmentalized to each of the processes within the system.

5.2 Strengths of our governance structure include

- Local control
    - Members of the not for profit are elected by community members
    - Board of Directors is appointed by Members
    - Board of Directors hires the Executive Director
    - The Executive Director hires community members to work in the business
    - Products of the business enhance the health and well being of the community members
- Transparency of the not for profit corporation
    - Public by-laws
    - No hidden owner
    - Business enterprise is invested into the community
    - Distribution pathways are clear
    - Financial management as per the Canada Not for Profit Corporations Act
- Value for investment
    - Product of the business improves health and well being of the community
- Simplicity
    - Strong governance structure in its simplicity

5.3 Risk Identification and Mitigation

1. Disagreement among members of the Board of Directors
    - Mitigation: We have developed a list of items in our unanimous member agreement which require approval by Extraordinary Resolution. "Extraordinary" approval is an 80% threshold, so for all intents and purposes, the requirement is unanimity considering the three parties identified as members.
2. OCN no longer acts in its capacity as agricultural technology supplier
    - Mitigation: We have a preference for the Korean technology which is supplied to the Smart Farm project for which OCN acts as a supplier. However, should their ability to act as a supplier become compromised, the success of the project is not dependant on them: alternative suppliers can be sought.
3. Knowledge translation partnerships dissolve
    - Mitigation: If the University of Manitoba partnership dissolves, alternative researchers at other Universities can be identified and hired. If NHR and OHA do not want to contribute towards supporting the research project, the University of Manitoba has identified that they will send up research assistants from their facility.
4. Delayed payment from Infrastructure Canada
    - Mitigation: Clearly defined timelines, outcomes, punctual reporting practices, early discussion on schedule changes.
5. One partner discontinues ongoing participation
    - Mitigation: The Board of Directors will reorganize themselves to accommodate for circumstances but continue to function as oversight for the project.

6 CHAPTER 6: ENGAGEMENT

The nature and size of our three communities, along with our long-established methods of intra-community communications, has enabled us to conduct broad and diversified engagement activities throughout the project definition and scoping processes, leading to our current position as a finalist in the Challenge. Our initial engagement involved brainstorming sessions with community leadership and active community members to identify key community needs. As we worked through development of our initial proposal, we broadened our engagement to further assist in sculpting the project. Our ongoing engagement activities look for the ideas, opinions, needs and vision of our diversified population ranging from youth, elders, families, businesses, special needs groups and our elected government officials. Through these activities, we have established a framework for engagement that we will continue to use throughout the implementation phase of our project.

The tools that we have utilized throughout our engagement process include:

- Surveys – business and general population
- Forums – special needs groups, business, leadership, health
- Social media – Facebook
- Scheduled feedback - groups that hold regular meetings and include Smart Cities on their agenda including governments, business, health, Boards
- Focus groups – people living with diabetes, disabilities, high risk youth, elders

Our engagement throughout the development phase has provided us with valuable insight and perspective as we shaped our project for future success. Insights gained are summarized below.

6.1 Community Engagement

6.1.1 General population

To ensure that the community would benefit from and support the goals of this project, our initial information was collected from the general public in all three communities by utilizing online and paper surveys that were completed at focus groups, the local grocery stores, schools, workplaces and community-based organizations. In order to obtain unbiased and comprehensive data to use moving forward, the surveys were completed by community members of all ages and demographics such as mothers, at-risk youth, elders, families with and without children, single adults, and people living with and without diabetes. Surveys were filled out anonymously to allow participants the opportunity to complete them openly and honestly. They were able to supply contact information if they wished to participate in further data collection such as focus groups or if they wished to be part of the future study group. We have had success in the past on other projects utilizing this method of data collection to engage community members and stakeholders and will continue to use it moving forward to collect information while informing the community about the status of the Smart Cities Challenge.

The surveys focused on:

- Impact of diabetes on the community
- Barriers to purchasing fresh produce
- Types and frequency of vegetables being purchased by the community
- Amount of the produce purchased thrown away due to spoilage
- Interest in and benefits of a delivery service
- Interest in a smart phone app to order produce and access recipes
- Interest in participation in a research group that utilizes wearable technology to monitor blood sugar to assist with controlling or preventing diabetes for the wearer.

We learned that 92% of community members feel that diabetes is a high priority issue that needs to be addressed immediately, 49% of participants said that either themselves and/or a spouse/child suffered from diabetes and 28% said that someone in their extended family is currently living with diabetes. The majority of those who are living with diabetes in their family would be willing to make changes to their diet and eating habits to minimize the impact on their bodies. They stated that being supplied with fresh vegetables would be a great incentive for them to participate in a group study and that they would participate in a study using wearable technology to track and monitor their blood sugar.

The most popular type of fresh produce currently being purchased in the community is leafy greens; 83% of participants who purchase produce at least once/week purchase leafy greens. To date, leafy greens are the main type of crop grown at the OCN pilot Smart Farm and are also one of the dietary items that can be beneficial in combatting diabetes. When asked if they would be more likely to consume fresh produce if it was locally grown, cheaper to buy and free of pesticides/chemicals, 88% of all participants answered that they would eat more if it was healthier and more accessible.

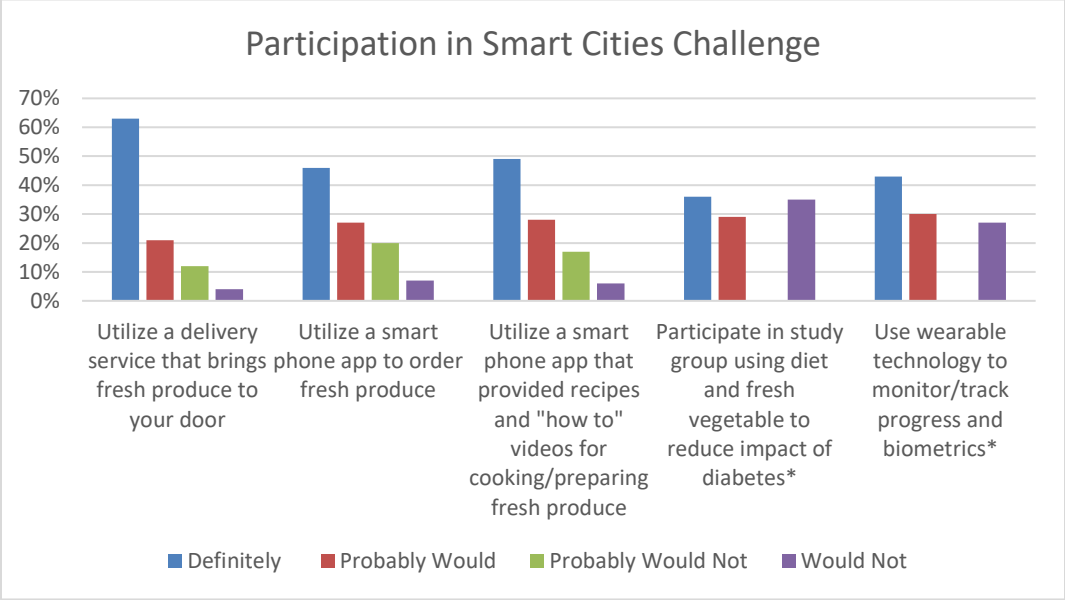


Figure 8 community survey results regarding scope definition of Smart Cities Challenge

This chart outlines the willingness of community members to participate in the Smart Cities Challenge. *24% of survey participants responded that they were not affected by diabetes, there was no "not applicable" answer option provided for them to choose.

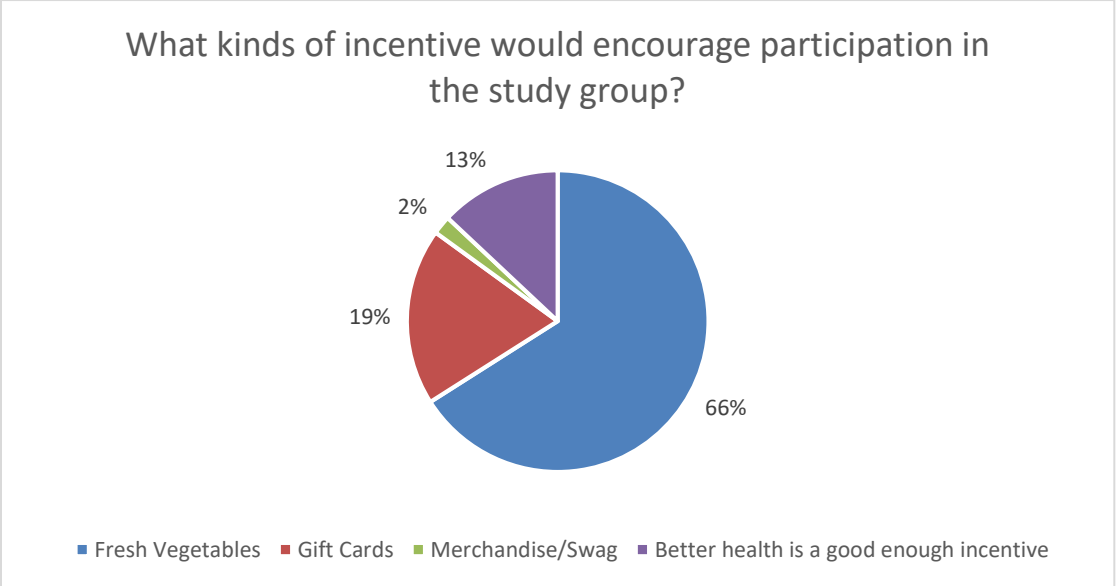


Figure 9 community feedback on desired study group participation incentive

This chart demonstrates that having access to fresh vegetables provides incentive for people living with diabetes to eat better which will help to control their blood sugar. Having locally grown produce available that is cheaper and more accessible will be beneficial in diabetes management for the

Social media is another common form of communication and source of feedback in our community. Our working group utilized Facebook to build our online presence, communicate with the tri-community and encourage participation in the challenge and community engagement strategy. The OCN pilot Smart Farm has an existing page with well established followers that is used to share posts, events, progress and online surveys. Posts made on this Facebook page reach anywhere from 500-5000 people who engage in the information being provided. Posts include information on diabetes education sessions, telehealth information sessions, cooking classes, services available, diabetes and health eating educational/informational posts, produce availability at the farm, online surveys for community members and businesses, Smart Cities updates, meetings and events, news stories, recipes and information on partners and stakeholders. We will continue to utilize the Facebook page to engage community members with targeted and scheduled posts. The page also gives us the ability to communicate and engage with people and potential consumers throughout the region, province and country.

Information and resources were provided to those who filled out surveys or participated in focus groups so that they could access services and support if needed. They were provided with contact information for health care professionals of both the Opaskwayak and Northern Health Authorities as well as information on up and coming education and information sessions. They were also provided with information on how to keep up-to-date with the Smart City Challenge progress and happenings.

6.1.2 Business Leadership

- ✓ Chamber of Commerce (150 members), Rotary Club (50 members)

A forum was held with members of the local Rotary Club. The club is comprised of local business people and professionals from many different vocations such as health care, education, finance, human resources, communications, media, agriculture, and other business representatives. The Club was provided with information on the Smart Cities Challenge project proposal. Following interest in this opportunity, there was further discussion regarding the current Smart Farm's production capabilities including the different kinds of crops and harvest times. Club members were asked to provide information on:

- quality and quantity of produce they are currently purchasing
- barriers they may face in purchasing fresh produce
- whether or not their family were impacted by diabetes, and
- what could be done to encourage more consumption of fresh produce.

The group responses indicate that one of the biggest barriers or concerns with current produce availability was the shelf life, stating it is much too short which leads to spoilage and waste. They further stated that if there were locally grown options with a longer shelf life it would very likely increase their consumption rates. The group had a lower rate of diabetes amongst themselves and their family at 27%, however the majority said they would still find information and education regarding diabetes and healthy eating beneficial.

The local Chamber of Commerce participated in a focus group and were asked to complete a survey for local businesses. The survey focussed on:

- The type of produce shipped
- Quantities
- Cost
- Shelf life
- Amount of waste/spoilage
- Challenges with current produce suppliers
- Frequency of shipments
- How likely they would be to use/purchase produce from the Smart Farm

The results of this survey are shown graphically in Figure 10. Of the businesses who were surveyed, 57% indicated that they use or sell fresh produce in their business with the most common being fresh leafy greens, root (potato, carrots) and edible plant stem (celery, asparagus) type vegetables, cruciferous vegetables (cauliflower, broccoli) allium (garlic, onion) and marrow (cucumber, tomato) type vegetables.

43% of businesses that use fresh produce receive shipments 2-3 times/week, 15% receive shipments 4-5 times per week, 42% receive shipments once per week. The average shelf life of the produce being delivered is anywhere from 3-10 days. Leafy greens have the shortest shelf life while root vegetables have the longest shelf life. 100% of businesses who use fresh produce stated they would be likely or very likely to use a local option that is less costly, has a longer shelf life and is free of pesticides/chemicals. 67% of these businesses feel they would definitely sell or use more fresh produce if there was a local, clean, less costly options and 33% feel they probably would sell/use more produce.

This information will be beneficial for the implementation phase of the project as it provides information for consideration and identifies what type of produce may be the focus to best meet consumer needs.

Figure 10 community feedback on present food source concerns

This graph indicates that our proposal recognizes and addresses primary concerns of both businesses and customers. The three most critical concerns are expense, spoilage rates and use of pesticides, closely followed by transportation. Transportation is a greater concern for businesses, spoilage is a consequence of transportation.

6.1.3 Youth - Ages 13-21

- ✓ University College of the North
- ✓ MBCI
- ✓ PACE
- ✓ Oscar Lathlin School

In order to engage the youth of the tri-community, focus groups were held and surveys were completed by schools in each community. We also used the opportunity to provide education and resources on the benefits of eating fresh produce. Lack of access to fresh produce was revealed as a huge barrier for the youth in the community. With 47% of youth who participated stating that they did not have access to fresh produce at home. Some of the top reasons provided by youth as to why parents/caregivers did not buy fresh produce were high costs, quick spoilage, as well as the convenience and cost efficiency of buying frozen alternatives. This feedback is illustrated in Figure 11 below. The clear message that came from the youth was that there was a desire to eat fresh vegetables, but lack of accessibility was a major roadblock. They also stated that school cafeterias were not able to provide many options to purchase fresh produce for lunches due to high costs and short shelf life, and if there were more options available, they would likely consume more fresh vegetables. Youth identified that access to cooking classes and education sessions would be highly beneficial to them and make it easier for youth to eat more fresh produce because they would know what to do with it.

Almost all of the youth who participated stated they would be interested in using a smart phone app where they could order fresh produce for delivery as well as accessing recipes and videos to assist with food preparation. Culinary students expressed an interest in producing videos to post on Facebook or on the smart phone app. Youth who are impacted by diabetes also stated they would be willing to participate in a study group utilizing wearable technology to monitor blood sugar and other biometrics to learn how to control their blood sugar, thus managing their diabetes. Youth said it would be cool to participate in friendly competition amongst their peers.

6.1.4 Elders/Seniors

- ✓ McGillivray Care Home residents
- ✓ Council of Elders

Focus groups with the Elders of the community revealed that they would consume more fresh produce and leafy greens if they were taught how to incorporate them with the traditional dishes that they are used to preparing. This information is illustrated in Figure 11 below. Half of the elders who participated in the focus group disclosed that they were living with diabetes. Of those who had been diagnosed with diabetes almost all said that they would be interested in further information and learning more about how making dietary changes could improve their health and assist them to have better control over their blood sugar. The Elders would be willing to participate in the study group and use wearable technology to monitor their blood glucose. Fifty percent of the Elders who are living with diabetes would use a smart app for produce delivery and recipes. This information is illustrated in Figure 8 above.

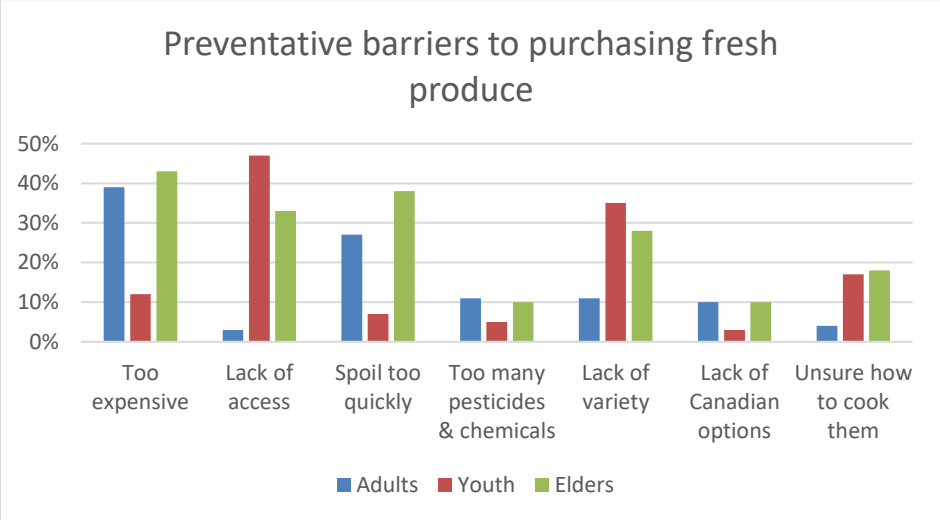


Figure 11 community engagement feedback identifying barriers to purchasing fresh produce

The diagram depicts their perspective barriers of purchasing fresh produce across the demographics.

6.1.5 Elected Leadership: Three elected governments

- ✓ Opaskwayak Onekanew and Onuschekawak (Cree words for Chief and Council)
- ✓ Town of The Pas Mayor and Council
- ✓ Rural Municipality of Kelsey Reeve and Council
- ✓ Tri-Council project team

The three governments that form the Tri-Council are heavily engaged and very supportive of the challenge, each appointing a representative to serve on the working group as well as participating with the project team to make decisions, act as a liaison for their respective council and provide feedback. The Smart Cities Challenge is a standing agenda item for the Tri-Council, which meets quarterly. As a Tri-Council they agreed on the Challenge Statement and concurred that the issues being addressed within the proposed project are a priority for each of the communities.

