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ABSTRACT

Knowledge mobilization has been proven crucial to increasing organization's efficiency, improving profitability and achieving competitive advantage. The paper aims to explore an approach to integrating knowledge mobilization within agri-food supply chains to enhance collaboration of all value chain actors and achieving a holistic reduction of waste. The research focus will be on the identification of knowledge brokers, artefacts and channels in order to facilitate knowledge mobilization crossing boundaries to reduce agri-food wastes. Cauliflower from Brittany, France's largest cauliflower production and export region, provides the data underlying the following analysis. Research methods includes semi-structured interview and documentation for data collection and thematic analysis for data analysis. This study has great potential in helping make the right supply chain decisions for eliminating lean wastes in agri-food industry.

Keywords: Knowledge Mobilization, Knowledge Brokers, Artefacts, Knowledge Channels, Muda (waste) Reduction, Agri-food Supply Chains

1. INTRODUCTION

Over the last decade, knowledge has become the engine of economic development (Brinkley, 2006). For the agricultural sector, knowledge management is used to develop new technologies to improve the quantity and quality of products it can produce (Semeon et al., 2013). In rural areas, the economic welfare of households depends on the decisions they make about the use of experience, information and knowledge. Therefore, knowledge management is also vital for increasing the growth of the agriculture sector (Semeon et al., 2013, Chyi Lee and Yang, 2000). Knowledge management in agri-food supply chains emphasizes collaboration since knowledge is created collectively in groups through mechanisms of networking and communication (Hartwich et al., 2007).

Lean manufacturing, a quality management approach initially developed to eliminate waste in Japanese corporation, Toyota, in the late 20s century, is defined as 'a system that utilizes fewer inputs and creates the same outputs while contributing more value to customers' (Womack et al., 1990). After decades of development, lean has expanded to further theories and was summarized into lean thinking that requires collaboration of all value chain actors with a common goal to boost customer satisfaction (Womack and Jones, 1997). Nowadays, its application is not only limited to the automobile sector, but also in other sectors particularly the agri-food industry (Dora et al., 2014; Zokaei and Simons, 2006). For example, it has been applied extensively to identify waste in the food industry, initially by Tesco in the late 1990's (IFR, 2007).

However, the fragmented nature of agri-food supply chains as a critical challenge is hindering knowledge production which leads to low levels of productivity (Cagliano et al., 2016; Anastasiadis and Poole, 2015). Thus, knowledge-based solutions such as lean has been proposed during the past to overcome the problem of the negative impact of fragmentation. The objectives of the lean are to maximize value and minimize waste within specific techniques (Childerhouse et. al., 2003). The lean principles are to increase the quality of products, increase value by eliminating waste and increase flow through the process. Knowledge mobilization differs in terms of what knowledge is to be transferred and how it is to be communicated (Eppler, 2006). The process of knowledge mobilization requires more shared interaction between decision-makers and experts. Given the fragmentation of agri-food supply chains, chain actors have few understandings about an issue (e.g. waste reduction), however they consequently can gain a complete comprehension by interactively aligning their mental models through knowledge mobilization. This means that when knowledge is shared between experts and decision makers, they create context-specific knowledge that can be used to create fresh perspectives or acquire new skills (Eppler, 2006; Chen et al., 2017). From all above, knowledge mobilization and lean have a positive influence on agri-food supply chains.

This study attempts to investigate what knowledge mobilization strategies can reduce waste in agri-food supply chains. Therefore, the identification of knowledge brokers, artefacts and channels to formulate knowledge mobilization strategies and the identification of lean wastes in agri-food supply chains have been emphasized in this study.

The paper is organized as follows. After this introduction, the second part discusses literature on knowledge mobilization and lean supply chain decisions in agri-food sector. Through literature review, a theoretical framework has been developed in part three. The fourth part is the research methodology for collecting empirical evidence, and the fifth part is the case study in the Brittany cauliflower supply chain, followed by part six on conclusions.

2. LITERATURE REVIEW

This review mainly focuses on two research contexts: knowledge mobilization and lean decisions in agri-food supply chains.

