



Scaling up private sector engagement in food security through convergent food innovation: Proof of concept and theory of change

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Acronyms and Abbreviations

| | |
|--------|---|
| A4NH | Agriculture for Nutrition and Health |
| AAFC | Agriculture and Agri-Food Canada |
| AI | Artificial Intelligence |
| ANF4W | Affordable Nutritious Foods for Women |
| CI | Convergent Innovation |
| CoE | Centre of Excellence |
| COIN | Co-Innovation Network |
| ECS | Enlighten Consultancy Services |
| GNR | Global Nutrition Report |
| ICAR | Indian Council of Agriculture Research |
| IFPRI | International Food Policy Research Institute |
| IPGA | India Pulses and Grains Association |
| IYP | International Year of Pulses |
| MCCHE | McGill Centre for the Convergence of Health and Economics |
| MDP | Management Development Program |
| NIFTEM | National Institute of Food Technology Entrepreneurship and Management |
| NRC | National Research Council |
| PHFI | Public Health Foundation of India |
| PIP | Pulse Innovation Platform |
| RISE | Raising Innovative Sustainable Enterprises |
| QES | Queen Elizabeth Scholars |
| SME | Small and Medium-sized Enterprise |
| TCi | Tata-Cornell Agriculture and Nutrition Initiative |
| TCL | Tata Chemicals Limited |
| TCS | Tata Consultancy Services |
| TIM | Technology Innovation Management |
| ToC | Theory of Change |

Executive summary

To address the triple burden of malnutrition (i.e., caloric deficiency, micronutrient deficiency, and caloric excess), which poses a serious challenge to long-term sustainable growth of countries across the globe, including India, in this IDRC program, we sought to deepen understanding of how to scale up private sector engagement in food security through food convergent innovation (CI). The overarching goal of this IDRC research program was to enable the operational specification of a Food Convergent Innovation Accelerator, a virtual platform comprising global and Indian partners spanning societal and industrial sectors, that can help food businesses develop nutritious food products and make them commercially viable. Through conducting multiple studies, collaborative leadership was fostered between various partners, including between the MCCHE and the National Institute of Food Technology Entrepreneurship and Management (NIFTEM) – a public research university located in Sonapat district of Haryana – with a focus on India as a country, and initially on pulse (and later millets, in addition) as naturally nutritious agricultural commodity that has had, and promises further high human and economic development impact in India.

Results from our work in mapping the consumption and innovation landscape for pulses (and subsequently millets), and in launching the Pulse Innovation Platform (PIP) globally and in India for advancing the Food CI Accelerator showed the complexity and dynamism of bringing about ecosystem transformation through convergent innovation (CI). Our study findings highlight the need to go beyond traditional approaches of research (e.g. through surveys, etc.), and the value of digital tools – including using artificial intelligence (AI) – that enable real-time, and predictive acquisition of the behavioral and cultural insights on rural and urban settings in different socio-economic segments. We show how to engage in diagnostic analysis across sectors, enabled by digital tools, rather than prescriptive analysis that has characterized decision-making in food and nutrition security, and related domains from the 20th century (Addy et al. 2014; Ostrom 2007; Ostrom 2010). Additionally, of particular note, the activities we engaged in for this IDRC program strengthened partnerships between platform organizations that spanned institutional sectors, including those in the Global PIP and PIP-India.

The PIP activities advanced as part of Objective 1 for this IDRC program were especially important for the implementation of CI, in refining the conceptual model of the CI Accelerator (Objective 2 of this IDRC program), and for specifying a theory of change (Objective 3). First, we see that pulse consumption trends are influenced by consumer perceptions of price, color, healthiness, and economic consequences. We also see that consumers have mostly positive sentiments towards the various dimensions of pulse-based food products. In particular, research outputs included a paper on the structure, methods, and development of an artificial intelligence (AI) platform to support CI through automated analysis of social media data, built on an integrative ontology that combined behavior, food, health, marketing, and food characteristics and consequences. Such behavioral insights will serve as a springboard for further empirical studies to support behavior change, product and service innovation, and branding across the pulse industry. The broader level research noted above was also buttressed by consumer insights conducted of proof-of-concept projects. For example, results of sensory tasting and focus group discussions around a traditional, pulse-based product, laddoo, showed that food aspects such as taste, texture, and color – which are modifiable through modern processing, such as roasting – and packaging were key for consumer acceptability of the product (Tandon et al. 2018).

Most vital to the operationalization of CI acceleration was the linking of global and local networks for engaging stakeholders from across societal sectors (Addy et al. 2018a). Whereas typically, business accelerator networks provide ventures with the opportunity to build strategic partnerships with potential

investors, customers, and other ventures, the network of the food CI Accelerator was innovative, reaching across institutional sectors, to provide opportunities for interactions between various stakeholders who hitherto were not connected. In particular, global and national CI platforms were launched – Global Pulse Innovation Platform (Global PIP) in March 2016, and PIP-India in March 2017 – as multi-actor collaboration networks that included the private sector, with large corporations, small and medium-sized enterprises (SMEs), NGOs, research institutes, and government agencies, simultaneously pursuing the realization of social, environmental, and economic value. The PIP platforms and the proof-of-concepts projects also provided empirical backing for a two-tiered model of modular governance that was proposed for CI: platform governance (the global and national platforms) and module governance, at the level of individual projects (Jha, Dubé and Gold 2016).

The experiences from this IDRC program informed the development of a theory of change, elaborated in a report on food convergent innovation as a new model of private sector engagement for nutrition security. The theory of change was structured in terms of Pulse Innovation Platform (PIP) activities, leading to outputs, and in turn, outcomes, feeding into the desired impact of nutrition security. The outputs from experiences with CI acceleration and the theory of change developed feeds into further food CI acceleration efforts by the CI platform members, including in India, Canada, and Ghana, among others. Additionally, efforts made by the project partners towards setting up PIP India with industrial and NGO partners have been brought to the attention of high-level decision makers in both India and Canada, and are shaping their development agendas.

The research problem

The triple burden of malnutrition (i.e., caloric deficiency, micronutrient deficiency, and caloric excess) poses a serious challenge to long-term sustainable growth of countries across the globe, including India. As these countries chalk out a trajectory of economic growth, they continue to suffer from a prevalence of food insecurity and undernutrition, on the one hand, and deal with the consequences of affluence such as over-nutrition, obesity, and food wastage, on the other hand. An approach viewing both modern and traditional society as part of the same food system is urgently needed to reach scale, with strategies that are informed by insights on the complexities of consumption (i.e., consumer behavior, trends, and consumption patterns), and related agricultural production and value addition.

To address the problem of malnutrition within the contest of food, this IDRC research program initially focused on pulses (i.e., chickpeas, lentils, beans, etc.), given their particularly strategic position as a food- and farm-based solution for creating a society with better health and nutrition outcomes. Pulses are excellent sources of nutrition, rich in protein, with low impact on natural resources providing necessary nutrition. Pulses have continued to gain momentum as a superfood since the United Nations declaration of 2016 as the International Year of Pulses (IYP). However, in our initial proposal for this research program, we noted that the pulse industry cannot develop pulse-based solutions on its own, but rather a whole of society approach was needed. Despite rising awareness and a growing world population, pulse consumption is declining, even in India, the world's largest pulse consumer with the longest tradition of using pulses on a daily basis. Declining consumption of strategic foods such as pulses permeates all socio-economic strata, accompanied by a decline in production, primarily due to their economic disadvantage vis-à-vis more lucrative crops. Between the farm, health, and economic benefits of pulses and other similar value chains lies human behavior (e.g., consumption, nutrition, health or healthcare) and food businesses (be they large corporations or small and medium enterprises). Local communities, schools, health systems and governments also have a role in creating ecosystems that enable the incorporation of

pulse food products and others similar to it, as a core component of a balanced diet to sustain health and help manage diseases.

Over more than a decade, the pulse industry has served as a testbed for the development of the *Convergent Innovation* model (Jha et al. 2014), with leadership by the McGill Centre for the Convergence of Health and Economics (MCCHE) and its extensive network of partners drawing on the beneficial aspects of business, government, and civil society approaches to food solutions. Food Convergent Innovation (CI) seeks to embed health, economic and environmental sustainability into new business model design from the start, rather than dealing with the consequences *post hoc*. CI represents an *innovation in the way we innovate*. Key aspects of CI include the development of global and local platforms of partners to support acceleration in scaling up engagement by the private sector, with government and civil society stakeholders in food and nutrition security, simultaneously targeting economic, social, and environmental outcomes.

Thus, the overarching goal of this IDRC research program was to enable the operational specification of a Food Convergent Innovation Accelerator, a virtual platform comprising global and Indian partners spanning societal and industrial sectors, that can help food businesses develop nutritious food products and make them commercially viable. In fostering collaborative leadership between the MCCHE and the National Institute of Food Technology Entrepreneurship and Management (NIFTEM) – a public research university located in Sonapat district of Haryana – Proofs of concept were to be developed that cover a spectrum of socio-economic development conditions, with many on-going food innovation projects; the proposed program was organized around three core objectives:

1. *Map the pulse innovation and consumption landscape* by acquiring behavioral and cultural insights on rural and urban consumer demand in different socio-economic segments, scouting for potential pulse-based food innovation and innovation capacity, and understanding the potential users of CI accelerator, their capabilities, needs, wants, and aspirations.
2. *Refine the concept and operating model of the food CI accelerator* by developing three pulse-based food innovations as proofs-of-concept, in partnership with global Pulse Innovation Platform (PIP) partners and Indian public, private and civil sector organizations. The experience and documentation of the process and its impact was to crystallize the operating model of the accelerator for subsequent scale-up. Aspects of this were modified. While the Convergent Innovation Accelerator proceeded with PIP partners, with delays experienced in the setting up of facilities and services at NIFTEM and in some of the pulse product development for commercialization, it was decided to also include millet-based food innovation among the proofs-of-concept. Thus, as detailed later in this report, two of the three food innovation prototypes selected for study are millet-based, but are otherwise a good fit for demonstration of CI.
3. *Advance a new model of private-sector engagement for nutrition security* through a systematic analysis of the process that will help advance a theory of change and lay the foundation for convergent innovation as a development approach for deep strategic investment of private sector into the convergence of human and economic outcome at scale.