Reports and updates are provided at each quarterly meeting, and each council has the opportunity to provide insight and engage in open discussions regarding the project, to make suggestions, and to assist with establishing the plan to move forward. Each of the three councils have individually passed resolutions to support and assist with sustaining our Smart Cities Challenge Statement in addition to passing resolutions as a Tri-Council. Resolution was passed by each council to support the submission of the original proposal on behalf of the Tri-Council to Smart Cities, resolutions were passed for a Funding Authorization Process which outlined the project committee members financial responsibility, and resolutions were passed to approve the hiring of the proposal manager and coordinator. The appointed representatives from each council are empowered by the resolutions to make decisions and provide approval when required. Each council receives updates from their respective representatives at least once a month during council meetings. These processes and approvals allow the working group to obtain quick authorization when decisions need to be made while maintaining open and steady communication with each of the councils.

6.1.6 Health Partners

- ✓ Northern Health Region/Opaskwayak Health Authority Joint Steering Committee
- ✓ Opaskwayak Health Authority Board of Directors
- ✓ Public Health Programs

The Northern Health Region (NHR) manages the hospital and clinics that provide health care services in the Town of The Pas that is funded by the provincial government. Opaskwayak Cree Nation manages and provides health services at the Beatrice Wilson Health Centre which is located on reserve territory and is funded by the federal government. The issues created by the jurisdictional policies and resource allocations have resulted in fractured health care service delivery that have historically not effectively met the needs of either jurisdiction. As a result, health leadership officials agreed that finding a better way to work together would be beneficial to all community members. As such, a Statement of Intent on collaboration on health services was signed by senior official between Opaskwayak Cree Nation and the Northern Health Region.

The purpose, as written within the Statement of Intent, reads as follows:

OCN and NHR agree to have a written statement on their intention to work together in a continuing partnership on health care and health services delivered in the area. The vision for the collaboration is to develop and enhance programs between these entities and to agree to an ongoing commitment and process for developing programs and infrastructure management. The two service entities, working together with the existing authorities in the federal and provincial governments, will achieve improved health outcomes.

Representatives from OHA and NHR meet once a month as a joint steering committee on health at which issues on health care service and service delivery are discussed and solutions are created. This joining of forces is a significant factor in the anticipated effectiveness of the Continuous Glucose Monitoring technology study group. Ongoing engagement with participants and health care providers will play a significant role in supporting the participant study group, other community members wishing to address health issues such as diabetes and supporting evaluation of the impact of our project on our anticipated outcomes.

Opaskwayak Health Authority Board of Directors and leadership staff have acknowledged their support of the Smart Cities Challenge project. They have approved the formation of a continuous glucose monitoring study group for the purpose of diabetes research and approved OCN's Research Lens in Ethical Decision Making that has been developed by OCN for the purpose of diabetes Type II research and was completed by OHA staff for the purpose of this proposal. Additionally, they have recommended the creation of an integrated care team, consisting of a physician, registered nurse, medical and clinical assistants and social worker to specifically support the population living with diabetes. The team will be supported by a Learning Circle which pulls groups of people together who have common concerns or interests. The Learning Circles at Beatrice Wilson are also responsible to ensure that the cultural component which is integral to the guiding principles of OHA are incorporated into all teaching sessions.

The Northern Health Authority Board of Directors has similarly expressed their support for ongoing collaboration between the NHR and Opaskwayak and support the anticipated research and program expansion as we continue to work together to reduce jurisdictional issues and meet the issues addressed in our challenge statement. The Northern Health Region has also established and formalized an Indigenous Cultural Training program that involves staff from OHA at every training day. The impact of this is reflected in the program development between the two organizations.

The integrated care team works directly with the Northern Health Region Diabetes Education Resource (DER) team which consists of dieticians and registered nurses also working to support individuals living with diabetes. This team is part of the provincial health region's primary care division and works out of health offices in The Pas. The NHR supports the work that the DER team does at Beatrice Wilson and their work with the integrated care team. The fluidity of services provides the basis for citizens of the Tri-Council region to have the choice of accessing care in either The Pas or Opaskwayak and to have the basis of care remain consistent. Participants of the study group with the wearable technology will also have the option of attending either facility for supportive care and follow up. Mental health is also provided for all citizens, with alternate providers within a similar structure.

The public health team provides educational opportunities throughout the Tri-council region offering lunch and learn opportunities, cooking classes and dietary counselling for anyone who requests. The food grown at the existing Vertical Smart Farm has already been introduced into the population over the past two years, and school education programs have been part of this effort. They have agreed that this form of support will continue and grow during the implementation phase.

6.2 Implementation Plan

We have found that community engagement serves as an effective tool for providing feedback on alignment between project outcomes and community expectations. Therefore, ongoing engagement with already established stakeholders as well as those that will be identified as the project progresses. Utilizing the engagement processes we have already completed, we will continue with a similar approach during the implementation phase as part of a feedback system to ensure our project is effectively meeting outcomes amongst our diverse population.

Ongoing feedback will identify the following information that can be provided by specific stakeholders and consumers.

6.2.1 General Population

Questions for all community members including those target groups listed below

- Consumption rates
- Awareness of relationship between diet and diabetes
- Smartphone distribution system effectiveness
- Study participation
- Product preference
- Overall satisfaction

6.2.2 Business Leadership

- Ordering, distribution of plant factory products
- Synergistic business opportunities – discussed below

6.2.3 Schools/Youth

- Study participation (with parental consent)
- Influence on families
- Preferences for lunch programs

6.2.4 Citizens with Disabilities

- Accessibility of Smart Farm produce
- Preferred foods – consideration in preparing, cutting, swallowing
- Ease of use of Smartphone distribution system
- Preferred options

6.2.5 Elders/seniors

- Accessibility of Smart Farm produce
- Project alignment with traditional values
- Project alignment with community values
- Project alignment with family values

6.2.6 Government Leadership

- Feedback from electorate
- Alignment with community priorities
- Potential synergies with other community development work

6.2.7 Health Partners

- Patient feedback
- Study group feedback
- Health professional feedback
- Public health feedback

6.3 Risk Identification and Mitigation

1. Competition with Local Farmers

   It is foreseeable that local farmers may feel the smart farm is in direct competition with their production. Mitigating this possibility will be done through collaboration. The growing season for local farmers is short. Therefore, the smart farm could schedule non-conflicting products during the season that farmers are selling their produce or offer farmers an opportunity to expand their market reach through project collaboration and leveraging the smartphone distribution system.

2. Competition with local businesses – grocery stores

   Local businesses have embraced the smart farm project; however, this position may change at some point during the implementation phase of the project. If this were to happen, mitigating strategies would include:

   - Discussion regarding the possibility of using the smart farm as a supplier (considering potential distribution contracts that they may already hold with other suppliers)
   - Exploring potential business synergies or non-competing add-on products options eg. Selling whole meal kits that include fruits and vegetables from the smart farm with products such as rice, bread, pasta, condiments, and so forth from their own store

3. Smartphone operation challenges

   Smartphone operation familiarity may vary greatly amongst community members, so it is anticipated that some individuals may find it stressful adopting this ordering platform. Training sessions or tutorials can be offered for these individuals to teach them how to use the smartphone app. Additionally,

instructional videos could be made available on the user-friendly website, offering step-by-step instructions, access produce, incentives and recipes.

Elders have indicated that their grandchildren assist them with their technology issues, so ensuring youth are familiar with operation of the smartphone application is important in reaching elders.

4. Unexpected technical issues

   Partnership with the OCN pilot Smart Farm provides the project team access to personnel experienced in the operation of the Smart Farm technology for troubleshooting potential issues with the Smart Farm. An ongoing relationship with the software development firm, as well as budgeting financial resources, will facilitate resolution of any major software issues that may arise.

5. Smartphone access

   The Smart Farm will have a website for online ordering so a computer can be used in place of a smartphone. In addition, we will also have a pickup location at the Smart Farm where community members can purchase fresh produce directly.

7 CHAPTER 7: DATA AND PRIVACY

Our project team has worked in cooperation with officers of the Manitoba Ombudsman's Office to understand and ensure that our project meets the applicable data and privacy legislation regulations. It is the objective of the project that all legislation be followed to ensure protection of our community members' privacy and confidentiality.

The Manitoba Ombudsman's Office suggested we consider the following authorities in completing our data and privacy impact assessment, as well as provide us with their privacy impact assessment tool. The Manitoba Ombudsman's Office further suggest that we consider Fair Information Principles throughout this process. The data protection authorities that were considered in identifying the impacts of data security throughout this project include:

- The Personal Health Information Act (PHIA)
- The Freedom of Information and Protection of Privacy Act (FIPPA)
- The Personal Information Protection and Electronic Documents Act (PIPEDA)

We are grateful for the staff at the Manitoba Ombudsman's Office and for the Office of the Privacy Commissioner of Canada for their review and comments during the completion of the Preliminary Privacy Impact Assessment Tools that are required for this project. We have provided these documents under separate submission.

To identify information transaction, including collection and distribution, it is necessary to identify the legal entity with whom the transaction is taking place. The commercial activity detailed in this proposal occurs between the community members (customer) and the not-for-profit corporation (to be established in the implementation phase, detailed in Chapter 8, herein referred to as the NFP). *Figure 12* illustrates the information flow considerations of the overall project and differentiates personal information transactions between the customer and the NFP (and financial institution), and health information transactions between the biometric feedback study patient and the healthcare authority in blue and orange respectively. This diagram serves to clearly identify that customers' personal information provided to the NFP is not disclosed to the healthcare provider, and the health information provided to the healthcare provider is not disclosed to the NFP; the customer/study participant is the only common link between these two aspects of the project.

A further discussion about each of the data protection authorities is included below.

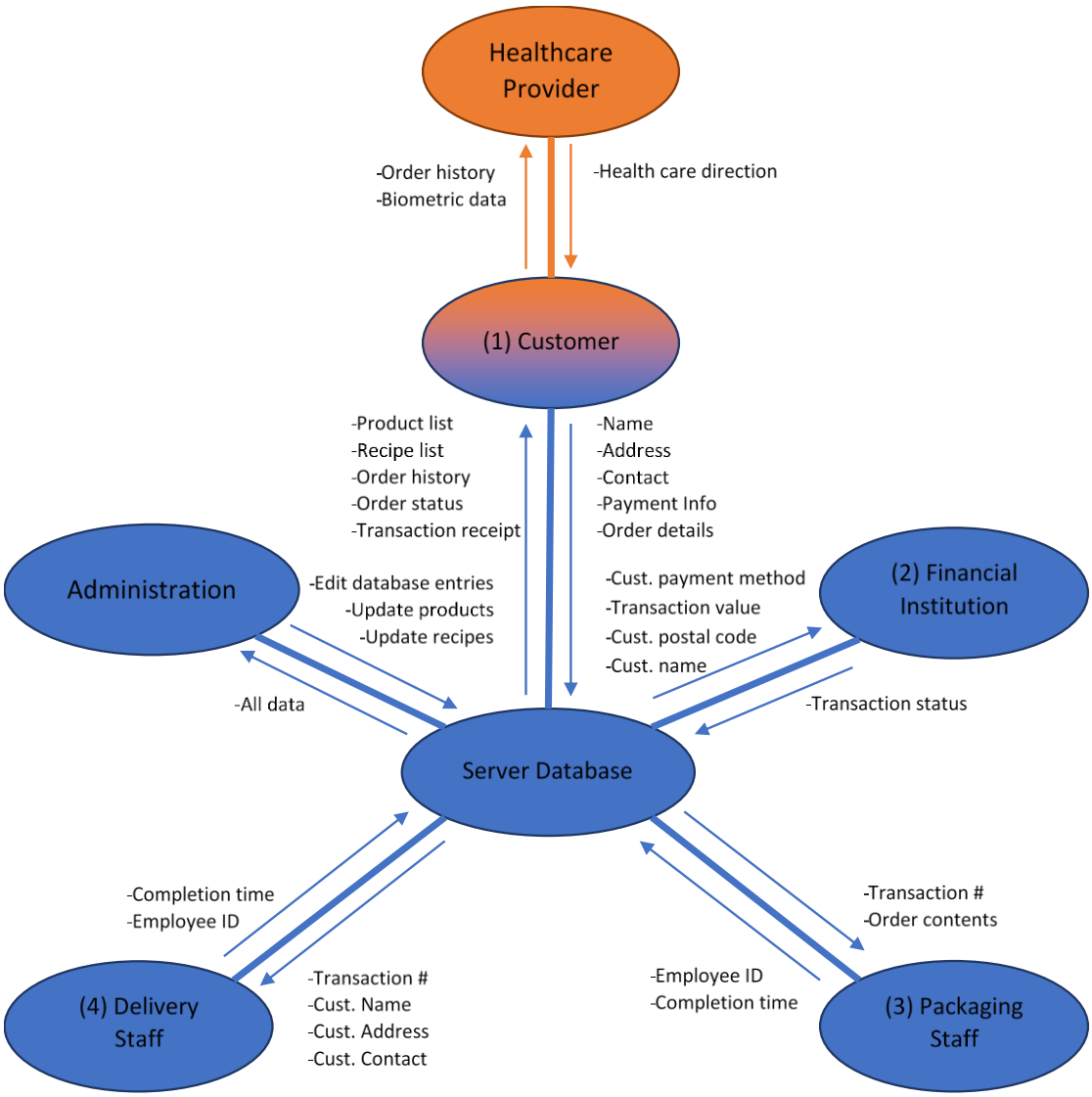


Figure 12 PIPEDA vs PHIA data

7.1 Consideration of Data Protection Authorities and Principles

7.1.1 The Personal Health Information Act (PHIA)

As per Manitoba legislation, PHIA provides access to information and protection of privacy rights concerning personal health information. PHIA allows individuals to examine and receive a copy of their own personal health information from a trustee holding this information. PHIA imposes obligations on trustees for the protection of personal health information, specifically its collection, use, disclosure and security. In our detailed analysis of the PHIA implications on this project, we will demonstrate that all personnel working with individuals in our health centre or performing research in any way that is related to this project, must always have completed PHIA training and signed agreement to maintain patient confidentiality. This applies to all records, information and conversations that have anything to do with personal health information of any sort.

7.1.2 The Freedom of Information and Protection of Privacy Act (FIPPA)

Upon consultation with the Manitoba Ombudsman's Office and their review of this submission, they have concluded that the Manitoba public bodies associated with this project (RM of Kelsey and Town of The Pas) will not be engaged in the collection, use or disclosure of personal information subject to FIPPA. Therefore, consideration of the requirements of FIPPA to personal information associated with the project is not required.

7.1.3 The Personal Information Protection and Electronic Documents Act (PIPEDA)

As per federal regulation and the Office of the Privacy Commissioner of Canada, PIPEDA is the federal privacy law for private-sector organizations not otherwise subject to provincial legislation which are engaged in commercial activity. It determines how businesses must handle personal information in the course of the commercial activity. The business activities of the NFP includes the growing and selling of food at the Smart Farm. This commercial activity includes the collection of the individual's name, address, contact information, payment information and order details. This information is subject to PIPEDA. We have addressed the requirements of PIPEDA in our Privacy Impact Assessment and sought response and contribution from both the Province of Manitoba Ombudsman's Office and the Office of the Privacy Commissioner of Canada in assuring that we are legally and appropriately managing personal information associated with this business.

7.1.4 Fair Information Principles

The fair information principles, provided by the Manitoba Ombudsman's office for our use, have been considered in our business plan and will continue to be addressed as we proceed. These principles include:

- Be accountable
- Identify the purpose
- Obtain valid, informed consent
- Limit collection
- Limit use, disclosure and retention
- Be accurate
- Use appropriate safeguards
- Be open
- Give individuals access
- Provide individuals with an avenue for recourse

7.2 Privacy Impact Assessment Tool

We have highlighted details of our plan for the collection, use and disclosure of information through completion of the Privacy Impact Assessment Tool (detailed below). We have identified how we plan to mitigate risks to the public as it pertains to the collection and use of their personal and personal health information as it relates to their interface with our planned project. As such, we have identified the following areas that must be considered:

- Data-minimization – we plan to collect, use and disclose only what is necessary for the customer to receive the goods and services that have identified as something they want and that they provide full consent for all information they share.
- De-identification – we plan to de-identify personal information wherever possible, such as package labelling using a QR code and utilizing a scanner to access information. Similarly, the health care follow-up and research will be done using the strict codes of ethics and research as established by the Canadian Institute for Health Research and the University of Manitoba, which includes de-identification as much as possible as well as early destruction of information collected when its use has expired. Additionally, this is only done with the individual's full knowledge and consent.
- Opt-out strategy – individuals may opt out of doing business with the Smart Farm at any time. Options for doing so may be that they opt-out of paying with a credit card and simply use an alternative such as preloading their account with cash at the Smart Farm. Alternatively, they may cancel their account with the business at any time. For financial reasons, the business must keep record of any financial transactions for seven years, but any personal information is deleted.
- Data governance and Privacy Management program – our proposed business will be supported by a policy that ensures the administrator of the data required to operate the business of the Smart Farm and delivery system is aware and compliant with PIPEDA and the importance of the confidentiality that each customer requires and can be ensured of receiving from the business regarding their information. The administrator will be the privacy lead and will report to the CEO or the business, who in turn reports to the Board of Directors of the business regarding auditing and compliance as well as managing breach of compliance. This will be supported by the policy. There are no other partners to consider as any other entities associated with the business are vendors and accessing their technology will also require agreements and conditions that support current legislation and controls.