2.1 Knowledge mobilization

Theoretical underpinnings of knowledge mobilization can be understood in terms of three primary perspectives: information-processing, cultural and political perspectives (Carlile, 2002; Carlile, 2004; Kellogg et al., 2006). Linear, one-way approach to knowledge mobilization has proven problematic in practice, therefore, it has been complemented by a number of models and frameworks, which also take into consideration cultural and political factors that shape the interactions among chain actors. These emphasize the bidirectional nature of knowledge mobilization, and the importance of contextual factors and the need for active engagement, interaction and collaboration in managing knowledge mobilization (Carlile, 2004). Knowledge boundary has been recognized as discontinuities that highlights the nature of cultural and political restrictions, and collaborations has been identified as the solution to successfully bridge any boundaries and fulfil the goal of knowledge mobilization (Kellogg et al., 2006). Boundaries can be defined as sociocultural differences between practices that can lead to discontinuity in action or interaction. This understanding of boundaries partially overlaps with the notion of gaps popular in the knowledge mobilization literature, where gaps are seen as the network holes, spaces and missing ties that create between group problems and opportunities for their resolution. The barriers to knowledge sharing crossing boundaries can be classified as *syntactic* (difference in language), *semantic* (difference in meaning) and *pragmatic* (difference in practice) (Carlile, 2002; Carlile, 2004; Kellogg et al., 2006). Three types of bridges can be identified from literature to cross these knowledge boundaries, *Knowledge brokers:* Middlemen, intermediaries or agents who act as negotiators, interpreters, messengers or commissioners between different merchants or individuals (OED, online). Knowledge brokers can exist in individuals, organizations and structures. Early examples of brokering include an informal network that connected to agriculture sector to 'county agent' in order to disseminate innovations to farmers in the USA (Rogers, 2003).Later, consultancy has been considered as a delegate for knowledge brokers (Jacobson et al. 2005; Sin, 2008). Until relatively recently, in agri-food contexts, knowledge brokering is often performed by organizations with professional roles, that is, the agricultural development agents (extension workers). Support groups act as brokers between the available knowledge and the individual needs of farming households. It is well known that the success of the implementation of new agricultural technology depends on the success of communication between the agricultural experts and the farmers (Islam, 2010).

Boundary objects: Artefacts possessing interpretative flexibility that allows them to overcome syntactic, semantic and pragmatic boundaries, hence contribute to knowledge mobilization (Kislov et al, 2011). For example, the knowledge processed are normally stored in knowledge artefacts pertaining to technology, laws or regulations, and so on (Semeon et al, 2013).

Boundary interactions: At the supply chain level, the way to identify, interact and exploit the value chain has been shown to overcome knowledge boundaries (Mason and Leek, 2008). Knowledge mobilization (vertically and horizontally) within organizations appears to be affected by knowledge communication mechanisms (e.g. ICT, conferences, training and community of practice) (Araujo et al., 2003; Kislov et al, 2011). Mason and Leek (2008) uncovered that the categories of 'hard' and 'soft' knowledge communication mechanisms can drive improvement to dynamic business models across supply chain networks.

2.2 Lean in agri-food supply chains

Lean penetration into agriculture sector is slow due to the perishability of a wide range of food products, complexity of the food supply chain and consumers' dynamic preferences (Dora et al., 2016). Cox and Chicksand (2008) argued that there is a clear need to understand the specific characteristics of the food supply chains, otherwise the lean manufacturing practices may not bring the expected result or be unfruitful. Three key characteristics of the food product market are identified: demand uncertainty, customer order lead time, and supply chain lead time allowance (Kittipanya-ngam et al., 2010). Demand uncertainty needs the development of product variety, updating packaging and improvement of product shelf life and so forth. The other two characteristics require high responsiveness by the supply chain management and greater supply chain flexibility. In terms of waste reduction, the flexibility requirements also support the same goal in perishable food supply chains (Taylor and Fearne, 2009; Ahumada and Villalobos, 2009; Kittipanya-ngam et al., 2010).

Scholars agree that one of the main principles of lean is waste reduction (e.g., Bhamu and Sangwan, 2014). Ohno (1988) divided wastes into seven categories. Shingo (1989) listed the same seven kinds of wastes identified in the Toyota Production System. More recently, the seven types of waste are further described by Liker (2003). Nowadays, lean in agri-food sector involves the same seven lean wastes, they are overproduction, defects, inventory, over processing, transport, motion, and waiting (De Steur et al., 2016). It is necessary to reduce waste at different sections of the chain in order to pursue overall efficient and effective supply chain's network performance. For example, in a study analyzing pork production supply chain, incorrect weights and fat levels at primary production were considered as defects (Taylor, 2005). As a lean waste, overproduction has appeared in food processing mainly due to misalignment of production with consumer demand for ready to eat foods (De Steur et al., 2016).