While neither the basic rationale nor the research problems presented were the object of major changes after the projects' approval by IDRC, lessons were learned, including about the length of time for implementing project activities. As it was not possible to complete key activities within the initial project

period that initially to expire by December 31, 2017, an extension until March 31, 2018 at no additional costs was requested, and granted. Concrete achievements by the project, as related to the three core objectives above included:

1. Integration of insights from mapping pulse consumption and innovation landscape into the preliminary model for the CI accelerator, as part of activities with institutions in India that strengthened partnerships, including those with Global Pulse Innovation Platform (Global PIP) and PIP-India members. Results from our mapping of the pulse consumption and innovation landscape showed extensive dynamism and demonstrated the value of new approaches using artificial intelligence (AI) for consumer insights, going beyond traditional approaches of research (e.g. through surveys, etc.), for real-time, and predictive acquisition of the behavioral and cultural insights on rural and urban settings in different socio-economic segments. We have started to develop a component to extract insights from user-generated content through social media to inform break-through innovation (Dubé et al. 2018). Future iterations of the platform will enable deeper insights on sub-aspects (e.g., what food textures has the most positive or negative valence) to further the development of consumer-centric products. The behavioral insights that we generated will serve as a springboard for further empirical studies to support behavior change, product and service innovation, and branding across the pulse industry. Engagement of stakeholders from various societal sectors was also achieved through activities such as the Management Development Program (MDP) workshop conducted at NIFTEM in December 5-6 2017, particularly with the engagement of SMEs.
2. Vital to the identification and development of three food innovations were Global and national CI platforms – the Global Pulse Innovation Platform (Global PIP) launched in March 2016, and PIP-India in March 2017 – that included the private sector, with large corporations, small and medium-sized enterprises (SMEs), NGOs, research institutes, and government agencies, simultaneously pursuing the realization of social, environmental, and economic value. The entrepreneurs leading the three proof-of-concept projects that we finally focused on for acceleration were referred to the CI Accelerator through the global and local PIPs, with networks of partners that this IDRC program developed, including other incubators and accelerators. We found that diversity in the expertise of PIP platform members was a vital ingredient in the operations of the CI accelerator. The food innovations that have been the clients of the CI accelerator are: (i) Bliss Tree Millet Cookies (formerly Hapi Millet) of Trichy, Tamil Nadu State, providing healthy and environmentally sustainable snacking options through targeting a general population, and seeking to extend into larger markets, with a strategy of obtaining investments broadly as well; (ii) Millet Bowl, which targets malnutrition among children in India, and used non-retail marketing approach through government-funded meal programs, and is now targeting venture capitalists and angel investors to increase its scope; and (iii) a global partnership between JVS and MotherFood, targeting malnutrition among adolescents and women of child-bearing age by developing traditionally inspired festivity pulse-based foods called laddoo, with a strategy to obtain investments globally. For the two millet-based products, the accelerator provided assistance for drawing up their business requirements and respectively prepare a five-year projection plan, with pitch decks prepared and modified based on feedback from two investment bankers in Bangalore. Pitches were planned to be made to two financial mentors of the Accelerator – from Bharat Innovations Fund and Indigram Labs Foundation. An expression of interest was

- shared with the Chennai Angels (investor group) for the Bliss Tree project. The JVS-MotherFood pulse-based Laddoo project was pitched by MotherFood in an initial conference call on January 24 2018 to the Gates Foundation and in a meeting with Purpose Capital on April 3 2018 (in addition to other MotherFood partnership projects). Work is in progress to have all three prototypes pitched to additional potential investors in India as well as in Canada (Purpose Capital, and at an event specific for this, with the Indian investment community in Montreal planned for October 2018).
3. The experiences from this IDRC program informed the development of a theory of change, elaborated in a report on food convergent innovation as a new model of private sector engagement for nutrition security. The theory of change was structured in terms of Pulse Innovation Platform (PIP) activities, leading to outputs, and in turn, outcomes, feeding into the desired impact of nutrition security. Additionally, efforts made by the project partners towards setting up PIP India with industrial and NGO partners have been brought to the attention of high-level decision makers in both India and Canada, and are shaping their development agendas. The Research Branch of Agriculture and Agri-Food Canada (AAFC) is pursuing Canada-India collaboration for R&D in pulses and is using the PIP-India base to bring together the relevant institutions and personnel. The network and relationship built by this IDRC project have been instrumental in conception and planning of forums held, including in April 2018, with partnerships being strengthened with Indian Council of Agriculture Research (ICAR). The development of food CI that occurred from this project has contributed to further research and industry commitments to agri-food in Canada, and its engagements in India and globally, as elaborated later in this report.

Progress towards milestones

The project objectives were achieved overall. Of the three project objectives, there were a total of eight milestones, which were mostly achieved, to varying degrees over the entire reporting period. We elaborate below on what was achieved and what was not achieved, and why.

Objective 1: Map the pulse innovation and consumption landscape

There were three milestones for this objective, which were all achieved overall to varying degrees. Under this objective, there were eleven (11) outputs anticipated. Nine (9) were completed fully, one (1) was partially completed and one (1) was not achieved, with reasons explained below.

1.1 Understanding pulse-based consumption patterns and demand drivers

Three outputs were initially anticipated for achieving this milestone. One output was modified. Two outputs were completed fully, with one partially completed.

- 1.1.1. First, reports from scouting of surveys on pulse consumption for different regions of India, as well as the market potential of pulses in traditional and modern Indian food was completed. (This output was modified from: report of local surveys outlining behavioural and cultural determinants of pulse consumption in reference to the full socio-economic and demographic spectrum (with region-specificity)). Reports were developed concurrently with region-specific and more focused publications. Further study is still in process, in particular to inform the further development of businesses that are engaging with the CI accelerator.
- 1.1.2. Second, a report on consumer perception and responsiveness to two current branding/communication strategies by CICILS/Pulse Canada and ICRISAT Smart Food was completed. The report presented the results of an online study that was conducted to analyze perception of pulses with respect to health and taste at different processing levels and with different branding strategies in India. These results were published in *Frontiers of Public Health*.
- 1.1.3. A report informing the exploration of market demand and potential impact of CI proofs of concepts was partially completed. Specifically, this deliverable was included in the report on a proof-of-concept project to develop pulse-based Laddoo product (**2.1.3c_1.1.3_Prototype3_Laddoo**).

1.2 Understanding the pulse-based food innovation landscape

Four outputs were initially anticipated for achieving this milestone. Based on lessons learned in the course of the project three of the outputs were modified. All were completed. These are summarized in a report (**2_1.2_1.3_RefineConceptualModel_FoodInnovationPrototypes**).

- 1.2.1. An inventory list of current pulse-based food innovations. An India Pulse Food Innovation list was completed based on Mintel Global New Products Database 2005-2015 (a free US global branded database). The list was further expanded with the support of NIFTEM students and discussed with industry partners between January and June 2017, and then further elaborated with data from the USDA (**1.2.1a_PIP_PulseInnovationInventory & 1.2.1b_PIP_Final_Data-base**). Roasting of pulses was selected to be the first processing operation to be investigated further as part of the Pulse Innovation Platform (PIP)-India activities. There were some delays due to misalignment between project timelines and the timelines for students to provide input into specifying the inventory of innovations. Lessons were thus learned about the need to align timelines when including student work in such a project. Despite delays, a report on roasting and pulse-based food innovations was completed in March 2018 (**1.2.1c_IndiaPulseRoastingWhitePaper**), and also informed the development of pulse-based food product prototype.

- 1.2.2. A report analyzing innovators, their needs, wants and key points of value creation. Since the completion of this report was highly contingent upon the support that the CI Accelerator was expected to provide to several SMEs, the breadth of data collection and analysis was modified, given the delays in getting the CI Accelerator initiated at NIFTEM, and unanticipated changes in the clients served. After four initial clients dropped out, studies were conducted on the needs, wants and key points of value creation for three CI Accelerator clients. Since the project could not find enough suitable cases for pulses within the time, after evaluation for the fit in terms of CI, a decision was made to accelerate two millet-based innovations (**2.1.3a_1.2.2a_Prototype1_BlissTree_HapiMillet** & **2.1.3b_1.2.2b_Prototype2_MilletBowl**), and one-pulse based innovation (**2.1.3c_1.1.3_1.2.2c_Prototype3_Laddoo**). The businesses were positioning themselves to process multiple millet crops and various food products that were similar to the popular offerings in the market but with enhanced nutritional quality. The pulse-based innovation, which was added in January 2018 to replace a previous client that dropped out, prepared project plans, and implemented pilot production of a pulse-based product, with nutritional evaluation and market testing.
- 1.2.3. Competition as part of an existing conference or workshop with official International Year of Pulses (IYP) status. During the 2015-16 school year, across Indian colleges and universities, student competitions were held as part of the India Pulse Food Innovation Competition, with national finals co-hosted by MCCHE and India Pulses and Grains Association (IPGA) February 2016, with IYP 2016 recognition (**Annex 1**). More information is available on our [website](#). No additional competition was held after, given realization of how long it takes to accelerate entrepreneurs from such competitions (mostly students). Rather, a decision was taken to network with various R&D teams in Indian institutions to identify ventures for acceleration.
- 1.2.4. Three (3) proof-of-concept projects selected for scaling as part of the food convergent innovation accelerator. A decision was made to reach out to external teams as the student teams selected from the student competitions dropped out due to reasons beyond our control (see 2nd and 3rd Interim Technical Reports – Sept. 12, 2016 and Dec. 31, 2016 respectively – for details). The three clients were referred to the Accelerator by PIP partners from early 2017.

1.3 Preliminary concept of CI accelerator

Four outputs were initially anticipated for achieving this milestone, of which three were completed, and one was modified as not possible to be completed during the project period. These are summarized in a report (**2_1.2_1.3_RefineConceptualModel_FoodInnovationPrototypes**).

- 1.3.1. Assessment of extended local interest/ engagement through a series of design workshops was previously completed. Several workshops were hosted in India, Canada, as well as in the US (**Annex 2**).

- 1.3.2. Preliminary business model for the CI accelerator. Based on core discussions on the preliminary business, governance model, targets and key projects held at meetings held in February and June 2016 (2nd Interim Technical Report), as well as in November and December 2016 (3rd Interim Technical Report), the basic business model was drafted and then updated with significant revisions based on the experiences of the CI Accelerator with its clients. Three proof-of-concept projects were handled during the project period. It was realized that a more structured arrangement is required for the Accelerator to continue beyond the project period. As NIFTEM's facilities are still being established, the following recommendations were made to the institution to continue with the Accelerator – Formalize the arrangement with the external pilot plants with MoUs, approach industrial CSR programs to obtain financial support and apply for funding from the Government of India through one of the Innovation support programs. It was quite clear that the institutional set of NIFTEM would need to be augmented with external support for the Accelerator to continue beyond the project period.
- 1.3.3. CI support package for SMEs looking to scale reaching 10 food processing factories for each of the three selected innovations was not possible to complete due to the delays noted in the project. Rather, lessons noted have been documented in the problems and challenges section of this report.
- 1.3.4. Creation of a global platform for convergent food innovations with engagement by all societal sectors (including private sector) with (3) large, (2) SMEs (modified from initially anticipated 6 SMEs), (2) NGOs, (6) research institutes and (2) government agencies as formalized partners is in process. While this was mostly completed, some MOUs were still in process of being finalized at the time of writing this report. SMEs were engaged through activities such as the Management Development Program (MDP) workshop conducted at NIFTEM in December 5-6 2017 (**1.3.4_3.1.5_InnovationManagementProgram_Summary**).

Objective 2: Refine the concept and operating model of the food CI accelerator

There were three milestones for this objective. One milestone was modified due to lessons learned, and two achieved. Under this objective, there were nine (9) outputs anticipated. Two (2) were completed fully, three (3) were partially completed, and four (4) were not achieved, with reasons explained below. These are summarized in a report (**2_1.2_1.3_RefineConceptualModel_FoodInnovationPrototypes**).

2.1 Formation of an CI acceleration team for each innovation

Three outputs were initially anticipated for achieving this milestone, of which one was completed, and two others were modified as not possible to be completed during the project period.

- 2.1.1. An innovation team assembled for each product innovation based on category of innovator. Due to delays in initiating the CI Accelerator, it was not possible to form separate innovation project teams.
- 2.1.2. Project kick-off meeting (as required). This was not completed, as it was not applicable given 2.1.1.
- 2.1.3. Detailed project plan for each innovation. Project plans were finalized for two millet-based innovations (**2.1.3a_1.2.2a_Prototype1_BlissTree_HapiMillet & 2.1.3b_1.2.2b_Prototype2_MilletBowl**), and one-pulse based innovation (**2.1.3c_1.1.3_1.2.2c_Prototype3_Laddoo**).

2.2 Project Monitoring and governance

One output was initially anticipated for achieving this milestone, and was partially completed, with some aspects in process.

- 2.2.1. Memorandum of Understanding (MoU) signed by all partners in each project is in process. A key MoU that was signed was with NIFTEM to host the Convergent Innovation CoE. A list of organizations with MOUs is provided in a report on this objective **(2_1.2_1.3_RefineConceptualModel_FoodInnovationPrototypes)**.

