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Nature of Innovation in Food Processing in Manitoba, Canada

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Abstract

Innovation among food processing firms is their lifeblood and commonly referred to as PPD—product and process development. For others—including the Organization for Economic Co-operation and Development [OECD] (2005) besides PPD innovation—this also includes marketing and organizational development. This paper examined the extent to which these other dimensions of innovation are evident in this sector based on eight actual commercialization experiences. Data was obtained from 61 in-depth interviews with senior executives of firms and those along their respective supply chains, including customers. The data revealed commercialization results from multiple advances, called innovative initiatives. This research found the presence of the PPD definition, but it alone is insufficient to explain the more robust nature of innovation. Food processors are successful when they co-invent with customers and seek expertise beyond their firms to those across their supply chains and engage specialists, such as researchers and industry organizations. Further research needs to examine how innovators balance both PPD with other business activities, the importance of trusted relations, and decisions about resource allocation over 2 to 12 years. These are all critical when commercializing innovation in the food processing sector.

Keywords: PPD innovation, multiple definitions of innovation, commercialization of innovation, agri-food processing sector, Manitoba Canada, case study research

1.0 Introduction

In the food processing sector, ideas transform many parts of the supply chain with investments and achievements in product and process development (Conway & Steward, 2009). For decades, novelty products from this sector become household words, and they changed both what is eaten and how food is consumed. The long record of novelty products stretches from TV dinners in the early 1950s to the compostable snack bag of chips in 2010 and more recently hemp oil (Toops, 2010). This sector is founded on such innovation as if PPD were part of its growth DNA. With sales of this sector estimated at $4.6 Billion annually (Ashton, Richards, Galatansou, & Bollman 2014), it remains integral to the Manitoba economy and many others. Yet, from a broader view, more innovation is called for as food processing across Canada is falling behind previous efforts (Uzea, 2014; Conference Board of Canada, 2015).

From a brief scan of related studies, government reports, and sector associations within the agri-food sector, there is a predominance of PPD when defining innovation (Conway & Steward, 2009). Yet, across many sectors innovation is widening beyond PPD. Over the last three decades, the OECD (2005) has assembled a significant body of work containing models and analytic frameworks to define and assess innovation in nations like Canada. Their work defines PPD and includes concurrent innovations in marketing and organization structure. These OECD definitions of innovation are presented in Table 1; each is significant on its own, and is often interconnected during commercialization (Cantuarias, 2014).

Table 1. *The Nature of Innovation Defined by Four 'Types.'*

Innovation can be defined by the implementation of a significant change in product, process, marketing or organization that is new (or significantly improved) to the company.
Product innovations involve significant changes in the capabilities of goods or services. Both entirely new goods and services and significant improvements to existing products are included. A product innovation is the introduction of a good or service that is new or significantly improved with respect to its functional characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
Process innovations represent significant changes in production and delivery methods. A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
Marketing innovations involve the implementation of new marketing methods. These can include changes in product design and packaging, in product promotion and placement, and in methods for pricing goods and services. A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
Organisational innovations refer to the implementation of new organisational methods. These can be changes in business practices, in workplace organisation or in the firm's external relations. An organisational innovation is the implementation of new organisational activities in the firm's business practices, workplace organisation or external relations.

Source: OECD (2005).

Increasingly today, some innovation initiatives are involving others, outside of the more specialized research and design units (Statistics Canada, 2009). Given the complexity of relations among firms, Harada (2015) found it difficult to examine the effects of both backward and forward linkages among firms involved in innovation.

Batterink, Wubben, & Omta (2006) add that innovation is about expenditures or investments with shared risks and rewards with those along the supply chain. In turn, innovation is reaching beyond the shop floor to suppliers and those downstream including customers and ultimately consumers. Food enzyme manufacturers invest in innovation as they work closely with the customers, including bakers, to identify how new enzymes can address process or formulation challenges (Mateo, Fernandez-Lorente, Guisan, & Fernandez-Lafuente, 2007). It is often said, report Birkinshaw, Bouquet, & Barsoux (2011), that innovation is 5% inspiration and 95% perspiration of many, and as such, a more open and inclusive approach to commercializing innovation means more are invited to contribute ideas and resources. The agri-food sector is well positioned with many well-established chains and network ties (Fortium & Omta, 2009).This approach also needs to be tempered caution Birkinshaw et al. (2011) and Epstein (2014). Since more ideas and more resources might be inherent with more engagement there is corresponding concern about lengthening time to market when commercializing innovation. Yet, larger companies are pushing forward with more open style innovation approaches, such as General Mills (see http://www.generalmills.com/Company/Innovation/G-Win.aspx).

To examine these various aspects of the nature of innovation, an overall approach or disciplinary base for this paper is largely one of management. The interest was to address Van de Ven's (1984) concern that to bring about new ideas in the market requires, among other things, the interaction of people, multiple relations, and institutional context. These aspects were examined within the context of the food processing sector, including the processors and those up and down their supply chains (McDonald, 2006). The term supply chain was preferred as opposed to value chain, an increasingly common term since this research in part was exploring what, if any, value the firms do add (Materia, Dries, & Pascucci, 2014). The value they each add is a consideration of this exploratory research. As a result, this paper is less about which definition of innovation is either right or wrong, and more about the presence or absence of definitions or explanations when commercializing innovation in the food processing sector.

2.0 Research Design and Methods

This project began several years ago in an attempt to examine the extent to which the PPD approach explains the practice of commercialization. As a result, this research was framed with a simple, yet critical question, knowing at times a simple question can shed light on many other related questions: Does PPD explain commercialization in the agri-food sector? While innovation is essential to the growth and vitality of this sector, of interest here was to explore if PPD accurately portrays the lived experiences of commercializing a new product.

