

STUDY 1

Connecting The Dots to Illuminate Cash In Another Firm's Trash: Opportunity Recognition in the Circular Economy

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Abstract

There is now, more than ever, a need for companies and their supply chains to operate in a sustainable manner while also maximizing long-term profits and resource utilization. The combination of these two concepts, the circular economy, contrasts the traditional linear models currently in use by most firms. Being a relatively new concept, the circular economy will need more time to become more accepted and commonly understood. Its success will also, at least in the beginning, depend on how entrepreneurs and business leaders identify and assess opportunities to operate in a circular manner. This phenomenon is especially true in established industries such as the food industry, where many agricultural resources are used and wasted each year.

The goal of this project was to analyze four firms that are undergoing opportunity recognition and evaluation of utilizing other firms' waste. Through this analysis, each firm's use of active search, alertness, prior knowledge, and various cognitive frames were examined both independently and in combination with one another. Commonalities and differences between aforementioned factors, in addition to industry clockspeed and entrepreneurial passion, were also assessed. In sum, this exploratory research presents insights on the micro-processes that enable firms to "connect the dots" to "see cash in the trash" of other firms.

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1. Introduction

Change is an inevitable factor in how products and processes are manufactured and implemented. While constant in almost all industries, agents of change at the early stages of any major innovation are often people who recognized such opportunities first. This tendency is no different for the adoption of circular economy principles, such as making use of waste materials, keeping products in use, and regenerating ecosystems, into firm supply chains. Multiple firms within the Quebec agro-food sector, in collaboration with the Center Transfer Technological In Écology Industrial (CTTEI), have undertaken such an endeavour in varying stages of implementation.

The objective of this paper is to reveal commonalities and trends between four small-to-medium-sized firms within the food sector that have successfully recognized opportunities in adopting circular economy principles. Firms will be analyzed on their ability to “see cash in the trash” and identify economic value in the waste other firms’ produce. Specifically, this research will examine common opportunity recognition timelines, cognitive frameworks, and antecedents between these four firms to describe and explain how opportunity recognition relates to the emergence of a circular bio-economy in the food industry.

2. Literature Review

Circular Economies and the Food Industry

While most businesses today operate within the linear economy, there are multitude of opportunities to transition to the circular economy. A linear economy is defined with a “take-make-dispose” model where materials are procured, transformed, and thrown away after use. Value is created in the linear economy by using as many materials as possible to maximize production.¹ While linear economies are simpler to establish and profitable in the short-term, it will face long-term market, operational, legal and environmental risks. By being further entrenched within linear economies, humanity will need 1.7 planets in order to meet its needs by 2030.²

This inevitable trend requires a major transition from a linear economy to a circular economy. Circular economies, in contrast to linear economies, follow the concept of the 3Rs: Reuse, Reduce, and Recycle. Within a circular economy, use of virgin material is minimized, reuse of existing products is maximized,

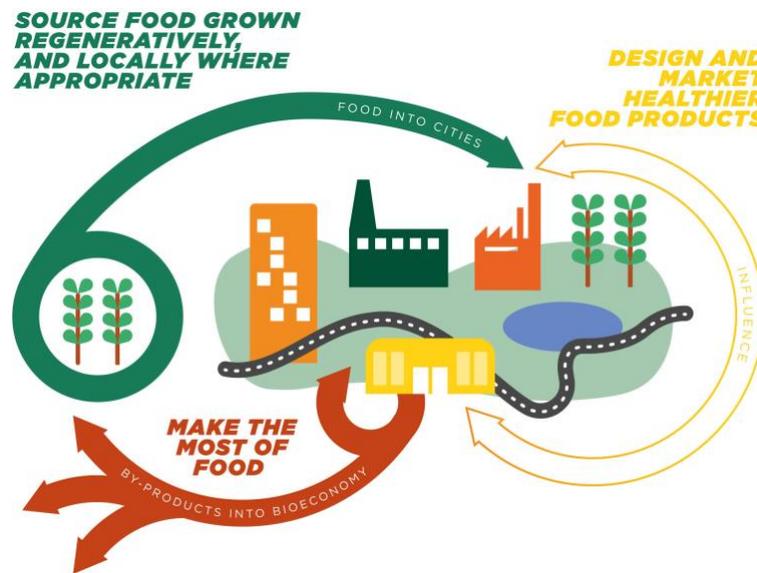
¹ A circular economy differs from a linear economy, but how? (n.d.). Retrieved from <https://kenniskaarten.hetgroenebrein.nl/en/knowledge-map-circular-economy/how-is-a-circular-economy-different-from-a-linear-economy/>

² Circular Transition Indicators. (n.d.). Retrieved from <https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Resources/Circular-Transition-Indicators>

and waste is recycled with the ultimate goal of sustaining and regenerating natural ecosystems.³ Unfortunately, only 8.6% of the world economy is operating circularly, down from 9.1% in 2019.⁴

Out of all the possible changes that can be made to further the circular economy, changing food systems is one of the most impactful in terms of creating biodiversity and curbing climate change. Although supporting much of societal growth, the current food system does not effectively address long-term needs. In particular, food production accounts for over 39 million hectares of degraded soil and 70% of freshwater globally.⁵ As such, it is important that changes are made to the current food system to source food regeneratively, design healthier products, and make the most of food (Table 1).

Table 1 – Food System Ambitions⁶



Opportunity Recognition

Opportunity recognition, in simple terms, is the process by which individuals identify, evaluate, and act on opportunities. In particular, opportunity recognition can pertain to how entrepreneurs and business people recognize and capitalize on new business opportunities.⁷ To successfully recognize legitimate opportunities, it is theorized that entrepreneurs need to utilize cognitive frameworks they developed

³ A circular economy differs from a linear economy, but how? (n.d.). Retrieved from <https://kenniskaarten.hetgroenebrein.nl/en/knowledge-map-circular-economy/how-is-a-circular-economy-different-from-a-linear-economy/>

⁴ What is a Circular Economy? (n.d.). Retrieved from <https://www.ellenmacarthurfoundation.org/circular-economy/concept>

⁵ Food and The Circular Economy. (n.d.). Retrieved from <https://www.ellenmacarthurfoundation.org/explore/food-cities-the-circular-economy>.

