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## Technology adoption process as an enabler of value innovation within Food & Agribusiness chains

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### **1. Abstract**

Most often technology decisions are addressed in a process driven manner rather than in a strategic way. In our view, when technology choice is worked out from a strategic perspective, it would not only address the process related issues but would also provide added differentiating elements such as better chain partnerships, higher flexibility in terms of product fine-tuning etc. In a process oriented technology decision approach for example, a business is seeking a dehydration technology to enhance the shelf-life of an assortment of slightly lower graded (but edible) fresh products. The same issue of lower grade products could also be approached from a strategic perspective of creating new and differentiating revenue streams. With such a strategic approach, the outcome could be a totally different technology which could offer a higher level of operational flexibility by enabling additional processing possibilities such as extraction of essential oils and anti-oxidants in addition to drying. In essence, a strategic approach to technology could enable a greater level of innovation and differentiation than a fully process oriented approach. In a worst case scenario, a strategic approach could lead to the same outcome as a process approach and in the best case it would lead to a substantially higher level of value creation and flexibility for the business and its chain partners. The objective of this paper is to clarify the strategic approach to the choice of technology and demonstrate how businesses should implement this in practice. To demonstrate the applicability in reality, we discuss 4 different examples to show the relevance of this approach for businesses operating along the entire food chain (including consumers).

*Key words: Technology adoption, Process driven technology choice, Strategic technology choice, Food chain*

### **2. Introduction and research set-up**

Large industrial corporations have been the key users and drivers of technological developments within the food and agribusiness sector. Because of their volume based operations, they have always rightly demanded efficiency and productivity driven innovations. And quite logically, the rest of the technology and equipment industry followed to cater for the demands of their customers (i.e., large industrial corporations). The above approach, in our view has led to two key interrelated challenges namely local optimization and lack of a strategic approach to technology adoption. Firstly, because the technology adoption has originated from an efficiency course of action of one or a few player(s) in the chain/network, this has mostly resulted in loss of efficiency and productivity for the upstream players in the chain thus creating just a local optimization situation. Secondly, because of the focus on efficiency and high volume production it limits the innovation, flexibility and market adaptability.

Here, we argue that the above two reasons namely the local optimization and lack of real innovations are occurring because of the belief that there is a trade-off that businesses have to make between cost-competitiveness and differentiation. Precisely because of this belief, technology decisions are mostly addressed in a process driven manner rather than in a strategic way. In our view, when the technology choice is worked out from a strategic perspective, it would not only address the process

related issues but also would provide added differentiating components such as better chain partnerships, sustainability, economic benefits etc. In this study, we make a serious attempt to enable entrepreneurs and businesses to carry out their technology based decisions strategically rather than in a process driven way.

We make use of main research questions to come-up with a framework which can enable firms to adopt a strategic approach to their technology choice.

*“Can the strategic use of technologies lead to differentiation of the product, flexibility and improve the business competitiveness of food companies?”*

We address the above main research question through the sub-questions indicated below:

- 1. How does a strategic approach to technology choice differ from a process driven approach to technology choice?*
- 2. How could food and agribusiness firms adopt a strategic technology choice to enhance their product differentiation, business competitiveness and agility?*

The core contribution of this paper is a systematic approach which can be leveraged by firms operating along the entire value chain. The approach is suggested in the form of a framework where each business can identify their positioning within the chain and work out their strategic technology choice process without neglecting the dynamics and interdependencies with the chain partners. To demonstrate the applicability in real life situations, we will discuss 4 different examples to show the relevance of this approach for businesses operating along the entire food chain (including consumers).

The rest of the research is organized as follows. In Section 3, we carry out the review of literature that relates with the research subject discussed in this paper. In Section 4, we build-up this research and present the framework which would enable businesses with a strategic approach to their technology choice. In Section 5, we present four different case studies one each for each compartment of the framework introduced in Section 4 to bring out the practical relevance and applicability of the developed framework. Finally in Section 6, we conclude the study and offer some suggestions for further research.

### **3. Literature study and research set-up**

To the best of our knowledge, there is no direct literature addressing the food sector dynamics that distinguishes the strategic vs process approach to technology choice. However, we have derived several useful lessons from the business strategy literature which in some ways have created the required starting points for this research.

Kouwenhoven et.al. (2012) within their framework of innovative entrepreneurship and food waste reduction have indicated new ways of processing for creating value within the food and agribusiness sector. Literature related to specific technology innovations and their effectiveness in overcoming the cost-differentiation trade-off provides key starting points to this study (Allende et al. 2006, Hansen et al. 2013).