  All health care data is protected by the personal health information legislation. Two health clinics will be utilized for the purpose of working with and supporting individuals who wish to be participants in the study group. One health clinic, Beatrice Wilson Health Centre, is operated by Opaskwayak Health Authority. The other clinic, The Pas Primary Care Clinic, is located within The Pas Health Complex in The Town of The Pas and is operated by the provincial Northern Regional Health Region. Both clinics follow the PHIA legislation and all staff have received PHIA training and have signed agreements of confidentiality under this legislation. All personal health information is

stored on an electronic medical record, Accuro, and the data is shared between the two sites. The Northern Regional Health Authority is the trustee of this data. Each of the clinics has a privacy officer, responsible for maintaining confidentiality, auditing, and to whom individuals may go to regarding concerns or any real or perceived breaches of their confidentiality that they wish to discuss.

- Community engagement and project transparency – we have completed comprehensive community engagement strategies including:
  - Surveys – business and general population
  - Forums – special needs groups, business, leadership, health
  - Social media – Facebook
  - Scheduled feedback - groups that hold regular meetings and include Smart Cities on their agenda including governments, business, health, Boards
  - Focus groups – people living with diabetes, disabilities, high risk youth, elders

  No privacy concerns were raised by users, residents, community members or other stakeholders during the community engagement process.
- Consent – individual consent is built into every step of our proposed project. Consent is necessary to access the server database of our business so that the individual may order and pay for food from the Smart Farm and have it delivered to their door. They may also access food by driving to the Smart Farm and ordering it directly and paying for it in any method they choose, so it is not that this food is inaccessible if they do not provide personal information. Consent is also required if individual's wish to participate in the study or research project associated with our proposal. All information shared by the individual at the health clinic's is covered by PHIA and consent of patients under that legislation.

7.3 PIPEDA Preliminary Privacy Impact Assessment

The NFP provides food production and distribution services to customers. Customers are able to purchase food products in two different ways from the NFP; pickup in person at the NFP business location, or delivery-to-door service through the smartphone application. Pickup of food products at the NFP business location in person does not require the collection of any personal information. However, customer's personal information must be collected by the NFP for the provision of food delivery services. Interaction between the NFP and the customer begins with the customer's downloading of the smartphone application.

Upon downloading the smartphone application used for placement of order to the NFP, customers will be required to create an account before they can access information and resources provided by the application. Creation of an account will involve the **collection** of personal information and is thus subject to PIPEDA considerations. The minimal amount of personal information needed in order to effectively deliver services will be collected.

Personal information items that will be collected by the application include:

- Name
- Address
- Contact information
- Payment information
- Order details

This information will be **used** by the NFP for internal business operations including:

- Packaging identification
- Product identification
- Location of order delivery

Information will only be provided to employees of the NFP on a need to know basis, in further pursuit of compliance with PIPEDA. This data will be re-used every time the customer places an order to minimize the number of steps that must be takes to place a food order; the easier it is to order food the higher probability this procurement path will be take and consequently the greater the impact on health.

There are two methods that will be available to customers for processing payment; credit card or preloaded account balance. Preloading of the customer's account can occur by depositing cash or cheque at the plant factory. However, processing of credit card payments requires the **disclosure** of personal information to the financial institution in order to process the transaction.

It is understood that any personal information **collection** or **disclosure** event must solicit the express consent of the customer in order to ensure compliance with PIPEDA legislation.

*Figure 13*Figure 13 below illustrates the data flow between the customer (green), NFP (blue), and financial institution (yellow); data collection and disclosure events are highlighted with red arrows. In pursuit of compliance with this legislation, a notice of data collection window will be displayed to the customer upon prompting the creation of an account with the NFP and must be agreed to prior to submission of any personal data. Secondly, a notice of disclosure window will be displayed, and must be acknowledged by the customer, prior to processing any transaction via credit card to ensure informed consent regarding NFP's required **disclosure** of personal information to perform this activity.

Customers will, at any time, be able to delete their account with the NFP through the smartphone application interface, thus deleting the existence of their personal information from the customer database. However, in compliance with financial legislation, there will be a record kept of any purchase transactions that the customer processed with the NFP. Furthermore, under PIPEDA legislation, customers have the right to request a copy of their personal information or request a correction of this information held by a business entity at any time. This will be observed by the following two measures:

1. Customers have 24-hour access to their personal information held on the NFP server through the smartphone application
2. Customers can contact the manager of the NFP in order to access their personal information

The smartphone application required for this project currently does not exist. Therefore, a software development contractor will be hired for the purposes of creating the required software solution. Furthermore, this company may be used from time to time to provide application updates to ensure compatibility with future operating system releases or to increase/modify features incorporated into the smartphone application. However, there is no anticipated disclosure of personal information through this process. To make this delineation clear, the following is a brief overview of the software architecture.

The smartphone application software will operates using three components:

- A frontend application
- A backend application
- An information database

The frontend application is the smartphone application that customers will download and run on their smartphone. This application will be placed on the Android Play store and the Apple Store so that it is easily accessed by all who desire to use the services of the NFP. The backend application resides on a server that will be located on the NFP business premises. The frontend application communicates with the backend application over the internet. The function of this backend application is to process commands and translate/organize information stored within the database so that it is correctly displayed on the smartphone application. To ensure data security at the place of residence, user information will be encrypted on the server hard-drive. To ensure data security within all internet-based communication links, industry standard TLS encryption will be used.

The software developer will create the code for the frontend application, the backend application, and the framework for the information database. During the development of these codes, or during the updating of these codes at a future date, the software developer does not require access to the database, they only require access to the frontend application and/or the backend application. Consequently, there is no disclosure of personal information to this third party at any time.

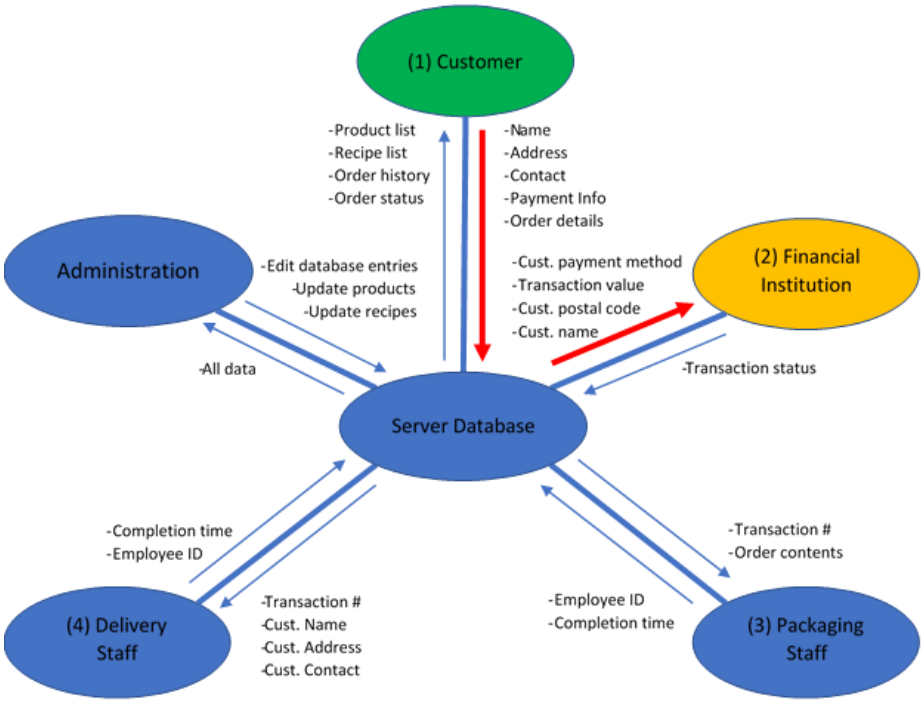


Figure 13 personal information flow diagram

Personal Information Collection and Disclosure Notice Statements

A notice of personal information collection statement must be agreed to by the customer prior to the NFP's collection of personal information. This statement will be displayed when the customer initiates account creation within the NFP's smartphone application. An example of a notice of personal information collection statement is:

By continuing with the creation of an account with the NFP corporation, you are agreeing to the collection and use of your personal information for the purposes of providing the services that the NFP corporation is offering.

A notice of personal information disclosure statement must be agreed to by the customer prior to the processing of payments for food products offered by the NFP. This statement will be displayed every time the customer initiates payment using a credit card as this requires disclosure of personal information to the financial institution. An example of a notice of personal information disclosure statement is:

By continuing, you understand and agree that your Name and Postal code will be disclosed to the financial institution for the purposes of processing the transaction.

7.4 PHIA Preliminary Privacy Impact Assessment

Health care professionals working at the Health Canada accredited health clinics will have access to study participant health information via the electronic medical record (EMR) which will be utilized to enrol and

follow the study participants. The EMR utilized in the region is Accuro, which is one of the EMR system approved for use by Manitoba eHealth.

All health care data is protected by the PHIA legislation that governs personal health information.

Two health clinics will be utilized for the purpose of working with and supporting individuals who wish to be participants in the study group. One health clinic, Beatrice Wilson Health Centre, is operated by Opaskwayak Health Authority. The other clinic, The Pas Primary Care Clinic, is located within The Pas Health Complex in The Town of The Pas and is operated by the provincial Northern Regional Health Region. Both clinics follow the PHIA legislation and all staff have received PHIA training and have signed agreements of confidentiality under this legislation. All patient data is stored on an electronic medical record, Accuro, and the data is shared between the two sites. **The Northern Regional Health Authority is the trustee of this data.** Opaskwayak Health Authority has signed a Privacy Impact Agreement with the Northern Regional Health Authority (NRHA) which includes a Privacy Impact Assessment compliance document that was jointly signed at the time that Accuro was first shared by the NRHA with Opaskwayak Health Authority. Each of the clinics has a privacy officer, responsible for maintaining confidentiality, auditing, and to whom individuals may go to regarding concerns or any real or perceived breaches of their confidentiality that they wish to discuss.

The PHIA information flow map, shown below in Figure 14, outlines the collection, use and disclosure of personal health information, with the corresponding PHIA article numbers which govern the information's use.

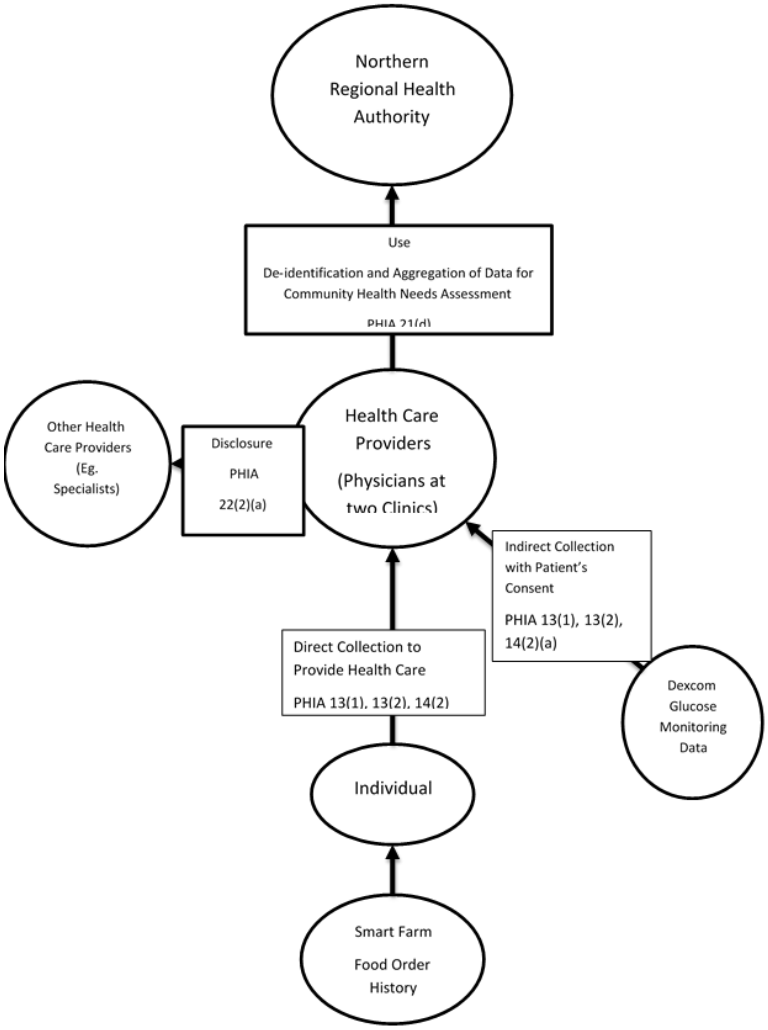


Figure 14 PHIA information flow map

7.4.1 Categories of personal (health) information to be collected, used and/or disclosed

Information collected by the healthcare clinics generally includes:

- name
- address
- contact information
- age
- sex
- allergies
- medications
- marital status
- medical history
- current health status
- other information as per current best practice in health care delivery

Additionally, the biometric feedback study participants will provide data from their smart phone that has captured biometric data from their wearable device and their dietary choices. Any person in the community can healthcare without being participants in the study group. The intended use of the study is to demonstrate the connection between dietary choices and diabetes. It is our intention to respond to the growing diabetes epidemic in our community by demonstrating, through the use of data, that we can impact our health in a positive way through dietary choices.

Personal health information is collected and used for the individual's health as per PHIA and best practice standards of the nursing and medical professionals and their code of conduct within the primary care clinics.

7.4.2 Authority for the collection, use and disclosure of personal (health) information

For participation in the biometric feedback study group, customers will become patients of one of two clinics and their information will be kept secure through PHIA and the information sharing agreement for the electronic medical record (EMR). The researcher will have everyone in the study group sign a consent form which includes risk, benefits, all data collected and storage of data.

Data collected from the continuous glucose monitoring device, manufactured by Dexcom, will be sharable with the healthcare provider through Dexcom's proprietary Clarity software. Dexcom provides secure, cloud based, storage of user data using AES-256 encryption and data transmission encryption using a minimum of TLS 1.1. Dexcom operates under the U.S. Health Insurance Portability and Accountability Act (HIPPA) of 1996. Authorization for use of the Dexcom hardware and software has been provided by Health Canada as these devices are readily available to anyone in Canada.

PHIA defines **"personal health information"** as recorded information about an identifiable individual that relates to

a) the individual's health, or health care history, including genetic information about the individual,

b) the provision of health care to the individual, or

c) payment for health care provided to the individual, and includes

d) the PHIN and any other identifying number, symbol or particular assigned to an individual, and

e) any identifying information about the individual that is collected in the course of, and is incidental to, the provision of health care or payment for health care;

The project will involve personal health information (PHI), including:

- demographic information
- health information related to the provision of health care to the individual
- biometric data from diabetes glucose monitoring device
- order history of food from the smart farm

7.4.2.1 Trustee

Under PHIA **"trustee"** means a health professional, health care facility, public body, or health services agency that collects or maintains personal health information.

The Northern Health Region is identified as the trustee for the purposes of this project. The personal health information will be collected by physicians (health professional) at medical clinics (health care facility). The Pas Primary Care Clinic (health care facility) and the Northern Health Region (public body) are both trustees. The Pas Primary Care Clinic is operated by the Northern Health Region, and the Region would also be considered the "trustee" of the PHI collected at the Clinic as the Region would "maintain" the PHI. The physicians at Beatrice Wilson Health Centre, OCN (operated by the Opaskwayak Health Authority) are contracted by the Northern Health Region and may be considered employees of the Region.

7.4.2.2 Collection

Personal health information to be collected includes information about an individual's health status and diabetes management and information about their food order history and glucose monitoring information relating to management of diabetes. Collection of personal health information will be for the purpose of providing health care to the individuals. The following provisions of PHIA provide authority for the collection of personal health information in these circumstances:

> **Restrictions on collection**
>
> **13(1)** A trustee shall not collect personal health information about an individual unless
>
> (a) the information is collected for a lawful purpose connected with a function or activity of the trustee; and
>
> (b) the collection of the information is necessary for that purpose.
>
> **Limit on amount of information collected**
>
> **13(2)** A trustee shall collect only as much personal health information about an individual as is reasonably necessary to accomplish the purpose for which it is collected.

7.4.2.3 Use

Use of the personal health information by health care providers at the clinics will be for the purpose of providing health care to the individual including to monitor and manage the health and diabetes of the individual, which is the purpose for which it was collected (s. 21 of PHIA). Anonymized and aggregated health information will be used by the Northern Health Region to conduct its community health needs assessment (project participants' health information will be included with all community members' health information) (s. 21(d) of PHIA). The following provision of PHIA provides authority for the use of PHI in these circumstances:

7.4.2.3.1 Restrictions on use of information

21 A trustee may use personal health information only for the purpose for which it was collected or received, and shall not use it for any other purpose, unless

(a) the other purpose is directly related to the purpose for which the personal health information was collected or received;

(d) the trustee is a public body, or a health care facility, and the personal health information is used

(i) to deliver, monitor or evaluate a program that relates to the provision of health care or payment for health care by the trustee, or

(ii) for research and planning that relates to the provision of health care or payment for health care by the trustee;

Limit on amount of information used or disclosed

20(2) Every use and disclosure by a trustee of personal health information must be limited to the minimum amount of information necessary to accomplish the purpose for which it is used or disclosed.

7.4.2.4 Disclosure

Disclosure of the personal health information would be authorized for the following purposes:

- Disclosure for a health care purpose to a person who is or will be providing or has provided health care to the individual (s. 22(2)(a) of PHIA)
- Disclosure with the consent of the individual (s. 22(1)(b) of PHIA)
- Disclosure to a researcher at University of Manitoba to conduct research with de-identified health information (s. 22(2)(f) and 24 of PHIA)

The disclosure of personal health information in the circumstances as noted above is authorized under the following provisions of PHIA:

Individual's consent to disclosure

22(1) Except as permitted by subsection (2), a trustee may disclose personal health information only if

(b) the individual the information is about has consented to the disclosure.