⁶ Ibid.

⁷ Baron, R.A. 2006. Opportunity Recognition as Pattern Recognition: How Entrepreneurs “Connect the Dots” to Identify New Business Opportunities. *Academy of Management Perspectives*, 104–119.

through past experiences to “connect the dots” between external factors. This pattern recognition process, integrating active search, alertness, and prior knowledge, serves as the basis for the creation of a new venture.

Additionally, for established businesses, organizational learning (OL) can also enhance the ability of a firm to capitalize on new opportunities. This school of thought has been posited by researchers to combine three approaches of OL - behavioral, cognitive, and action - with two phases of a creativity-based opportunity recognition model - Discovery and Formation. This insight can prove useful to firms that accumulate knowledge to their strategic advantage.⁸

Finally, firm-wide opportunity recognition can often be determined by specific industry clockspeeds, defined as the rate of industry change in products, processes, and organizations. Research suggests that fast-clockspeed industries can benefit more from higher complexity in their strategic schemas while firms in slow-clockspeed industries may benefit more from higher strategic focus. This dynamic influences the effectiveness and speed of opportunity recognition.⁹

3. Methodology

Throughout the course of the project, primary research was conducted through remote interviews with representatives from the four firms, firm partners, and CTTEI facilitators. Secondary research was completed through reviewing opportunity recognition literature on Google Scholar, Web of Science, and other sources. This study will utilize an abductive method to collect qualitative data and form analyses. Specifically, the study will start with clear theoretical framing around the circular economy within the food industry and opportunity recognition. Next, the four firm case studies will be used to elaborate and refine existing theory on opportunity recognition. In doing so, the research project hopes to examine the relationships between concepts, introduce new concepts, or investigate the limits of concepts of opportunity recognition theory in the context of the circular economy within the food sector.¹⁰

⁸ Lumpkin, G.T., Lichtenstein, Benjamin. 2005. The Role of Organizational Learning in the Opportunity Recognition Process. *Entrepreneurship Theory and Practice*, 451–472.

⁹ Nadkarni, S., & Narayanan, V.K. 2007. Strategic Schemas, Strategic Flexibility, and Firm Performance: The Moderating Role of Industry Clockspeed. *Strategic Management Journal*. 243–266.

¹⁰ Ketokivi, M., & Choi, T. 2014. Renaissance of Case Research as a Scientific Method. *Journal of Operations Management*. 232–240.

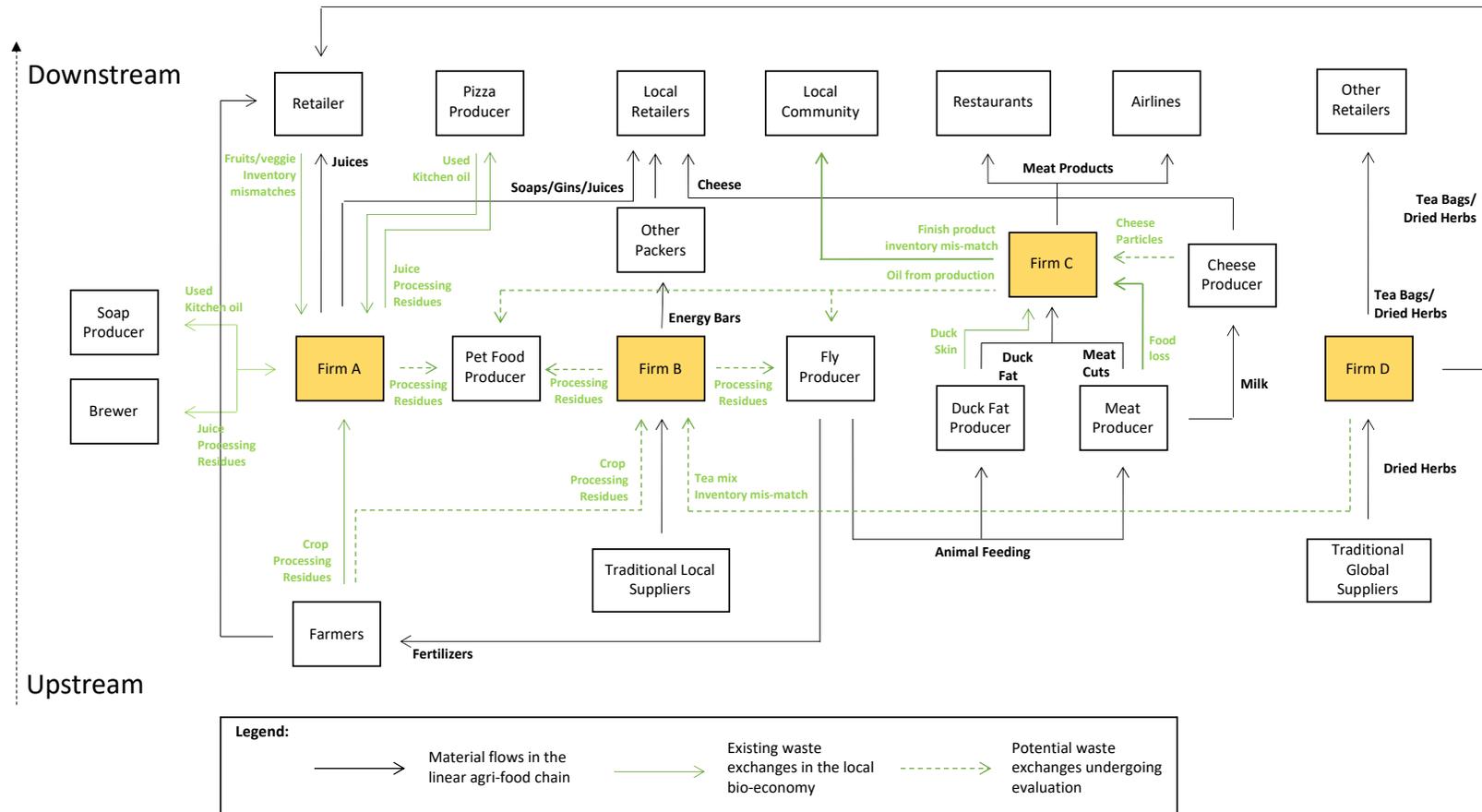
Table 2 – List of Case Studies and Interviews