Disruptive innovation work by Christenson (1997) which outlines the competitive dynamics between disrruptees and disruptors provides us with good insights related to a strategic approach of a technology choice process. And surprisingly, to the best of our knowledge the disruptive innovation theory has been put to limited use in the context of Food and Agribusiness sector.

The literature related to value innovation [Kim and Mauborgne (1997); Matthijssens et al. (2006) and Berghman et al. (2012)] suggests a strategic approach to creating a differentiated value proposition. While Kim and Mauborgne (1997) demonstrate value innovation at the organizational level the other two studies look at it from a supply chain perspective. In most sectors including the food sector technology is a key intervention and hence it needs to be looked at from a strategic perspective to be able to achieve differentiation either at an organizational level or at a supply chain level. Enabling a strategic approach to technology choice forms the key focus and contribution of this paper.

In the next section, the core contribution of this research which is the technology adoption framework is developed.

#### **4. Technology adoption framework**

To put this research in the right context, here we provide an explanation on the key elements of this paper namely the process vs strategic approach to technology choice in the context of the food sector. While, in a process driven approach the key focus is on a specific technology type to create and utilize the capacity, the strategic approach takes a market perspective. That is to say that the process approach adopts a push approach in bringing the produce (products) to market and the strategic approach focusses on demand pull created from the market side. Another key differentiation is that in a process driven approach the technology choice is less aligned with that of the organizational strategy while in the case of a strategic approach the technology choice is embedded within the main organizational strategy. Finally, and most importantly, the impact of a technology on the business processes of the upstream and downstream players is not taken into consideration in a process driven approach while in a strategic approach the impact of a technology choice on chain partnerships is a key consideration. Because of the above differentiation, we believe that a strategic approach to technology choice enables not only a sustainable business competitiveness, better chain partnerships but also enable much needed flexibility and market relevance for a longer period of time.

Examples of process approach to technology choice could be seeking for a process technology such as dehydration, packaging, pasteurization, extraction, grinding etc. On the other hand, examples of strategic way of defining a technology choice problem could be done in several ways some examples are presented below:

1. Enabling processing closer to the source to increase shelf-stability, product differentiation and flexibility
2. Creating new revenue streams by carrying out processing of lower (edible) grade produce to meet specific market needs
3. Processing in multiple steps. A basic processing closer to the source to increase the shelf stability of the product and a subsequent added value processing closer to the market to offer higher level of responsiveness and market relevance

4. Ability to deliver multiple product types/lines within the same technology infrastructure
5. Changing consumers retailing experience by offering higher level of customization and convenience
6. Enabling higher level of customization, product freshness and better product experience by enabling processing at the level of the consumer

From the above examples, it can be understood that in a strategic approach the objectives are defined in a business/market driven manner and mandates a higher level of effort to achieve the above objectives. Though technology would be a critical intervention in addressing the above objectives profitably, the specifics of the technology and the processes are left open. This enables the possibility for asking certain questions which would not necessarily be asked if the technology process is already well defined. Though this approach might require a higher level of resources and effort at the start, it would present the organization with an opportunity to differentiate and most importantly can protect an organization from making non-strategic investments.

With this understanding of the two different technology choice approaches, we continue further to introduce our framework (in Figure 1).