2.3 Research gaps

Despite several studies in the area of knowledge mobilization, the clear evidence surrounding this issue is relatively weak, especially the knowledge artefacts strategy. In addition, related work to knowledge mobilization was mainly conducted in the health sector, but there is a lack of empirical study focusing on agri-food supply chains (Levin, 2008). Moreover, knowledge communication mechanisms are not systematically described, so knowledge channels remain intangible. This has caused poor coordination of the collective knowledge among supply chain actors to enhance decision support systems (Neal, 2015; Ali et al, 2016).

Given the benefits of artefacts in knowledge mobilization field, it has been paid more and more attention nowadays. According to Mariano and Awazu (2016), through the use of artefacts, knowledge could be better organized and performed in organizational contexts. Therefore, when implementing a knowledge mobilization process, decision-maker and experts would be aware of the role of artefacts and their related benefits. There are several manifestations on artefacts in the knowledge mobilization (Mariano and Awazu, 2016). For instance, artefacts are defined as sketches and diagrams (Holford, 2016); intranet applications, enterprise resource planning system, repositories and quality management systems (Hustad, 2007); digital earing instruments (Kreiner, 2002); photographs or non-immersive photorealistic virtual reality (Rountree et al., 2002); consolidated knowledge platforms (Padova and Scarso, 2012); referrals, laboratory reports and instructions, as well as routines and rules, standards, drawings and documentations (Maaninen-Olsson et al., 2008); software development project patterns (Martin et al., 2012); co-created assessment tools (Kajamaa, 2011); ZingThing™ groupware and cognitive artefacts (Singh et al., 2009); and principles and methods for evaluation (Zuo and Panda, 2013).

knowledge communication mechanisms play an integral role in knowledge mobilization process (Mason and Leek, 2008). Two different types of knowledge communication mechanisms are identified: hard and soft. Hard mechanism can be understood as an institutionalized way to mobilize knowledge by written documents that may be available in paper or in electronic format (Hansen and Hass, 2001). Research on hard mechanism to knowledge mobilization has examined issues such as explicit knowledge can be mobilized more easily through many formal channels for gaining attention in supply chains (Hasselbladh and Kallinikos, 2000; Morris et al., 2005). Hutchinson and Quintas (2008) indicated that formal channel concerns policies, plans, structures and initiatives that are named and governed by the concept of knowledge mobilization. In contrast, soft mechanisms promote the social production of new knowledge that allows chain actors to adapt and apply their learning about specific skill sets in their own specific cultural and institutional contexts (Taminiau et al., 2009). Research on tacit knowledge has emphasized the role of soft mechanisms in facilitating knowledge mobilization (Reagans and McEvily, 2003). Moreover, it seems difficult to divorce from these two knowledge communication mechanisms and they are both found to be applied in the knowledge mobilization literature. Examples are IT system (Egbu and Botterill, 2002); training and organizational culture (Moffett et al., 2003; Oyemomi et al., 2018); informal communication and interaction (Taminiau et al., 2009; Egbu et al., 2003) and learning environment (Davenport and Prusak, 1998).

The Japanese word Muda is synonymous with waste. In the literature, Muda is considered to be waste, while the main principle of lean is waste reduction. Thus, it is interesting to use the Muda concept on a program to reduce waste. Besides that, there are few literatures related to lean penetration into agriculture sector, especially extend lean to the entire supply chain in order to achieve a holistic reduction of waste (Dora et al, 2014; Zokaei and Simons, 2006).

Since knowledge mobilization and lean are described in their respective way, and knowledge artefacts and knowledge communication mechanisms (knowledge channels) as the important parts of knowledge mobilization, are rarely mentioned together. In order to address these gaps mentioned above, this study attempts to explore a way to merge knowledge mobilization with lean decisions (e.g. waste reduction) in agri-food supply chains.

3. THEORETICAL FRAMEWORK

Based on the review of literature in Section, a theoretical knowledge mobilization framework is proposed, as shown in Figure 1. On the left hand side of the framework, it is the integration of knowledge brokers, artefacts, and knowledge channels to support knowledge mobilization crossing boundaries. On the right hand side are the seven types of waste. The arrow from the left to right represents the impact of knowledge mobilization on waste reduction.