Disclosure without individual's consent

22(2) A trustee may disclose personal health information without the consent of the individual the information is about if the disclosure is

(a) to a person who is or will be providing or has provided health care to the individual, to the extent necessary to provide health care to the individual, unless the individual has instructed the trustee not to make the disclosure;

(f) in accordance with subsection 22(2.2) (disclosure to another government), section 23 (disclosure to patient's family), section 23.1 (disclosure to religious organization), section 23.2 (disclosure for fundraising), section 24 or 24.1 (disclosure for health research) or section 25 (disclosure to an information manager);

7.4.2.4.1 Disclosure for health research

24(1) A trustee may disclose personal health information to a person conducting health research if the research has been approved under this section.

Who may give an approval?

24(2) An approval may be given by

(a) the health information privacy committee established under section 59, if the personal health information is maintained by the government or a government agency; and

(b) an institutional research review committee, if the personal health information is maintained by a trustee other than the government or a government agency.

Conditions for approval

24(3) An approval may be given under this section only if the health information privacy committee or the institutional research review committee, as the case may be, has determined that

(a) the research is of sufficient importance to outweigh the intrusion into privacy that would result from the disclosure of personal health information;

(b) the research purpose cannot reasonably be accomplished unless the personal health information is provided in a form that identifies or may identify individuals;

(c) it is unreasonable or impractical for the person proposing the research to obtain consent from the individuals the personal health information is about; and

(d) the research proposal contains

(i) reasonable safeguards to protect the confidentiality and security of the personal health information, and

(ii) procedures to destroy or remove, at the earliest opportunity consistent with the purposes of the research, any information that, either by itself or when combined with other information available to the holder, allows individuals to be readily identified.

7.4.3 Agreement required

24(4) An approval under this section is conditional on the person proposing the research project entering into an agreement with the trustee, in accordance with the regulations, in which the person agrees

(a) not to publish the personal health information requested in a form that could reasonably be expected to identify the individuals concerned;

(b) to use the personal health information requested solely for the purposes of the approved research project; and

(c) to ensure that the research project complies with the safeguards and procedures described in clause (3)(d).

7.4.4 Source and accuracy of personal (health) information

Source of information

14(1) Whenever possible, a trustee shall collect personal health information directly from the individual the information is about.

Exceptions

14(2) Subsection (1) does not apply if

(a) the individual has authorized another method of collection;

For the purposes of our project, personal health information is obtained directly from the individual and not from a family member or another RHA or government department. Patients will provide their food order history data and their glucose monitoring information gathered by their wearable device that is stored on their smart phone to their health care provider (if glucose monitoring data is not collected directly from the patient, the collection from another source (Dexcom) may be authorized by the patient (s.14(2)(a) of PHIA).

7.4.5 Notification statements

Notice of collection is required under s. 15(1) and (2) of PHIA:

Notice of collection practices

15(1) A trustee who collects personal health information directly from the individual the information is about shall, before it is collected or as soon as practicable afterwards, take reasonable steps to inform the individual

(a) of the purpose for which the information is being collected; and

(b) if the trustee is not a health professional, how to contact an officer or employee of the trustee who can answer the individual's questions about the collection.

Exception if information already provided

15(2) A trustee need not comply with subsection (1) if the trustee has recently provided the individual with the information referred to in that subsection about the collection of the same or similar personal health information for the same or a related purpose.

Personal Health Information Disclosure Statement:

As part of receiving or providing health care services at a site within the Northern Health Region; we only collect, use and disclose your personal information and personal health information as permitted by The

Personal Health Information Act (PHIA) and The Freedom of Information and Protection of Privacy Act (FIPPA). These Acts require Northern Health Region to protect the privacy of your information.

7.5 Risk Identification and Mitigation

One of the risks associated with the collection of any type of data is that it becomes compromised through a security breach. It is generally accepted that proper encryption techniques, both for the transmission and storage of this data, are suitable measures for mitigating this risk.

Inappropriate access to information, by employees of the organization that holds the information, is another mechanism whereby personal information security can be breached. This can take place with both personal information and personal health information. Implementation and enforcement of policies and procedures which outline the access to information on a need-to-know basis are understood to be the most effective methods for mitigating this risk.

8 CHAPTER 8: FINANCIAL

We have created a budget that reflects the four milestones of our project as per our performance-based outcomes measurement plan discussed in Chapter 2 and the project management plan discussed in Chapter 3. As outlined in these Chapters, we propose four reporting periods over five years, in which all activities associated with that reporting period are met, as the framework for our outcomes-based contribution plan. Release of installment payments are anticipated to occur following the successful review by Infrastructure Canada of milestone reports; the reports outlined in Chapter 2. The budget reflects a comprehensive detailed breakdown of costs associated with implementation of the project.

The implementation process for this project breaks down the development of each of the three critical levers, identified in Chapter 1, and divides them into two stages of development: **building** and **operating**. The project budget breakdown reflects this approach; building costs and operating costs are assigned to each of the project lever categories.

8.1 Summary Project Budget

Overall Project		*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
Project Budget	***$ 9,990,399.57***	***$ 6,224,777.11***	***$ 1,112,069.83***	***$ 2,413,637.83***	***$ 239,914.80***
General					
Budget Summary		*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
		$ 340,200.00	*$ 127,575.00*	*$ 402,675.00*	*$ 85,050.00*
General					
General Costs ($)		$ 300,000.00	$ 112,500.00	$ 362,500.00	$ 75,000.00
Total Costs ($)		**$ 324,000.00**	**$ 121,500.00**	**$ 383,500.00**	**$ 81,000.00**
Buffer	*5%*	*$ 16,200.00*	*$ 6,075.00*	*$ 19,175.00*	*$ 4,050.00*
Total Budget - General ($)		***$ 340,200.00***	***$ 127,575.00***	***$ 402,675.00***	***$ 85,050.00***
Smart Farm					
Budget Summary		*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
		$ 5,252,270.34	*$ 706,401.37*	*$ 419,332.30*	*$ 58,152.97*
GENERAL COSTS					
Electricity Costs ($)		$ 79,873.05	$ 50,639.41	$ 172,579.21	$ 59,110.51
Water Cost ($)		$ 306.96	$ 2,953.04	$ 15,977.48	$ 5,981.32
Rent Cost ($)		$ 256,666.67	$ 105,000.00	$ 245,000.00	$ 70,000.00
BUILDING COSTS					
Preparation Costs ($)		$ 1,175,200.00	$ -	$ -	$ -
Equipment Costs ($)		$ 3,017,194.92	$ -	$ -	$ -
OPERATING COSTS					
Consumables Costs ($)		$ -	$ 92,519.61	$ 447,658.51	$ 150,451.92
Miscellaneous Costs ($)		$ 37,950.00	$ 20,900.00	$ 44,500.00	$ 5,400.00
Labour Costs ($)		$ -	$ 342,250.00	$ 1,314,250.00	$ 426,500.00
Total Costs ($)		**$ 4,567,191.60**	**$ 614,262.06**	**$ 2,239,965.19**	**$ 717,443.75**
INCOME					
Production Income ($)		$ -	$ -	$ 2,156,627.67	$ 766,907.34
Total Income ($)		**$ -**	**$ -**	**$ 2,156,627.67**	**$ 766,907.34**
Buffer	*15%*	*$ 685,078.74*	*$ 92,139.31*	*$ 335,994.78*	*$ 107,616.56*
TOTAL BUDGET - Smart Farm ($)		***$ 5,252,270.34***	***$ 706,401.37***	***$ 419,332.30***	***$ 58,152.97***
Smartphone Distribution System Costs					
Budget Summary		*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
		$ 632,306.77	*$ 105,593.46*	*$ 478,179.80*	*$ 96,711.83*
Building Costs					
Equipment Costs ($)		$ 267,478.80	$ -	$ 108,640.00	$ -
Software Development Total ($)		$ 282,500.00	$ 28,250.00	$ 56,500.00	$ -
Operating Costs					
Vehicles Costs ($)		$ -	$ 3,979.51	$ 18,149.42	$ 5,513.98
Labour Costs ($)		$ -	$ 60,000.00	$ 233,333.33	$ 80,000.00
Total Costs ($)		**$ 549,978.80**	**$ 92,229.51**	**$ 416,622.76**	**$ 85,513.98**
Income					
Charging Station Income ($)		$ 198.65	$ 553.50	$ 1,101.61	$ 1,916.76
Total Income($)		**$ 198.65**	**$ 553.50**	**$ 1,101.61**	**$ 1,916.76**
Buffer	*15%*	*$ 82,526.62*	*$ 13,917.45*	*$ 62,658.65*	*$ 13,114.61*
TOTAL BUDGET - Smartphone Distribution System($)		***$ 632,306.77***	***$ 105,593.46***	***$ 478,179.80***	***$ 96,711.83***
Biometric Feedback Study					
Budget Summary		*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
		$ -	*$ 172,500.00*	*$ 1,113,450.73*	*$ -*
Implementation Costs					
Equipment Costs ($)		$ -	$ -	$ 331,171.36	$ -
Operating Costs ($)		$ -	$ 150,000.00	$ 637,046.67	$ -
Total Costs ($)		**$ -**	**$ 150,000.00**	**$ 968,218.03**	**$ -**
Buffer	*15%*	*$ -*	*$ 22,500.00*	*$ 145,232.70*	*$ -*
TOTAL BUDGET - Biometric Study ($)		***$ -***	***$ 172,500.00***	***$ 1,113,450.73***	***$ -***

8.2 Comprehensive Project Budget

8.2.1 Budget Timeline

The budget has been developed around an outcomes-based contribution model. As such, the each of the four financial installments identified in this chapter, are directly associated with completion of project milestones. Milestone reports will be submitted to Infrastructure Canada upon completion of the outcomes identified in Chapter 2. The estimated date of report submission are identified in the project financial schedule in *Figure 15* below with red diamonds. Ten weeks has been provided allotted for milestone report review by Infrastructure Canada, with the anticipated release of the subsequent funding installment following that review.

A complete Gantt chart, including the information below along with corresponding project activities and tasks can be found in Chapter 3.

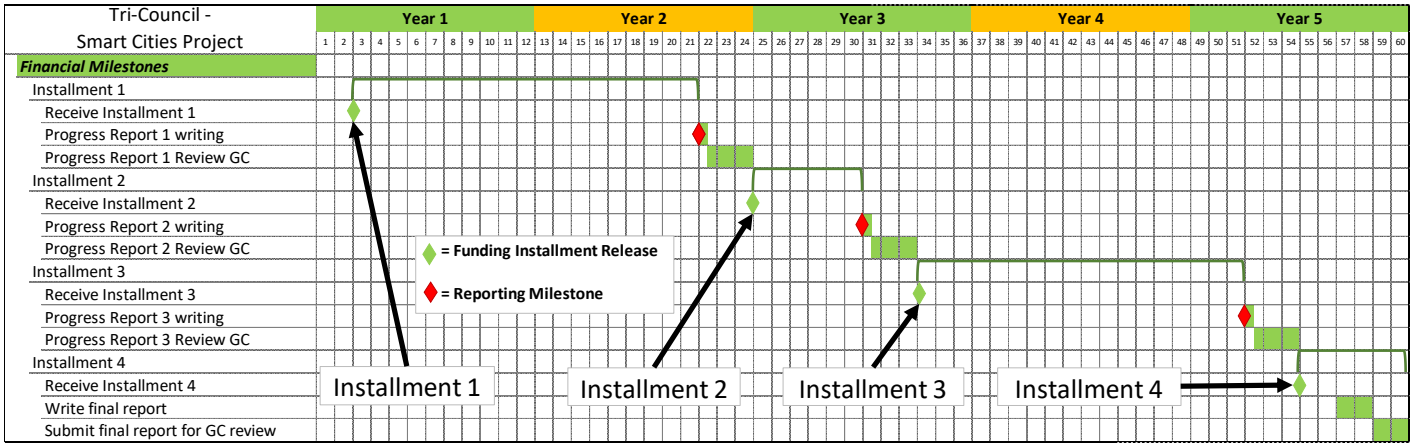


Figure 15 project funding timeline

The following sections present detailed budgets for each of the three main project activities; the Smart Farm, smartphone distribution system, and biometric feedback study. Each of these activities is then broken down into two stages; building and operating. Furthermore, each of these stages, within each activity, is broken down to a list of equipment expenses and labour expenses (hard expenses and soft expenses). There are several general costs that are associated with project management and overall project implementation and those are capture in the general operations section below.

8.2.2 General Operations Budget

The general operating budget includes items that are associated with project management and overall project implementation. This portion of the budget is included below in *Figure 16*.

A general manager will be needed to act as a coordinator for all activities included in the project. This individual will be responsible for coordinating project tasks and procurement, hiring staff, and writing milestone reports for Infrastructure Canada. It is anticipated that this person will have to travel from time to time, and so a travel budget is additionally included in the budget to accommodate these expenses as they arrive.

A community engagement coordinator will be needed from time to time throughout the implementation of the project to coordinate community engagement activities. A budget to cover their time is also included here. Those activities will include those listed in Chapter 6 and will be pertinent to the successful implementation of the project.

A community health needs assessment report was produced by The Pas and OCN in 2017-2018. The cost of that report was covered by the provincial government for The Pas and Kelsey; however, given that OCN does not fall within provincial jurisdiction, the cost of developing that report for the population of OCN was covered by the OCN band. The cost of this report was roughly $100,000. In order to ensure that an equivalent report is produced upon completion of the implementation phase, this amount has been added to the budget as it is a necessary piece of data required to accurately assess the effectiveness of the project in decreasing diabetes rates in the region.

General *Budget Summary*				*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
				$ 340,200.00	*$ 127,575.00*	*$ 402,675.00*	*$ 85,050.00*
General							
General							
Category	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Travel for meetings	$ 40,000.00	/year		$ 80,000.00	$ 30,000.00	$ 70,000.00	$ 20,000.00
General Project Manager	$ 110,000.00	/year		$ 220,000.00	$ 82,500.00	$ 192,500.00	$ 55,000.00
Community Engagement Coordinator	$ 12,000.00						
Health Needs Assessment Report Contribution	$ 100,000.00			$ -	$ -	$ 100,000.00	$ -
General Costs ($)				$ 300,000.00	$ 112,500.00	$ 362,500.00	$ 75,000.00
Total Costs ($)				***$ 324,000.00***	***$ 121,500.00***	***$ 383,500.00***	***$ 81,000.00***
Buffer		*5%*		*$ 16,200.00*	*$ 6,075.00*	*$ 19,175.00*	*$ 4,050.00*
Total Budget - General ($)				***$ 340,200.00***	***$ 127,575.00***	***$ 402,675.00***	***$ 85,050.00***

Figure 16 general project budget

8.2.3 Smart Farm Budget

The following budget, *Figure 17*, is a complete budget for the Smart Farm, presented in two activity categories, building and operating, and further broken down to a list of equipment expenses and labour expenses (hard expenses and soft expenses). Detailed descriptions follow.

Smart Farm

Budget Summary

	Installment 1	*Installment 2*	*Installment 3*	*Installment 4*
	##########	*$ 706,401.37*	*$ 419,332.30*	*$ 58,152.97*
Growing Space (ramp up to full production expected)	Year 1	Year 2	Year 3	Year 4
Active growing units	0	21	41	48
Active grow beds	0	84	164	192
Square ft grow space	0	9,148	17,860	20,909

GENERAL COSTS

Energy Use

Category	**Value**	**Units**	**Qty**	Installment 1	Installment 2	Installment 3	Installment 4
Lights Energy Use (kw*h)				0	239,206	1,076,429	358,810
Air Conditioner (kw*h)				0	84,096	378,432	126,144
Nutrients (kw*h)				0	23,635	106,356	35,452
Misc (kw*h)				1,425,705	534,639	1,247,492	356,426
Total Energy Use (kw*h)				1,425,705	881,576	2,808,709	876,832
Electricity Cost							
Basic Electricity Cost ($)				$ 356.40	$ 388.48	$ 420.55	$ 452.63
First 11,000 kwh/month ($/kw*h)				$ 0.09	$ 0.10	$ 0.10	$ 0.11
Next 8,500 kwh/month ($/kw*h)				$ 0.06	$ 0.07	$ 0.07	$ 0.08
Additional kwh/month ($/kw*h)				$ 0.04	$ 0.04	$ 0.05	$ 0.05
Electricity Costs ($)				$ 79,873.05	$ 50,639.41	$ 172,579.21	$ 59,110.51

Water Use

Category	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Total water in beds (gallons)	250	L/bed		0	50,526	227,368	75,789
Water Use per harvest (gallons/harvest)	500%	consumed / harvest		0	252,632	1,136,842	378,947
Water Use per month (gallons/month)	10	harvests/year (average)		0	210,526	947,368	315,789
Water Cost							
Service Charge (quarterly rate)				$ 34.27	$ 42.47	$ 52.63	$ 65.23
Service Charge (annual)				$ 137.08	$ 169.88	$ 210.53	$ 260.90
First 20,000 gallons ($/1,000 gallons)				$ 11.71	$ 11.75	$ 11.78	$ 11.82
Over 20,000 gallons ($/1,000 gallons)				$ 9.93	$ 11.74	$ 13.87	$ 16.40
Water Cost ($)				$ 306.96	$ 2,953.04	$ 15,977.48	$ 5,981.32

Rent

Item	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Rental of space in Otineka mall	$ 140,000.00	/year		$ 256,666.67	$ 105,000.00	$ 245,000.00	$ 70,000.00
Rent Cost ($)				$ 256,666.67	$ 105,000.00	$ 245,000.00	$ 70,000.00