A qualitative approach that employs case studies is best for investigating innovation, since there is no absolute or agreed-upon definition. Paraphrasing Yin (2003), an explanatory case study is well-suited when answering 'how' questions. An empirical inquiry enables the researcher to create a desired understanding of otherwise complex social phenomena, along with the characteristics of real-life events. More specifically, Yin's (2014) multi-case design method is appropriate since the intent of this paper was to say something about how innovation occurs in the food processing sector in a particular locale and time and from a particular point of view—namely of those involved first-hand. Here, patterns in data are paramount across multiple cases, thus enabling data triangulation. This research design will

enable generalizations about the nature of how innovation occurs specifically when there are repeated descriptions of the phenomena.

Purposefully selected cases from Manitoba have in the last five years commercialized an agri-food innovation. This research asked those directly involved in the commercialization to describe what happened to bring about the identified new product and/or process. Based on recall, they provided data to help determine if, for example:

- the emphasis is only on PPD or if there were a more asymmetrical relation to the less reported innovations in marketing and organization;
- innovation is the achievement of a single individual or are others needed to get the innovation off the ground; and
- the purgative of the investor reined, meaning the sooner an idea is commercialized the quicker revenues are made; hence minimizing the duration between spending money to making money.

The specifics of the research methods are described, after elaborating on case study selection.

2.1 Selection of Sample Cases and Profiles

After three years of research in the food processing industry, the researchers had established rapport with many firms in Manitoba. This relationship is important because with familiarity comes a willingness to participate in research, in part because the firms see value in applied research. The challenge of accessing top executives is a reoccurring theme in qualitative research methods (Harvey, 2010). Such relations meant the researchers could draw on previous contacts when identifying and selecting cases. Also, a goal of this research was to say something about innovation that is specific to one sector (bulk food ingredient processors) in one jurisdiction (Manitoba), since others have found there are differences in innovation between sectors (e.g., health, mining, aerospace) and across jurisdictions (Malerba, 2005). Since there is a range of firms processing bulk ingredients for sale to other food manufacturers, we wanted the selected cases to reflect such diversity. This diversity would enable us to make conclusions that can speak to this sector more so than if the cases were all the same (e.g., same products, same suppliers, same customers).

Four criteria bring about maximum diversity among the case studies to enable generalizations: (1) firms with different commodities, (2) small to a large number of employees, (3) new versus well-established businesses, and (4) being located in Manitoba, Canada. An initial list of bulk ingredient firms came from contacts with industry associations in Manitoba, those at the Manitoba Food Development Centre, and from previous Rural Development Institute projects. Over a dozen processing firms met the case study criteria. Randomly listed, they were contacted by phone until eight agreed to be part of this study. The appendix profiles the eight selected cases, namely: Richardson Milling (RM), Shape Foods (SF), Canadian Prairie Garden Purees (CPG), Hemp Oil Canada Inc. (HOCI), Floating Leaf Fine Foods (FL), Bee Maid Honey (BM), True North Foods (TNF), and Brar Natural Flour Mills (BNFM). The full case descriptions are available in the report: *Innovation in agri-food processing: A case study of commercialization of bulk food ingredients in Manitoba* (Ashton, Richards, Galatansou, & Woods, 2015).

2.2 Data Collection

The first-hand account resulted from a semi-structured interview to a guided discussion with questions about the PPD process—who is doing what activities, along what timeline, and when do activities intensify? Interviews began with senior executives of processors in each of the eight cases and were audio recorded. Following suggestions from the processors about upstream suppliers and downstream customers, a second round of interviews was completed.

A pilot of the case study interview process included three cases, from recruiting and interviewing senior executives of firms and a few along their supply chains. Three important revisions were made for the subsequent cases: First, we did not lead off with talking about innovation but rather about what was causing growth in the firm. This helped to resolve some confusion they had about what was meant by innovation. Second, as part of the introduction to the interview, we shared a definition of PPD along with marketing and organization innovation (see Table 1). Many said these explanations helped them "figure out" what was meant by innovation. A third change resulted in not asking about the financial aspects of their innovation efforts. Their response to the financial aspects of innovation in the pilot demonstrated significant reluctance to publically releasing such information.

After making revisions in the guide, interviews were completed in each case until significant repetition of data occurred from multiple sources. Typically, this meant about five in-depth interviews, and some had a few more. In total, 61 interviews formed the database for the cases.

2.3 Data Analysis

This paper reflects the analysis across all eight cases—more of a macro analysis—leaving a more detailed analysis for another paper. Knowing that the nature of innovation consists of overcoming challenges and hurtles with imagination and resources (Epstein, 2014), for this paper, these events are innovation initiatives. The interview discussions often focused on what happened to overcome challenges, either existing or anticipated. These responses formed innovation initiatives about PPD and marketing and organizational innovation along with who was involved, the duration of involvement, and intensity of activities. While we began with a known agri-food innovation in each case, the unknown was the range of innovation initiatives critical to commercialization.

An innovation initiative was the unit of analysis for this paper. Those interviewed categorized their initiatives and reported if any initiative was paired with one or more types to realize successful commercialization. Such pairing among the types of innovation has been termed "chain-linked" innovation (Cantuarias, 2014). Such simple categorizations were relative terms to each case, but they were effective in capturing the nature of the innovation (Agriculture Management Institute, 2013). Based on a simplified supply chain, the participants identified who was involved and if the involvement was evenly distributed among members of the supply chain. This enabled an analysis of the involvement of those, be it evenly distributed among firms along the supply chain or if there were 'hot spots' or concentrations of involvement. In terms of timelines, the data helped determine at a macro-level if the initiative occurred over a long term or was a more concentrated effort. While the participants described what happened, thematic analysis organized the innovative initiatives.

Several participants from each case reviewed and commented on the initiatives, which helped to validate them.