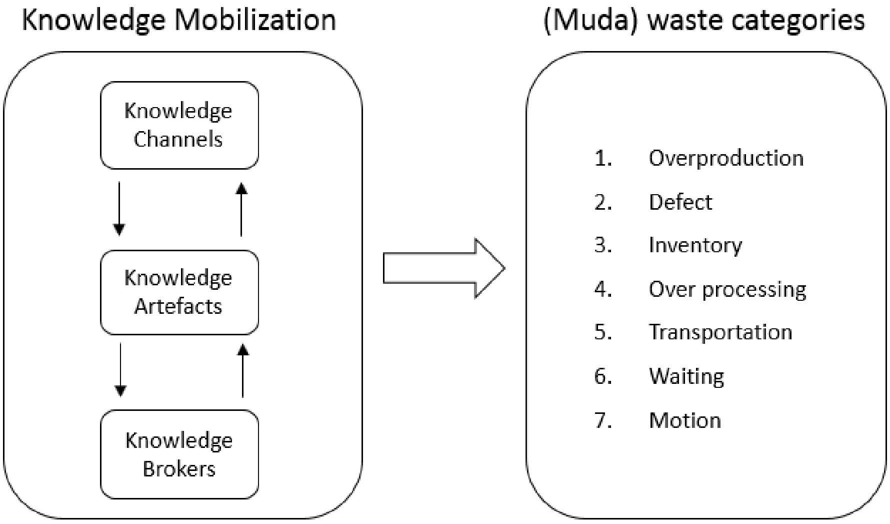

Figure 1: A knowledge mobilization framework

The seven types of wastes have been refined by Liu (2013) as a model used in supply chain management scope, which will be used as the foundation for this research but will be extended to agri-food supply chains:

1. Overproduction: producing too much or too soon required by the downstream operations in the supply chain.
2. Defect: products provided by suppliers/upstream operations have quality problems or poor delivery performance.
3. Inventory: surplus storage between up-stream and down-stream operations in the supply chain.
4. Over processing: non-value adding operations resulting from poor supply network design.
5. Transportation: moving products among supply chain actors unnecessarily.
6. Waiting: long lead-time for products from upstream operations/suppliers.
7. Motion: poor workplace organization resulting in poor ergonomics in the supply chain.

Finding waste is a difficult task and various knowledge mobilization tools are needed to analyze the physical product and information environment. Therefore, in terms of knowledge mobilization process, relevant agricultural supply chain knowledge should be captured from the knowledge sources. These knowledge need to be transferred to agricultural knowledge brokering by using suitable communication mechanisms. Knowledge then is applied by all chain actors for making lean decisions in various agricultural areas. The following section discusses the research methodology which supports empirical data collection and analysis to validate the theoretical framework. .

4. METHDOLOGY

4.1 Data collection approach

According to Jasti and Kodali (2014), the most popular empirical research methodological approach in the field of lean is the case study. Moreover, the majority of the lean studies in the food sector is based on the case study approach in order to concentrate on lean manufacturing techniques (Dora et al, 2014). Case study approach has several advantages: it can more easily discover a research problem and find out a range of ideas about the problem.

It can also help to understand different perspectives between groups of participants. Moreover, such an approach can answer what, why and how research questions necessary to make the study more in depth (Morse, 2003). Therefore, the case study approach has been used for this study. Two data collection tools are conducted including semi-structured individual interviews and documentation. Interview questions are derived from the review of relevant literature and the theoretical study adopted. The interview questions are pre-tested with academicians and practitioners to ensure all items are clearly understood with no ambiguity. According to Saunders et al. (2009), an individual interview is a conversation between two persons which is designed to elicit the interviewee's knowledge and perspective on knowledge mobilization and waste reduction in this study. Individual interviews are not only useful for exploring the interviewee's understandings, experiences and perspectives of an issue, but also allow the interviewer to ask into a complex issue, to learn more about the contextual factors that govern individual experiences. The authors also have access to company databases include the order data, point of sale data and delivery data and so forth to complete data collection process.

4.2 Data analysis approach

The thematic analysis was employed to analyze data collected through interviews in this study. Thematic analysis is one of the approaches in analyzing qualitative data; it concentrates on the themes and patterns, emphasizing, pinpointing, examining and recording patterns within the data (Braun and Clarke, 2006). Thematic analysis is normally concerned with experiences focused methodologies (Jayawickrama et al., 2017). According to King and Horrocks (2010), a number of themes are identified by the following three stages:

- Descriptive coding (first-order codes): the researcher identifies those parts of the transcript data that address the research questions and allocates descriptive codes throughout the whole transcript.
- Interpretative coding (second-order themes): the researcher groups together descriptive codes that seem to share some common meaning and create an interpretative code that captures this.
- Defining overarching themes (aggregate dimensions): the researcher identifies a number of overarching themes that characterize key concepts in the analysis.