2.3 Documenting the food convergent innovation process and outcomes

Five outputs were initially anticipated for achieving this milestone, of which one was fully completed, two were partially completed, and two were modified as not possible to be completed during the project period.

- 2.3.1. Report outlining the food CI process and potential for further convergence and ecosystem transformation projects was completed **(2_1.2_1.3_RefineConceptualModel_FoodInnovationPrototypes)**.
- 2.3.2. Data informing consumer acceptance and market performance of the nutritious food innovations was partially completed **(2.1.3c_1.1.3_1.2.2c_Prototype3_Laddoo)**. While we obtained preliminary data on consumer acceptance of the food innovations, it was not possible to get products to market, due to delays in initiating the CI Accelerator activities. Getting the products to market is ongoing, and efforts will be made to collect data on market performance to inform future work being developed.
- 2.3.3. Draft publication exploring the linkage of convergent food innovations with projects in Odisha and Maharashtra to scale and transform farm and food systems was not possible to complete in the project period, due to delays in initiating the CI Accelerator activities. Efforts will be made to collect data to inform future work being developed.
- 2.3.4. Three (3) pulse-based food innovations to market in India by March 31, 2018 was only partially completed, with aspects still in process. Assistance was provided to Bliss Tree and Millet Bowl for drawing up their business requirements and respectively prepare a five-year projection plan. Pitch decks were prepared and shared with two investment bankers in Bangalore, and the decks were updated based on their comments. The draft deck was planned to be presented to two financial mentors of the Accelerator – Mr. Hemendra Mathur, Partner, Bharat Innovations Fund and Mr. Uma Mahesvaram, Chief Mentor and Investments Officer, Indigram Labs Foundation. However, both the clients could not travel to New Delhi for making this presentation in person. The files were shared with the mentors and the clients introduced to them. Mr. Mathur has shown interest to speak with both the parties on the phone and set up a meeting at a later date based on the preliminary discussion. An expression of interest has been shared with the Chennai Angels (investor group) for the Bliss Tree project. The JVS-MotherFood pulse-based Laddoo project was pitched by MotherFood in an initial conference call on January 24 2018 to the Gates Foundation and in a meeting with Purpose Capital on April 3 2018 (in addition to other MotherFood partnership projects), with product prototypes to be sent to them when completed for potential follow up pitching. Work is in progress to have all three prototypes pitched to additional potential investors in India as well as in Canada (Purpose Capital, and at an event specific for this, with the Indian investment community in Montreal planned for October 2018).
- 2.3.5. Integration into ongoing development projects as a driver of food security and nutrition in 20 villages of Kandhmal and Rayagada districts of Odisha will not be possible to complete during the current project period. We will however make progress and learn what is needed to succeed even beyond the project.

Objective 3: Advance a new model of private-sector engagement for nutrition security

There were two milestones for this objective, which were achieved. Under this objective, there were nine (9) outputs anticipated. Three (2) were completed fully, three (3) were partially completed, and three (3) were not achieved, with reasons explained below.

3.1 Theory of Change (ToC) development

Five outputs were initially anticipated for achieving this milestone, of which one (1) was fully completed, two (2) were partially completed, and two (2) were modified as not possible to be completed during the project period.

- 3.1.1. Publication outlining the development of a theory of change for food convergent innovation as a new model of private sector engagement was completed (**3.1_CITheoryOfChange**).
- 3.1.2. Development of a new research strand that places management and other social, political and economic sciences underlying CI as a core complement to current agriculture and nutrition research. Will not be possible to complete this during current project due to the delays previously noted. We will however make progress and learn what is needed to succeed even beyond the project.
- 3.1.3. Series of ToC work sessions. This was partially completed, with aspects still in process. While CI theory of change work sessions were held during the course of the project, it was not possible to have work sessions based on the three prototype projects during the period, due to the delays previously noted. We will however make progress and learn what is needed to succeed even beyond the project.
- 3.1.4. Presentation/ think tank to key stakeholders to illustrate their willingness to adapt and adopt. It was not possible to complete this during current project, due to the delays previously noted. We will however make progress and learn what is needed to succeed even beyond the project.
- 3.1.5. Increased awareness of the importance of pulse food innovation in synergy with IYP, was partially completed. While we perceive increased awareness through the IYP competition at NIFTEM, as well as meetings and webinars with diverse Indian, Canadian, and other international stakeholders, and from evaluation after the December 5-6 2017 Management Development Program at NIFTEM (**1.3.4_3.1.5_InnovationManagementProgram_Summary**), it was not possible to explicitly measure this, due to delays previously noted.

3.2 Establishment of PIP-India/Global as virtual practice-based knowledge platform

Four outputs were initially anticipated for achieving this milestone, of which two (2) were completed, one (1) is in process, and one (1) was modified as not possible to be completed during the project period.

- 3.2.1. Series of meetings with relevant partners and potential stakeholders were completed. Workshops and meetings were previously hosted in India and Canada for information sharing, training, dissemination and uptake of lessons learned for advancing CI.
- 3.2.2. Development of an open knowledge platform with capacity for sharing market insights, tools and reports, blog posts, chat rooms, etc was modified as not possible to achieve during the project period, as discussed in the 4th Interim Technical Report of July 31, 2017, due to delays noted earlier.
- 3.2.3. Project management and collaborative space for projects, starting with those from the food innovation competition and food was only partially completed, due to delays noted earlier.

- 3.2.4. Synergistic linkage with PIP-India and PIP-global to further innovation goals
- Launch of PIP-global. PIP Global was on March 10, 2016.
 - Launch of PIP-India on March 8 and 9, 2017.
 - Various work sessions were organized with partners in India, Canada, and others, including virtually in US, Ethiopia, Ghana to collaborate on a knowledge platform for global and national PIPs.

Synthesis of research results and development outcomes

As part of this IDRC program, multiple studies were conducted, with key roles by the McGill Centre for the Convergence of Health and Economics (MCCHE), the National Institute of Food Technology Entrepreneurship and Management (NIFTEM), and other partners. Results from our work in mapping the consumption and innovation landscape for pulses (and subsequently including millets projects), and in launching the Pulse Innovation Platform (PIP) globally and in India for advancing the Food CI Accelerator showed the complexity and dynamism of bringing about ecosystem transformation through convergent innovation (CI). Our study findings highlight the need to go beyond traditional approaches of research (e.g. through surveys, etc.), and the value of digital tools – including using artificial intelligence (AI) – that enable real-time, and predictive acquisition of the behavioral and cultural insights on rural and urban settings in different socio-economic segments. We show how to engage in diagnostic analysis across sectors, enabled by digital tools, rather than prescriptive analysis that has characterized decision-making in food and nutrition security, and related domains from the 20th century (Addy et al. 2014; Ostrom 2007; Ostrom 2010). Additionally, of particular note, the activities we engaged in for this IDRC program strengthened partnerships between platform organizations that spanned institutional sectors, including those in the Global PIP and PIP-India.

The PIP activities advanced as part of this IDRC program (Objective 1) were especially important for the implementation of CI, in refining the conceptual model of the CI Accelerator (Objective 2 of this IDRC program), and for specifying a theory of change (Objective 3). We note that the PIP activities themselves have been the result of extensive prior collaborative work by academic/research institutions, businesses, civil society and public sector members to foster better convergence between economic growth and human development. Supported by seed funding from the Bill & Melinda Gates Foundation and the Rockefeller Foundation, PIP emerged from partnerships between the the McGill Centre for the Convergence of Health and Economics (MCCHE); the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH), led by the International Food Policy Research Institute (IFPRI), which helps realize the potential of agricultural development to deliver gender-equitable health and nutritional benefits to the poor; INCLIN Trust, with leadership of the Tata Cornell Agriculture and Nutrition Initiative and AFM-Canada respectively for India and Canada, the two focal countries. These core partners had shared leadership in articulating the transdisciplinary scientific foundation of CI, producing special features in the [Proceedings of the National Academy of Sciences](#) and the [Annals of the New York Academy of Sciences](#) with two supporting books (Dube et al. 2010; Hawkes et al. 2009). Pulse Innovation Platform member, CICILS, spearheaded the policy and political process leading to the declaration by the United Nations of 2016 as being the International Year of Pulses (IYP 2016), with PIP being the food innovation arm of this initiative.

This IDRC program allowed for taking the work of PIP partners to a higher level, with outputs and outcomes that are leading to the transformation of food production, value addition, and consumption, enabled by the environment envisioned by CI to address nutrition security. The work has included individual and collaborative efforts by the CGIAR-CRP Grain Legumes, pulse grower associations (Pulse

Canada, in addition to the global association of pulse producer, CICILS) and leading private sector organizations from agriculture, food, trade and marketing that play a key connecting role in pulse value chains between agricultural supply and the consumption of foods. These companies provide agricultural equipment and food processing technologies (e.g., Buhler), ingredients and sensory technologies (e.g., Firmenich), and micro-nutrients (e.g., DSM) on the supply side and, on the demand side, trade commodities.

This IDRC program has yielded key outputs and lessons that we are building upon, for leading to convergence and ecosystem transformation projects, even beyond this project funding. Of great significance, this IDRC program has contributed to the partnership between MCCHE and TCS, particularly for the development of a digital platform that integrates food production, value addition, and consumer insights, while also enabling linkages with key enablers, such as financial services, policy-making, and research, etc. Following work sessions and design workshops, some of which were funded through this project (see project outputs in **Annex 2**), for using TCS digital support to small-holder farmer agriculture as a key building block for food CI digital backbone, the government of India is making TCS' digital platform available to farmers in India villages. Specifically, the government has made commitments to digitally connect at least ten farmers in every village in India by the latter part of 2018. Additionally, state agricultural departments are to be empowered with digital tools to increase their quality of service and create "farmer-centric" eco-systems. The platforms are also to enable agri-preneurs and other agri-food stakeholders to directly reach out to small and marginal farmers through a common platform and sell/provide services. These are key steps in the institutionalization of a CI digital backbone that links food production with value addition and consumer insights, in an enabling environment.

Additionally, efforts made by the project partners towards setting up PIP India with industrial and NGO partners have been brought to the attention of high-level decision makers in both India and Canada, and are shaping their development agendas. The Research Branch of Agriculture and Agri-Food Canada (AAFC) is pursuing Canada-India collaboration for R&D in pulses and has sought to use the PIP-India base to bring together the relevant institutions and personnel. This key initiative is seen as an important event considering the latest developments in pulses trade between the two countries. The network and relationship built by this IDRC project have been instrumental in conception and planning of this activity, with partnerships being strengthened with Indian Council of Agriculture Research (ICAR). The development of food CI that occurred from this project has contributed to further research and industry commitments to agri-food in Canada, and its engagements in India and globally. More directly for the MCCHE, the work from this IDRC program is contributing to the agenda of McGill's new Bensadoun School of Retail Management in having healthy food and consumer insights as one of its focus areas. Further, in building on the PIP experiences, the MCCHE and the Bensadoun School will be vibrant knowledge bases for aspects of retail that span the full agri-food chain, in contributing to Canada's [Protein Industries Supercluster](#) that is increasing the value of key crops, such as pulses that are coveted in high-growth markets like India, as well as to satisfy growing markets in North America for plant-based meat alternatives and new food products. The researcher and practitioner experiences in this IDRC program are also informing South-South cooperation in training and partnerships. For example, as part of ongoing initiatives such as the [Queen Elizabeth Scholars \(QES\)](#) program, MotherFood International, one of the SMEs that partnered with MCCHE, JVS Foods, and Indian organizations for food innovation is similarly brokering partnerships with Ghanaian organizations, informed by the India experiences. Below, we synthesis more specifically key research results and development outcomes of this IDRC program.