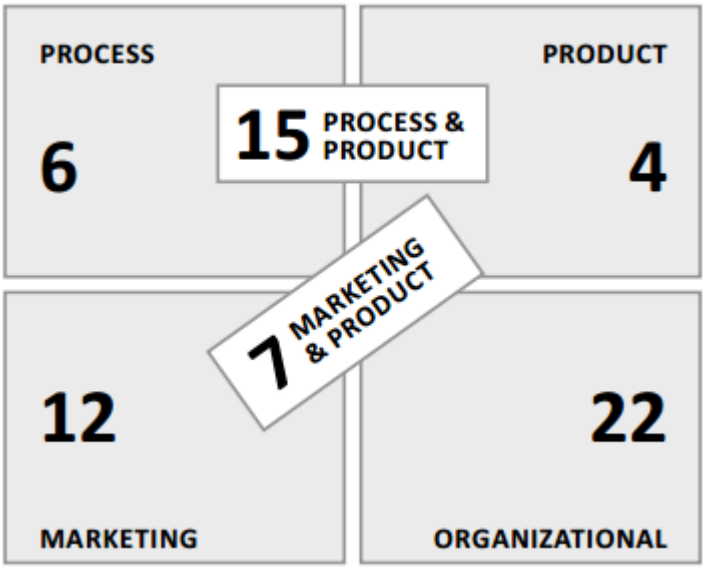
3.0 Findings

After the thematic analysis of data from 61 in-depth interviews, the result was an inventory of 66 innovation initiatives (see Appendix). The number of innovation initiatives ranged from seven to nine for each case. The findings brought forward results about the number of innovative initiatives that participants related to PPD, as well as those related to marketing and organizational innovations. In addition, findings depicted stakeholders and their linkages along the supply chain and the duration of innovations.

3.1 Product and Process Development as Innovation in the Food Sector

As can be seen in Figure 1, 10 or about 15% of the initiatives were defined as PPD. Floating Leaf, for example, developed a new process to cook wild rice in less than half the time of conventional rice (FL1). Six initiatives are process innovation, including for example, companies through the supply chain purchased equipment and processes to keep up-to-date (FL6, BM7). There are four product initiatives. Shape Foods, for example, worked with manufacturing customers to develop new retail products for their flax ingredients (SF4). Also noted in Figure 1 are 15 (23%) initiatives that pair both process and product developments. Often a new product involves a novel process, making it impossible for participants or researchers to categorize the type of innovation clearly. For example, CPG2 implemented thermal processing technology for high viscosity, low acid foods where it was process oriented products, thus characterized as paired. In total, 25 or 38% of the initiatives are PPD.

Figure 1: Distribution of 66 Innovation Initiatives across Four Types of Innovation in the Food Processing Sector



Source: Ashton et al., 2015.

Participants described marketing and organizational innovations as well, thus reflecting the broader OECD definitions of innovation. There were 12 (18%) marketing initiatives, and most were pursuing new domestic markets or markets related to health benefits and labeling. For example, an initiative for wild rice was expanding into new markets for export. At the same time it was marketed as an organic ingredient by targeting vegetarians and on grocery shelves as a starch alternative (FL7). A total of 22 (23%) diverse initiatives were identified as organizational innovation. They included, for example, hiring experienced staff (CPG3), establishing a company through an innovative idea (BM1, BNFM1, TNF1), and creating a new spinoff company to make hemp products to serve the health food and nutraceutical markets (HOC17).

Similar to paired initiatives with PPD, participants also involved marketing and organization innovations. For example, early-on as the hemp food industry was being formed, priority was given to growing hemp seeds (product) and creating ingredients (product/process) such as hulled hemp seeds (HO12). This new product needed to be marketed to food manufacturers which resulted in a new retail product—a new energy food bar (HOC13). This, in turn, required product/process development and new marketing. Seven (10%) such pairings of marketing and product development were among the 66 initiatives. For example, the development of culinary flavoured flax oil (SF3) required significant product development and customer research. These 22-paired initiatives (15 with PPD, 7 with marketing and product) illustrated a complex relationship among the four types of innovation. Further research should explore the practical linkages over time regarding how innovators balance both PPD with the necessities of innovating marketing and organizational initiatives that support the launch of a new product. One would suspect established linkages exist when innovating within an existing business versus a start-up where new linkages would be a necessity (Desouza et al., 2009).

3.2 Innovation Linkages Among Stakeholders Along the Supply Chain

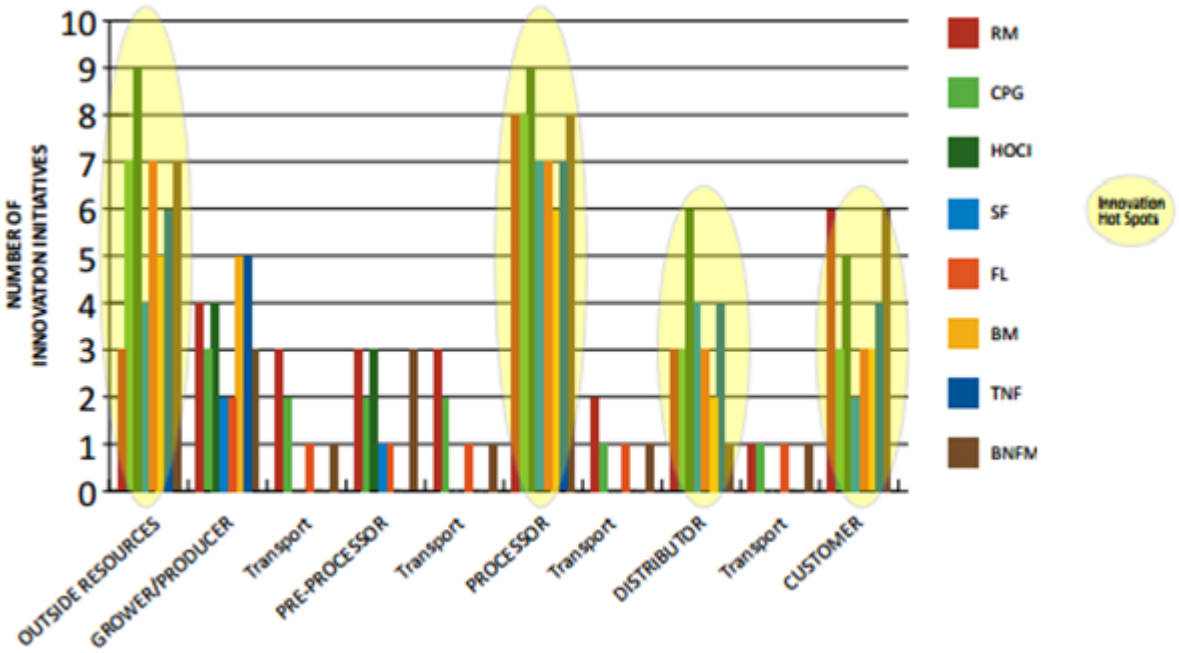
Solid working relationships along the supply chain of various agri-food processing sectors are an important competitive advantage (Agricultural Management Institute, 2013). In terms of commercializing innovation, trusted relationships are fundamental. Without strong, well-established relations among firms, they can render a supply chain inefficient, where good ideas can go unfunded, undeveloped, and unrealized (Cantuarias, 2014). Despite the differences in commodities and firms across the supply chains of the eight cases, there are similar patterns in terms of who is involved with innovation initiatives.