In this study, the second-order themes were identified using first-order codes and they were categorized as aggregated dimensions to reveal knowledge brokers, artefacts and knowledge channels in order to enhance knowledge mobilization and achieve lean supply chains. Then to discover the main identified wastes and the solutions to reduce the wastes. Each interview transcript was read by several times and coded on the basis of terms or phrases used by participants (See Figure 2).

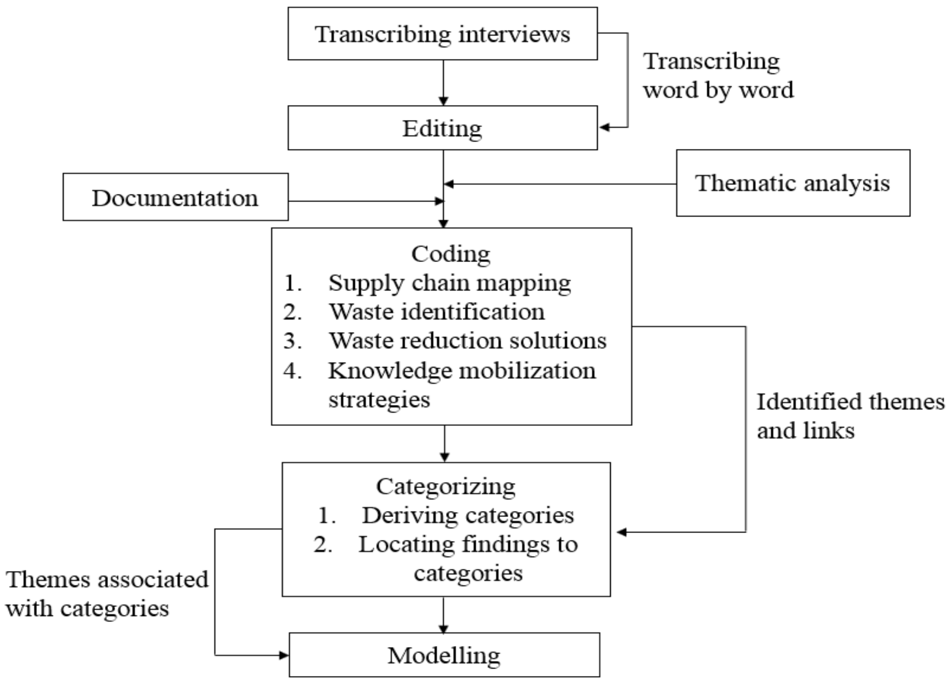

Figure 2: Analysis process

4.3 Sampling techniques

This study adopts purposive sampling technique over other techniques available under non-probability sampling method because in purposive sampling, participants are selected based on the research objectives and this ensures adequate representation of important themes. For this reason, it is sometimes known as judgemental sampling. It is often used when working with very small samples such as case study research (Neuman, 2013; Saunders et al., 2009). France is a key player on the market as the world's sixth largest cauliflower producer. Brittany is the highest producer of cauliflower in France. Thus, its choice as a sampling state was appropriate (Breton cauliflower, 2015). Data was collected from chain actors in the Brittany cauliflower sector. Through semi-structured interviews, 9 chain actors were interviewed, which include 3 producers, 1 cooperative, 2 logistics service providers, 1 wholesaler and 2 retailers. The respondents were business owners or company managers who were responsible for major supply chain activities in the companies. Some questions were reworded to improve validity and clarity based on the feedback from the pilot test.

The demographic profile of the participants in the interviews are detailed in the Table 1. The participated CEOs and company managers are all highly educated and experienced.

Table 1: Demographic profile of the respondents

Types of classification	Category	Number of respondents
Gender	Male	8
	Female	1
Age	25-34 years	1
	35-44 years	5

	45-54 years	2
	55-64 years	1
Education	Doctorate	1
	Master	3
	Bachelor	4
	High School/Technical training diploma	1
Position	CEO	3
	Company manager	6
Work experience	2-5 years	1
	6-10 years	5
	More than 11 years	3

5. CASE STUDY

5.1 Cauliflower supply chain mapping

Even if China and India share 70% of the world production, three-quarters of the French production of cauliflower are grown in the North West of France, on the Breton coast. France is the sixth largest producer of cauliflowers in the world (representing 2% of global production). China comes first with 45% of global production (the equivalent of 7 million tons), followed by India, Italy, Spain and the United States (Breton cauliflower, 2015). Besides that, 80% of French production takes place in Brittany, representing around 300,000 tons per year. Brittany is the leading region for cauliflower production in Europe. It contains around 1500 cauliflower producers. 80% of Breton farms grow cauliflowers, on an average plot of 27 acres. That represents a production surface area of 45,000 acres, or 95% of the surface area dedicated to cauliflower growing in France (Sharma et al., 2005; Singh et al., 2018; Stringer et al., 2009).