Case	Location	Number of Employees	Products	Waste Exchange Proficiency	Interviewees
Firm A	Montreal, Quebec	25	Food recovery and transformation (juices, soaps, alcohol)	High: Currently producing fruit juices, alcohol, and soaps made out of wasted produce, potato peels, and fat. Recycled products account for 100% of its product portfolio. Now expanding via replication in California.	Founder, Firm Partner (Retailer and Supplier), Circularity broker (PME Montreal)
Firm B	Chateaugay, Quebec	70	Private label nutrition bars	Medium: Currently evaluating the adoption of flour, produce, and dairy in various bars.	Vice President of Business Development, Circularity broker (CRE Montérégie)
Firm C	Saint-Hyacinthe, Quebec/Palencia, Spain	100	Prepared meat dishes	Medium-High: Duck fat, meat trimmings are currently sourced and used into 5-10% of the product offerings. The firm is assessing a new waste exchange involving cheese particles.	Director of Operations, Circularity broker (CRE Montérégie)
Firm D	St-Bruno, Quebec	135	Tea bags	Medium-Low feel motivated but still gathering information and resources. Stuck in the discovery phase for now. Considering selling its waste to beer producers and sourcing produce (such as fruit pulp) to produce tea.	Project Coordinator, General Manager, Circularity broker (CRE Montérégie).

Network Map of Case Studies

A network map of all four firms and their related partners can be seen in Table 3.

Table 3 –Network Map¹¹



Note: This emergent network could potentially be more resilient to short-term supply and demand shocks because each actor diversifies their input and output sources, resulting in higher interconnection but lower interdependency in the regional system.

¹¹ Firm Interviews.

Case Studies – Single Case Synthesis

Firm A

Firm A, being an outlier in this study, is a startup consisting of 25 people based on Montreal, Quebec.¹² The firm was founded four years ago by an entrepreneur with previous experience in the food and beverage industry. Having experienced first-hand large amounts of food being wasted at previous businesses, the founder recognized the opportunity from a phone call from a major family owned distributor of produce in Montreal that was also throwing away good food. This firm offered the founder the opportunity to utilize another firm's waste to produce new products, prompting the founder to extrapolate the opportunity to the broader market and close his prior business to start Firm A. The firm is currently a food recovery and transformation business that specializes in sourcing food waste and transforming it into juices, soaps, and alcohol.

Firm A was founded with a crowdfunding campaign to test the market with some experimental juices, realizing online success. The founder stated that since he already possessed expertise in the food and beverage industry, a market study was deemed unnecessary. Firm A then started producing juices with a co-packer to send its products to market while minimizing capital costs. Currently, the firm has an in-house production facility, producing over 24 varieties of juices, soaps, and alcoholic drinks.¹³ Juices are produced in-house whereas soaps and alcoholic drinks are produced via third parties, requiring the firm to utilize its spare capacity and leverage its network of small, local suppliers. It still maintains a relationship with the initial firm (who also happens to be its largest supplier of waste) that first made contact more than four years ago and started selling its own waste to downstream partners, such as pet food manufacturers.

Firm B

Firm B is a private label bar manufacturer and co-packer located in Chateauguay, Quebec. The firm started in 2001 under five key values: Professionalism, Engagement, Respect, Flexibility, and Innovation.¹⁴ In terms of innovation, Firm B engages multiple parts of its business to spur novel ideas and solution. While new ideas often come from the R&D department, whose interns are encouraged to look at industry trends and point the firm towards new types of bars and other products, all employees can propose and champion innovations. Potential innovations are then decided upon unanimously during cross-department meetings. Firm B has recently been looking at the trend around recycled items after being exposed to the opportunity twice, five and two years ago. The firm is aware of the growing amounts of waste that companies produce, in addition to companies that "create value out of nothing" in the sharing economy, such as Uber and Airbnb. Firm B claims to be ahead of its time as other firms in

¹² Retrieved from firm website.

¹³ Retrieved from firm website.

¹⁴ Retrieved from firm website.

the food space were not ready to operationally exploit circular economy principles, ingredients were too expensive, and organizational resources were too limited or inflexible at the time.

Currently, Firm B is looking to source multiple types of waste, including fruits, vegetables, flour, and dairy products. The firm facilitates a short product development cycle of three months and realizes that it can capitalize not only on cheap waste to source, but also on the environmental concerns of consumers. Despite it claiming to have little challenges in scalability of waste, Firm B still needs to alleviate organizational constraints to fully implement its ideas. Although Firm B does not claim to have previous expertise in the circular economy, its decision to source and process other firms' food waste or loss¹⁵ was made with a strong conviction that recycled products constitute the future of the food industry. It is not at the moment executing on any waste synergies.

Firm C

Founded in the early 2000s, Firm C is a Spanish firm started by two entrepreneurs with the goal of offering high-end, semi-processed meat products to restaurants, caterers, airlines and other customers. The firm has two facilities in Palencia, Spain and Saint-Hyacinthe, Quebec, and mainly sells to local partners.¹⁶ Security is a key offering of Firm C, as its manufacturing (sous vide) process can easily eliminate contaminants. This process not only ensures product quality and safety, but also offers flexibility as the firm actively works with customers to ensure products are customized to their needs. However, because Firm C has strong relationships with customers, the firm can modify client requests through negotiation to become more operationally convenient. As a result of high product quality and flexibility, Firm C commands a higher price point for its products.

Currently, Firm C is looking to instead buy waste from other firms and integrate them into its products. Because the firm has already had experience sourcing waste from other firms, Firm C is confident in its ability to successfully utilize recycled materials given its expertise and operational flexibility. The firm started its circular economy practices around 2009 when it launched new operations in Quebec. Specifically, Firm C looked to introduce beef cheeks, a popular dish in Spain, to the Canadian market. It accomplished this feat by showing its suppliers, who were selling their beef cheeks to ground beef manufacturers at a low price, the true value of selling the meat in its original form. Since then, Firm C has had many successes, such as sourcing wasted sweetbreads, in producing products from wasted material. The firm operates with a culture of creativity that allows for new ideas and innovations to emerge. Creativity is present in many parts of the organization, including sales, chefs, and food scientists. The firm also actively visits its suppliers to both deepen their relationship and discover new ways to collaborate. Currently, Firm C is examining opportunities to source and process wasted duck fat, meat trimmings, and cheese particles from other food processors in its own products, which currently comprise of 5-10% waste inputs.