BUILDING COSTS

Preparation

Category	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Renovations							
Construction Drawings	$ 30,000.00			$ 30,000.00	$ -	$ -	$ -
Procurment (building supplies)	$ 400,000.00			$ 400,000.00	$ -	$ -	$ -
Construction	$ 400,000.00			$ 400,000.00	$ -	$ -	$ -
Central Vacuum	$ 10,000.00			$ 10,000.00	$ -	$ -	$ -
Lockers, shelving, boot racks for staff	$ 10,000.00			$ 10,000.00	$ -	$ -	$ -
Fixture (counters, sinks, coolers, tables)	$ 105,000.00			$ 105,000.00	$ -	$ -	$ -
Completion	$ 50,000.00			$ 50,000.00	$ -	$ -	$ -
Security Camera system	$ 35,000.00	/system		$ 35,000.00	$ -	0	0
Preparation Costs Subtotal ($)				**$ 1,040,000.00**	**$ -**	**$ -**	**$ -**
GST				*$ 52,000.00*	$ -	$ -	$ -
PST				*$ 83,200.00*	$ -	$ -	$ -
Preparation Costs ($)				$ 1,175,200.00	$ -	$ -	$ -

Equipment

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Smart Farm System Cost (terms 50% down, 40% on arrival, 10% aft. training)						$ -	
Electrical system	$ 33,000.00	/each	1	$ 33,000.00	$ -	0	0
Physical Structure	$ 6,500.00	/each	48	$ 312,000.00	$ -	0	0
Environmental System	$ 4,000.00	/each	4	$ 16,000.00	$ -	0	0
Lighting System	$ 300.00	/each	3072	$ 921,600.00	$ -	0	0
Nutrient System	$ 100,000.00	/each	4	$ 400,000.00	$ -	0	0
Control System	$ 9,500.00	/each	4	$ 38,000.00	$ -	0	0
HVAC System	$ 39,000.00	/each	4	$ 156,000.00	$ -	0	0
Labour	$ 500.00	/day/engineer	800	$ 400,000.00	$ -	0	0
Training Fees	$ 1,500.00	/ engineer	30	$ 45,000.00	$ -	0	0
Packaging/Shipping	$ 6,000.00	/container	10	$ 60,000.00	$ -	0	0
Extras	$ 15,000.00	/container	10	$ 150,000.00	$ -	0	0
System Installation (contracted)	$ 100,000.00			$ 100,000.00	$ -	$ -	$ -
Produce Bagging Station	$ 728.00		3 stations	$ 2,184.00	$ -	$ -	$ -
bag dispenser	$ 128.00	/ stand					
rolling carts	$ 600.00	/table					
Packaging station	$ 1,750.00		10 stations	$ 17,500.00	$ -	$ -	$ -
workbench	$ 750.00	/each					
tablet	$ 800.00	/each					
wall mount for tablet	$ 200.00	/each					
Admin offices	$ 2,200.00		4 stations	$ 8,800.00	$ -	$ -	$ -
Computer stations	$ 1,200.00	/station					
Desk	$ 350.00						
Chair	$ 200.00						
Printer	$ 250.00						
Whiteboard	$ 200.00						
Server	$ 10,000.00	/each		$ 10,000.00	$ -	$ -	$ -
Equipment Costs Subtotal ($)				**$ 2,670,084.00**	**$ -**	**$ -**	**$ -**
GST				*$ 133,504.20*	*$ -*	*$ -*	*$ -*
PST				*$ 213,606.72*	*$ -*	*$ -*	*$ -*
Equipment Costs ($)				$ 3,017,194.92	$ -	$ -	$ -

OPERATING COSTS

Consumables

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Seeding							
Total plants				0	983,040	1,597,440	737,280
Seed cost	$ 0.0035	/ seed (avg)		$ -	$ 3,440.64	$ 5,591.04	$ 2,580.48
Grow medium sponges	$ 0.01	/ sponge		$ -	$ 9,830.40	$ 15,974.40	$ 7,372.80
Polystyrene rafts	$ 5.00	/raft	1 year/raft set	$ -	$ -	$ 10,240.00	$ -
Cleaning							
Vinegar	$ 2.98	/gallon	0.5 gallons/units/month	$ -	$ 643.68	$ 1,501.92	$ 429.12
Baking Soda	$ 1.98	/package	0.5 packages/unit/month	$ -	$ 427.68	$ 997.92	$ 285.12
Bleach	$ 2.99	/gallon	2 gallons/unit/year	$ -	$ 215.28	$ 502.32	$ 143.52
Others (sponges, bottle cleaners, etc)	$ 45.00	/package	0.5 packages/unit/year	$ -	$ 810.00	$ 1,890.00	$ 540.00
Fertilizer							
Nutrient Mixture A	$ 10.00	/pound	25 pounds/unit/year	$ -	$ 4,000.00	$ 18,000.00	$ 6,000.00
Nutrient Mixture B	$ 10.00	/pound	25 pounds/unit/year	$ -	$ 4,000.00	$ 18,000.00	$ 6,000.00
Additions Nitric Acid (60%) 4L	$ 55.00	/gallon	1 gallons/unit/year	$ -	$ 880.00	$ 3,960.00	$ 1,320.00
Phosporic Acid 4L	$ 40.00	/gallon	0.5 gallons/unit/year	$ -	$ 320.00	$ 1,440.00	$ 480.00
Sanitizer (Boot Tray Apon Entry to Room)	$ 44.95	/gallon	0.5 gallons/month	$ -	$ 202.28	$ 471.98	$ 134.85
Hygene							
Hairnets (100/per package)	$ 10.95	/package	0.3 packages/employee/m	$ -	$ 364.64	$ 1,448.69	$ 473.04
Lab Coats (1/ package)	$ 83.00	/package	1 packages/employee/ye	$ -	$ 9,213.00	$ 29,797.00	$ 7,968.00
Gloves (100 pair / package)	$ 29.99	/package	3 packages/employee/ye	$ -	$ 832.22	$ 3,306.40	$ 1,079.64
Visitor lab coats (10 pack)	$ 66.95	/package	1 packages/month	$ -	$ 602.55	$ 1,405.95	$ 401.70
Other Supplies							
Mops	$ 34.98	/each	3 items/year	$ -	$ 104.94	$ 209.88	$ 104.94
Buckets	$ 5.47	/each	1 items/unit/year	$ -	$ 87.52	$ 437.60	$ 262.56
Extentable Swiffers (w/ 5 cloths)	$ 39.99	/each	25 items/year	$ -	$ 999.75	$ 1,999.50	$ 999.75
Squeegee	$ 34.98	/each	0.25 items/unit/year	$ -	$ 139.92	$ 699.60	$ 419.76
Cleaning rags (15 lbs / box)	$ 49.99	/ box	1 boxes/unit/year	$ -	$ 799.84	$ 3,999.20	$ 2,399.52
Papertowel (12 rolls / package)	$ 23.99	/package	4 packages/unit/year	$ -	$ 1,535.36	$ 7,676.80	$ 4,606.08
Garbage Bags (32 / box)	$ 19.45	/box	1 boxes/unit/year	$ -	$ 311.20	$ 1,556.00	$ 933.60
Packaging							
Paper bags (500/bundle)	$ 67.00	/bundle	2 bundles/unit/month	$ -	$ 19,296.00	$ 115,776.00	$ 38,592.00
Printer Labels (2 1/8 x 4)	$ 18.00	/roll (220)	5 labels/unit/month	$ -	$ 12,960.00	$ 77,760.00	$ 25,920.00
Plastic bags	$ 63.00	/roll (750)	2 bags/unit/month	$ -	$ 18,144.00	$ 108,864.00	$ 36,288.00
Consumables Subtotal ($)				**$ -**	**$ 90,160.89**	**$ 433,506.19**	**$ 145,734.48**
GST				*$ -*	*$ 907.20*	*$ 5,443.20*	*$ 1,814.40*
PST				*$ -*	*$ 1,451.52*	*$ 8,709.12*	*$ 2,903.04*
Consumables Costs ($)				$ -	$ 92,519.61	$ 447,658.51	$ 150,451.92

Miscellaneous

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Operating / Administrative Costs							
Internet and phones	$ 250.00	/month		$ 1,750.00	$ 2,250.00	$ 5,250.00	$ 1,500.00
Legal fees	$ 7,500.00	/year		$ 15,000.00	$ 7,500.00	$ 15,000.00	$ -
Annual accountant fees	$ 5,000.00	/year		$ 5,000.00	$ 5,000.00	$ 10,000.00	$ -
Software (ex quickbooks)	$ 300.00	/year		$ 600.00	$ 300.00	$ 600.00	$ -
Community engagement	$ 500.00	/month		$ 12,000.00	$ 4,500.00	$ 10,500.00	$ 3,000.00
Employee perks (ex coffee)	$ 150.00	/month		$ 3,600.00	$ 1,350.00	$ 3,150.00	$ 900.00
Miscellaneous Costs ($)				$ 37,950.00	$ 20,900.00	$ 44,500.00	$ 5,400.00

Labour

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Number of employees							
Manager (book keeping, promotions, order supplies)				0	1	1	1
Supervisor (planting supervisor and packaging supervisor)				0	1	1	1
Planter/harvestor			3 units / harvestor	0	6	11	16
Packager			3 harvesters / packager	0	2	4	6
Custodian							
Total Employees				0	10	17	24
Cost of employees							
Manager Salary	$ 60,000.00	/year		$ -	$ 45,000.00	$ 105,000.00	$ 30,000.00
Supervisor Salary	$ 45,000.00	/year		$ -	$ 33,750.00	$ 78,750.00	$ 22,500.00
Planter/harvestor Salary	$ 34,000.00	/year		$ -	$ 195,500.00	$ 824,500.00	$ 272,000.00
Packager Salary	$ 34,000.00	/year		$ -	$ 68,000.00	$ 306,000.00	$ 102,000.00
Custodian Salary	$ 30,000.00	/year		$ 7,500.00	$ 22,500.00	$ 7,500.00	$ -
Labour Costs ($)				$ -	$ 342,250.00	$ 1,314,250.00	$ 426,500.00
Total Costs ($)				**$ 4,567,191.60**	**$ 614,262.06**	**$ 2,239,965.19**	**$ 717,443.75**

INCOME

Active Beds				0	21	41	48
Product Spoilage Rates					50%	30%	15%

Local production

Product	lbs (or bunches)/plant/l	Cycle Time		Density and Price	Installment 1	Installment 2	Installment 3	Installment 4
Strawberries	2.5	12	weeks/harvest	4 plants/sq.ft. $ 3.99 /lb	0 $ -	1.7 $ 58,055.50	3.6 $ 387,873.49	4 $ 130,546.42
Lettuce	1	4	weeks/harvest	8 plants/sq.ft. $ 1.98 /head	0 $ -	1.3 $ 54,566.74	2.6 $ 333,380.36	3 $ 116,608.38
Spinach	0.25	4	weeks/harvest	8 plants/sq.ft. $ 7.11 /lb	0 $ -	1.3 $ 48,986.05	2.6 $ 299,284.64	3 $ 104,682.52
Bok Choi		6	weeks/harvest	4 plants/sq.ft. $ 2.26 /head	0 $ -	1.3 $ 20,761.08	2 $ 97,833.05	2 $ 29,577.43
Honeydew Melo		8	weeks/harvest	0.5 plants/sq.ft. $ 4.79 /per	0 $ -	0 $ -	1.1 $ 11,528.05	2 $ 5,877.04
Cantaloupe		8	weeks/harvest	0.5 plants/sq.ft. $ 2.99 /per	0 $ -	0 $ -	1.1 $ 7,196.00	2 $ 3,668.55
Tomatoes	5	8	weeks/harvest	1 plants/sq.ft. $ 2.98 /lb	0 $ -	1.3 $ 25,664.28	2 $ 120,938.53	2 $ 36,562.81
Cabbage		8	weeks/harvest	1 plants/sq.ft. $ 3.60 /per	0 $ -	1.3 $ 6,200.77	2 $ 29,220.05	2 $ 8,833.97
Broccoli		8	weeks/harvest	1 plants/sq.ft. $ 3.50 /per	0 $ -	1.3 $ 9,909.90	2 $ 34,684.65	2 $ 9,909.90
Cauliflower		12	weeks/harvest	1 plants/sq.ft. $ 3.50 /per	0 $ -	1.3 $ 4,019.02	2 $ 18,938.92	2 $ 5,725.72
Onion		12	weeks/harvest	8 plants/sq.ft. $ 1.15 /per	0 $ -	1.3 $ 10,564.27	2 $ 49,782.30	2 $ 15,050.46
Kohlrabi		6.4	weeks/harvest	4 plants/sq.ft. $ 3.97 /per	0 $ -	0 $ -	1.1 $ 95,545.59	2 $ 48,709.52
Chard		4	weeks/harvest	4 plants/sq.ft. $ 2.97 head	0 $ -	0 $ -	1.1 $ 114,365.91	2 $ 58,304.19
Beets		6	weeks/harvest	8 plants/sq.ft. $ 0.62 /per	0 $ -	1.3 $ 11,391.04	2 $ 53,678.31	2 $ 16,228.33
Radishes		4	weeks/harvest	16 plants/sq.ft. $ 0.30 /per	0 $ -	0 $ -	1.1 $ 46,208.45	2 $ 23,557.25
Kale		6	weeks/harvest	1 plants/sq.ft. $ 2.98 head	0 $ -	1.3 $ 6,843.81	2 $ 32,250.28	2 $ 9,750.08
Carrots		10	weeks/harvest	16 plants/sq.ft. $ 0.50 /per	0 $ -	1.3 $ 11,023.58	2 $ 51,946.75	2 $ 15,704.83
Celery		12	weeks/harvest	4 plants/sq.ft. $ 1.97 /per	0 $ -	0 $ -	1.1 $ 25,286.29	2 $ 12,891.05
Okra	1	8	weeks/harvest	1 plants/sq.ft. $ 4.99 /lb	0 $ -	0.7 $ 4,591.82	2 $ 40,502.23	2 $ 12,244.86
Basil	1	9	weeks/harvest	2 plants/sq.ft. ##### /lb	0 $ -	1.3 $ 34,173.11	2.6 $ 208,783.66	3 $ 73,027.47
Cilantro	2	4	weeks/harvest	1 plants/sq.ft. $ 2.00 /bunch	0 $ -	1 $ 10,098.66	1 $ 32,466.72	1 $ 9,815.52
Dill	2	4	weeks/harvest	1 plants/sq.ft. $ 2.00 /bunch	0 $ -	1 $ 10,098.66	1 $ 32,466.72	1 $ 9,815.52
Mint	2	4	weeks/harvest	1 plants/sq.ft. $ 2.00 /bunch	0 $ -	1 $ 10,098.66	1 $ 32,466.72	1 $ 9,815.52
Ice plant	?				0 $ -	0 $ -	0 $ -	0 $ -
Production Income ($)					**$ -**	**$ -**	**$ 2,156,627.67**	**$ 766,907.34**
Total Income ($)					**$ -**	**$ -**	**$ 2,156,627.67**	**$ 766,907.34**
Buffer		*15%*			*$ 685,078.74*	*$ 92,139.31*	*$ 335,994.78*	*$ 107,616.56*
TOTAL BUDGET - Smart Farm ($)					***$ 5,252,270.34***	***$ 706,401.37***	***$ 419,332.30***	***$ 58,152.97***

Figure 17 Smart Farm detailed budget

8.2.3.1 General Budget

8.2.3.1.1 Energy Use Budget

Electricity is primarily used for operation of the Smart Farm and serves many functions, most notably it is the feedstock for light energy needed for food growth. The Smart Farm will use more than 3000 light units to drive photosynthesis. The conversion of electricity to light is accompanied by heat generation and so air conditioning system will be used to remove that heat from the grow area. The Smart Farm technology from KAST utilizes high efficiency LED lighting system to minimize heat production; however, some degree of heat production is unavoidable. Circulation of nutrients with pumps and mixers is another source of energy usage. General lighting, control system operation, air circulation, and dehumidification are also users of electricity in the Smart Farm. During the construction phase this will also include power tool operation, and other miscellaneous contractor equipment.

Figure 18 illustrates the relative contribution of each of these categories to the overall energy bill, based on KAST's recommended energy use numbers, and the projected cost of energy at each installment based on Manitoba Hydro commercial account rates and projected rate increases over the coming five years.

Energy Use

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Lights Energy Use (kw*h)				0	239,206	1,076,429	358,810
Air Conditioner (kw*h)				0	84,096	378,432	126,144
Nutrients (kw*h)				0	23,635	106,356	35,452
Misc (kw*h)				1,425,705	534,639	1,247,492	356,426
Total Energy Use (kw*h)				1,425,705	881,576	2,808,709	876,832
Electricity Cost							
Basic Electricity Cost ($)				$ 356.40	$ 388.48	$ 420.55	$ 452.63
First 11,000 kwh/month ($/kw*h)				$ 0.09	$ 0.10	$ 0.10	$ 0.11
Next 8,500 kwh/month ($/kw*h)				$ 0.06	$ 0.07	$ 0.07	$ 0.08
Additional kwh/month ($/kw*h)				$ 0.04	$ 0.04	$ 0.05	$ 0.05
Electricity Costs ($)				$ 79,873.05	$ 50,639.41	$ 172,579.21	$ 59,110.51

Figure 18 Smart Farm - energy use budget

8.2.3.1.2 Water Use Budget

Water is used extensively in the Smart Farm as it is the nutrient delivery medium, and a critical input in the cultivation of food products. Water usage is estimated based on KAST's recommended values of monthly consumption per month as well as the volume required to refill beds following a quarterly cleaning cycle. The cost of water is then calculated based on a quarterly service charge and cost per 1000 gallons delivered as per municipality rates. *Figure 19* below identifies these costs and rates in a tabular format.