The first stage of this study is value chain mapping and identifying the supply chain members for cauliflower. The data were collected from the reports of CERAFEL (Association of Producer Organizations vegetables, fruits and horticulture) and the Chambers of Agriculture of Brittany. The daily operation model is shown at Figure 3. The operations are based on orders: the producer provides products to the cooperative. The retailer places an order with the wholesaler. All products are gathered in the cooperative and are transported via cooperative to the wholesaler and the retailer. In this model, the cooperative takes an important role in managing the supply chain because it is responsible for the vulnerable producer. Moreover, cooperatives increase producer’s income in a number of ways. These include: raising the general price level for products marketed or lowering the level for supplies purchased; reducing per-unit handling or processing costs by assembling large volumes, e.g., economies of size or scale; upgrading the quality of supplies or farm products handled (Valentinov, 2007; Mather and Preston, 1980). The model also brings savings and more efficiency into the process. For example, shelf availability has improved a lot. Each day the cooperative checks the remaining shelf life of each product item manually in order to find out the impact of the buffer stock on product freshness. As a result, the remaining shelf life decreased by more than one day, and it increases the risk of products becoming waste. Therefore, there is still room for improvement in balancing availability and lost profit.

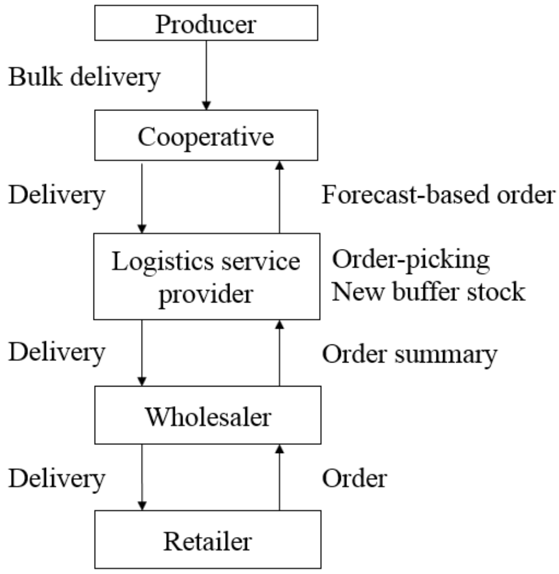

Figure 3: Daily operation model

Since the Brittany cauliflower sector suffered from various problems such as shelf-life management, demand forecast and waste management, several case features have been identified in Table 2.

Table 2: Case features

Features	Cauliflower
Time period studied	One month
Product shelf life	7-21 days
Structure of supply chain	Producer, cooperative, logistics service provider, wholesaler, retailer
Main problems	Inadequate response to demand changes; High inventory levels in stores; lots of wasted products at the retailer; products reach the store with a short remaining shelf life, inaccurate ordering

5.2 Waste identification in cauliflower sector

The second stage of this study is identifying the wastes in the Brittany cauliflower supply chain. Muda (waste) can take various forms. The typical types of Muda are as follows:

- Muda of overproduction
- Muda of inventory
- Muda of defects
- Muda of transportation and motion
- Muda of over processing
- Muda of waiting

Typical examples of Muda in the Brittany cauliflower sector are identified by analyzing interview data using the thematic analysis method. This method in this stage is to examine findings compared with the pre-defined framework. The findings indicate main identified wastes are Muda of overproduction, Muda of inventory and Muda of defects *(Aggregate dimension)*.