¹⁵ Food loss is defined as the decrease in edible food mass throughout part of the supply that specifically leads to human consumption, while food waste is food loss that occurs at the end of the supply chain, such as consumption.

¹⁶ Retrieved from firm website.

Firm D

Founded in 1992, Firm D is a tea bag manufacturer that uses herbs and spices to make herbal teas. Located in St-Bruno, Quebec, Firm D currently has around 59 unique products under four proprietary brands and sells its product wholesale.¹⁷ Traditionally, the firm imports ingredients globally as not many of its materials grow naturally in Canada. In addition to sourcing globally, Firm D also sells globally to customers in over five countries. Along with producing tea bags, Firm D also sells dried herbs and herb blends with all blending and packing in-house. With a long history of mandating sustainable practices across its products, Firm D has a clear passion for sustainability; the firm was one of the first in Quebec to introduce fair trade and organic products. In terms of product development, Firm D leverages its research capabilities to answer to the needs of clients.

Six months ago, in November, managers at Firm D started becoming curious about circularity within their business, as the firm is in possession of many raw materials that go to waste. Having attended the first cohort of a government program surrounding the circular economy, Firm D realized that it was not yet ready as its waste was too variable in quantities and qualities and the infrastructure to utilize waste did not yet exist. Nevertheless, partly because of its past commitment to sustainability, the firm somehow decided to explore and pursue opportunities of leveraging its own and other firms' waste. Eventually, the CEO of the firm attended a circular economy event, where she met a budding entrepreneur who was using recycled materials to make pizza crust. This exemplar venture proved to be intriguing to Firm D and serves as inspiration for its own circularity journey. The firm is currently thinking about how to allocate appropriate resources to exploit potential opportunities in selling its waste for beer production or sourcing wasted produce (such as fruit pulp) to make tea. It does so in part by attending various industry events and government programs.

4. Case studies – Cross-case Comparison and Theory Elaboration

Timelines

Examining the history and decision-making timelines of each firm, along with information processing capacities, may help discern similar patterns in opportunity recognition. With the exception of Firm A, all firms are well-established and founded in the 1990s or early 2000s. Throughout their history, two of the established companies (Firm B and C) have prior experience in either experimenting with the idea of sourcing waste or doing it outright. However, Firm B abandoned the idea five years ago, citing insufficient operational capabilities and poor market infrastructure and readiness. Firm D, having previously innovated fair trade and organic products in Quebec, is now investigating the idea of the circular economy for the first time. Currently, all firms (including Firm A) are pursuing, in some shape or form, the integration of other firms' waste into their product lines. Having said that, the nature of integration, opportunity assessment, and progress of each firm varies greatly. For example, Firm A, being only four years old, is a startup that has been selling recycled products ever since its inception. Meanwhile, Firm B and C are actively pursuing opportunities using waste in nutrition bars and meat

¹⁷ Retrieved from firm website.

products, respectively. Lastly, Firm D is still exploring which specific opportunities within waste to pursue.

Table 4 – Firm Timelines¹⁸

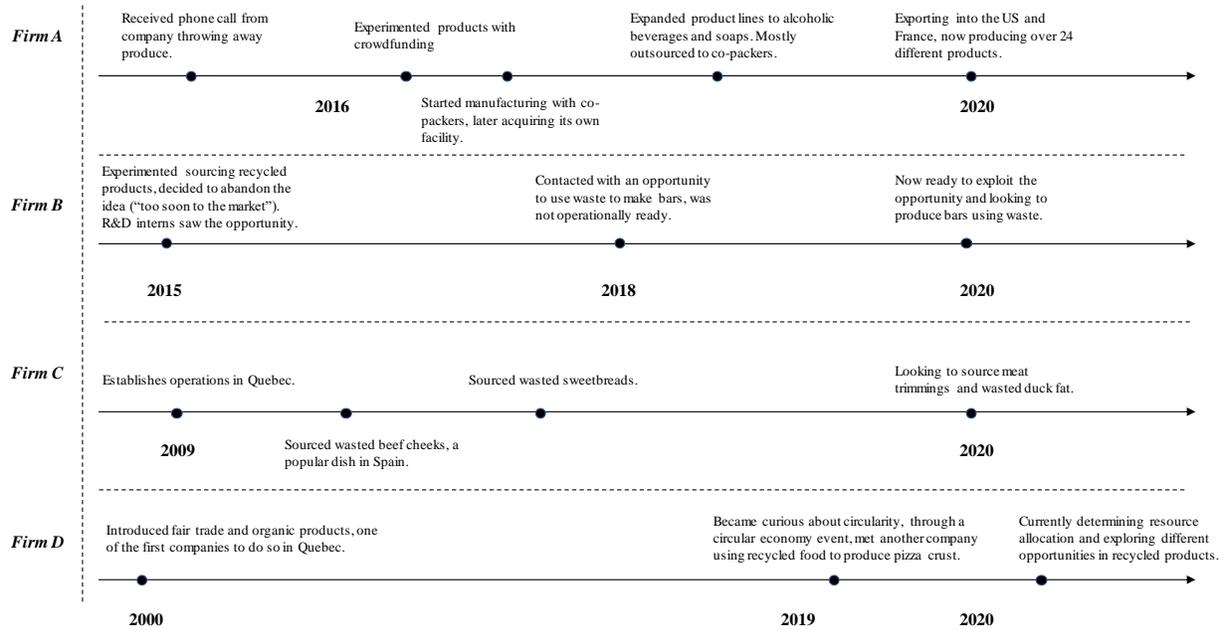


Table 5 shows Lumpkin, Hills, and Shrader’s (2004) *Creativity-based Model of Entrepreneurial Opportunity Recognition*, a model that depicts opportunity recognition as a staged, iterative, and recursive process that involves a “Discovery” phase consisting of preparation, incubation and insight, and a “Formation” phase consisting of evaluation and elaboration. Specifically, elaboration refers to a step within the Formation phase where entrepreneurs try to capture value from an opportunity, evaluation refers to analyzing whether ideas formed in the Discovery phases are “workable”, and incubation refers to contemplation around an opportunity.¹⁹