Water Use

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Total water in beds (gallons)	250	L/bed		0	50,526	227,368	75,789
Water Use per harvest (gallons/harvest)	500%	consumed / harvest		0	252,632	1,136,842	378,947
Water Use per month (gallons/month)	10	harvests/year (average)		0	210,526	947,368	315,789
Water Cost							
Service Charge (quarterly rate)				$ 34.27	$ 42.47	$ 52.63	$ 65.23
Service Charge (annual)				$ 137.08	$ 169.88	$ 210.53	$ 260.90
First 20,000 gallons ($/1,000 gallons)				$ 11.71	$ 11.75	$ 11.78	$ 11.82
Over 20,000 gallons ($/1,000 gallons)				$ 9.93	$ 11.74	$ 13.87	$ 16.40
Water Cost ($)				$ 306.96	$ 2,953.04	$ 15,977.48	$ 5,981.32

Figure 19 Smart Farm - water use budget

8.2.3.1.3 Rent Budget

Rent in the Otineka mall is payable monthly and has been quoted by administration. The current tenant of the space is departing in May of 2019, and so the 19,500 square foot space will be available for the implementation of this project. Rent rates have been quoted by mall administration. *Figure 20* illustrates this monthly expense by installment.

Rent

Item	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Rental of space in Otineka mall	$ 140,000.00	/year		$ 256,666.67	$ 105,000.00	$ 245,000.00	$ 70,000.00
Rent Cost ($)				$ 256,666.67	$ 105,000.00	$ 245,000.00	$ 70,000.00

Figure 20 Smart Farm - rent budget

8.2.3.2 Building Budget

8.2.3.2.1 Preparation Budget

In preparation for the Smart Farm system, the space in the Otineka mall will need to be renovated to provide partition walls and the electrical infrastructure for operation of the Smart Farm. A preliminary rendering of the space is attached at the end of this chapter for reference. An estimated $50/square foot has been used for calculation of construction costs given the minimal remodelling needed for the space; construction of a few walls, installation of basic electrical infrastructure within those walls, as well as some plumbing infrastructure.

Figure 21 identifies items within this budget, including completion of construction drawings, which will be done upon progression to the implementation phase, general construction materials and contract labour, as well as fixtures and appliances such as vacuums, lockers and shelving for employees, as well as coolers and tables for processing of plant factory products.

Preparation

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Renovations							
Construction Drawings	$ 30,000.00			$ 30,000.00	$ -	$ -	$ -
Procurment (building supplies)	$ 400,000.00			$ 400,000.00	$ -	$ -	$ -
Construction	$ 400,000.00			$ 400,000.00	$ -	$ -	$ -
Central Vacuum	$ 10,000.00			$ 10,000.00	$ -	$ -	$ -
Lockers, shelving, boot racks for staff	$ 10,000.00			$ 10,000.00	$ -	$ -	$ -
Fixture (counters, sinks, coolers, tables)	$ 105,000.00			$ 105,000.00	$ -	$ -	$ -
Completion	$ 50,000.00			$ 50,000.00	$ -	$ -	$ -
Security Camera system	$ 35,000.00	/system		$ 35,000.00	$ -	0	0
Preparation Costs Subtotal ($)				**$ 1,040,000.00**	**$ -**	**$ -**	**$ -**
GST				*$ 52,000.00*	*$ -*	*$ -*	*$ -*
PST				*$ 83,200.00*	*$ -*	*$ -*	*$ -*
Preparation Costs ($)				$ 1,175,200.00	$ -	$ -	$ -

Figure 21 Smart Farm building - preparation budget

8.2.3.2.2 Equipment Budget

The equipment required for this project is identified in *Figure 22*. The largest item in this budget is the Smart Farm hardware, for which a quote has been provided by KAST, along with preliminary floorplan drawings outlining the intended equipment layout. Equipment will be received in shipping containers and system assembly and installation will take place following its receipt by technicians of the pilot OCN Smart Farm

project. Contracted support staff will be used to assist the technicians in assembling this equipment. Cost estimates have been made for assembly and installation costs based on the known assembly time of the pilot Smart Farm and the increased scale of this Smart Farm.

Prices for bagging stations, packaging stations, administrative office equipment, and server equipment is based on supplier list pricing for components.

Equipment

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Smart Farm System Cost (terms 50% down, 40% on arrival, 10% aft. training)						$ -	
Electrical system	$ 33,000.00	/each	1	$ 33,000.00	$ -	0	0
Physical Structure	$ 6,500.00	/each	48	$ 312,000.00	$ -	0	0
Environmental System	$ 4,000.00	/each	4	$ 16,000.00	$ -	0	0
Lighting System	$ 300.00	/each	3072	$ 921,600.00	$ -	0	0
Nutrient System	$ 100,000.00	/each	4	$ 400,000.00	$ -	0	0
Control System	$ 9,500.00	/each	4	$ 38,000.00	$ -	0	0
HVAC System	$ 39,000.00	/each	4	$ 156,000.00	$ -	0	0
Labour	$ 500.00	/day/engineer	800	$ 400,000.00	$ -	0	0
Training Fees	$ 1,500.00	/ engineer	30	$ 45,000.00	$ -	0	0
Packaging/Shipping	$ 6,000.00	/container	10	$ 60,000.00	$ -	0	0
Extras	$ 15,000.00	/container	10	$ 150,000.00	$ -	0	0
System Installation (contracted)	$ 100,000.00			$ 100,000.00	$ -	$ -	$ -
Produce Bagging Station	$ 728.00		3 stations	$ 2,184.00	$ -	$ -	$ -
bag dispenser	$ 128.00	/ stand					
rolling carts	$ 600.00	/table					
Packaging station	$ 1,750.00		10 stations	$ 17,500.00	$ -	$ -	$ -
workbench	$ 750.00	/each					
tablet	$ 800.00	/each					
wall mount for tablet	$ 200.00	/each					
Admin offices	$ 2,200.00		4 stations	$ 8,800.00	$ -	$ -	$ -
Computer stations	$ 1,200.00	/station					
Desk	$ 350.00						
Chair	$ 200.00						
Printer	$ 250.00						
Whiteboard	$ 200.00						
Server	$ 10,000.00	/each		$ 10,000.00	$ -	$ -	$ -
Equipment Costs Subtotal ($)				**$ 2,670,084.00**	**$ -**	**$ -**	**$ -**
GST				*$ 133,504.20*	*$ -*	*$ -*	*$ -*
PST				*$ 213,606.72*	*$ -*	*$ -*	*$ -*
Equipment Costs ($)				$ 3,017,194.92	$ -	$ -	$ -

Figure 22 Smart Farm building - equipment budget

8.2.3.3 Operating Budget

8.2.3.3.1 Consumables Budget

Operation of the Smart Farm includes the use of many consumables, identified in *Figure 23*. The items identified on the list below are derived from the operations budget of the pilot Smart Farm that has been running in OCN since 2015. By scaling the quantity of items used for the pilot Smart Farm, based on relative number of growing beds available, costs for seeding, cleaning, and nutrients have been assigned. The price of hygiene supplies, including lab coats, gloves, and hairnets are catalog prices from the supplier and quantities needed have been estimated based on the number of employees anticipated to be working at the Smart Farm through each installment stage. The pilot Smart Farm has experienced a significant number of visitors throughout the past 4 years, and so, visitor hygiene supplies have been estimated based on these known values.

The price of cleaning supplies and packaging supplies is established based on catalog price from suppliers. Quantities of cleaning supplies are estimated based on the known quantity needed for the pilot Smart Farm

and the proportional size of the Smart Farm facility in question. Quantities of packaging supplies are estimated based on projected production rates.

Consumables

Category		Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Seeding								
Total plants					0	983,040	1,597,440	737,280
Seed cost		$ 0.0035	/ seed (avg)		$ -	$ 3,440.64	$ 5,591.04	$ 2,580.48
Grow medium sponges		$ 0.01	/ sponge		$ -	$ 9,830.40	$ 15,974.40	$ 7,372.80
Polystyrene rafts		$ 5.00	/raft	1 year/raft set	$ -	$ -	$ 10,240.00	$ -
Cleaning								
Vinegar		$ 2.98	/gallon	0.5 gallons/units/month	$ -	$ 643.68	$ 1,501.92	$ 429.12
Baking Soda		$ 1.98	/package	0.5 packages/unit/month	$ -	$ 427.68	$ 997.92	$ 285.12
Bleach		$ 2.99	/gallon	2 gallons/unit/year	$ -	$ 215.28	$ 502.32	$ 143.52
Others (sponges, bottle cleaners, etc)		$ 45.00	/package	0.5 packages/unit/year	$ -	$ 810.00	$ 1,890.00	$ 540.00
Fertilizer								
Nutrient Mixture A		$ 10.00	/pound	25 pounds/unit/year	$ -	$ 4,000.00	$ 18,000.00	$ 6,000.00
Nutrient Mixture B		$ 10.00	/pound	25 pounds/unit/year	$ -	$ 4,000.00	$ 18,000.00	$ 6,000.00
Additions	Nitric Acid (60%) 4L	$ 55.00	/gallon	1 gallons/unit/year	$ -	$ 880.00	$ 3,960.00	$ 1,320.00
	Phosporic Acid 4L	$ 40.00	/gallon	0.5 gallons/unit/year	$ -	$ 320.00	$ 1,440.00	$ 480.00
Sanitizer	(Boot Tray Apon Entry to Room)	$ 44.95	/gallon	0.5 gallons/month	$ -	$ 202.28	$ 471.98	$ 134.85
Hygene								
Hairnets (100/per package)		$ 10.95	/package	0.3 packages/employee/m	$ -	$ 364.64	$ 1,448.69	$ 473.04
Lab Coats (1/ package)		$ 83.00	/package	1 packages/employee/ye	$ -	$ 9,213.00	$ 29,797.00	$ 7,968.00
Gloves (100 pair / package)		$ 29.99	/package	3 packages/employee/ye	$ -	$ 832.22	$ 3,306.40	$ 1,079.64
Visitor lab coats (10 pack)		$ 66.95	/package	1 packages/month	$ -	$ 602.55	$ 1,405.95	$ 401.70
Other Supplies								
Mops		$ 34.98	/each	3 items/year	$ -	$ 104.94	$ 209.88	$ 104.94
Buckets		$ 5.47	/each	1 items/unit/year	$ -	$ 87.52	$ 437.60	$ 262.56
Extentable Swiffers (w/ 5 cloths)		$ 39.99	/each	25 items/year	$ -	$ 999.75	$ 1,999.50	$ 999.75
Squeegee		$ 34.98	/each	0.25 items/unit/year	$ -	$ 139.92	$ 699.60	$ 419.76
Cleaning rags (15 lbs / box)		$ 49.99	/ box	1 boxes/unit/year	$ -	$ 799.84	$ 3,999.20	$ 2,399.52
Papertowel (12 rolls / package)		$ 23.99	/package	4 packages/unit/year	$ -	$ 1,535.36	$ 7,676.80	$ 4,606.08
Garbage Bags (32 / box)		$ 19.45	/box	1 boxes/unit/year	$ -	$ 311.20	$ 1,556.00	$ 933.60
Packaging								
Paper bags (500/bundle)		$ 67.00	/bundle	2 bundles/unit/month	$ -	$ 19,296.00	$ 115,776.00	$ 38,592.00
Printer Labels (2 1/8 x 4)		$ 18.00	/roll (220)	5 labels/unit/month	$ -	$ 12,960.00	$ 77,760.00	$ 25,920.00
Plastic bags		$ 63.00	/roll (750)	2 bags/unit/month	$ -	$ 18,144.00	$ 108,864.00	$ 36,288.00
Consumables Subtotal ($)					**$ -**	**$ 90,160.89**	**$ 433,506.19**	**$ 145,734.48**
GST					*$ -*	*$ 907.20*	*$ 5,443.20*	*$ 1,814.40*
PST					*$ -*	*$ 1,451.52*	*$ 8,709.12*	*$ 2,903.04*
Consumables Costs ($)					$ -	$ 92,519.61	$ 447,658.51	$ 150,451.92

Figure 23 Smart Farm operations – consumables budget

8.2.3.3.2 Miscellaneous Budget

A list of miscellaneous operating costs is included in *Figure 24* below.

There are several ongoing operating costs, including internet, phone, community engagement costs (ex. printing, survey software subscriptions, community cooking class consumables, travel costs associated with visiting the school or similar activities) that are anticipated to occur on a monthly basis. The price of the internet and phone are based on list prices from local service providers. Community engagement costs are estimated based on projected activities. This cost is calculated as a monthly cost in the budget, however it is not anticipated to be recurring with the same consistency as phone and internet expenses.

Legal fees have been assigned based on the estimated cost for completion of the formation of the not-for-profit corporation identified in Chapter 2, as well as the creation of associated by-law documents. Annual accounting fees are assigned for the completion of year end financial documents required for the not-for-profit corporation. These will need to be completed on an annual basis. Bookkeeping software, such as Quickbooks, will be required to keep track of income and expenses on a month to month basis. The subscription for this software has been established based on a list price from the supplier's website.

Miscellaneous								
Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Operating / Administrative Costs							
Internet and phones	$ 250.00	/month		$ 1,750.00	$ 2,250.00	$ 5,250.00	$ 1,500.00
Legal fees	$ 7,500.00	/year		$ 15,000.00	$ 7,500.00	$ 15,000.00	$ -
Annual accountant fees	$ 5,000.00	/year		$ 5,000.00	$ 5,000.00	$ 10,000.00	$ -
Software (ex quickbooks)	$ 300.00	/year		$ 600.00	$ 300.00	$ 600.00	$ -
Community engagement	$ 500.00	/month		$ 12,000.00	$ 4,500.00	$ 10,500.00	$ 3,000.00
Employee perks (ex coffee)	$ 150.00	/month		$ 3,600.00	$ 1,350.00	$ 3,150.00	$ 900.00
Miscellaneous Costs ($)				$ 37,950.00	$ 20,900.00	$ 44,500.00	$ 5,400.00

Figure 24 Smart Farm operations - miscellaneous budget

8.2.3.3.3 Labour Budget

Operation of the Smart Farm will require the hiring of staff for the positions of Smart Farm manager, supervisor, planter/harvester, packager, and custodian. (Note, labour costs associated with operation of the smartphone distribution system are identified in a later section). All salary values are assigned based on values used for the pilot Plant Factory. The number of personnel assigned to the role of planter/harvester and packager are estimated by scaling the number of employees required to operate the pilot Smart Farm in OCN. It is assumed that a similar ratio of planters/harvesters and packagers to number of active beds is consistent between the pilot Smart Farm and this project's Smart Farm. Therefore, based on the number of active Smart Farm beds that will be operating throughout the ramp up process of this project, the number of required employees has been estimated. These values are all presented in *Figure 25* below.

The intended strategy for establishing the correct employee to active grow bed ratio will involve starting with a fewer number of employees and having them perform seeding, planting, and harvesting operations through several harvesting cycles. As they gain familiarity with their required tasks, the number of beds they are responsible for will be increased and further employees will be added as necessary.

Labour							
Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Number of employees							
Manager (book keeping, promotions, order supplies)				0	1	1	1
Supervisor (planting supervisor and packaging supervisor)				0	1	1	1
Planter/harvestor			3 units / harvestor	0	6	11	16
Packager			3 harvesters / packager	0	2	4	6
Custodian							
Total Employees				0	10	17	24
Cost of employees							
Manager Salary	$ 60,000.00	/year		$ -	$ 45,000.00	$ 105,000.00	$ 30,000.00
Supervisor Salary	$ 45,000.00	/year		$ -	$ 33,750.00	$ 78,750.00	$ 22,500.00
Planter/harvestor Salary	$ 34,000.00	/year		$ -	$ 195,500.00	$ 824,500.00	$ 272,000.00
Packager Salary	$ 34,000.00	/year		$ -	$ 68,000.00	$ 306,000.00	$ 102,000.00
Custodian Salary	$ 30,000.00	/year		$ 7,500.00	$ 22,500.00	$ 7,500.00	$ -
Labour Costs ($)				$ -	$ 342,250.00	$ 1,314,250.00	$ 426,500.00

Figure 25 Smart Farm operations - labour budget

8.2.3.4 Income Budget

Operation of the Smart Farm will commence following the release of installment 2. The food products created through operation of the Smart Farm will be sold to community members and so the income associated with projected sales is outlined below in *Figure 26*. The calculation is performed on a month to month basis and is based on the number of anticipated active beds, species specific planting density, spoilage rates, and the projected market bearable price per unit.

Species specific planting density is well-established knowledge in the hydroponic community and the Smart Farm manufacturer furthermore provides recommendations for planting densities for their equipment.

Spoilage rate considerations include anticipated crop failure while employees are establishing familiarity with the equipment and unpurchased product. Furthermore, during the ramp up stage following receipt of installment 2, no income is calculated. This is done to create a financially safe learning period where operations are not dependent on revenue for sustainability.

Price per unit of each product has been determined based on a market survey of same-species products at superstore in Winnipeg; generally considered an inexpensive produce supplier in the region. Those prices will be further refined with time, giving consideration both to market bearable prices and to cover operating costs. The intention is to establish a pricing model and product mix that decreases the cost of high-quality food within the community.