Objective 1: Map the pulse innovation and consumption landscape

Results from our mapping of the pulse consumption and innovation landscape showed extensive dynamism and demonstrated the value of new approaches using artificial intelligence (AI) for consumer insights. In this section, we first highlight our findings regarding pulse-based consumption patterns and demand drivers, necessitating the development of consumer insights modules in digital support tools for decision-makers in the contexts where they operate to address food and nutrition security. Second, we highlight the diverse range of pulse-based food innovations. Lessons learned from the integration of consumption and innovation insights were integrated into the preliminary model for the CI accelerator, as part of activities with institutions in India that strengthened partnerships, including those with Global Pulse Innovation Platform (Global PIP) and PIP-India members.

Understanding pulse-based consumption patterns and demand drivers

First, we highlight the understanding we developed about pulse-based consumption patterns and demand drivers, synthesizing findings from (i) a white paper on consumer insights on demand drivers for traditional and modern food consumption, drawing from three empirical studies of pulses in India to inform food innovation, behavior change, and health promotion (Dubé and McRae 2018); (ii) a report on consumer perception and responsiveness to two current branding/communication strategies by CICILS/Pulse Canada and ICRISAT Smart Food, published in the *Frontiers of Public Health* (Dubé et al. 2016); and (iii) consumer insights from proof-of-concept projects implemented in this IDRC program (Addy et al. 2018b; Sosle 2018b; Sosle 2018a; Tandon et al. 2018).

Overall, we see that pulse consumption trends are influenced by consumer perceptions of price, color, healthiness, and economic consequences. We also see that consumers have mostly positive sentiments towards the various dimensions of pulse-based food products. In particular, research outputs included a paper on the structure, methods, and development of an artificial intelligence (AI) platform to support CI through automated analysis of social media data, built on an integrative ontology that combined behavior, food, health, marketing, and food characteristics and consequences. Such behavioral insights will serve as a springboard for further empirical studies to support behavior change, product and service innovation, and branding across the pulse industry.

We specifically note lessons learned about behavior change, food product and service innovation, and ecosystem branding. First, CI aims to bring about behavioral change and ecosystem transformation for sustainable prosperity and affordable healthcare by better bridging technologies with social and institutional innovations. With the highest aspiration to "change the world through food," the CI approach accelerates successful go-to-market strategies for appealing and nutritious food innovations in a manner which is both economically and environmentally sustainable, while also improving the diets of all. Rather than a dichotomy between positive "carrots" and negative "sticks" to change behavior, we find that a combination of multiple approaches is required to target behavioral change and develop a systematic framework to improve the uptake of pulses, including *the choice architecture approach*, which uses the idea that decisions are susceptible to design contexts in which behavior could be steered appropriately. Digital tools enable decision-makers to determine which approaches to use in any given context.

Second, this IDRC program enabled us to advance a new paradigm of innovation that will modernize pulse-based food commercialization by providing deep insights into consumer minds and industry trends, using advanced digital platforms and infrastructure with leading scientific knowledge on the drivers of human behavior in varying contexts. The research we conducted, on "Convergent Innovation in Food through Big Data and Artificial Intelligence for Societal-Scale Inclusive Growth" enabled us to garner a better

understanding of how to provide decision-makers with a tool for testing new ideas, products, and policies. We have started to develop a component to extract insights from user-generated content through social media to inform break-through innovation (Dubé et al. 2018). Future iterations of the platform will enable deeper insights on sub-aspects (e.g., what food textures has the most positive or negative valence) to further the development of consumer-centric products. With the addition of nutritional science, processing technologies, and consumer insights on behavioral properties, many of traditional methods can be scaled up to craft commercially-successful pulse-based products through new approaches to value addition. To bring such pulse-based innovation to fruition, agri-food businesses must: (1) place nutrition and health sensitivity as a core driver of innovation, product category transformation, and commercialization, and (2) change their product and brand portfolio in a nutritious and health sensitive direction.

Finally, our research and other activities yielded insights into branding. In modern society, brands have become one of the most valuable intangible assets in a business, functioning as a powerful differentiator for organizations and their products, and as a decision-making tool for consumers. During the 2016 International Year of Pulses, the global pulse brand served as a trigger for consumer engagement in marketing and advertising, as well as an ingredient brand on processed foods and packaged whole pulse products. PIP forums in India and Canada pointed out the dearth of research and its translation for pulse branding. At the same time, efforts of Global PIP partners are yielding insights that we will build upon as we work beyond this project. Notably, PIP partner, DSM/Sight and Life has been engaged in a branding program, targeting women in Ghana, part of the Affordable Nutritious Foods for Women (ANF4W) program from 2013-2017. In a second phase of the program, the insights gained from this IDRC program are being used to further develop the approach to creating consumer demand, product development, and making linkages with strategic value chains, including in pulses.

Understanding pulse-based food innovation

This IDRC program also deepened our understanding of pulse-based food innovation, and we synthesize the findings from (i) an inventory list of pulse-based food innovations, developed by scouting for potential pulse-based food innovation and innovation capacity (Sosle ; Sosle 2018b); and (ii) the needs, wants, aspirations, and key points of value creation of innovators, particularly the potential users of the CI accelerator, and the proof-of-concept projects implemented in this IDRC program (Addy et al. 2018b; Sosle 2018b; Sosle 2018a; Tandon et al. 2018).

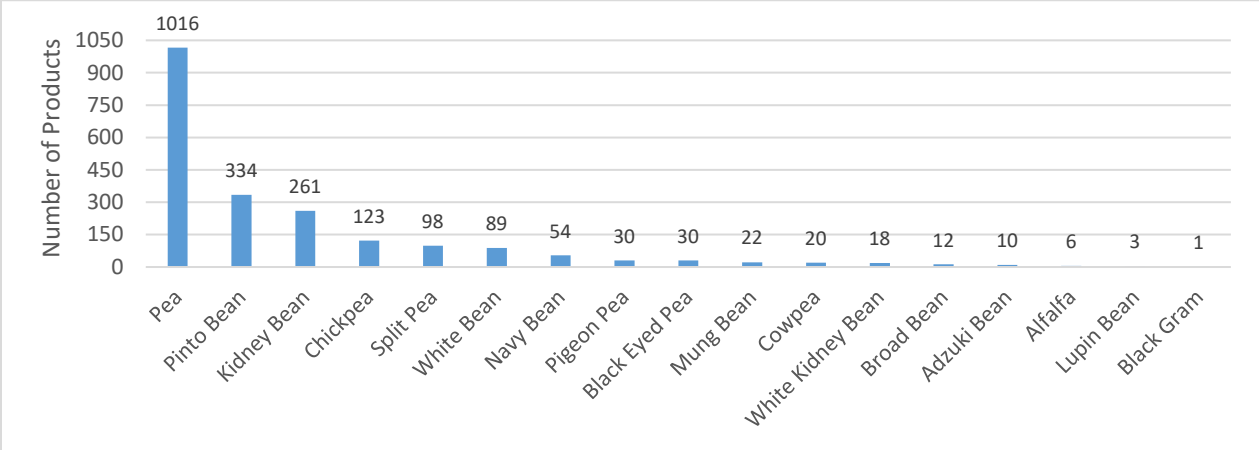
To inform our understanding of the pulse-based food innovation landscape, a group of 13 students led by Dr. Venkatesh Sosle at NIFTEM performed a desk-based market scan for global pulse products (**Annex 1.2.1a_PIP_PulseInnovationInventory and 1.2.1b_PIP_Final_Data-base**). Internet keyword searches were performed for “product category + pulse” and “product category + pulse type.” For example, “beverage + pulse” and “beverage + chickpea” were queried using a common internet search engine. All products identified were then logged in a common template along with their respective attributes, and integrated by Dr. Sosle. Across 28 countries, 157 products were identified that span 12 categories (see Table 1). Chickpea (26%), lentils (20%), and black bean (10%) were the top ingredients present in the innovations identified. The snack food category has been the target of most pulse food innovations identified, with 88 products (56% of new products) identified within the category. Fried and frozen pulse products also saw a greater amount of innovation than other categories. Most product innovations originated from the United States (47%), followed by Canada (13%) and India (7%).

Table 1. Pulse product inventory stratified by product category (Source: NIFTEM)

| Product Category | # of Products | Top Pulse Ingredients | Frequently Mentioned Foods |
|------------------|---------------|------------------------------------|---|
| Beverages | 7 | Chickpea, pea, bean | Pulse-added smoothies and alcoholic beverages |
| Bread | 1 | Chickpea | Whole-grain bread |
| Cereal | 1 | Navy bean, lentil, garbanzo bean | Mixed pulse breakfast cereal |
| Desserts | 8 | Black gram, horse gram, white bean | Pulse flour based confections |
| Fried | 15 | Chickpea, lentil, pea | Falafel, pulse chips, pulse fries |
| Frozen | 17 | Lentil, black bean, chickpea | Slow cooker meals, fries, and burgers |
| Pasta | 2 | Chickpea | Chickpea flour pasta |
| Roasted | 8 | Navy bean, fava bean, chickpea | Roasted whole pulse snacks, nutrition bars |
| Snacks | 88 | Chickpea, lentil, black bean | Appetizers, salads, nutrition bars, falafel |
| Dips and Spreads | 10 | Chickpea, lentil, black bean | Bean jam and chutney, hummus spreads, salsa |

To supplement the research performed by NIFTEM students, two USDA Food Composition Databases were queried using the same methodology as above: (1) USDA National Nutrient Database for Standard Reference, and (2) USDA Branded Food Products Database. 2138 pulse-based products were identified and recorded from the USDA databases. Present limitations in data quality have limited us to product name and pulse type (Figure 1). Peas, by far, were the largest product category with 1016 pea products identified. 334 pinto bean, 261 kidney bean, and 123 chickpea products were identified. All other pulse varieties individually contribute to less than 5% of the overall number of products identified. Further work is underway to link nutritional data to the product inventory, to expand our understanding of the potential impact of real pulse-based innovations on nutrition and health.

Figure 1. Number of Pulse Product Innovations by Pulse Variety (Source: USDA)



Additional research by students at NIFTEM showed how modern processing techniques, such as roasting, can be used to create foods that better meet consumer demands through new nutrient, sensory, and behavioral profiles, while also contributing to collective health and economic systems across the agri-food value chain (Meda 2018). The broader level research noted above was also buttressed by consumer insights conducted of proof-of-concept projects. Results of sensory tasting and focus group discussions around a traditional, pulse-based product, laddoo, showed that food aspects such as taste, texture, and color – which are modifiable through roasting – and packaging were key for consumer acceptability of the product (Tandon et al. 2018).

Also in addressing Objective 1, the lessons learned from research on pulse consumption and innovation were integrated in developing preliminary plans for the CI accelerator, summarized in the project plan for “Raising Innovative Sustainable Enterprises” (RISE) at NIFTEM (Sosle 2018a), as part of activities with cross-sector partners, including those involved in the launch of the Global Pulse Innovation Platform (Global PIP) and PIP-India. While initially there were challenges with limited engagement of SMEs due to lack of understanding about the factors that shape their decision-making in the specific contexts in India where the project is taking place, activities such as the Management Development Program (MDP) workshop conducted at NIFTEM in December 5-6, 2017 allowed for greater engagement of SMEs (**Annex 1.3.4_3.1.5_InnovationManagementProgram_Summary**).