Figure 2 highlights different levels of participation in initiatives by firms and organizations along the supply chain. A simplified supply chain is helpful to explain the connections in all eight cases that include growers to processors to distributors to customers or food manufacturers. Not one initiative was undertaken alone by a single firm. Forty percent (27/66) of the initiatives involved a company working with just one partner and 60% (39/66) of the initiatives involved multiple partners. Innovation involving proprietary processes or information tended to have fewer participants. Companies regularly access outside resource expertise to complement in-house capabilities to bring about successful commercialization of innovations. This suggests that many of the partners are jointly invested in the innovation initiatives. There are as many as four 'hotspots' where innovation initiatives are the greatest in number, specifically with processors, their customers, distributors, and

outside resources. This suggests that commercializing innovations in the food processing sector is complicated with so many involved in these initiatives.

Involvement of processors across all eight cases is not surprising as the processors were the first firms contacted in each of the cases. Resources outside the supply chain also made significant contributions to 72% of the initiatives (48/66). For example, plant breeders or studies from health researchers interacted with many along the supply chain. Other resources were provided by equipment suppliers (processing and agricultural), researchers (plant and seed breeders, medical, processing), commodity and industry organizations, consultants, and government.

Figure 2: Four Hotspots along a Simplified Supply Chain Indicate a Concentration of Innovation Efforts Found in all Eight Food Processing Cases



Source: Ashton et al., 2015.

In all cases but one, the raw products were pre-processed to food-grade before being processed into an ingredient. The difference is pre-processing occurred at different points across cases. For example, the oilseed processors (SF1 and HOCI) purchased food grade seed from specialized seed cleaners, as did BMFM. Trucking is the main mode of transport of crops and ingredients. Driven by concerns for food safety, transportation companies are also innovating within their business and industry (CPG6), including implementing ways to avoid cross-contamination when transporting gluten-free product (RM7). Trains and ships transport crops and products depending on the destinations and volumes. For example, Richardson Milling ships large volumes by train within Canada to the US. Shaped Foods exports to Asia via train and ship.

All firms along the supply chains are innovating for different reasons. The importance of relationships, trust, and open communications between suppliers and customers are valued in all cases. Further research needs to examine the nature of

the relationships and what are the prerequisites for working together to solve problems, innovate, and grow their businesses together.

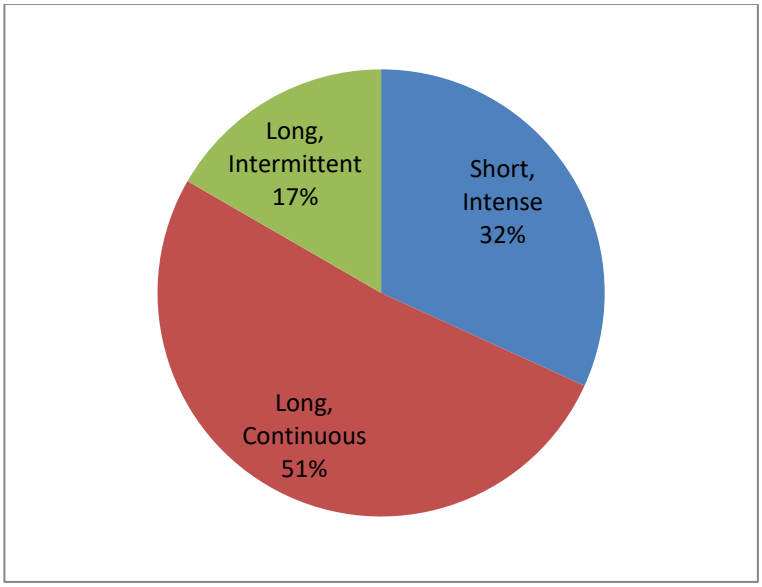
3.3 Timeline of Innovation Initiatives

When starting from an original inspirational idea, innovations take time to commercialize and realize value. In this study, each initiative served as a proxy for the nature of the commitment by those involved and can be interpreted to indicate there is significant investment of resources. This research was not privy to specific investment amounts or detailed timelines in each case or each of the firms along the supply chains. From interview data, simplified timelines of the past, present, and future helped standardize the chronologies of the initiatives.

There was also an indication of different levels of activity over the years, from little or no activities to some activity, and even intense periods of activity to realize the innovation. Therefore, both the time and intensity of activities form a chronological analysis.

When all 66 initiatives were arrayed in a simple timeline (past, present, future), three chronological patterns emerged: (1) short and intense, (2) long and continuous, and (3) long and intermittent (see Figure 3). About 34% (21/66) of the initiatives were short and intense, generally for less than three years. These periods are sometimes preceded by research or followed by periods of less intense activity. These are usually due to an innovation with significant impact on the company's growth. Examples of short and intense include major advancements in processing (e.g., CPG1&2, SF1, HOCI1&2), organizational changes (RM4, TNF1, 2, 3), and new plants (CPG8, FL8). Across the cases, once these initiatives were commercialized, they were then internalized into the company as normal operations, as innovation is viewed completed.