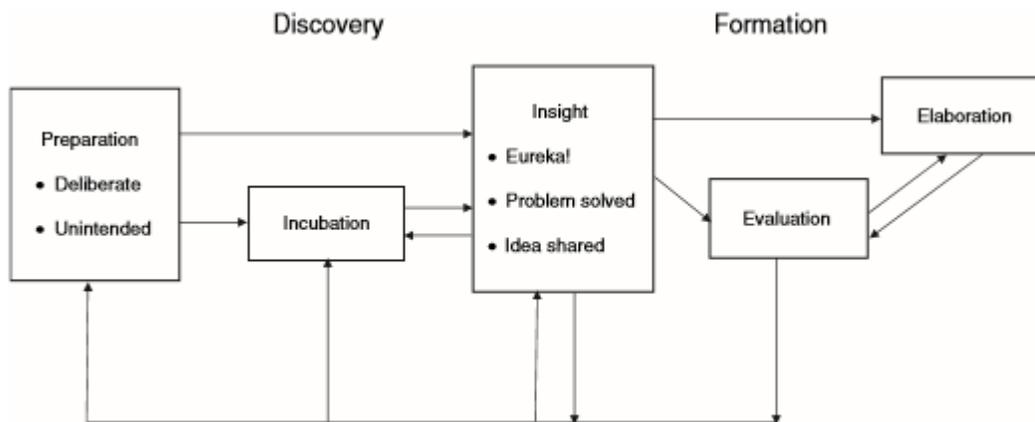
Looking at Table 5, firms that are studied can be grouped in either the Discovery phase (investigation of opportunities) or Formation phase (executing on opportunities). Firm C, being in the process of implementing specific waste synergies and estimating project timelines, are on the evaluation and elaboration stages in the Formation phase while Firm B and D are further behind in the incubation and evaluation stages, respectively. Specifically, Firm C is currently trying to execute on the opportunity of wasted duck fat by engaging with its supplier. This execution is not possible for Firm B and D, as they have not decided which opportunities to pursue. Seeing as all firms other than Firm D have previously considered or successfully tried sourcing waste from another firm, they have an easier time grasping the

¹⁸ Firm Interviews.

¹⁹ Ibid.

concept of a circular economy due to the recursive nature of entrepreneurial thinking.²⁰ This advantage in opportunity recognition is emphasized for Firm A (which has gone through this process many times) and is minimized for Firm D (which is exploring this opportunity for the first time). Thus, it is possible that Firm D is further behind Firm C in its circular economy integration (despite starting to collaborate with CTTEI around the same time) and has to spend more resources in the Discovery phase to compensate for its relative inexperience in the circular economy. This finding of course, leaves out Firm B which, even having recognized the opportunity long before Firm D, is not very ahead in achieving its desired synergies.

Table 5 – Creativity-based Model of Entrepreneurial Opportunity Recognition²¹



It is also clear that each firm got exposed to food waste opportunities in different ways; Firm A received a random phone call, Firm B was informed by its R&D department, Firm C saw value in waste due to cultural differences, and Firm D was connected to another firm that was already experimenting with such a concept. Except for Firm D (which is still assembling resources), all firms have either completed gathering information around the opportunity or are currently in the process of doing so. This process of course, also differs between firms; Firm A experimented with a crowdfunding campaign while Firm B and C are looking into product synergies and potential waste suppliers. A brief summary of each firm’s progress towards circularity, as well as their similarities and differences, are shown in Table 6.

²⁰ Ibid.

²¹ Lumpkin, G.T., & Lichtenstein, B. 2005. The Role of Organizational Learning in the Opportunity Recognition Process. *Entrepreneurship Theory and Practice*, 451–472.

Table 6 – Summary of Circularity Progress Among Firms²²

Case	Opportunity Recognition Ability	Waste Exchange Proficiency
Firm A	High: “Automatic” search via phone call, forgoing active search; Alertness due to entrepreneurship background; Prior knowledge of food and nutrition, circular economy, entrepreneurship accumulated by starting businesses in the food industry; “exemplary” cognitive frame.	High: Currently producing fruit juices, alcohol, and soaps made out of wasted produce, potato peels, and fat. Recycled products account for 100% of its product portfolio. Now expanding via <i>replication</i> in California.
Firm B	High: “Automatic” search via R&D interns, forgoing active search; Cognitive learning due to R&D and innovative culture; Prior knowledge of bar ingredients; “exemplary” cognitive frame.	Medium: Currently evaluating the adoption of flour, produce, and dairy in various bars.
Firm C	High: “Automatic” search via food scientists and chefs, forgoing active search; Cognitive learning due to innovative culture around food; Prior knowledge of food waste; “exemplary” cognitive frame.	Medium-High: Duck fat, meat trimmings are currently sourced and used into 5-10% of the product offerings. The firm is assessing a new waste exchange involving cheese particles
Firm D	Medium-Low: “Direct” search via government programs; No cognitive learning around food waste; “prototype” cognitive frame.	Medium-Low feel motivated but still gathering information and resources. Stuck in the discovery phase for now. CTTEI cited potential synergies in supplying its waste for beer production and sourcing produce for tea.

Information Processing

Active Search, Alertness, Prior Knowledge and Cognitive Learning

Three factors have been examined to play an important role in recognizing opportunities: engaging in an active search, high alertness to opportunities, and prior industry knowledge.²³ It is worth noting that while these three factors are traditionally studied independently, they are also interrelated. They will be first analyzed independently in the context of the four firms, then all together later in the analysis.

Regarding **active search**, past studies have shown that entrepreneurs are less likely to recognize opportunities through public sources of information, such as the news. Instead, entrepreneurs are much more likely to depend on niche, unique, and personal sources of knowledge.²⁴ This method of sourcing

²² Firm Interviews.

²³ Ibid.