Active Beds					0	21	41	48	
Product Spoilage Rates						50%	30%	15%	
Local production									
Product	**lbs (or bunches)/plant/l**	**Cycle Time**		**Density and Price**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**	
Strawberries	2.5	12	weeks/harvest	4 plants/sq.ft. $ 3.99 /lb	0 $ -	1.7 $ 58,055.50	3.6 $ 387,873.49	4 $ 130,546.42	
Lettuce	1	4	weeks/harvest	8 plants/sq.ft. $ 1.98 /head	0 $ -	1.3 $ 54,566.74	2.6 $ 333,380.36	3 $ 116,608.38	
Spinach	0.25	4	weeks/harvest	8 plants/sq.ft. $ 7.11 /lb	0 $ -	1.3 $ 48,986.05	2.6 $ 299,284.64	3 $ 104,682.52	
Bok Choi		6	weeks/harvest	4 plants/sq.ft. $ 2.26 /head	0 $ -	1.3 $ 20,761.08	2 $ 97,833.05	2 $ 29,577.43	
Honeydew Melo		8	weeks/harvest	0.5 plants/sq.ft. $ 4.79 /per	0 $ -	0 $ -	1.1 $ 11,528.05	2 $ 5,877.04	
Cantaloupe		8	weeks/harvest	0.5 plants/sq.ft. $ 2.99 /per	0 $ -	0 $ -	1.1 $ 7,196.00	2 $ 3,668.55	
Tomatoes	5	8	weeks/harvest	1 plants/sq.ft. $ 2.98 /lb	0 $ -	1.3 $ 25,664.28	2 $ 120,938.53	2 $ 36,562.81	
Cabbage		8	weeks/harvest	1 plants/sq.ft. $ 3.60 /per	0 $ -	1.3 $ 6,200.77	2 $ 29,220.05	2 $ 8,833.97	
Broccoli		8	weeks/harvest	1 plants/sq.ft. $ 3.50 /per	0 $ -	1.3 $ 9,909.90	2 $ 34,684.65	2 $ 9,909.90	
Cauliflower		12	weeks/harvest	1 plants/sq.ft. $ 3.50 /per	0 $ -	1.3 $ 4,019.02	2 $ 18,938.92	2 $ 5,725.72	
Onion		12	weeks/harvest	8 plants/sq.ft. $ 1.15 /per	0 $ -	1.3 $ 10,564.27	2 $ 49,782.30	2 $ 15,050.46	
Kohlrabi		6.4	weeks/harvest	4 plants/sq.ft. $ 3.97 /per	0 $ -	0 $ -	1.1 $ 95,545.59	2 $ 48,709.52	
Chard		4	weeks/harvest	4 plants/sq.ft. $ 2.97 head	0 $ -	0 $ -	1.1 $ 114,365.91	2 $ 58,304.19	
Beets		6	weeks/harvest	8 plants/sq.ft. $ 0.62 /per	0 $ -	1.3 $ 11,391.04	2 $ 53,678.31	2 $ 16,228.33	
Radishes		4	weeks/harvest	16 plants/sq.ft. $ 0.30 /per	0 $ -	0 $ -	1.1 $ 46,208.45	2 $ 23,557.25	
Kale		6	weeks/harvest	1 plants/sq.ft. $ 2.98 head	0 $ -	1.3 $ 6,843.81	2 $ 32,250.28	2 $ 9,750.08	
Carrots		10	weeks/harvest	16 plants/sq.ft. $ 0.50 /per	0 $ -	1.3 $ 11,023.58	2 $ 51,946.75	2 $ 15,704.83	
Celery		12	weeks/harvest	4 plants/sq.ft. $ 1.97 /per	0 $ -	0 $ -	1.1 $ 25,286.29	2 $ 12,891.05	
Okra	1	8	weeks/harvest	1 plants/sq.ft. $ 4.99 /lb	0 $ -	0.7 $ 4,591.82	2 $ 40,502.23	2 $ 12,244.86	
Basil	1	9	weeks/harvest	2 plants/sq.ft. $ 11.16 /lb	0 $ -	1.3 $ 34,173.11	2.6 $ 208,783.66	3 $ 73,027.47	
Cilantro	2	4	weeks/harvest	1 plants/sq.ft. $ 2.00 /bunch	0 $ -	1 $ 10,098.66	1 $ 32,466.72	1 $ 9,815.52	
Dill	2	4	weeks/harvest	1 plants/sq.ft. $ 2.00 /bunch	0 $ -	1 $ 10,098.66	1 $ 32,466.72	1 $ 9,815.52	
Mint	2	4	weeks/harvest	1 plants/sq.ft. $ 2.00 /bunch	0 $ -	1 $ 10,098.66	1 $ 32,466.72	1 $ 9,815.52	
Ice plant	?				0 $ -	0 $ -	0 $ -	0 $ -	
Production Income ($)					**$ -**	**$ -**	**$ 2,156,627.67**	**$ 766,907.34**	

Figure 26 Smart Farm operations - income budget

8.2.4 Smartphone Distribution System Budget

The following budget, *Figure 27*, is a complete budget for the smartphone distribution system, presented in two activity categories, building and operating, and further broken down to a list of equipment expenses and labour expenses (hard expenses and soft expenses). Detailed descriptions follow.

Smartphone Distribution System Costs *Budget Summary*				*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
				$ 632,306.77	*$ 105,593.46*	*$ 478,179.80*	*$ 96,711.83*
Building Costs							
Equipment							
Product	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Vehicles	$ 48,500.00			2	0	2	0
Chevy bolt	$ 47,000.00			$ 94,000.00	$ -	$ 94,000.00	$ -
Vehicle tablet and mounting	$ 1,000.00			$ 2,000.00	$ -	$ 2,000.00	$ -
Installation	$ 500.00			$ 1,000.00	$ -	$ 1,000.00	$ -
DC rapid charging station				2	0	0	0
Flo DC Rapid Charger	$ 40,000.00	/each		$ 80,000.00	$ -	$ -	$ -
Charging station installation	$ 5,000.00	/each		$ 10,000.00	$ -	$ -	$ -
75kva 600v transformer	$ 5,000.00	/each		$ 10,000.00	$ -	$ -	$ -
6/3 Teck Cable	$ 15.18	/m	250 m/system	$ 30.36	$ -	$ -	$ -
Level 2 Charging station				2	0	0	0
Flo Level 2	$ 12,100.00	/each		$ 24,200.00	$ -	$ -	$ -
Charging station installation	$ 5,000.00	/each		$ 10,000.00	$ -	$ -	$ -
6/3 Teck Cable	$ 15.18	/m	250 m/system	$ 7,590.00	$ -	$ -	$ -
Equipment Subtotal ($)				**$ 238,820.36**	**$ -**	**$ 97,000.00**	**$ -**
GST				*$ 11,941.02*	*$ -*	*$ 4,850.00*	*$ -*
PST				*$ 16,717.43*	*$ -*	*$ 6,790.00*	*$ -*
Equipment Costs ($)				**$ 267,478.80**	**$ -**	**$ 108,640.00**	**$ -**
Software Development Costs							
Category	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Software Development							
Online marketplace, packaging and distributi	$ 250,000.00			$ 250,000.00	$ -	$ -	$ -
Maintenance							
Annual software updates	$ 25,000.00			$ -	$ 25,000.00	$ 50,000.00	$ -
Software Development Subtotal ($)				$ 250,000.00	$ 25,000.00	$ 50,000.00	$ -
GST				*$ 12,500.00*	*$ 1,250.00*	*$ 2,500.00*	*$ -*
PST				*$ 20,000.00*	*$ 2,000.00*	*$ 4,000.00*	*$ -*
Software Development Total ($)				**$ 282,500.00**	**$ 28,250.00**	**$ 56,500.00**	**$ -**
Operating Costs							
Vehicles							
Product	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Total vehicles				0	2	4	4
Electricity (200km/day, 250days/year)	0.16	kw*h/km	50,000 km/vehicle/year	$ -	$ 581.69	$ 2,544.77	$ 959.63
Maintenance (brakes, tire rotation, wiper blade	$ 500.00	/vehicle/year		$ -	$ 750.00	$ 3,000.00	$ 1,000.00
Tires (100,000km replacement interval)	$ 1,000.00	/vehicle		$ -	$ -	$ 2,000.00	$ -
Consumables (wiper fluid, car washes, etc)	$ 500.00	/vehicle/year		$ -	$ 750.00	$ 2,916.67	$ 1,000.00
Cell phone plan for tablet	$ 80.00	/vehicle/month		$ -	$ 1,440.00	$ 5,600.00	$ 1,920.00
Vehicles Subtotal ($)				**$ -**	**$ 3,521.69**	**$ 16,061.44**	**$ 4,879.63**
GST				*$ -*	*$ 176.08*	*$ 803.07*	*$ 243.98*
PST				*$ -*	*$ 281.74*	*$ 1,284.91*	*$ 390.37*
Vehicles Costs ($)				**$ -**	**$ 3,979.51**	**$ 18,149.42**	**$ 5,513.98**
Labour							
Category	**Value**	**Units**		**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Drivers				0	2	4	4
Driver salary	$ 40,000.00	/driver/year		$ -	$ 60,000.00	$ 233,333.33	$ 80,000.00
Labour Costs ($)				**$ -**	**$ 60,000.00**	**$ 233,333.33**	**$ 80,000.00**
Total Costs ($)				**$ 549,978.80**	**$ 92,229.51**	**$ 416,622.76**	**$ 85,513.98**
Income							
Charging Stations							
Category	**Value**	**Units**		**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Customers/year				25	67	336	150
Energy / year (kwh/year)	50	kwh/customer (avg)		1,250	3,350	16,800	7,500
Energy price ($/kwh)				$ 0.04	$ 0.04	$ 0.05	$ 0.05
Energy Cost				$ 51.35	$ 150.50	$ 328.39	$ 657.24
Charge price ($/h)				$ 10.00	$ 11.00	$ 11.00	$ 11.00
Gross Income				$ 250.00	$ 704.00	$ 1,430.00	$ 2,574.00
Charging Station Income ($)				**$ 198.65**	**$ 553.50**	**$ 1,101.61**	**$ 1,916.76**
Total Income($)				**$ 198.65**	**$ 553.50**	**$ 1,101.61**	**$ 1,916.76**
Buffer	*15%*			*$ 82,526.62*	*$ 13,917.45*	*$ 62,658.65*	*$ 13,114.61*
TOTAL BUDGET - Smartphone Distribution System($)				***$ 632,306.77***	***$ 105,593.46***	***$ 478,179.80***	***$ 96,711.83***

Figure 27 smartphone distribution detailed budget

8.2.4.1 Building Budget

8.2.4.1.1 Equipment Budget

The smartphone distribution system requires acquisition of electric vehicles and their supporting charging infrastructure. Quotes have been secured for all components as well as estimates on installation of the charging infrastructure. Acquisition of vehicles and installation of their chargers will take place during the building stage of project implementation with monies from Installment 1. The need for two additional vehicles is anticipated at some point in year four with financing from installment 3. The costs associated with these items is outlined in *Figure 28*.

Equipment								
Product	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Vehicles	$ 48,500.00			2	0	2	0
Chevy bolt	$ 47,000.00			$ 94,000.00	$ -	$ 94,000.00	$ -
Vehicle tablet and mounting	$ 1,000.00			$ 2,000.00	$ -	$ 2,000.00	$ -
Installation	$ 500.00			$ 1,000.00	$ -	$ 1,000.00	$ -
DC rapid charging station				2	0	0	0
Flo DC Rapid Charger	$ 40,000.00	/each		$ 80,000.00	$ -	$ -	$ -
Charging station installation	$ 5,000.00	/each		$ 10,000.00	$ -	$ -	$ -
75kva 600v transformer	$ 5,000.00	/each		$ 10,000.00	$ -	$ -	$ -
6/3 Teck Cable	$ 15.18	/m	250 m/system	$ 30.36	$ -	$ -	$ -
Level 2 Charging station				2	0	0	0
Flo Level 2	$ 12,100.00	/each		$ 24,200.00	$ -	$ -	$ -
Charging station installation	$ 5,000.00	/each		$ 10,000.00	$ -	$ -	$ -
6/3 Teck Cable	$ 15.18	/m	250 m/system	$ 7,590.00	$ -	$ -	$ -
Equipment Subtotal ($)				**$ 238,820.36**	**$ -**	**$ 97,000.00**	**$ -**
GST				*$ 11,941.02*	*$ -*	*$ 4,850.00*	*$ -*
PST				*$ 16,717.43*	*$ -*	*$ 6,790.00*	*$ -*
Equipment Costs ($)				**$ 267,478.80**	**$ -**	**$ 108,640.00**	**$ -**

Figure 28 smartphone distribution system building - equipment budget

8.2.4.1.2 Software Development Budget

Development of specialized software will take place during the building stage of this project with financing from Installment 1. A preliminary requirements document was developed and provided to several software development firms in order to receive quotes. Further refinement of the requirements document will be performed in the first year in collaboration with the selected software developer, at which point a precise quote will be received. The allotted financial resources in Installment 1, presented in *Figure 29* below, are anticipated to adequately cover the required software feature development, as established by conversations with each of the contacted firms.

There may be a need, from time to time, to have updates performed on the software platform for a variety of reasons including:

- Maintaining compatibility with newer operating systems
- Increasing feature deployment
- Bug patching
- Other unforeseen issues

For this reason, an annual software maintenance budget has been assigned and is allotted for dispersion in Installment 2 and 3.

Software Development Costs

Category	Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Software Development							
Online marketplace, packaging and distributi	$ 250,000.00			$ 250,000.00	$ -	$ -	$ -
Maintenance							
Annual software updates	$ 25,000.00			$ -	$ 25,000.00	$ 50,000.00	$ -
Software Development Subtotal ($)				$ 250,000.00	$ 25,000.00	$ 50,000.00	$ -
GST				*$ 12,500.00*	*$ 1,250.00*	*$ 2,500.00*	*$ -*
PST				*$ 20,000.00*	*$ 2,000.00*	*$ 4,000.00*	*$ -*
Software Development Total ($)				**$ 282,500.00**	**$ 28,250.00**	**$ 56,500.00**	**$ -**

Figure 29 smartphone distribution system building - software budget

8.2.4.2 Operating Budget

8.2.4.2.1 Vehicle Budget

As with any vehicle, electric vehicles have operating costs that must be accounted for. *Figure 30* outlines a budgetary list of these anticipated costs.

The electricity cost is calculated based on an assumed 200km travel per day per vehicle, operation of distribution services for 250 days of the year, and 0.16 kwh/km (the electric vehicle analogue for fuel economy; liters/100km or miles/gallon). Based on these numbers, and the anticipated number of vehicles on the road performing deliver activities, the costs are identified in the table below.

There are less maintenance activities with electric vehicles than with conventional vehicles because there are no oil changes, engine cooling systems, fuel filters, or emissions systems. As such, maintenance activities are anticipated to include brake pad changes, tire rotations, and wiper blade replacements, for which $500/year has been allotted. Tire changes are anticipated at the 100,000 km mark on each vehicle, and so this expense has been budgeted according to anticipated annual travel.

Miscellaneous consumables, such as wiper fluid and car washes have been assigned a value of $500/year for the duration of vehicle operation.

Given that each driver will utilize a tablet installed in the vehicle to provide delivery instruction, and those instructions will be dispatched over the internet, each vehicle will need an internet connected tablet. The carrier cost associated with this data plan is included below based on list prices and the anticipated data allotment.

Vehicles

Product		Value	Units	Qty	Installment 1	Installment 2	Installment 3	Installment 4
Total vehicles					0	2	4	4
Electricity	(200km/day, 250days/year)	0.16	kw*h/km	50,000 km/vehicle/year	$ -	$ 581.69	$ 2,544.77	$ 959.63
Maintenance	(brakes, tire rotation, wiper blade	$ 500.00	/vehicle/year		$ -	$ 750.00	$ 3,000.00	$ 1,000.00
Tires	(100,000km replacement interval)	$ 1,000.00	/vehicle		$ -	$ -	$ 2,000.00	$ -
Consumables	(wiper fluid, car washes, etc)	$ 500.00	/vehicle/year		$ -	$ 750.00	$ 2,916.67	$ 1,000.00
Cell phone plan for tablet		$ 80.00	/vehicle/month		$ -	$ 1,440.00	$ 5,600.00	$ 1,920.00
Vehicles Subtotal ($)					**$ -**	**$ 3,521.69**	**$ 16,061.44**	**$ 4,879.63**
GST					*$ -*	*$ 176.08*	*$ 803.07*	*$ 243.98*
PST					*$ -*	*$ 281.74*	*$ 1,284.91*	*$ 390.37*
Vehicles Costs ($)					**$ -**	**$ 3,979.51**	**$ 18,149.42**	**$ 5,513.98**

Figure 30 smartphone distribution system operation - vehicle budget

8.2.4.2.2 Labour Budget

Each vehicle will need a driver, and so, based on estimated salary requirements for this role, and the number of planned vehicles, the following budget has been assigned. *Figure 31* assigns a salary to this individual and identifies the number of employees that will be supported through each installment.

Labour						
Category	Value	Units	Installment 1	Installment 2	Installment 3	Installment 4
Drivers			0	2	4	4
Driver salary	$ 40,000.00	/driver/year	$ -	$ 60,000.00	$ 233,333.33	$ 80,000.00
Labour Costs ($)			**$ -**	**$ 60,000.00**	**$ 233,333.33**	**$ 80,000.00**

Figure 31 smartphone distribution system operation - labour budget

8.2.4.3 Income Budget

There is a small amount of revenue anticipated to come from the level 3 electric vehicle charging stations as outlined in *Figure 32*. For budgeting purposes, the number of customers has been estimated on a monthly basis. Income is calculated based on the difference between the cost of energy delivered and the selling price on an hourly basis. Refinement of this pricing model will take place as actual usership rates are established and infrastructure is operational. Is should be noted that the purpose of this piece of infrastructure is not principally to serve as a revenue source. Its purpose is primarily to enable the rapid re-energizing of distribution vehicles and secondarily to provide a value-add service, charging of future community vehicles, to the Smart Farm customers as well as other customers of the Otineka mall. The pricing structure will reflect these goals and so this revenue is critical to the sustained operation of the Smart Farm and smartphone distribution system.

Charging Stations						
Category	Value	Units	Installment 1	Installment 2	Installment 3	Installment 4
Customers/year			25	67	336	150
Energy / year (kwh/year)	50	kwh/customer (avg)	1,250	3,350	16,800	7,500
Energy price ($/kwh)			$ 0.04	$ 0.04	$ 0.05	$ 0.05
Energy Cost			$ 51.35	$ 150.50	$ 328.39	$ 657.24
Charge price ($/h)			$ 10.00	$ 11.00	$ 11.00	$ 11.00
Gross Income			$ 250.00	$ 704.00	$ 1,430.00	$ 2,574.00
Charging Station Income ($)			**$ 198.65**	**$ 553.50**	**$ 1,101.61**	**$ 1,916.76**

Figure 32 smartphone distribution system operation - income budget

8.2.5 Biometric Feedback Study

The following budget, *Figure 33*, is a complete budget for the smartphone distribution system. Unlike the other two activity budgets, the development stage of this study is not anticipated to incur any costs other than the labour of the project manager. Consequently, this budget only includes the implementation stage of the biometric feedback study by broking it down to a list of equipment expenses and operating expenses, including labour (hard expenses and soft expenses). Detailed descriptions follow.