Figure 3: Three Common Durations of Innovation from Eight Cases and 66 Initiatives



Source: Ashton et al., 2015.

About 51% (34/66) of the initiatives were long and continuous. Such initiatives stretched over many years, even more than a decade. Such initiatives were, for example, in agronomy, updated technology, and research on health benefits. Although long, the continuous initiatives also included several periods of intense activity, including those leading to health claims for oats (RM6) and flax (SF7). Many of these initiatives combined both independent initiatives in one firm and at times with several. The remaining 17% (11/66) of the initiatives occurred intermittently over the long term, with brief periods of intense activity. These included, for example, expansion and pre-processing (CPG 4), packaging (FL4, BNFM7), and incremental development of a cooperative organizational structure for honey production (BM1 2, 8). Cases with either of these longer timelines suggested the people and firms involved were pursuing new innovations before customers could even define the requirements of what was needed, which reflects what Epstein (2014) found when creating value with long-cycle businesses, including airplane engine manufacturing.

In all eight cases, innovation occurred over different time scales, all the while advancing by resolving the current challenge. Short-term as well as long term innovations were evident. The latter initiatives were generally solving issues related to continuous improvements such as health benefits, product development, and expansion into new markets. Knowing time is money when commercializing innovation, further research is needed to understand the allocation mechanisms and decision rationales better when planning and accessing funding and resources over short and longer commercialization cycles. When taken together, these 66 initiatives seem fundamental to realizing the recognized innovation central to each of the eight case studies.

4.0 Discussion

This research brings forward three significant points to discuss to better understand the nature of innovation in the food processing sector in Manitoba. Comments about generalizing the findings, in terms of reliability and validity are included, along with further research.

4.1 Innovation is more than Product and Process Development

First, in the food processing sector, as described in the literature and echoed in the 61 interviews, innovation commonly is framed emphasizing PPD. From this research, a full 38% (25/66) of initiatives were PPD, and those interviewed could not differentiate 15 of these initiatives, calling them paired between product and process. This further supports the nomenclature of PPD. Yet a larger view emerges of innovation (OECD, 2005) which adds to PPD two other areas of innovation, namely marketing and organizational change as part of the food development story. Put differently, Conway and Steward's (2009) image innovation as an iceberg, where some might focus on what is above the water line, while a more complete understanding is available by considering the seldom examined initiatives 'below' the water line. Here, PPD initiatives form the tip of the innovation iceberg in this sector. What is below the waterline, meaning initiatives typically not considered in the innovation discussions, amount to as much as 62% (41/66) of the initiatives. From this research, 34 initiatives or roughly 50% are clearly below the 'water line' with seven paired initiatives. This suggests marketing and organizational initiatives hold their own, though they may be viewed as secondary to the recognized primary

efforts of PPD, making an asymmetrical relation between the four types which emphasizes PPD (Sperling & Cheney, 2014).

The examination of the four types of innovation (OECD, 2005) has two important implications to the commercialization and understanding of the nature of innovation in agri-food development. First, knowing all four types of innovation are likely part of new food development, this may well create a challenge since along with a focus of PPD; there is a concurrent necessity of marketing and organizational initiatives. To assume the road to success is just PPD, leaves untouched and possibly underfunded timely marketing and organizational initiatives. The struggle for the innovator is to balance PPD with the right amount of 'business' initiatives of marketing and organizational initiatives, and other business aspects from cash flow to HR recruitment. A second implication is for those supporting the commercialization of innovation from the government, NGOs, and the private sector. For these necessary and important supports to be most effective, their services and advice might well benefit from knowing more about the four types of innovation for successful commercialization, as they reach well beyond PPD. Further research needs to shed light on how to allocate resources and achieve a balance between investing in innovation (ie3., PPD) and at the same time investing in business aspects when commercializing (meaning marketing and organizational development). Moreover, knowledge mobilization is needed to assist support agencies to better align their services to recognize the importance of all four types of innovation during commercialization of food development innovation.

4.2 Many Involved in Agri-food Innovation, yet Commercialization System not Mentioned

Second, Wang, Plump, and Ringel (2015) speak of an evolving trajectory for innovation involving more collaboration and inclusive process of stakeholders, while Costa and Jongen (2006) report food development is increasingly more customer oriented. The findings related to the innovation 'hotspots' (see Figure 2) highlight high levels of participation of processors and firms along the supply chain, and report a strong customer-orientation. These hotspots are evidence innovation in the food sector involves many, and innovation is not a solo activity (Batterink et al., 2006). Such an emphasis is evident in the agri-food literature (Sperling & Cheney, 2014). When considering the industry's emphasis on PPD and their forward-looking input from customers, this suggests the nature of innovation may be predicated on strong existing relations along the supply chain and the involvement in initiatives, which strengthens stakeholder linkages and commitments including technology suppliers. Equally important, these hotstops illustrate internal and external resources are rallied to commercialize innovation (Fortium & Omta, 2009), reflecting a more open innovation approach (Birkinshaw et al., 2011).

What was absent from the interviews was any mention of an established approach or innovation system among those interviewed. Though not asked about specifically, one might expect senior officials would offer such information about their common practices unprompted. The topic of an innovation approach requires further applied research aimed at confirming if some approach or model should be used and how well it is working, coupled with the practices in the industry. It may be that there are many individual approaches contributing to or responding to the individualized circumstances of those along the supply chain. Also, such research could examine

how best to introduce and adopt leading-edge commercialization practices and systems for start-ups and small and medium enterprises along a supply chain.