²⁴ Hills, G.E., & Shrader, R.C. 1998. Successful entrepreneurs’ insights into opportunity recognition. In P.D. Reynolds et al. (Eds.), *Frontiers of entrepreneurship research* (30–43). Wellsley, MA: Babson College.

information is unequivocally true for all four firms studied; Firm A received a call from a personal contact at another firm, Firm B utilized R&D to look into the circular economy, Firm C draws from its supplier relationships, and Firm D was exposed to another entrepreneur in the space. One difference, however, is that Firm D searched *directly* through attending a government program, while Firm A, B, and C searched *automatically* through firm resources or sheer luck. This difference indicates that searches for opportunities can sometimes occur automatically rather than in a directed manner.²⁵ Ultimately, this finding suggests that both methods of search can equally result in successful opportunity recognition if information is sufficiently sourced.

Secondly, **alertness** can also play a major factor in helping entrepreneurs and business leaders identify opportunities. In particular, having high alertness to opportunities allows individuals to find opportunities without having to instigate a formal search. In particular, a high level of alertness allows an entrepreneur to search *automatically*, forgoing active search. The factor explains how Firm A, B, and C were able to find opportunities related to food waste without explicitly searching; Firm A had someone in its network offer an opportunity, Firm B utilized R&D, and Firm C sourced ideas from chefs and food scientists. A factor that often leads to an individual having a high level of alertness is a high level of intelligence, creativity, and risk tolerance.^{26,27} Although intelligence and creativity are difficult to measure and have not been included as empirical evidence in this paper, the founder of Firm A indeed demonstrates high risk tolerance. Being a serial entrepreneur, the founder of Firm A is an individual who is uniquely profiled in this study to constantly take advantage of new ideas by starting new businesses.

Next, having **prior knowledge and experiences** is greatly useful in identifying opportunities. Past research has shown that having a rich set of life experiences, coupled with the persistence in acquiring new knowledge (through active search, alertness, or otherwise), helps entrepreneurs recognize and provide novel solutions to problems.^{28, 29} This insight from the literature could again be tied to the founder of Firm A, whose entrepreneurial background in the food industry may have helped him recognize problems and subsequent opportunities around wasted produce. The founder's background could additionally position himself to constantly acquire new knowledge, as a serial entrepreneur is likely to possess the skills to continuously search for new business opportunities. For example, the founder stated that he knew almost immediately that Firm A would never be short of waste for its new products. This conclusion resulted from his past restaurant experience; food waste was never below 9% despite having implemented a short menu and saturated capacity. It could be argued that prior

²⁵ Ardichvili, A., Cardozo, R., & Ray, S. 2003. A Theory of Entrepreneurial Opportunity Identification and Development. *Journal of Business Venturing*, 18, 105–123.

²⁶ Baron, R.A. 2006. Opportunity Recognition as Pattern Recognition: How Entrepreneurs “Connect the Dots” to Identify New Business Opportunities. *Academy of Management Perspectives*, 104–119.

²⁷ Krueger, N., & Dickson, P.R. 1994. How Believing in Ourselves Increases Risk-Taking: Perceived Self-Efficacy and Opportunity Recognition. *Decision Sciences* Volume 25. 385–400.

²⁸ Baron, R.A. 2006. Opportunity Recognition as Pattern Recognition: How Entrepreneurs “Connect the Dots” to Identify New Business Opportunities. *Academy of Management Perspectives*, 104–119.

²⁹ McKelvie, A., & Wiklund, J. 2004. How knowledge affects opportunity discovery and exploitation among new ventures in dynamic markets. *Opportunity Identification and Entrepreneurial Behavior*. 219– 239. Greenwich, Ct: Information Age Publishing.

knowledge, on an individual level, can stem from one's personal background and thus lend itself well to opportunity recognition. Top management interviewed at the four firms all have relevant backgrounds pertaining to the food industry; Firm C's management has culinary and food science backgrounds, while Firm A's management and partners have backgrounds in entrepreneurship, nutrition, and operations.

Search, alertness and prior knowledge at an individual level, however, can only partly be utilized in strengthening the firm's ability to recognize opportunities. Instead, opportunity recognition at the organizational level can also be bolstered by elements of OL. Notably, Lumpkin and Lichtenstein (2005) postulated that the greater elements of creativity and innovation within an organization, the greater its ability to recognize opportunities.³⁰ Within this model of OL, "**cognitive learning**" seems to achieve the greatest effect. Cognitive learning is explained primarily as a firm's ability to increase internal knowledge transference capabilities to increase its "transformational capacity." Transformational capacity refers to a firm's capacity to innovate new products or reorganized internal processes to maximize information processing capacity.³¹ Simply put, cognitive learning is useful in an entrepreneurial setting by allowing companies to acquire and utilize knowledge quickly. Firm B and C, despite being well-established, are embodiments of high cognitive learning; Firm B leverages bright summer interns within its R&D department to survey new trends, potentially translating into new product, while Firm C possesses a quick development cycle where chefs and food scientists explore and prototype new dishes. Cognitive learning through these mechanisms enable "seeing" non-obvious opportunities because firms are able to accumulate and mobilize information over time, thereby increasing their knowledge base and agility. As both companies operate with a culture of entrepreneurialism and creativity, they are quicker to translate organizational knowledge into new opportunities in the Discovery phase of the *Creativity-based Opportunity Recognition Model*. Connecting back to firm timelines, Firm D may be slower to progress through its Discovery phase as a result of lower cognitive learning capabilities. However, a distinction needs to be made between being well-positioned to *recognize* opportunities and successfully *executing* on opportunities. Such as in the case of Firm B, being slow to actually integrate circularity into its business, having high cognitive learning does not guarantee successful implementation during the Formation phase. This point is further elaborated in a second study that focuses on operational agility and how it manifests in the context of the circular economy.

Finally, certain **cognitive frameworks** can aid the opportunity recognition process. A cognitive framework (or cognitive frame) refers to a collection of past experiences and events that aid an entrepreneur in recognizing connections between external trends. These connections between societal, economic, political, and technological factors can then be used to form new ideas for products or services. New ideas can create a catalyst for change, resulting in new businesses or innovation.³² In the case of the four firms studied, investigating cognitive frames will be important in revealing

³⁰ Lumpkin, G.T., & Lichtenstein, B. 2005. The Role of Organizational Learning in the Opportunity Recognition Process. *Entrepreneurship Theory and Practice*, 451–472.

³¹ Ibid.