Muda of overproduction is a constant issue because of weather conditions *(second-order theme)*. To quote the producers:

"The first trimester of 2018 experienced an exceptionally cold and wet transition into the new year of production. Throughout Europe, we saw heavy rainfall and exceptionally cold temperatures until mid-April. The most difficult is winter harvests. A possible consequence is the postponement of the harvest period by several weeks. The cauliflower harvest in Brittany was also delayed. We only saw larger harvest volumes at the end of April. Expected revenues were lower than planned because of the overproduction." (First-order code)

At the same time, an outdated forecast can result in Muda of overproduction as well *(second-order theme)*. Producers said:

"Customers are not involved in the company, that is, not giving feedback for improvement work which is a big issue to us." (First-order code)

The goal of inventory management is to produce just what the customers want for delivery when they need it. However, excessive inventory is always caused by overproduction and poor planning in transportation and unbalanced process flow (Heymans, 2015) *(second-order theme)*. Following is the remark of logistics service providers:

"In many cases inventory lying idle or waiting. The implementation of First-in-first-out between packaging and logistics ensures that no unnecessary product would be kept waiting." (First-order code)

Muda of defects usually arise from microbial spoilage associated with a number of factors including short shelf life, variation in size and shape and scrap or poor quality. Defects also occurred in storage where the products are exposed to ambient temperature for prolonged periods (De Steur et al., 2016) (*second-order theme)*. Following is the comment of the cooperative:

"Poor quality is a big challenge especially in cooling and transportation stage. The application of total quality control to improve quality is most relevant. In our company, we have the evaporative coolers that are used to extend shelf life of products and avoid spoilage by keeping products at lower-than-room temperatures without having to use electricity." (First-order code)

5.3 Solutions for waste reduction

The third stage of this study is exploring the solutions for waste reduction in the Brittany cauliflower supply chain. The thematic analysis approach here takes a more exploratory perspective, encouraging to consider and code all data, allowing for new impressions to shape the interpretation in different and unexpected directions (Attride-Stirling, 2001). The findings of waste reduction solutions are new compared with the pre-defined framework. The following solutions are outlined in the interviews:

Overproduction can be reduced by collaboration of the cauliflower supply chain (*second-order theme)*. The producers said:

“There is a lack of proper communication structure is a major obstacle in reducing the overproduction. My organization have not adopted advanced forecasting techniques which is identified as cause of the waste between the producer and the retailer. Thus, consolidation is the key to remove this waste.” (First-order code)

In addition, policy changes such as price policies favor to the producers will also help to solve the overproduction waste.

Inventory can be backward integration with the producers. The production planning and scheduling at the cooperative also need to be paid special attention.

Defects can be eliminated by increasing shelf life and selecting the right technology and proper storage (*second-order theme).* The respondents from packaging center mentioned:

In case of short remaining shelf life, we have the opportunity to repack or freeze products. There is a computer system to record the products’ date of expiry. The other chain actors have access to this data. The poor quality sometimes will be recycled by selling to the canned company at lower price. (First-order code)

Transportation and motion can be addressed with large-scale units located near to farm fields and collaborate the outbound shipment through large distributors.

Over processing is always occurred in food processing industry. According to the interviewees’ point of view, it is not compatible with the fresh cauliflower supply chain. But, they think consolidation of industry is again useful for removal of this waste.

Waiting can be reduced by integrating backwards till farmers in the form of contract farming. Again, policy change may be useful to remove the problem as well.

5.4 Knowledge mobilization strategies in cauliflower sector

The fourth stage of this study is exploring the knowledge mobilization strategies that are used to enhance lean decisions (e.g. waste reduction) in the Brittany cauliflower supply chain. On one hand, knowledge artefact and knowledge channel are identified as the main tools of knowledge mobilization. On the other hand, in order to connect networking and communication to support lean, some knowledge mobilization studies have also highlighted the role of knowledge brokering in the agri-food sector. Knowledge brokering contextualizes the knowledge by communicating with farmer groups or producer associations. Furthermore, in linking rural farmers with the national and international researchers, the farmers’ community, research institutes or training centers could also develop a self-driven system to manage all crucial issues. In agri-food sector, agricultural authorities are the ones who have the whole idea about the agri-food supply chain and have core information about its operations. They have to keep communicating with the farmers and give necessary advice. Acknowledging farmers is the key to streamline the supply chain process where the authorities can create demand driven mindset by providing a sufficient knowledge on consumer requirements, farmer techniques and so forth. In Brittany, there are research and experimentation centers (e.g. CERAFEL-association of producer organization; VEGENOV-biotechnology; OBS-seed selection and product variety; CATE-greenhouse and open field) and training center (e.g. ISFFEL), which are act as the role of knowledge brokers (See table 3).