4.3 Agri-food Innovation Requires Resources and Social Capital with Many Along the Supply Chain

Third, the timeline of initiatives highlights another significant aspect to the nature of innovation, being that innovation requires the responsible allocation of resources. While time and intensity of activities to realize initiatives are our proxy for investment of resources (e.g., ideas/creativity, cash, human recourses, technology), they point to three patterns on innovation: (1) short and intense, (2) long with intense periods, and (3) long and intermittent. The short and intense approach might reflect the axiom "Time is money," —get it done quickly—which it was for Shape Foods' flax product. The innovation seemed well-defined as do the related initiatives for success. The other cases required more time, and there Epstein's (2014) concern may have been at play, which suggests with more people the lengthier the innovation cycle. Undoubtedly, each of the three approaches presented unique implications for many along the supply chain, including the processor or innovator. For example, if a short and intense sequence of innovation is pursued, this would require an assured 'stock' of resources that is easily mobilized and effectively deployed. When pursuing either of the longer-term approaches to innovation, a high level of certainty for the success of an initiative might not emerge immediately as there are many trail-and-error learnings, even though there is a well-established supply chain where trust is equally high. As a result, there is confidence in recruiting ongoing strategic investment of resources among firms – hence sharing this risk or "having skin in the game" (Batterink et al., 2006). A longer-term commercialization process may not be anticipated early on, though the goal a new product requires new processes, and likely much more. For example, a longer term approach allows for equipment to be designed, built, tested and refined, as it goes from concept to small scale prototype to scaling up and involving others along the supply chain. A longer duration, while enabling incremental progress on the initiative and gradual development of the business aspects, it can equally lead to loss of interest and momentum. To maintain interest and commitment for the initiative may well require a periodic investment of time and resources, in such activities as updates, which reinforce social capital among those along the supply chain.

For either short or longer approaches to innovation, both require the masterful management and allocation of resources and interests. However, this mastery and leadership is not in the hands of one person or a boss but rests among individuals in contributing firms along the supply chain. This suggests a more distributed notion of leadership. One that is collaborative and open (Wang, et al., 2015). Yet from this researcher's view, it is not a team or the followership similar to a conductor of a symphony, but rather more like reaching agreement among equals. Further research is needed regarding leadership roles across the supply chain and the notion of what value each firm brings, coupled with how resources are coordinated over short and longer commercialization efforts. Certainly how trusted relations are established and enable collaboration within a more transactional context also seem important, along with if there are aspects that are transformational which nourish the relationship and foster an ongoing commitment to innovation.

4.4 Considering Reliability of Collecting Data and Validity of Findings

This research method has been completed with high levels of reliability and steps taken to strengthen the validity of the findings. In terms of reliability, conducting the pilots and refining the protocol used for all cases resulted in a highly consistent process to collecting data. Both internal and external validity were strengthened from the engagement of those interviewed. They defined the initiatives and later reviewed the description of the initiatives that led to revisions and later additional comments led to refining the case studies. Yet this research did not address other topics related to innovation. From even a brief review of agri-food literature, other aspects not investigated include, for example, financial (Sutton, 1998), protecting ideas and intellectual property (Canadian Intellectual Property Office, 2015), market analyses (Tirole, 1994; Rosenberg, 1994; Lam (2005), systems approach (Anthony et al., 2014), consumer and sector behaviours (Rogers, 1999), regional or cluster analysis (Trienkens et al., (2008), and innovation failures (Markovitch et al., 2014). Given these limitations, the findings cannot be generalized to all manufacturing sectors. However, they will be informative for the ingredient processors in Manitoba today, and have implications for policy makers and others.

5.0 Conclusions and Further Research

The research question is: *Does PPD explain commercialization in the agri-food sector?*

At face value, the process and product development (PPD) accounted for 15% of the initiatives, and raise to 57% when all paired initiatives (15 + 7) are included. But PPD is not the entire explanation.

Based on the OECD's (2005) definition of innovation, the balance of the initiatives includes marketing (12, 18%) and organization (22, 33%) initiatives. With a third of the initiatives paired, the net effect is innovation in the agri-food sector includes sets of complicated relations among the four types. Put differently, a more complete understanding of innovation in the food processing sector in Manitoba is possible when examining all four types of innovation.

Examining who is involved in innovation probes another critical aspect of the anatomy. To be successful processors are involving their customers, working with equipment and technology specialists, benefiting from those along their supply chains, and outside resources. Innovation is not a solo effort, meaning more are involved than just a processor. Also, innovation is not a single or new product or process, but rather entails many other innovative initiatives by others. The 66 initiatives uncover the complicated intricacies of innovation along the supply chains, meaning an innovation is not one product or process, but rather each innovation is realized with many initiatives by many trusted along the supply chain.

Another aspect of the nature of innovation is about time. Given the expression 'Time is money', commercializing innovation quickly only applied to one case, and the seven others had longer innovation cycles, from 5 to 12 years. Time in this research did not seem to be the determining aspect for commercialization in the food processing sector. However, when time is coupled with the intensity of activities, this can become a proxy for investment decisions and resource. Yet, this information from the case studies does not say anything about if the timelines were planned or

were a result of a more deliberate and incremental approach of problem-solving determined in large part by available resources, including investment financing.

The nature of innovation across eight cases clearly reveals the complexity beyond PPD and requires the integration of marketing and organizational initiatives. Equally important seem to be the complicated yet trusted relations of firms along the supply chain. These are the ones responsible for many supportive initiatives, coupled with an enduring commitment of resources over multiple years.

Further research is needed regarding how innovators balance both PPD with other business activities of marketing and organizational change, the importance of trusted relations along with their supply chains, decisions about resource allocation, and what benefits of growth are critical when commercializing innovation.

Food processing adds significantly to the provincial and national economies in Canada. This research points to a critical question: What might be added if attention is given to value-add processing of the many agri-food products leaving provinces and shipped from our coasts only to have them processed upon arrival in foreign markets?

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References

Aghion, J., & Tirole, A. (1994). The management of innovation. *The Quarterly Journal of Economics, 109*(4), 1185–1209.

Anthony, S., Duncan, D., & Siren, P. (2014). Building an innovation engine in 90 days. *Harvard Business Review, 92*(12), 59–68.