Objective 2: Refine concept and operating model of the food CI accelerator

Food and nutrition insecurity, at the nexus of food, health, and other related systems, are conceptualized as complex societal problems. Such problems are also known as “grand challenges” (George et al. 2016; Grand Challenges Canada 2011; Hilbert 1902) or “wicked problems” (Churchman 1967; Head and Alford 2013; Rittel and Webber 1973). We show how convergent innovation acceleration addresses such complex problems, which are distinct from complicated problems that require expertise from a given institutional sector (Snowden and Boon 2007). Our conceptualization of CI recognizes the tendency of various institutional sectors to show leadership in some aspects of innovation, with CI providing the framework for the various stakeholders to engage in innovation together from the start of processes (Figure 1). For example, there continues to be leadership respectively by the private sector, civil society, and government as they work together, intertwining technological, social, and institutional aspects of convergent innovation, to bring about improvements in food and nutrition security.

One of the objectives of this IDRC-funded project was to refine the concept and operating model of the food CI accelerator. The CI accelerator was conceived innovatively to have extensive global and Indian partners spanning public, private and civil sector organizations, working individually and collectively towards the development of three pulse-based food innovations as proofs-of-concept. The experience and documentation of the process and its impact was to crystallize the operating model of the accelerator for subsequent scale-up. Our initial conceptualization of the CI accelerator draws upon recent knowledge that is being gleaned about business accelerators as a means for enabling businesses, particularly those at early stages, to innovate. While existing literature acknowledges the relative lack of research on innovation processes, and in particular on business accelerators, we note three key success factors of accelerators, which respond to the needs, wants, and key points of value creation for innovators: the need for extensive networks to access knowledge and resources, among others; competitive selection that contributes to raising the level of ventures; and services available for commercialization of innovations (Clarysse and Yusubova 2014).

As we note in a report on the CI accelerator processes (Addy et al. 2018a), most vital to the operationalization of CI acceleration was the linking of global and local networks for engaging stakeholders from across societal sectors. Whereas typically, business accelerator networks provide ventures with the opportunity to build strategic partnerships with potential investors, customers, and other ventures, the network of the food CI Accelerator was innovative, reaching across institutional sectors, to provide opportunities for interactions between various stakeholders who hitherto were not connected. In particular, global and national CI platforms were launched – Global Pulse Innovation Platform (Global PIP) in March 2016, and PIP-India in March 2017 – as multi-actor collaboration networks that included the private sector, with large corporations, small and medium-sized enterprises (SMEs),

NGOs, research institutes, and government agencies, simultaneously pursuing the realization of social, environmental, and economic value. Stakeholders in the Global PIP and PIP-India ranged from collaborators, sponsors, and those with which Memoranda of understanding (MOUs) were signed (Table 2). Having the extensive network proved to be vital for overcoming a number of challenges that were experienced in the course of this project.

Table 2. Active Partners in Global PIP or PIP-India Food CI Networks

| LARGE COMPANIES | | |
|--|-------------|-------------------------------|
| Name | Location | Collaborator/ Sponsor/ MOU |
| Tata Consultancy Services (TCS) | India | MOU in process |
| Pepsico | USA | Sponsor |
| Firmenich | France | Sponsor |
| Tata Chemicals | India | Collaborator |
| YES Bank | India | Collaborator |
| DSM/Sight and Life | Switzerland | Collaborator |
| ITC Foods | India | Collaborator |
| SMALL TO MED ENTERPRISES (SME) | | |
| Name | Location | Sponsor or MOU |
| MotherFood International | Canada | MOU |
| JVS Foods | India | Collaborator |
| Bliss Tree/Happi Millets | India | Collaborator |
| Millet Bowl | India | Collaborator |
| NON-GOVERNMENT ORGANIZATIONS (NGO) | | |
| Name | Location | Sponsor or MOU |
| PATH | India | MOU |
| Indian Dietetic Association | India | MOU |
| Pulse Crops Canada | Canada | Sponsor |
| Indian Pulses and Grains Association (IPGA) | India | Collaborator |
| PFNDAI | India | Collaborator |
| Public Health Foundation of India | India | Collaborator |
| RESEARCH INSTITUTES | | |
| Name | Location | Sponsor or MOU |
| National Institute of Food Technology Entrepreneurship and Management (NIFTEM) | India | MOU |
| John Hopkins University | USA | Collaborator |
| IIM Lucknow | India | MOU |
| Shobhit University | India | MOU |
| INCLIN Trust International | India | MOU |
| IFPRI | India | Sponsor |
| CGIAR | Switzerland | Collaborator |
| Indian Institute of Pulse Research | India | Collaborator |
| ICRISAT | India | Collaborator |
| GOVERNMENT AGENCIES | | |
| Name | Location | Sponsor or MOU |
| National Research Council (NRC) | Canada | Collaborator |
| Agriculture and Agri-Food Canada (AAFC) | Canada | Collaborator |

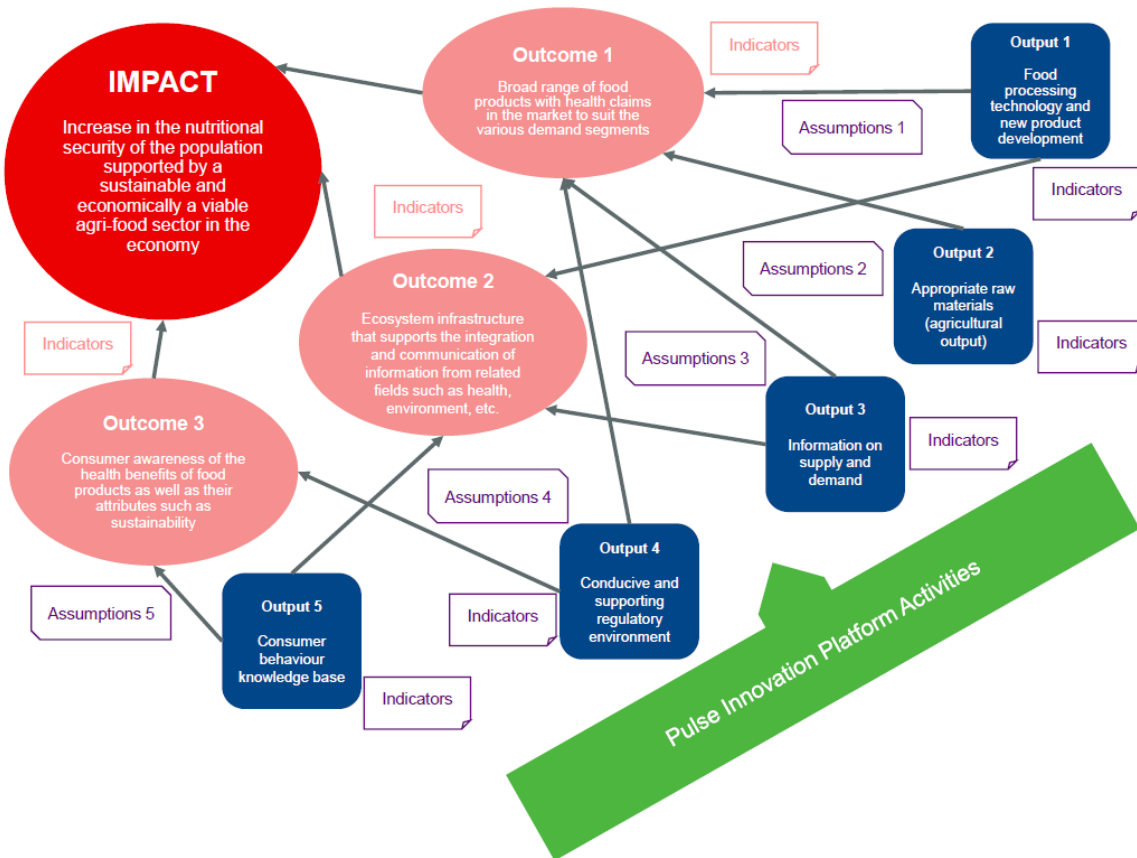
The effort that had been put into developing the extensive PIP network yielded dividends. In an unanticipated manner that characterizes complex problems, the three proof-of-concept projects that we

finally focused on for acceleration were referred to the CI Accelerator through the global and local networks of partners that this IDRC program developed, rather through the initially anticipated approach of student competitions in India. Since we could not find three suitable cases of pulses ventures for acceleration within the time limits, two business concepts in millet products were selected, with one pulse-based innovation. Millets were chosen for a number of reasons. Millets are more advanced than pulses in terms of commercial food innovation, with wider awareness and uptake across the agri-food industry. In addition, the McGill CI network (at McGill's MacDonald campus in particular with Dr. Vijaya Raghavan and Valerie Orsat) has done extensive research on millets over the past decade. Though a compromise was made in selecting non-pulse products due to the time constraints, millets have similar attributes in terms of a CI approach, and were thus deemed suitable candidates for this exercise. Consistent with the high level of variability that we noted from research on pulse consumption and innovation (Objective 1), there was diversity among the CI accelerator clients, who were targeting diverse consumers, engaged in different types of innovation, were at different stages in their process, and were inclined to follow different approaches from each other. The variation in approaches and the interactions of the CI Accelerator with the clients also highlighted the need for decision support tools that equip decision-makers to adapt and deal with complexity, through diagnostic analysis, rather than prescriptive analysis that has characterized decision-making in food and nutrition security from the 20th century. Thus, we found that diversity in the expertise of PIP platform members was a vital ingredient in the operations of the CI accelerator. The food innovations that have been the initial clients of the CI accelerator are: (i) Bliss Tree Millet Cookies (formerly Hapi Millet) of Trichy, Tamil Nadu State, providing healthy and environmentally sustainable snacking options through targeting a general population, and seeking to extend into larger markets, with a strategy of obtaining investments broadly as well; (ii) Millet Bowl, which targets malnutrition among children in India, and used non-retail marketing approach through government-funded meal programs, and is now targeting venture capitalists and angel investors to increase its scope; and (iii) a global partnership between JVS and MotherFood, targeting malnutrition among adolescents and women of child-bearing age by developing traditionally inspired festivity pulse-based foods called laddoo, with a strategy to obtain investments globally. Details of the acceleration of each of the innovations are provided in project reports (Addy et al. 2018a). The PIP platforms and the proof-of-concepts projects also provided empirical backing for a two-tiered model of modular governance that was proposed for CI: platform governance (global and national platforms) and module governance, at the level of individual projects (Jha, Dubé and Gold 2016).

Objective 3: Theory of change for food convergent innovation in private sector engagement

The experiences from this IDRC program informed the development of a theory of change, elaborated in a report on food convergent innovation as a new model of private sector engagement for nutrition security. The theory of change was structured in terms of Pulse Innovation Platform (PIP) activities, leading to outputs, and in turn, outcomes, feeding into the desired impact of nutrition security (Figure 3).

Figure 3. The Theory of Change illustration



As noted in the current IDRC program, the setting up of PIP at global and local levels was key for PIP activities, and outputs generated. In the specific cases noted above, platform activities contributed to new product development, among other outputs. In the present case, the concept of a CI Centre of Excellence (CoE), embedded within the Global PIP and PIP-India, as a seed of the CI platform was pursued. Starting off a CI Accelerator, the body was expected to develop into a CoE that would develop into a resource of CI and an eventual CI Champion that would assist developing the CI Platforms. The CI Accelerator was located at NIFTEM, and extensive efforts were made to equip it with sustainable funding.