Biometric Feedback Study *Budget Summary*						*Installment 1*	*Installment 2*	*Installment 3*	*Installment 4*
						$ -	*$ 172,500.00*	*$ 1,113,450.73*	*$ -*
Implementation Costs									
# Study Patients						0	0	224	0
Equipment									
Product		**Value**	**Units**	**Qty**		**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Dexcom									
Transmitter	(3 month replac	$ 389.00	/box (3 months)/patient			$ -	$ -	$ 80,912.00	$ -
Sensor	(monthly boxes)	$ 340.00	/box (1 month)/patient			$ -	$ -	$ 212,160.00	$ -
Equipment Subtotal ($)						**$ -**	**$ -**	**$ 293,072.00**	**$ -**
GST						*$ -*	*$ -*	*$ 14,653.60*	*$ -*
PST						*$ -*	*$ -*	*$ 23,445.76*	*$ -*
Equipment Costs ($)						**$ -**	**$ -**	**$ 331,171.36**	**$ -**
Operating									
Category		**Value**	**Units**	**Qty**		**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Healthcare (# patients)									
# Nurses						0	0	2	0
# Phlebotomist						0	0	1	0
Nurse salary		$ 100,000.00	/nurse/year	2 /year/nurse		$ -	$ -	$ 350,000.00	$ -
Phlebotomist Salary		$ 50,000.00	/person/year	1 /year/phlebotomist		$ -	$ -	$ 54,166.67	$ -
Healthcare visit consumables		$ 20.00	/patient/month			$ -	$ -	$ 4,480.00	$ -
Lab fees		$ 50.00	/patient/month			$ -	$ -	$ 11,200.00	$ -
Patient Incentive		$ 300.00	/patient			$ -	$ -	$ 67,200.00	$ -
UofM research contribution		$ 150,000.00	/year			$ -	$ 150,000.00	$ 150,000.00	$ -
Operating Costs ($)						**$ -**	**$ 150,000.00**	**$ 637,046.67**	**$ -**
Total Costs ($)						**$ -**	**$ 150,000.00**	**$ 968,218.03**	**$ -**
Buffer			*15%*			*$ -*	*$ 22,500.00*	*$ 145,232.70*	*$ -*
TOTAL BUDGET - Biometric Study ($)						***$ -***	***$ 172,500.00***	***$ 1,113,450.73***	***$ -***

Figure 33 biometric feedback study detailed budget

8.2.5.1 Implementation Budget

8.2.5.1.1 Equipment

Continuous Glucose Monitoring wearable technology is the sole equipment cost for the implementation of the biometric feedback study. At time of writing, Dexcom G5 is the only product available in the Canadian market that provides this functionality, although there are several additional equipment suppliers on the horizon. Therefore, the following prices are included in the budget based on a quote provided by Dexcom.

There are two components required for operation of this technology; a transmitter and an adhesive sensor patch that must be fastened to the torso of the subject. Adhesive sensor patches are priced at $340 per box and a box is anticipated to last for one month of operation. The transmitter, which physical attaches to the sensor and, via a Bluetooth connection, transmits data to the subject's smartphone, lasts three months before requiring replacement and costs $389. The total of these costs, along with the preliminary estimate of the total number of study participants that will be wearing these devices, is identified in *Figure 34* below.

The preliminary biometric feedback study design, developed during the finalist phase of this project, requires that participants wear the CGM system for six weeks. This is the minimum required interval for the collection of statistically significant data. However, in the interest of maximizing the value add to the community from each transmitter, a complete three-month supply of sensors has been budgeted for, so that study participants can be provided with an additional six weeks of real-time biometric feedback. This is done in the intention of further establishing knowledge of the connection between diet and diabetes among the study participants and with the hopes of spreading that message to the greater community.

# Study Patients					0	0	224	0
Equipment								
Product		**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Dexcom								
Transmitter	(3 month replac	$ 389.00	/box (3 months)/patient		$ -	$ -	$ 80,912.00	$ -
Sensor	(monthly boxes)	$ 340.00	/box (1 month)/patient		$ -	$ -	$ 212,160.00	$ -
Equipment Subtotal ($)					**$ -**	**$ -**	**$ 293,072.00**	**$ -**
GST					*$ -*	*$ -*	*$ 14,653.60*	*$ -*
PST					*$ -*	*$ -*	*$ 23,445.76*	*$ -*
Equipment Costs ($)					**$ -**	**$ -**	**$ 331,171.36**	**$ -**

Figure 34 biometric feedback study implementation - equipment budget

8.2.5.2 Operating Budget

The biometric feedback study will be conducted by University researchers in collaboration with healthcare providers at the local healthcare centers. This budget, outlined in *Figure 35* below, accounts for hiring two contract nurses to provide healthcare support to study participants, both during the study and for a six-month period following the study. A phlebotomist will be needed for collection of blood samples from study participants on a regular basis for laboratory analysis of diabetes markers beyond blood sugar. Budgeting for a phlebotomist, as well as laboratory fees and healthcare visit consumables (example: needles, Band-Aids, and sterilization supplies) is budgeted for to minimize the financial burden on local healthcare facilities and ensure successful implementation of the biometric feedback study.

Study participants will be required to carry a smartphone with a data connection throughout the study process, as well as drive themselves to and from their appointment. To cover these costs, as well as provide an incentive to the participants, $300 has been budgeted per person to cover these costs. Based on community engagement survey results, discussed in Chapter 6, those community members that were interested in participating in a biometric feedback study identified fresh food as the most desired incentive to compensate participation. The cost of this has been accounted for in the Smart Farm section.

Operating								
Category	**Value**	**Units**	**Qty**	**Installment 1**	**Installment 2**	**Installment 3**	**Installment 4**
Healthcare (# patients)							
# Nurses				0	0	2	0
# Phlebotomist				0	0	1	0
Nurse salary	$ 100,000.00	/nurse/year	2 /year/nurse	$ -	$ -	$ 350,000.00	$ -
Phlebotomist Salary	$ 50,000.00	/person/year	1 /year/phlebotomist	$ -	$ -	$ 54,166.67	$ -
Healthcare visit consumables	$ 20.00	/patient/month		$ -	$ -	$ 4,480.00	$ -
Lab fees	$ 50.00	/patient/month		$ -	$ -	$ 11,200.00	$ -
Patient Incentive	$ 300.00	/patient		$ -	$ -	$ 67,200.00	$ -
UofM research contribution	$ 150,000.00	/year		$ -	$ 150,000.00	$ 150,000.00	$ -
Operating Costs ($)				**$ -**	**$ 150,000.00**	**$ 637,046.67**	**$ -**

Figure 35 biometric feedback study implementation - operating budget

8.3 Financial tools and methodologies

The Smart Farm will be utilizing Cash Basis Accounting: income is recorded when it's received, and expenses are reported when they're actually paid. We will record revenue when a customer pays for a product and will record a payable when it is paid.

Financial administration associated with building and operating the Smart Farms will be aided by the utilization of QuickBooks Pro. This is a financial accounting software program intended for a business of the size and scale we are considering. With features that are aimed at supporting accounting tasks such as accounts receivable, accounts payable, bank statement reconciliation, payroll and financial reporting, this software is suitable for our purposes. Specifically, this software allows us to complete the following tasks:

Money Management:

All recurring invoices and payments with their due dates and transaction detail can be keyed in. Cheques can be printed directly through QuickBooks and every transaction is documented, making future audit reports easily accessible. Additionally, the Smart Farm bank account can be connected directly to QuickBooks should we wish to utilize that option.

Sales Invoicing:

One of the sources of revenue, besides sales to community members, will be to service customer contracts for cash crops such as herbs, which are in growing demand. QuickBooks will allow us to track sales and generate receipts and invoices instantly. These invoices can be electronically delivered which saves on administrative time.

Financial Reporting:

QuickBooks will allow us to generate financial reports specific to the topic required including year-over-year income, expenditures, trends and forecasting documents. All reports can be exported to the Tri-Council membership and Board of Directors should they request these at any time, including for Board meeting preparation. These up to date reports impact the ability of the Board to make decisions based on real time facts.

Ease of Use:

QuickBooks has been selected as the accounting software of choice because it is user-friendly and uncomplicated.

8.4 Report on Finalist Grant

SMART CITIES CHALLENGE BUDGET				
Expense Category	**Description**	**$ Amount**	**TOTAL**	**$ Balance**
				$250,000.00
Service Contracts	• Proposal development (2) • Videographer • Community Engagement • Communications • Legal Fees	$ 130,200.00 $ 10,500.00 $ 3,000.00 $ 3,840.00 $ 1,695.00	$149,235.00	$100,765.00
Travel & Accommodation	• Winnipeg – The Pas/OCN & Toronto Jury Check-in	$ 11,212.43	$ 11,212.43	$ 89,552.57
Hospitality and Meeting fees	• Tri-Council, Project Team meetings • Information Sharing, update meetings • Smart Cities Challenge team visit	$ 503.30		$ 89,049.27
Webpage Development	• Infrastructure Canada and public access to proposal and video	$ 500.00		$ 88,549.27
Administration	• Printing, financial, meeting space, staff hours	$ 10,000.00	$ 10,000.00	$ 78,549.27
Estimated Costs for Showcase Ottawa May 14, 2019	• Travel for project team • Display costs • Food/Accommodations • Taxis	$ 35,000.00	$ 35,000.00	$ 43,549.27
Project Wind-up Activities*	• Leadership to Determine	$ 43,549.27		

*unallotted funds at time of proposal submission

Tri-Council leadership jointly signed a Funding Authorization Process which detailed how spending of monies from the finalist contribution would proceed.

A project team was established consisting of a representative from each of the governments, as well as a project proposal manager and a project proposal coordinator. These five individuals carried the responsibility to ensure completion of the proposal and to ensure all criteria were met. All financial requirements were compiled by the proposal coordinator and forwarded to the three government representatives for approval. All service contracts were signed by these three individuals. An invoice was

created for each expense and forwarded to the Opaskwayak Health Authority finance department who have held the finalist contribution money on behalf of the Tri-Council. All cheques were processed by the finance committee and signed by two authorized personnel. Monies were maintained in a chequing account established solely for the purpose of housing the finalist contribution.

Details on the expense categories listed in the table above are as follows:

1. Service Contracts: all individuals requested to work on the development of this proposal, besides the government representatives who were not paid for this work, were hired on a contract basis.
    - Two individuals were the primary proposal writers. They travel between Winnipeg and the Tri-Council region on a regular basis and increased their travel for this project. Their roles included developing and coordinating all aspects of the proposal including the regular calls with the Smart Cities team and hosting the in-community visit of the team representatives, participating in all webinars hosted by the Smart Cities team, preparing for and travelling to Toronto for the jury check-in, writing all contracts for other service providers, preparing presentations to the government bodies and the Tri-Council, working with the videographer to complete the mandatory 5 minute video, working with the community engagement personnel in completing the preparation of surveys and other community engagement strategies, developing the plan and all aspects of the proposal, responding to media, and keeping everyone informed of communications, and working with the lawyer to develop the governance structure. These individuals will also be responsible to prepare for the showcase event in Ottawa in May 2019 and to travel to Ottawa with the project team at that time.
    - One individual was hired to produce the 5-minute video. The individual lives and works in the community and came highly recommended by the project team and community members. He photographed and interviewed a wide range of people; the inclusiveness and professionalism are noted in his final submission.
    - One individual was hired to complete community engagement activities on behalf of the project. She lives and works in the community and was able to complete extensive engagement activities during the initial proposal period as well as during the finalist period of this Challenge.
    - One individual has been hired for communications, including creating agendas and materials to present to the Tri-Council governments, and ongoing relationship development among communities.
    - A lawyer was hired to create the not for profit corporation as the form of governance structure that was agreed to by the Tri-Council as the best model for implementation of this project. Onekanew (Chief) Sinclair of OCN suggested the use of the lawyer preferred by OCN and it was this lawyer that was used for the development of the articles of incorporation.

2. Travel and Accommodation: This cost category included all travel and accommodation that was required by the project coordinator and project manager to complete the tasks requested of them as detailed in their description of services above. The amount is impacted by the northern remote location of the Tri-Council region.
3. Hospitality and Meeting fees: This cost category included costs associated with meetings of the project team, Tri-Council, hosting the Smart Cities Challenge team community visit and strategic planning meetings. Items included food, logo printing, and printed presentations.
4. Webpage Development: This cost category reflects the funds utilized to pay an individual to develop the webpage that contains the links to the final proposal submission and the finalist video.
5. Administration: Opaskwayak Health Authority incurred costs associated with staff time to establish and maintain the bank account, process invoices, prepare and deposit cheques, cover printing costs for materials, arrange for and provide meeting space, locate and provide documents pertaining to the existing OCN Smart Farm, provide staff time for interviews and expertise. A standard 10% administration fee has been allotted for these services.
6. Estimated Costs for Showcase Ottawa May 14, 2019: The project team has determined that five people will be attending the showcase in Ottawa. Costs associated with return travel from the Tri-Council region to Winnipeg and then on to Ottawa, as well as those required to set up the trade style display, are reflected in this cost category.
7. Project Wind-up activities: While currently unallotted, the remainder of the monies will be utilized for final legal fees and other costs associated with the completion of the proposal phase and moving into the implementation phase of the project.

8.5 Risk Identification and Mitigation

Risks and mitigating techniques are discussed within the narrative of the comprehensive budget review above.

9 CHAPTER 9: IMPLEMENTATION PHASE REQUIREMENTS

9.1 Duty to Consult and Modern Treaty Obligations

In Canada, we have recognized in the Constitution Act of 1982 that in affairs of the Crown, also known as the federal, provincial and territorial governments, that we have a duty to consult with Indigenous peoples when contemplating actions or decisions that may impact our Indigenous peoples. The Smart Cities Challenge is an initiative of the federal government and the Tri-Council within this proposal is contemplating a project that may be implemented in the event the Tri-Council is successful in the challenge.

The project we are proposing as a Tri-Council has a unique structure in that one of the three governments comprising the Tri-Council is Opaskwayak Cree Nation; a First Nation signatory to Treaty #5. The Friendship Accord among the three governments has been in effect since 2014. The governance structure identified in Chapter 5 of our proposal is the first formalized structure created by the Tri-council. This not for profit corporation will have equal representation from each of the three governments. While the articles of incorporation are standard, our unanimous member agreement outlines a list of items which require approval by Extraordinary Resolution. "Extraordinary" approval requires an 80% agreement threshold, so for all intents and purposes, the requirement is unanimity meaning no one voice can be silenced. Therefore, upon our success in this challenge and as our project proceeds, Opaskwayak Cree Nation, The Town of The Pas, and the RM of Kelsey will have equal voice at decisions made by the Board of Directors.

The national voice in Canada supports reconciliation with Indigenous peoples in Canada for the injustices of the past. We each carry a personal responsibility to move towards inclusiveness in our country. It is within the richness of inclusiveness, working together as we respectfully listen to the ideas and opinions of each other, that we can rise to greatness and achieve together what we could never achieve alone. The work of the Tri-Council demonstrates this move towards reconciliation at a local level. As we work together on issues that impact our communities, we are learning more about each other – our differences and our similarities. The Smart Cities Challenge project has provided another opportunity to know each other and to embrace our cultural diversity and the richness this brings to our communities.

9.2 Community Employment Benefit (CEB)

- The CEB is a federal initiative that requires implicated projects, such as that described in this proposal, to provide employment and/or procurement opportunities for at least three of the groups identified below. Tri-Council leadership publicly voices their intentions to continue to grow a stronger and more inclusive community by building on successes of the past. Our view is that providing diverse employment opportunities, as outlined in the CEB guidelines, are as innovative and important to our prosperity in the future as is the use of technological innovation. As the project unfolds, it is anticipated that the following groups will be included as our targeted community employment beneficiaries.

- Indigenous peoples – the current vertical smart farm is located on Opaskwayak Cree Nation (OCN) and all current employees are Indigenous. Our expanded smart farm location is also on OCN land and all employment opportunities will be posted in OCN as well as the other partnering communities.
- Women – the current Manager of the smart farm and Chief Technician are women. They will be vital to the skills, training and procurement for the expansion of the smart farm. We anticipate that women will continue to seek employment and be strong leaders in this business as throughout this project.
- Veterans – veterans will be encouraged to apply just as all community members are
- Youth – dietary change begins with the youth. It is our plan that youth be integrated into the operations of the smart farm, beginning with school tours and continuing into employment opportunities, particularly summer term positions while they are students and on to full time should they chose opportunity for employment at this location.
- Recent immigrants – there are increasing numbers of immigrants to the Tri-Council region and their submissions for employment will be met with the same enthusiasm as all other community members.
- Small/Medium enterprises – we have listed in Chapter 5 that our agricultural technology partnership and supplier is the OCN LED Smart Farm. Our smart farm expansion will bring direct financial gain to this enterprise. Others may follow as the project unfolds.

Upon success of our challenge and the funding decision, we will provide specific targets for each of these identified employment benefit groups.

9.3 Climate Lens Assessment (CLA)

As instructed by the Smart Cities Challenge team, we are asserting that the total cost of our project with a primary focus on climate change adaptation, resilience, disaster mitigation, or a reduction in GHG emissions is less than $10 million.

9.4 Risk Identification and Mitigation

1. Unequal voice at the governance table
    - Mitigation: Inclusive governance structure with legal items to ensure unanimity as detailed in Chapter 5.
2. Identified groups for CEB are uninterested in employment at the Smart Farm
    - Mitigation: widespread dissemination of job postings; provide adequate training; ensure salaries meet industry standards; ensure administrative protocols in place to foster a supportive work environment.