Ashton, W., Richards, G., Galatansou, E., & Woods, S. (2015). *Innovation in agri-food processing: A case study of commercialization of bulk food ingredients in Manitoba.* Report. Brandon, Manitoba, Canada: Brandon University, Rural Development Institute.

Ashton, W., Richards, G., Galatansou, E., & Bollman, R. (2014). *Food & beverage processing industry growth pathways to 2020.* Brandon, Manitoba, Canada: Brandon University, Rural Development Institute.

Batterink, M., Wubben, W., & Omta, S. (2006). Factors related to innovative output in the Dutch agri-food industry. *Journal on Chain and Network Science, 6*(1): 31–44.

Birkinshaw J., Bouquet, C., & Barsoux, J. (2011). The 5 myths of innovation. *Sloan Management Review, Winter,* 1–8.

Canadian Intellectual Property Office. (2015). *Stand out from your competitors.* Retrieved from the Canadian Intellectual Property Office http://www.ic.gc.ca/eic/site/cipointernet-internetopic.nsf/eng/wr00822.html#no3

Cantuarias, E. (2014). Better value: Implementing a value chain for management. *Performance*, *6*(1), 54–59.

Cesar Mateo, J. M. P.., Fernandez-Lorente, G., Guisan, J. M., Fernandez-Lafuente, R. (2007). Improvement of enzyme activity, stability and selectivity via immobilization techniques. *Enzyme and Microbial Technology*, *40*(6), 1451–1463.

Conference Board of Canada. (2015). *Canada's innovation performance: A scorecard.* Waterloo, Ontario, Canada: Centre for digital entrepreneurship and economic performance and Conference Board of Canada. University of Waterloo. http://deepcentre.com/wordpress/wp-content/uploads/2015/03/DEEP-Centre-Canadas-Innovation-Performance-March-2015.pdf

Conway, S., & Steward, F. (2009). *Managing and shaping innovation*. Oxford, United Kingdom: Oxford University Press.

Costa, A. & Jongen, W. (2006). New insights into consumer-led food product development. *Trends in Food Science & Technology*, *17*(8), 457–465.

Desouza, K., Dombrowski, C., Awazu, Y., Baloh, P., & Papagari, S., Jha, S., & Kim, J. Y. (2009). Crafting organizational innovation processes. *Innovation: Management, Policy & Practice*, *11*(1), 6–33.

Epstein, A. (2014). Innovation and value creation in a very long-cycle business. *Research Technology Management, 57*(6), 21–25.

Fortium F., & Omta, O. (2009). Innovation drivers and barriers in food processing. British Food Journal. Vol. III No. 8, 839-51.

Harada, T. (2015). Changing productive relations, linkage effects, and industrialization. *Economic Systems Research, 27*(3), 374–390.

Harvey, W. S. (2010). Methodological approaches for interviewing elites. *Geography Compass, 4*(3), 193–205.

Lam, A. (2005). Organizational innovation. In J. Fagerberg, D. Mowery, & R. R. Nelson (Eds.), *The Oxford handbook of innovation* (pp. 115–147). Oxford, United Kingdom: Oxford University Press.

Malerba, F. (2005). Sectoral systems: How and why innovation differs across sectors. In J. Fagerberg, D. Mowery, R. R. Nelson (Eds.). *The Oxford handbook of innovation* (pp. 380–406). Oxford, United Kingdom: Oxford University Press.

Markovitch, D. G., Steckel, J. H., Michaut, A., Philip, D., & Tracy, W. M. (2015). Behavioural reasons for new product failure: does overconfidence induce over-forecasts. *Journal of Product Innovation Management*, *32*(5), 825–841.

Materia, V. C., Dries, L., & Pascucci, S. (2014, March). Innovation in agro-food supply chains: The EU policy context. COMPETE Working paper, 5. Leibniz Institute of Agricultural Development in Transition Economies. Retrieved from http://www.compete-project.eu/fileadmin/compete/files/working_paper/COMPETE_Working_paper_5_Innovation_Introduction.pdf

McDonald, J. (2006). *Factors impacting innovation activity in Western Canadian food processing firms* (Master of Science Thesis). University of Saskatchewan, Department of Agricultural Economics, Saskatoon, Saskatchewan.

Organization for Economic Cooperation and Development [OECD]/Eurostat Agri-food. (2005). *Guidelines for collecting and interpreting innovation data, 3rd edition.* The measurement of scientific and technological activities, OECD. Paris: Publishing. Retrieved from http://www.oecd.org/sti/inno/oslomanualguidelinesforcollectingandinterpretinginnovationdata3rdedition.htm

Rogers, E. (1995). *Diffusion of innovations*. Fourth Edition. New York: Free Press.

Rosenberg, N. (1994). *Exploring the black box: Technology, economics, and history*. Cambridge: Cambridge University Press.

Schmidt, C., Gooch, M., Siren, C., and Wilson, J. (2013). Benchmarking the nature of value chain relationships in Ontario agriculture. Report. Guelph, ON. Agricultural Management Institute. Accessed Nov'24'15. Retrieved from https://vcm-international.com/wp-content/uploads/2013/06/AMI-Value-Chain-Benchmarking-Report.pdf

Sparling, D., & Cheney, E. (2014). *The performance of the Canadian food manufacturing industry*. Report. Ottawa, Ontario, Canada: Canadian Agri-food Policy Institute. Retrieved from https://www.ivey.uwo.ca/cmsmedia/3779172/sparling-cheney-food-manufacturing-performance-full-report-march-10.pdf

Statistics Canada. (2009). *Survey of innovation and business strategy*. Accessed May 14, 2015. Retrieved from the Innovation, Science and Economic Development Canada site https://www.google.com/?gws_rd=ssl#q=Statistics+Canada+2009+survey+of+innovation+and+business

Sutton, J. (1998). *Technology and market structure: Theory and history*. Cambridge, MA: MIT Press.