The outputs from experiences with CI acceleration and the theory of change developed here feeds into further food CI acceleration efforts by the CI platform members noted earlier in this synthesis, including in Canada, India, and Ghana, among others. The CI Accelerator at NIFTEM is envisioned as one of a network of similar entities in the CI ecosystem, with one or more CoEs. Depending on their strengths and available resources, in the contexts within which they are embedded, each Accelerator would focus on one or more areas of innovation, with outputs that are linked with those of other Accelerators. They would thus operate with target outcomes, keeping the expected impact of improved nutrition security in the line of sight. For instance, the Accelerator at NIFTEM focused on identifying, supporting and promoting innovation in food processing and food product development (Output 1), contributing to a broad range of food products with health claims in the market to suit various segments of consumer demand (Outcome

1). However, it has inclusion criteria that would consider the benefits to the crop sector on the back end, as well as the health benefits to the consumers at the other end. From end to end, the types of insights about consumer and innovation that were generated in Objective 1, as well as documentation of the processes as done for Objective 2 for this IDRC program will inform diagnostic analysis by diverse sets of decision-makers engaged in interlinked platform activities. Similarly, an Accelerator that might support novel agricultural production activities in this ecosystem would consider the sustainability and environment benefits along with the output geared at benefiting the food processing industry or consumers of the commodity. Such a networked system of Accelerators could be envisaged across geographical or sectoral boundaries that feed into each other to deliver the desired impact on nutrition security, taking into account social, gender and environmental dimensions as appropriate.

Synthesis of results towards AFS themes

The overall project results have impacts in the short term on improving access to resources, and/or markets and income (Accessibility); in the medium term on informing policy, and increasing agricultural productivity (Availability); and in the long term on improving nutrition (Utilization).

Improving access to resources, and/or markets and income (Accessibility)

Most immediately, the project contributed to (i) successful partnership models, and (ii) to addressing bottlenecks and constraints that food entrepreneurs – in this case those with innovative, healthy products targeting children (Millet Bowl project), women (Laddoo project), and rural populations (all three proof-of-concept projects) - face in accessing financing and access to markets. First, as we note in a report on the CI accelerator processes (Addy et al. 2018a), a key outcome of this project was the linking of global and local networks for providing businesses with access to supportive networks. Whereas typically, business accelerator networks provide ventures with the opportunity to build strategic partnerships with potential investors, customers, and other ventures, the network of the food CI Accelerator was innovative, reaching across institutional sectors, to provide opportunities for interactions between food entrepreneurs and other stakeholders who hitherto they were not connected with. In particular, global and national CI platforms were launched – Global Pulse Innovation Platform (Global PIP) in March 2016, and PIP-India in March 2017 – as multi-actor collaboration networks that included the private sector, with large corporations, small and medium-sized enterprises (SMEs), NGOs, research institutes, and government agencies, simultaneously pursuing the realization of social, environmental, and economic value. Stakeholders in the Global PIP and PIP-India ranged from collaborators, sponsors, and those with which Memoranda of understanding (MOUs) were signed. Having the extensive network proved to be vital for overcoming a number of challenges that food entrepreneurs face. The entrepreneurs leading the three proof-of-concept projects that we finally focused on for acceleration were referred to the CI Accelerator through the global and local networks of partners that this IDRC program developed, including other incubators and accelerators. We found that diversity in the expertise of PIP platform members was a vital ingredient in the operations of the CI accelerator. The food innovations that have been the initial clients of the CI accelerator are: (i) Bliss Tree Millet Cookies (formerly Hapi Millet) of Trichy, Tamil Nadu State, providing healthy and environmentally sustainable snacking options through targeting a general population, and seeking to extend into larger markets, with a strategy of obtaining investments broadly as well; (ii) Millet Bowl, which targets malnutrition among children in India, and used non-retail marketing approach through government-funded meal programs, and is now targeting venture capitalists and angel investors to increase its scope; and (iii) a global partnership between JVS and MotherFood, targeting malnutrition among adolescents and women of child-bearing age by developing traditionally inspired festivity pulse-based foods called laddoo, with a strategy to obtain investments globally.

As detailed in the empirical proofs of concept projects (Addy et al. 2018b; Sosle 2018b; Sosle 2018a; Tandon et al. 2018), this IDRC program contributed to the following needs of agri-food businesses:

1. **Food processing technology and new product development** – Development and deployment of appropriate food processing technology and new product development capability by the industry to provide the market with the healthy food products desired by the consumers
2. **Access to key inputs, such as funding and raw materials** – Timely availability of funding and the raw material (the target crop) to the food processing industry in proper quality and sufficient quantities
3. **Information on supply and demand** – Access to high quality information on supply and demand of all components involved in the value chain across the sectors
4. **Conducive and supporting regulatory environment** – A regulatory environment that encourages smooth commercialization of innovation across the value chains
5. **Consumer behaviour knowledge base** – Development of a detailed consumer behaviour knowledge base that could be used for both product development as well as behavioural change communication

Informing policy

Additionally, in the medium term, the project is contributing to informing policy for improving food and nutrition security. The efforts made by the project partners towards setting up PIP India with industrial and NGO partners have been brought to the attention of high-level policymakers and other decision-makers in both India and Canada, and are shaping their development agendas. The Research Branch of Agriculture and Agri-Food Canada (AAFC) is pursuing Canada-India collaboration for R&D in pulses and has sought to use the PIP-India base to bring together the relevant institutions and personnel. This key initiative is seen as an important event considering the latest developments in pulses trade between the two countries. The network and relationship built by this IDRC project have been instrumental in conception and planning of this activity, with partnerships being strengthened with Indian Council of Agriculture Research (ICAR). The development of food CI that occurred from this project has contributed to further research and industry commitments to agri-food in Canada, and its engagements in India and globally. More directly for the MCCHE, the work from this IDRC program is contributing to the agenda of McGill's new Bensadoun School of Retail Management in having healthy food and consumer insights as one of its focus areas. Further, in building on the PIP experiences, the MCCHE and the Bensadoun School will be vibrant knowledge bases for aspects of retail that span the full agri-food chain, in contributing to Canada's [Protein Industries Supercluster](#) that is increasing the value of key crops, such as pulses that are coveted in high-growth markets like India, as well as to satisfy growing markets in North America for plant-based meat alternatives and new food products. The researcher and practitioner experiences in this IDRC program are also informing South-South cooperation in training and partnerships. For example, as part of ongoing initiatives such as the [Queen Elizabeth Scholars \(QES\)](#) program, MotherFood International, one of the SMEs that partnered with MCCHE, JVS Foods, and Indian organizations for food innovation is similarly brokering partnerships with Ghanaian organizations, informed by the India experiences.

Increasing agricultural productivity (Availability)

Additionally in the medium term, the project is contributing to increasing agricultural productivity, although due to the limitations of the project timeline, we are unable to quantify this until later. Notably, this IDRC program has contributed to the partnership between MCCHE and TCS, particularly for the development of a digital platform that integrates food production, value addition, and consumer insights, while also enabling linkages with key enablers, such as financial services, policy-making, and research, etc. Following work sessions and design workshops, some of which were funded through this project (see project outputs in **Annex 2**), for using TCS digital support to small-holder farmer agriculture as a key building block for food CI digital backbone, the government of India is making TCS' digital platform available to farmers in India villages. Specifically, the government has made commitments to digitally connect at least ten farmers in every village in India by the latter part of 2018. Additionally, state agricultural departments are to be empowered with digital tools to increase their quality of service and create "farmer-centric" eco-systems. The platforms are also to enable agripreneurs and other agri-food stakeholders to directly reach out to small and marginal farmers through a common platform and sell/provide services. These are key steps in the institutionalization of a CI digital backbone that links food production with value addition and consumer insights, in an enabling environment.

Improving nutrition (Utilization)

Finally, in the long term, this project contributes to improving nutrition, although given limitations in the data we collected we are only able to argue this indirectly, from the theory of change outlined. In a simple concept of the value chain that we outlined, the farmer produces a crop which is purchased by the processor who then sells the finished product to the consumer in various forms. To nudge this system to effectively work towards achieving a condition where healthy food products are available in desirable forms at affordable rates by the consumers, it is first necessary to understand the underlying linkages, their scope and the pressures on them. Farmers choose to produce crops that ensure guaranteed, profitable returns, which involves selection of the right seeds, management and marketing. However, in a country where majority of the agricultural activity is under the mercy of natural events (such as seasonal rainfall), unorganized financial system, traditional markets with little or no support to the farmer and ineffective government policies, substantial changes need to occur to move towards the desired conditions. A supporting environment for production of crops with high nutritional quality requires innovations in farmer training, production technology, management practices, financial support (credit and insurance), marketing system and consumer awareness. The activities of the PIP network in this project have targeted food value addition, to make available a broad range of food products with health claims in the market to suit the various demand segments (Outcome 1 of a theory of change). Together with activities that lead to infrastructure that supports the ecosystem to integrate and communicate information from related fields such as health, environment, nutrition, economy, etc. (Outcome 2); and Consumer awareness of the health benefits of food products as well as their attributes such as sustainability (Outcome 3), we argue that nutrition security is improved.

Project outputs

The list of project outputs to date are summarized in **Annex 2**. In accordance with the requirements of IDRC's [Open Access Policy](#), publications were made in open access journals. As noted previously, while most outputs planned were delivered, some are still in process, whereas others were not completed. The section on progress towards milestones earlier explains why some outputs are still in process, or were not completed.

Problems and challenges

There were a number of challenges faced by the project that provided learning opportunities. A first set of pertains to unexpected delays. Following the execution of a MOU with NIFTEM (National Institute of Food Technology Entrepreneurship and Management) in March 2016, the setting up of the CI Accelerator experienced excessive delay mostly due to the slow progress of developments at NIFTEM. The institute, with its planned infrastructure in food processing (Pilot Plants, facilities for training and food testing laboratories) was expected to provide most required facilities for the CI Accelerator from end to end, starting from product development through incubation and commercialization, up to large-scale product launch. However, the government due process in soliciting, acquiring and scrutiny of bids for setting up of the Pilot Plants was very slow. In addition, the recruitment of the Project Coordinator, provided for by the project, was slow, as per the government guidelines, which called for a structured process that took time.

Since NIFTEM support to entrepreneurs' needs and requirements (R&D resources, process development validation through Pilot production) was not expected to be completed in time to carry out the project, it was decided that a networking approach had to be taken while the pilot plant facilities at NIFTEM were being set up. This required further budgetary resources for capacity-building at NIFTEM, as well as to

engage with, and develop a broader network of established facilities in India to be utilized for the purpose. The identification of four Food Business Incubators (two with Pilot Plants) in four states in India, all located within government institutions, called for the need of formal arrangements, which led to further unexpected delays for the drafting and signing of MoUs. The development of this network, an innovative way to deal with the challenges we faced, added the benefit of wider regional coverage in the country, especially for the initial stages of the innovation pipeline.

We faced another set of challenges in the identification of innovations and SMEs that could be further funneled into the CI Accelerator support activities. Initially, our approach was to co-host Pulse Food Innovation Competitions targeting student bodies across Indian colleges and universities (**Annex 1**). Our experience in co-hosting the Student Pulse Food Innovation Competition with the India Pulses and Grains Association (IPGA) during the 2015-16 school year demonstrated that organizing such events required too much time (from the period of organizing and hosting the competition, and to begin acceleration), in consideration to the project period. It was thus decided to forgo the competition for the year 2017, and instead try to acquire the innovative efforts through other means, such as the output from the R&D efforts of the PIP-India network. It was also pointed out that the model of student competitions may be something that NIFTEM could continue on their own in the future on a regular basis¹.

Another set of challenges was in identifying and engaging with SMEs willing to take up the innovations in the development of pulse-based food products with health benefits for commercialization. As we learned through this project, one of the major problems SMEs face in India is the effort required in the market to create awareness among the consumers that would lead to preference for their products. Market studies and publicity campaigns required for driving such changes are beyond the means of the SMEs who are more comfortable in dealing with well-established traditional products (fried or roasted snacks for instance) or those that have been already promoted by other external agencies (such as pasta or noodles with pulses). The number of SMEs engaged in the project has thus been lower than initially expected (3 instead of 10+) due to these reasons, the time it takes for the development of products for commercialization and delays in getting the CI Accelerator established.