Table 3: Main activities within knowledge broker

Knowledge broker	Main activities
CERAFEL	Supportive agricultural policy for food, spices and allied agricultural crops; stable prices for agricultural products; increase production in selected crops; customer friendly and result oriented administrative system; investigation on marketing issues.
VEGENOV	Cell biology; genetic fingerprints of plants and their pathogens; crop protection (stimulation of plant defenses, disinfection of greenhouses and shelters, products pesticides ...); sensory and nutritional quality of fruits and vegetables; monitoring, consulting and support of innovation.
OBS	Planting breeding; increase yield per plot; introduce resistance and improve plant efficiency; satisfy specific consumer expectations
CATE	Guaranty competitiveness of the products (production costs, commercial quality); development of sustainable agriculture and food security; work on diversification and segmentation
ISFFEL	Collection, analysis and dissemination of market information; analysis on consumer behavior; conducting surveys to establish benchmark conditions; researching on problems related to the input supply and support services

In terms of what knowledge mobilization strategies (knowledge broker, artefact and knowledge channel) can reduce the identified major wastes, the findings are concluded in the Table 4.

Table 4: Lean waste and knowledge broker/artefact/channel matrix

Knowledge broker	Knowledge artefact	Knowledge channel	Muda (waste)
• CERAFEL • VEGENOV • OBS • CATE • ISFFEL	• Policy • Operating system • Database • Web portal • Content-management-system (CMS) platform • Documents • Reports • Protocols	• IT system (Internet and Intranet) • Training • Appraisal and reward system • Community of practice (CoP) • Social events (Team building) • Personal relationships • Discussion board/forum • Informal communication channel: meetings, telephone, video and audio conferences, voicemail, email etc.	• Overproduction • Inventory • Defects • Transportation and motion • Waiting • Over processing

For example, in order to reduce the overproduction waste, adhering to the production schedule which stored in protocols can generate the right amount of output. In addition, the internet has helped chain actors to communicate better and information can be shared over a wide geographical area (Connelly and Kelloway, 2003). The internet also can help chain actors to learn more about the best practices of others, which could save time and money. Therefore, the internet has become a very useful source of information.

In order to reduce the inventory waste, operating system optimization can reduce the level to the minimum. For instance, in Brittany, lacking adequate storage forces producers to deliver all food products to the cooperative, however, in the cooperative, there are evaporative coolers which strictly followed the technological rules to store products. Technological system application is transferred by trainings between experts and grass roots. In Brittany, ISFFEL is a training center which provides training courses in the trades of commerce, distribution, logistics and quality to meet the needs of customer requirements. Through such training, chain actors have a better understanding of the agriculture knowledge and the concept of knowledge mobilization.

In order to reduce the defects waste, quality control which is normally stored in the documents and reports have a positive influence on preventing the obsolete products occurred. Improving standards by documenting them and training operators can reduce the defects waste as well. Then, the community of practice (CoP) has emerged as one of the most widely praised approaches to knowledge mobilization in agri-food sector. CoP are “groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (Wenger et al., 2002). CoP provides a platform for innovation among its members. It aims to construct a holistic and inclusive approach to develop actionable knowledge for innovations in agriculture (Cox et al., 2008). In terms of quality control, all chain actors are not only trying to complement, encourage discussion to take place within the CoPs, but also trying to bring members to the attention of others when there may be a potential for synergies. CoP members would play a role by interacting voluntarily among each other to find common solutions to problems. Members learn from each other, discuss new ideas, emerging technologies, share resources to improve their skills through collaborative learning (Ahmed et al., 2007; Scarborough and Carter, 2001).

6. CONCLUSIONS

First, in Brittany cauliflower supply chain, research institutions act as knowledge brokers between the available knowledge system and the individual needs of various chain actors. The technical as well as intellectual capability of development research institutes determines effective mobilization of the agricultural knowledge to chain actors.

Second, two distinct of knowledge communication mechanisms are identified: hard and soft. Hard knowledge transfer mechanisms represent ways of circulating knowledge to develop shared best practice such as knowledge management system (KMS). However, soft knowledge transfer mechanisms foster the social production of new knowledge, allowing actors to adapt and apply their learning about specific skill sets in their own specific cultural and institutional contexts, therefore, communities of practice (COP) seems central to business model improvement.

Our findings also suggest that discarded product is mainly attributed to defects, inventory and overproduction waste categories as described in lean manufacturing. Consequently, the lean methods to reduce wastes are explicitly highlighted in the agri-food industry.

Despite this study offered implications for the development of more mature and reliable knowledge communication channels and mobilization strategies, the agri-food sector can be configured in a variety of different ways. Supply network classification of different products in different regions need to be further clarified. Moreover, this study has limitation that presents opportunities for future research. Different industries may prefer a specific knowledge mobilization strategy in the worldwide marketplace. In this regard, future research should investigate knowledge mobilization in different industries.

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