Toops, D. (2010). Food processing: A history. *Food Processing*. Retrieved from https://www.foodprocessing.com/articles/2010/anniversary

Trienekens, J., Hvolby, H.-H., Steger-Jensen, K.., & Falster, P. (2008). Architectural frameworks for business information system analysis and design. In T. Kosh (Ed.), *Lean business systems and beyond* (pp.413–421). Boston, MA: Springer.

Uzea, N. (2014). Drivers of innovation in food manufacturing: managerial and policy implications. Western University, Ivey School of Business, London, ON. Retrieved from http://sites.ivey.ca/agri-food/2014/10/09/drivers-of-innovation-in-food-manufacturing-managerial-and-policy-implications-3/

Van de Ven, A., H. (1984). *Central problems in the management of innovation*. Discussion Paper #21. University of Minnesota, Minnesota Strategic Management Research Center.

Wang, L., Plump, A., & Ringel, M. (2015). Racing to define pharmaceutical R&D external innovation models. *Drug Discovery Today, 20*(3), 361–370.

Yin. R. (2003). *Case study research: Design and methods*. 3rd ed. Thousand Oaks, CA: Sage.

Yin. R. (2014). *Case study research: design and methods*. 5rd ed. Thousand Oaks, CA: Sage.

Appendix

66 Innovation Initiatives Cross Eight Case Studies of Food Processors in Manitoba

Richardson Milling	Shape Foods	Canadian Prairie Gardens	Hemp Oil Canada Inc.
RM1 – kiln and product development with ingredient customers	**SF1 –** unique process gives shelf stable product with excellent taste	**CPG1 –** novel process, direct steam injection retains colour and nutrients	**HOCI1 –** novel hemp seed crushing, cold pressing and filtering processes
RM2 – gaining market share after "oat-bran collapse", gradual growth of reputation and sales	**SF2 –** ingredient diversification	**CPG2 –** novel asceptic packaging gives shelf stable product	**HOCI2 –** novel processes to de-hull and roast hemp seeds
RM3 – grower and handler education gives better raw oat supply	**SF3 –** new oil flavours	**CPG3 –** hiring and consulting experienced people	**HOCI3 –** product development through the hemp food chain
RM4 – acquisition by Richardson International leads to investment and logistical efficiencies	**SF4 –** product development with ingredient customers	**CPG4 –** pre-processing of raw crop	**HOCI4 –** marketing of and research on health benefits of hemp food products
RM5 – plant breeding gives specialist products and disease resistance	**SF5 –** new flax products & markets	**CPG5 –** plant breeding and agronomy give higher yields	**HOCI5 –** plant breeding and agronomy research and guide for new producers
RM6 – past and new health claims lead to higher consumption	**SF6 –** plant breeding and agronomy gives higher yields and specialist products	**CPG6 –** food safety certification & training	**HOCI6 –** expansion of processing capacity, investment in equipment and processes through the supply chain
RM7 – taking advantage of oats natural lack of gluten	**SF7 –** health claims increase human flax consumption	**CPG7 –** demo product development for ingredient customers, product development with food manufacturers	**HOCI7 –** planned new company for healthy hemp seed extracts, research into health benefits
RM8 – additional oat products made from fractions of oats		**CPG8 –** increase number of processing lines from 1 to 6, licensing and spin-off companies	**HOCI8 –** opportunity to use the whole plant and expand the industry
		CPG9 – health claims and supplementation	**HOCI9 –** opportunity expand into new market sectors and geographies

Source: Ashton et al. (2015).

Appendix continued

Floating Leaf Fine Foods	Bee Maid Honey Ltd.	True North Foods	Brar Natural Flour Mills
FL1 – proprietary wild rice roasting and quick cook rice processes	**BM1 –** producer-owned cooperative, makes company "honey experts"	**TNF1 –** federally licenced ruminant processing plant	**BNFM1 –** traditional Indian ingredients, made in Canada
FL2 – wild rice blends with pulses and other grains	**BM2 –** product development, new flavours, textures and products	**TNF2 –** small, flexible federal plant, gathering animals from 100-200 mile radius	**BNFM2 –** product development of atta, corn, millett and chana daal flours
FL3 – product development, pastas and pancake mix, potential new health products	**BM3 –** Packaging design and manufacture, retains and opens markets	**TNF3 –** individual "pod" processing gives increased flexibility and traceability	**BNFM3 –** development of healthier products: high fibre atta, gluten free flours and low glycemic index atta
FL4 – updating retail packaging to retain or increase market share	**BM4 –** New markets: food service, Chinese exports, potential health benefits	**TNF4 –** custom processing service to multiple species and specialty markets	**BNFM4 –** marketing health and nutritional benefits of ingredients and foods
FL5 – world class BRC food safety certification opens new markets	**BM5 –** Bee health: working with multiple partners to stay ahead of pests, diseases and weather	**TNF5 –** environmentally sustainable and low cost solution to disposal of waste water	**BNFM5 –** International Year of Pulses: increasing awarenes of uses, nutritional benefits and sustainability of pulses
FL6 – upgrading equipment and processes, through the supply chain from harvesters to distributors	**BM6 –** Increase in crop pollination services and monoculture	**TNF6 –** livestock breeding for customer preferences, feed efficiency and profitability	**BNFM6 –** modernizing and upgrading technology and facilities through the supply chain
FL7 – expansion opportunities in export and ingredient markets: vegetarian, organic and starch alternatives	**BM7 –** Updating technolgy, machinery and practices through the supply chain	**TNF7 –** new livestock management techniques and adoption of new technology	**BNFM7 –** innovative marketing and packaging
FL8 – future expansion and upgrading of FL processing facilites	**BM8 –** diversification to reduce risk and serve customers	**TNF8 –** marketing meat's nutritional properties, serving niche markets	**BNFM8 –** opportunities for new markets: food service, exports or convenience foods
		TNF9 – opportunity for added value processing for Canadian and export markets	

Source: Ashton et al. (2015).