The challenges faced were related to the initial approach that was proposed of having NIFTEM playing a more central role, and student competitions being a key mechanism for the identification and development of food innovations. True to using the project to refine the operational model of CI, we learned lessons for refining our approach, including the need to accelerate the deployment of food products through more the more extensive networks of the Global and national Pulse Innovation Platforms (PIP). The development of the Global and India PIPs allowed for moving at speed when the initial candidate products dropped out. For example, by connecting MotherFood International from the Global PIP, with local Indian partners, over the period from January through March 2018, we were able to quickly develop the prototypes of the laddoo, and conduct consumer tests to modify the product, and generate

¹ Interestingly, the approach of using competitions is also being developed for student entrepreneurs as part of the Food and Agribusiness Convergent Innovation Prize that has been established in 2016 by MCCHE and the Faculty of Agricultural and Environmental Sciences (FAES) at McGill, as part of the university's flagship annual entrepreneurship competition, the Dobson Cup that is organized by the Dobson Centre for Entrepreneurship. As reported in the 3rd technical report, a team from NIFTEM, including NIFTEM Dean, Ashutosh Upadhyay and 5 students visited McGill in 2016 and participated in some of the activities of the Dobson Centre for Entrepreneurship as part of capacity building. Although we are yet to formally explore collaboration between teams from Indian student competitions and McGill teams, this is something that we would like to further explore beyond the project period. Two of the three McGill Dobson Food and Agribusiness Convergent Innovation Prize winning teams thus far have developed their business ventures with the commercialization of pulse-based food products to derive economic, social and environmental benefits.

the interest of investors in Canada, as well as the interest of the Gates Foundation. This is illustrative of how quickly CI accelerates the deployment of food products. Also, there is the need to recognize the significant amount of time required to create such a vibrant and expansive ecosystem of scientists and organizations from private sector, civil society, and government. Over the past three years, we have held several high-level and strategic workshops as key building blocks in developing the CI network. The strong relationships between McGill, NIFTEM, AAFC and other industry partners from both countries are significant achievements. With AAFC as an enthusiastic partner, we are optimistic about operationalizing the concept and getting CI food products to market. We have also realized that the FCI accelerator has two parallel paths of value creation for (1) start ups and (2) large businesses. In India we have focused on nurturing early start-up and setting up the supporting CI ecosystem to do so. In Canada, we have begun advancing the CI model with large businesses, which will inform our future efforts to extend our learnings to large businesses in the Indian agri-food industry.

Overall assessment and recommendations

Overall, lessons learned pointed to the need for flexibility and a longer-term timeframe in a project such as this, which involved multiple interacting organizations from across institutional sectors, and spanning multiple countries. One of the reasons why organizations from across institutional sectors and geographies do not collaborate is the length of time it takes to overcome deeply entrenched institutional differences in norms, routines, etc. In implementing this project, we learned a great deal about the need for patience for such a complex endeavor. IDRC showed great flexibility in allowing for a no-cost extension for this project, after we had learned lessons regarding the flexibility and time needed to advance the project. In the future, for a project such as this, it would be helpful to have a mid-project workshop with the various project stakeholders and IDRC staff from different levels, to inform decisions that can be made about the funding levels and timeframes of such projects as they proceed.

Annexes

Annex 1: India Pulse Food Innovation Competition

The poster features a vertical strip on the left showing various pulses: yellow lentils, green lentils, yellow chickpeas, yellow kidney beans, red kidney beans, and black lentils. The main title 'PULSE FOOD INNOVATION COMPETITION' is in large red letters, with '2016 INTERNATIONAL YEAR OF PULSES' in smaller green and red text to the right. A logo of a spoon with colorful dots is also present. The text describes the competition's purpose and lists national winners.

PULSE FOOD INNOVATION COMPETITION

2016
INTERNATIONAL YEAR OF PULSES

On the occasion of the International Year of Pulses in 2016, food innovation competitions are being hosted around the world to harness the creative power of individuals, students, professions and organizations. Youth talents in culinary and food science and technology colleges were invited to compete in cooperative spirits across India. The competition offers students the opportunity to showcase their entrepreneurial spirits, aspirations and talents through exciting cooking competitions for innovative foods and recipes containing pulses.

OBJECTIVE

The objective of this competition is to create an innovative pulse-containing snack or convenience food ('ready to eat' or 'ready to cook'), that showcases at least one pulse, and helps build awareness of the UN-declared International Year of Pulses in 2016.

NATIONAL WINNERS

1. **Adzuki Coins**, Institute of Hotel Management, Bangalore
2. **Flax, Millets and Pulse Chips**, National Institute of Food Technology Entrepreneurship and Management
3. **imPULSE Cookies**, Institute of Hotel Management, Sri Shakti

 Saskatchewan  INDIA PULSES AND GRAINS ASSOCIATION  McGill Centre for the Convergence of Health and Economics  IDRC  CRDI

Annex 2: List of Project Outputs and Dissemination Activities

A2.1 Dissemination Activities

- **Feb 16-18, 2016 Washington, DC**

The purpose of this meeting at FAO was to elaborate the Global Pulse Innovation Platform agenda within the context of developing countries (with a particular focus on Ethiopia). The Ethiopia Initiative was discussed with several American IGOs such as FAO and CGIAR.

- **Feb 17-19, 2016 Jaipur, India**



MCCHE cohosted the [National Finals of the Pulse Food Innovation Competition](#) with the [India Pulses and Grains Association \(IPGA\)](#) and participated in the [Pulses Conclave Conference](#) in India, with participation by Dr. Chris Lannon of MCCHE. The winners of the Pulse Food Innovation Competition were announced. Other meetings regarding USAID funding for PIP were also organized.

- **March 10-11, 2016 Montreal, QC**

[Global Pulse Innovation Platform launch](#). To discover new ways of promoting pulses like lentils and peas to tackle obesity and undernutrition, MCCHE launched the Global Pulse Innovation Platform (PIP) on March 10, 2016 at McGill University. This launch involved panel discussions with prominent academics, researchers and industry partners, workshops and presentations by SME all related to enhancing pulse production and consumption. A Convergent Innovation training and dissemination workshop was held the following day, with presentations from agri-food entrepreneurs in the greater Montreal community.

- **March 17-18, 2016 Delhi and Bangalore, India**

Attended two important events: 1) AAHAR—a national food conference in India where winners of the Pulse Food Innovation Competition were showcased in the Government of Saskatchewan booth (Saskatchewan Trade and Export Partnership); 2) attended the International Conference on Food Value Chain: Innovations and Challenges at NIFTEM where we announced an MOU to form the Pulse Centre of Excellence at NIFTEM, which will serve as an accelerator to catalyze commercialization of SME-borne innovations.

- **May 31-June 1, 2016 Delhi, India**

Organized a session at the [“Conference on Pulses for Sustainable Agriculture and Human Health”](#) hosted by IFPRI. The session was titled “Value addition for Pulses through Food Convergent Innovation”. Prof. Laurette Dubé gave a presentation on the strategic role of SME’s for food and ingredients in the India Pulse Innovation Platform. IDRC team member Srivardhini Jha co-presented in the session, along with Tribhuvan Nath from NIFTEM.

- **June 1-3, 2016 Delhi, India**

Pre-launch of PIP-India

This VIP event convened leaders who have been engaged over the last four years in making the collective ambition for PIP-India possible. This event was designed with the purpose of:

1. Exploring challenges, possibilities, and key transformational levers in this undertaking;
2. Updating the community of Indian leaders on the current planning status for PIP-India;
3. Engaging a rich a base of new members as we approach the formal launch in December.

The cocktail session convened a rich group of high-profile Indian and International leaders from pulse production and trade, businesses, NGOs, health, development and academia. Nadir Patel (High Commissioner for Canada to India) gave opening remarks at the session.

Private Design and Planning Workshop for Platform and Projects

The workshop convened a group of leaders and invited partner organizations who have played, or are invited to play, a key role in the development of the PIP-India ecosystem, 3 flagships projects, and interfaces with the global and other national PIPs. The specific objectives of this workshop were:

1. Validate and refine specification and plans for PIP-India aspirations, core capabilities, activity pillars and milestones, as well as platform and project governance, private/public model of individual and collaborative value creation/capture, as well as key performance indicators;
2. Recognize Indian leaders and build project-specific partnerships around core flagship projects to elaborate strategic targets and operationalize development plans;
3. Articulate plans for further partnership recruitments and project planning refinements for PIP-India, leading to the December 2016 formal launch.

- **June 17, 2016 Sonipat, India**

The objective of this meeting was to introduce PIP-India and explore possible synergies between the platform and the India Foundation for Humanistic Development. Synergies for discussion included:

1. Entrepreneurship Development: IFHD's existing work in ProCIF focuses in on building the entrepreneurial capacity (business plan development, streamlining internal business processes/ financial management systems, etc.) of FPOs. This has a connection with one of PIP India's focus on defining an entrepreneurship business model through improving pulses supply and demand by supporting small scale community /micro entrepreneurs.
2. Geographical presence: IFHD is present in PIP India's focus states - Tamil Nadu, Rajasthan, and Maharashtra through its FPOs.
3. Market potential: Much of ProCIF's work has been around supporting the FPOs with market linkages. This ties in well with one of the objectives of PIP which deals with preliminary market potential for pulse food CI which requires assessment of markets and products.

- **July 31 – August 4, 2016 Montreal, QC**

Meetings and workshops at McGill University during visit by NIFTEM Dean, Ashutosh Upadhyay and 5 NIFTEM students. Included researchers working on entrepreneurship, as well as the McGill

X-1 Accelerator Program presentations by entrepreneurs, with student participation as well.

- **September 26-27, 2016 Montreal, QC**

Series of work sessions spread over two days on the occasion of Montreal visit of Srinivasu Pappula, global lead of TCS Digital Platform. Two days consisted of 3 work sessions are to pursue ongoing elaboration of collaborative projects between scientists, practitioners, and organizations in a diversity of disciplines and sectors around convergent innovation platforms that are in development

- **October 31-November 2, 2016 Montreal, QC**

Specialty CI works sessions hosted by MCCHE. Partners and collaborators from industry, academia, government and NGOs participated in the 3-day work sessions to give presentations, contribute to round-table discussion to advance objectives in 1) PIP 2) Sustainability, business leadership and policy 3) Digital CI platforms. Full day (Oct 31st) work session was dedicated to global and national pulse innovation platforms (PIPs) by advancing Flagship Projects.



- **November 1, 2016 – From Promise to Impact: Ending Malnutrition by 2030, Montreal QC**

[Evening event](#) that celebrated the launch of the [2016 Global Nutrition Report \(GNR\)](#) and included an expert panel discussion, presentations, and various healthy food start-ups & pulse start-ups. This event was geared to a wide audience to highlight the finding of the GNR and raise awareness and discussion of food, agriculture and policy to promote sustainable nutrition for all.



- **December 13-14, 2016 – Bangalore, India**

Valérie Orsat, a partner with MCCHE, along with Venkatesh Sosle, met with the representatives of ITC Foods, an industry partner in PIP-India. The two also held discussions with Srivardhini Jha at the Indian Institute of Management, Bangalore to identify activities that would be carried out by the CoE Accelerator along with the industry partners in India.

- **December 14-17 2016 – Mumbai, India**

The McGill team represented by Laurette Dubé and Valérie Orsat met with the representatives of Tata Chemicals Limited (TCL), Tata Consultancy Services (TCS) and the Tata Chemicals Society for Rural Development (TCSR) to discuss the PIP-India activities focusing on the production of pulses. The team also met with the Board of Indian Pulse Growers Association. These meetings covered the role of the Indian industry partners in establishing PIP-India activities over the coming months. The discussions with TCL-TCS-TCSR helped understand how the digital backbone for agricultural production could be applied for greater integration of the CI activities.