³² Baron, R.A. 2006. Opportunity Recognition as Pattern Recognition: How Entrepreneurs "Connect the Dots" to Identify New Business Opportunities. *Academy of Management Perspectives*, 104–119.

commonalities among firms and why some people, but not others, can recognize opportunities. According to Hahn and Chater (1997), there exist two main types of cognitive frames: prototypes and exemplars.³³ Prototypes refer to a model of pattern recognition where individuals employ a “prototype” (objects or events that seem to belong together) to compare against new information in an effort to categorize where it belongs. For example, a business leader may have a prototype of a “good business opportunity” (untapped market, high margins, etc.) and validate it against opportunities related to food waste. Incidentally, it seems that Firm D utilizes a prototype cognitive frame to recognize opportunities in waste, as it has no prior exposure to the circular economy. Contrastingly, the exemplar model is comparatively quicker, comparing new information to similar examples learned in the past instead of idealized prototypes.³⁴ Three out of the four firms studied (A, B, and C) seem to recognize opportunities using exemplary cognitive frames, as all three companies have a repository of prior knowledge on the circular economy to draw on. As an evident example, due to Firm C’s previous experience in sourcing beef cheeks and sweetbreads, it could see an opportunity in duck fat and meat trimmings using past examples. This distinction seems to originate, once again, from differing levels of prior knowledge and cognitive learning between Firm D and every other firm.

“Connecting the Dots”

Of course, the question remains as to how each firm combined **active search, alertness, prior knowledge, cognitive learning and cognitive frameworks** synergistically to “connect the dots” and recognize opportunities around food waste.

Active search, alertness, and prior knowledge, in the context of pattern recognition, can all be used to simplify the task of creating connections between seemingly unrelated events. Firm D, while utilizing active search, came across an exemplary firm using wasted food to produce pizza crusts and made the connection to waste within its own business. Firm A, B, and C, on the other hand, have cognitive learning embedded in their businesses, allowing them to lean on alertness and prior knowledge to passively detect opportunities.³⁵ These differences between firms link back to cognitive frames; because this is Firm D’s first time entertaining the idea of circular integration, it does not have sufficient cognitive learning and is therefore forced to use a slower, more forceful prototype model of pattern identification. Simply put, Firm D’s low alertness and prior knowledge, as well as its reliance on an active search (government programs, reaching out to people in the industry, etc.) make it slower to evaluate the opportunity of sourcing food waste. Contrastingly, Firm A, B, and C are free to utilize a faster exemplary model of pattern recognition as a result of high alertness, cognitive learning, and prior knowledge. These firm factors merit a high opportunity recognition ability and could partially explain why Firm D is relatively less advanced regarding the circular economy. All constituents of opportunity recognition ability are appended to the *Creativity-based Model of Entrepreneurial Opportunity*

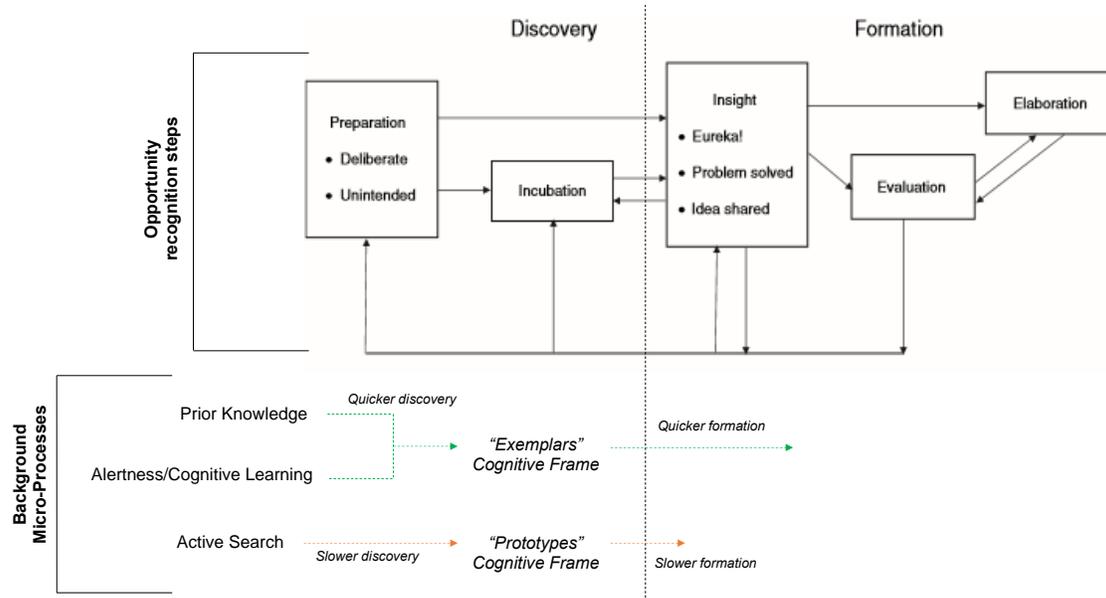
³³ Hahn, U., & Chater, N. 1997. Concepts and Similarity. Knowledge Concepts and Categories. 43–92. Cambridge, MA: MIT Press.

³⁴ Ibid.

³⁵ Being an outlier, Firm A’s founder also possesses *individual* (as opposed to organizational) alertness and prior knowledge due to his entrepreneurial background, as discussed earlier.

Recognition in Table 7 below, outlining “background micro-processes” that occur while firms are in the opportunity recognition process.

Table 7 – Background Micro-processes of opportunity recognition.



In summary, active search, alertness, prior knowledge and cognitive learning, in combination with a cognitive frame, all serve the same purpose of “connecting the dots” around opportunity recognition. However, a combination of high alertness and prior knowledge at the top management level and cognitive learning at the organizational level seem to empower firms to utilize an exemplar cognitive frame, a superior method of pattern recognition in comparison to prototype models and active search.

Other Antecedents

Industry Clockspeed

Seeing as all firms operate in the food industry, it is worth exploring the speed of industry clockspeed and other dimensions to draw further commonalities in opportunity recognition between companies.