- **December 17- 19 2016 – Delhi, India**

In New Delhi, the McGill team met with NIFTEM (including Satyendra Chaudhary, the newly hired Coordinator) to discuss the next steps for the CoE Accelerator and the activities over the coming months. In another set of meetings, representatives of PATH India, INCLIN Trust and Sight and Life worked to identify the common ground and applying their resources to develop activities which would contribute to the study of consumer behaviour as part of CI. The McGill team, along with TCL and PATH representatives met with the Trade Commissioner at the Canadian High Commission to brief the HC on PIP-India activities. Subsequently, the team took the opportunity to meet with USAID representatives to explore opportunities for activities in India as well as in other international locations.

- **January 11, 2017 – Montreal, Canada**

Meeting with MCCHE team, AG-BioCentre, and partners from the Faculty of Agriculture, McGill University to advance the partnership between McGill and AG-Bio Centre through the establishment of concrete synergistic opportunities to support startups and SMEs within the context of QC, Canada, and India and developing strategies for the India platform.

- **January 13-31, 2017 – New Delhi & Mumbai, India**

Laurette Dube and Dora Koop travelled to India to meet with key partners including PATH, INCLIN, Tata Trust, TCS, and Sight and Life to discuss ongoing collaboration and strategize for the future of PIP India. Also attended a pulse meeting at the Consulate General of Canada in Mumbai called “Healthy and Pulsating 2017.”

- **March 8 & 9, 2017 – Mumbai & New Delhi, India**

[Launch of PIP-India](#), the first national platform of PIP-Global in the presence of the Honourable Lawrence MacAulay, Canada's Minister of Agriculture and Agri-Food. Organizations involved in creating PIP-India include NIFTEM, Tata-Cornell Agriculture and Nutrition Initiative (TCi), the International Food Policy Research Institute (IFPRI), the Public Health Foundation of India (PHFI), Tata Chemicals Ltd., INCLEN, and the Indian Pulse Growers Association (IPGA).



- **May 3-5, 2017 – Coimbatore, India**

Venkatesh Sosle and Satyendra Singh met with TNAU Food Business Incubators and potential clients for the accelerator; site visits to processing facilities of two entrepreneurs.

- **May 22, 2017 – Sonipat, India**

MCCHE sponsored 22 Student presentations on recent innovations in pulse food products at NIFTEM.

- **June 5-6, 2017 – Delhi, India**

Valerie Orsat and Venkatesh Sosle met with PATH foundation, INCLEN Trust, and ICRISAT to explore avenues for further collaboration for rural interventions.

- **June 7, 2017 – Mumbai, India**

Meetings with TCS and TCSR for the elaboration of a research proposal to be submitted to the Bill and Melinda Gates Foundation.

- **June 8, 2017 – Mumbai, India**

MCCHE, with co-sponsor Dupont and support from Indian Dietetic Association (IDA) Mumbai Chapter, sponsored [seminar](#) on healthy ingredients for health and fitness with special emphasis on proteins and fibres that was organized by the [Protein Foods & Nutrition Development Association of India](#), at Hotel Orchid, Mumbai. Dr. Valérie Orsat of MCCHE presented on Incorporating Pulse Ingredients into Newer Products. There was a panel discussion on changing diets and how to ensure adequate nutrition, with the following panelists: Dr. Valérie Orsat, McGill, Mr. Sujith Sathyadas, Dupont Nutrition & Health, Ms. Naaznin Husein, Nutritionist, Dr. Jix Anthony, ITC Foods, Mr. Sachin Saxena, Marico, Mr. Sanjay Singh, Ruchi Soya and Dr. N. Ramasubramanian, VR FoodTech. The seminar was attended by about 100 food scientists and nutritionists coming from industry, academics, research institutions, etc.

- **June 9, 2017 – Mumbai, India**

At the backend of the IDA conference, Venkatesh Sosle organized several consultation meetings on the CI digital backbone with key partners and active interest in Mumbai.

- **June 12-13, 2017 – New Delhi, India**

Venkatesh Sosle and Satyendra Singh met with ICAR officials in New Delhi to discuss PIP India and accelerators.

- **June 21-23, 2017 – Hyderabad, India**

Venaktesh Sosle and Satyendra Singh met with ICRISAT in Hyderabad for collaboration in PIP-India; met with millet entrepreneurs

- **September 15, 2017 – Montreal, Canada**

As part of a design workshop, discussions were held on “Food Convergent Innovation (FCI) Digital Backbone” to build on the CI work in India. Participants included Rajiv Tandon, Technical Director, PATH India; Raju Goteti, VP, Co-Innovation Network (COIN), Tata Consultancy Services (TCS); Sharmila Mande, Chief Scientist and Head of Bio-Sciences R&D, TCS ; Jeff Baikowitz, Founder, Motherfood International; Bob Chapman, Principal Research Officer, National Research Council (NRC) Canada; Shawn Brown, Chief Software Architect, CBRAIN, McGill University; and Laurette Dube, Nii Addy, and Srinivasan Jayaraman of MCCHE.

- **November 30, 2017 – Montreal, Canada**

Food Convergent Innovation Forum, organized by Dr. Nii Addy with McGill student organization and Montreal community incubator/accelerator. With over 190 participants (students, food and agribusiness entrepreneurs and industry, and community partners) analyzing different case studies on food insecurity developed from research in India and other locations (South Sudan, USA, and Northern Canada). Reflection questions allowed groups to explore multiple aspects of food insecurity as lived by communities across the globe. Participants reflected on the ways in which food insecurity could be addressed through a convergent innovation framework. They also developed pitches to communicate their ideas to other groups.

- Summary article: <https://www.mcgill.ca/desautels/channels/news/engaging-students-food-industry-and-community-stakeholders-explore-innovation-addresses-food-283841>
 - Short video clip (1:46 minutes): <https://www.youtube.com/watch?v=OrEF8-eiUio>
- **December 5-6, 2017 – Sonipat, India:**
[Management Development Program \(MDP\)](#) workshop conducted at NIFTEM on Innovation management, jointly organised by RISE (Raising Innovative and Sustainable Enterprises -India Centre of Excellence for Food Convergent Innovation), NIFTEM and MCCHE. Delivered by Dr. Venkatesh Sosle, Satyendra Singh of MCCHE; Prof. Ashutosh Upadhyay, HOD, Department of Food Science and Technology, NIFTEM; Dr. Vimal Pant- Associate Professor in the Department of Food Business Management, NIFTEM; Patrick Vespa, Founding Partner and CEO of Enlighten Consultancy Services (ECS); Ms. Gayatri Swahar, Co-founder and Brand Custodian of start-up Ycook India (Most innovative enterprise award in World Food India-2017). There were 22 participants, including from MNC, GSK, DuPont (Danisco India Pvt. Ltd.); from Indian corporate, KRBL, Gadre Marine Exports, Surya Fluorescents, Samar Retail; from SME, Accurate Grain Processing, Shayona Corporation, Ganesh Engineering; from Consultancy, Photo 51 Scientific Consultancy, from research institutions, National Agri-Food Biotechnology Institute (NABI) and from NIFTEM including faculty and research scholars. In program evaluations, the module that participants rated the best was “Convergent Innovation in Practice in Agri-Food.”
 - Article announcing the MDP in the [Hindu Business Line](#)

A2.2 Publications

- **The Healthier the Tastier? USA–India Comparison Studies on Consumer Perception of a Nutritious Agricultural Product at Different Food Processing Levels**
Article published [online](#) January 28th, 2016.
Dubé, L., Fatemi, H., Lu, J., & Hertzler, C. (2016). The Healthier the Tastier? USA–India Comparison Studies on Consumer Perception of a Nutritious Agricultural Product at Different Food Processing Levels. *Frontiers in Public Health*, 4.
- **Reinventing Value Addition by Modernizing Traditional Indian Pulse Foods and Processes through Convergent Innovation**

Article published in [The Pulse Pod](#), Global Pulse Confederation E-magazine in May 2016. Coauthors: Laurette Dubé & Vilas Shirhatti (Tata Chemicals).

- **Convergent Innovation Platform for Solutions at Scale to Complex Social Problems: A Conceptual Framework of Tiered Governance**
Paper accepted for presentation at the [2016 Academy of Management Annual Meeting](#) held August 5-9, 2016 in Anaheim, California. Coauthors: Srivardhini Jha, Laurette Dubé and Richard Gold.
- **Pulse Value Chain Transformation through Food Convergent Innovation for Healthy Diet**
[Book chapter](#) accepted and *in press* in an upcoming IFPRI publication “Multidisciplinary Study of Pulses in India”, edited by P.K. Joshi. Coauthors: Laurette Dubé, Srivardhini Jha and John McDermott.
- **Convergent Innovation for Addressing Malnutrition: Scaling up cross-sector solutions from the social economy**
[Book chapter](#) accepted and *in press* in “Good Nutrition for One World” published by Jonathan Steffen Limited in Cambridge, UK. Coauthors: Laurette Dubé, T. Nana Mokoah Ackatia-Armah and Nii Antiaye Addy.
- **Setting New Frontiers for 21st Century Food Systems Research and Action: Agriculture for Nutrition and Health (A4NH) and Convergent Innovation (CI)**
[Article](#) in Sight and Life Magazine 30(1)/2016, [Focus on Food Systems](#) in July 2016. Coauthors: John McDermott, Laurette Dubé, Nii A Addy, Inge Brouwer, and Ruerd Ruben.
- **Convergent Innovation Platform to Address Complex Social Problems: A Tiered Governance Model**
Paper presented at the [2016 Academy of Management Annual Meeting](#) held August 5-9, 2016 in Anaheim, California. Coauthors: Srivardhini Jha, Laurette Dubé and Richard Gold. (See <http://proceedings.aom.org/content/2016/1/15150.short?related-urls=yes&legid=amproc;2016/1/15150>)
- **The Global Pulse Brand as a Legacy of 2016 IYP: Strategy, Challenges and Possibilities**
[Article](#) in [The Pulse Pod](#), Global Pulse Confederation E-magazine. September 2016. Coauthors: Laurette Dubé, Gordon Bacon and Hakan Bahceci.
- **Convergent Innovation for Addressing Malnutrition: Scaling up cross-sector solutions from the social economy**
[Book chapter](#) in “[Good Nutrition: Perspectives for the 21st Century](#)” published by Jonathan Steffen Limited in Cambridge, UK. October 2016. Coauthors: Laurette Dubé, T. Nana Mokoah Ackatia-Armah and Nii Antiaye Addy.
- **Bridging pulse tradition and modern innovation to accelerate food solutions to sustainable development: A convergent innovation research and action strategy**

Article in The Pulse Pod, Global Pulse Confederation E-Magazine. January 2017 Coauthors: Laurette Dubé, Vilas Shirhatti & Sushil K Chaturvedi.

http://www.cicilsiptic.org/images/emagazine/0_54882100_1484204740Emagazine_January2017.pdf

- **Food Convergent Innovation Webinar Series: Pulses Program**
Article in The Pulse Pod, Global Pulse Confederation E-Magazine. March 2017. Coauthors: Laurette Dubé and Gordon Bacon.
https://www.mcgill.ca/desautels/files/desautels/food_ci_webinar_pulse_pod.pdf
- **Moving toward Intelligent Packaging to Support 21st Century Premium Branding of Pulse Value-Added Food as Solution for Sustainable Development and Nutrition**
Article in The Pulse Pod, Global Pulse Confederation E-magazine. July 2017. Coauthors: Claire Sand, Gordon Bacon, and Laurette Dubé.
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A2.3 Other

PIP website: [PIP website page](#) was launched in 2017.

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