The food industry, being exposed to changing consumer tastes, is estimated to have a high clockspeed, meaning a relatively quick rate of industry change in products, processes, and organizations.³⁶ As a result of this dynamic, firms in the food industry need to be strategically flexible and engage frequently in innovation or risk falling behind its competitors.³⁷ In order to accomplish frequent innovation, firms also need to constantly create new resources reallocating to new initiatives. Seeing as all four firms are

³⁶ Nadkarni, S., & Narayanan, V.K. 2007. Strategic Schemas, Strategic Flexibility, and Firm Performance: The Moderating Role of Industry Clockspeed. *Strategic Management Journal*. 243–266.

³⁷ Ibid.

engaged with CTTEI and have at least started thinking about resource allocation, their ability to recognize opportunities related to the circular economy is aided by industry dynamics.

Additionally, there are three dimensions of industry change: rate (captured by industry clockspeed), turbulence (variability in industry change), and magnitude (size of industry change). Although the food industry has a high industry clockspeed, its turbulence and magnitude are quite low; product innovation is incremental and predictable, with little discontinuities. For example, Firm A, B, C, and D all currently offer similar products compared to their inception (Firm A still offers juices, Firm B nutrition bars, Firm C meat products, and Firm D tea bags) with small incremental changes in dimensions such as flavours. This environment may allow firms more resources to better recognize opportunities related to the circular economy, as companies have little to worry regarding regulatory and technological threats. In sum, coupling high industry clockspeed along with low turbulence and magnitude is doubly beneficial for the firms' capacity to see value in waste.

Passion and Motivation

Throughout all the interviews conducted, it was clear that there was a common thread between three of the participants regarding passion and motivation for sustainability. Specifically, the interviewees of Firm A, B, and D all stated that they themselves felt a duty towards being sustainable by finding a use for food waste. While not necessarily a prerequisite to recognize opportunities surrounding the circular economy, passion for reducing waste may play a role in deciding whether to move forward. Described as an experience of "intense pleasantness, arousal and energy mobilization involving the entrepreneur and the venture,"³⁸ entrepreneurial passion can engage a business leader to pursue an opportunity with which he or she is not familiar. This dynamic is also common between Firm A, B, and D, all citing either passion towards sustainability or an "entrepreneurial feeling" for reasons behind pursuing circularity. However, it was difficult to discern evidence of passion for sustainability from Firm C, which may have other passions or motivations not recognized throughout the interview. Ultimately, although passion can play a role in pursuing opportunities, it is not always necessary and cannot replace an appropriate cognitive frame.

5. Conclusion and Limitations

Considering the analysis conducted around firm timelines, information processing, and common antecedents, the paper advances four theoretical insights, summarized here below.

Firstly, the level of prior knowledge at the top management level and cognitive learning within a firm, mediated by an exemplar cognitive frame, aids firms in "connecting the dots" and evaluating opportunities. To explain this finding with concepts introduced in the analysis, opportunity recognition ability (as composed of elements such as search, alterness, prior knowledge, cognitive learning and cognitive frames) plays a central role in helping firms overcome the Discovery phase, where new ideas

³⁸ Cardon, M.S., Wincent, J., Singh, J., & Drnovsek, M. 2005. Entrepreneurial Passion: The Nature of Emotions in Entrepreneurship. Academy of Management Best Conference Paper.

are first being formed. This point is evident in Firm D, being the only firm still in the Discovery phase and not possessing sufficient opportunity recognition ability. As Firm D did not embed within itself cognitive learning structures, such as a firm-wide mandate of innovation, it was not in a position to properly accumulate prior knowledge or alertness regarding the circular economy. As it exclusively utilizes its product development capabilities to cater to client needs, Firm D had to leverage a prototype model, together with active search, to recognize and explore the prospect of food waste. This connection is of course, contrasted with Firm A, B, and C, who all have specific mechanisms to foster innovation and creativity beyond customer demands.

Second, although opportunity recognition ability helps to initiate a waste exchange synergies, it may not be enough to execute and sustain it well. This conclusion could be due to the fact that opportunity recognition *alone* may not be enough to achieve waste exchange proficiency in the Formation phase, as there are many other organizational and operational factors at play. For example, Firm B and Firm C are very similar on all dimensions of opportunity recognition, and yet Firm C is much more “ahead” in its circular economy integration than Firm B. Although Firm B possesses sufficient opportunity recognition ability to overcome the Discovery phase, it is slow to move forward in the Formation phase. This point is further elaborated in a second study that focuses on operational agility and how it manifests in the context of the circular economy.

Third, high industry clockspeed, coupled with low turbulence and magnitude of industry change, may also help position each firm to succeed in their efforts to integrate food waste. With the combined factors of needing to be strategically flexible and low exogenous variability, firms within the food industry are theoretically better positioned to exploit opportunities of sourcing food waste. A limitation to this finding is 1) the limited number of firms that were interviewed, and 2) the fact that firms from other industries have not been contacted. To solidify this finding, further cross-sectoral research needs to be conducted, as there is a possibility of revealing firms from slow clockspeed industries that have quickly recognized and implemented opportunities to source waste.

Finally, there may be a connection between being passionate about sustainability and pursuing opportunities related to the circular economy. This phenomenon can be seen most clearly in the Firm D which, despite having no prior knowledge about the circular economy and limited cognitive learning, decided to pursue the possibility of sourcing waste. However, more firms need to be interviewed in order to further investigate this pattern. As explained earlier with contrasting information from Firm C, “passion” for sustainability may be *beneficial*, but not *necessary* in prompting a firm to pursue opportunities around the circular economy.

A possible **next step** to investigate this phenomenon would be to collect data on decision-making processes of each firm to better map their cognitive frames. Another next step would be to examine a connection between *top management* alertness and prior knowledge to *organizational* cognitive learning. Simply put, would organizational cognitive learning trickle down to high alertness at the top management level or are these fairly independent? To further complicate the issue, only one or two representatives have been interviewed at each firm; individual recollections of firm culture and claims to

innovation may differ. Thus, there is a need to contact additional people at every firm to explore further. Further, only firms which have agreed to try an source waste were interviewed, whereas firms that have declined the opportunity have not. Due to the possibility that another firm in the food industry possessing similar levels of Cognitive Learning could have *declined* the opportunity offered by CTTEI, it is uncertain whether prior knowledge, cognitive learning, and exemplar cognitive frames are necessary for a firm to identify the possibility of sourcing and using food waste in their products.