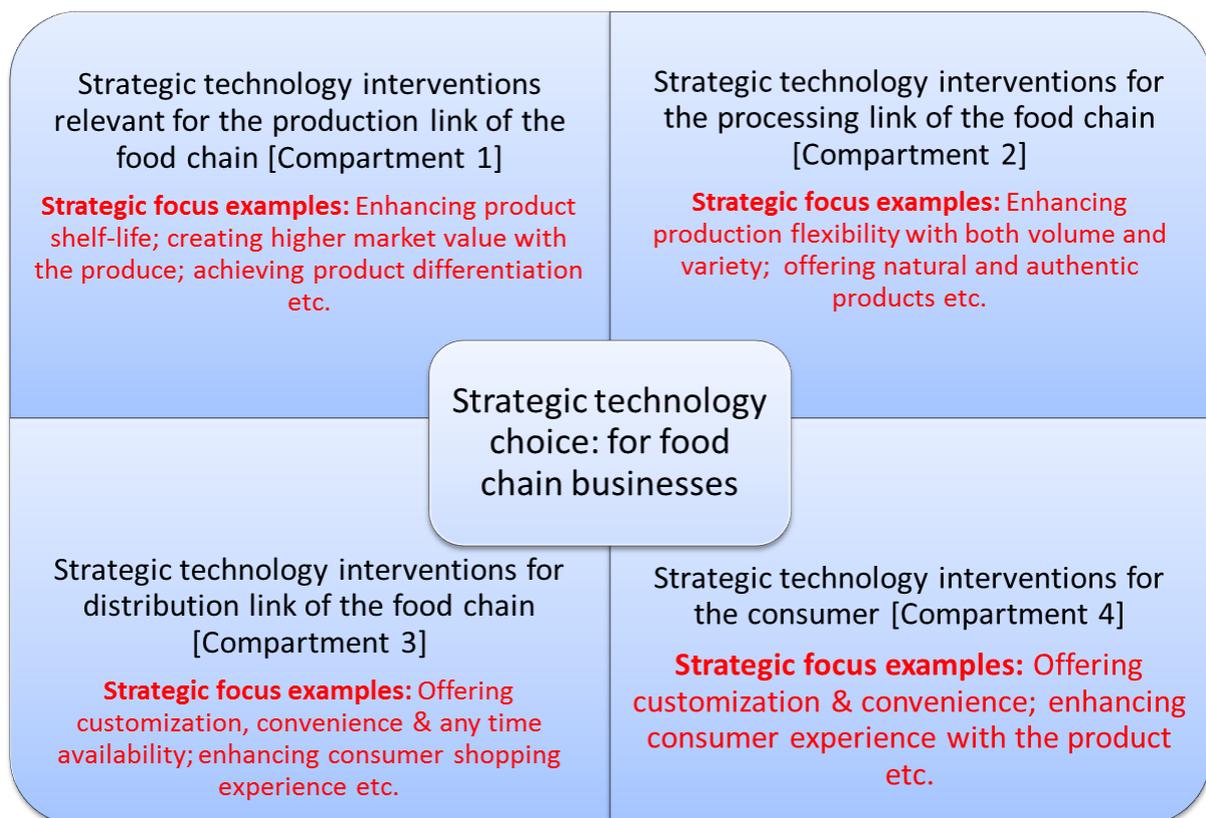


Figure 1: A technology adoption framework for different links of the food chain

Here we present some specific characteristics of the framework presented in Figure 1:

1. The framework provides a starting reference point for businesses to approach their technology choice process in a strategic manner. To realize this objective, the framework provides a guideline on strategic choices that businesses operating at different levels within a food chain could make. Subsequently in this study when we discuss a specific case study for each compartment of the framework the applicability of this framework to a specific business would become much more clearer
2. This framework is relevant for businesses operating along the entire value chain irrespective of their positioning in the chain [growers, processors, distribution and consumer]. The advantage of having such a framework is that each player operating in the chain can place himself within one or more components of the framework. Furthermore and most importantly, a player is able to understand the influence his/her decision will have on other chain partners.
3. As the framework position growers and consumers within the same framework it should remind businesses to make the consumer relevance and go-to-market approach as an integral part of their technology decision process

Coming to the framework, the first compartment deals with growers and here we demonstrate how growers can adopt a strategic approach to leverage the right technology possibilities and become more market driven and increase their market scope. Some of the strategic challenges businesses at this upstream end of the chain are confronted with could be defined as:

- Lack of product variety and productivity differentiation because of standardization of production inputs (such as seeds, fertilizers and pesticides)
- Lack of sufficient and timely information of critical production factors [external and internal] and hence no valuable decision support tools
- Lower shelf life for their products offering them a short time-window for selling their produce
- Insufficient demand and lower price realizations during the peak production periods
- Higher level of aesthetic specifications imposed by downstream partners leading to perfectly edible left-overs
- Complete dependency on the channel partners for their sales
- Lack of understanding of the market trends and customer preferences in the category of their operations

The objective here is not to provide an exhaustive list of the strategic challenges but to give an indication on how the real strategic challenge could be defined. Once the issues to be resolved are defined in the above manner, it is possible to seek for solutions that enable them to address these issues. For example, creating a product variety differentiation could be obtained by investing in customized breeding programs complimented by right positioning at the market level. Most of the post-harvest & demand side issues could be addressed by investing in appropriate primary and secondary processing. Substantial developments that are taking place in the world of ICT could enable them with the right and timely Information thus enhancing their timely decision making ability and business effectiveness.

Within this study we discuss a case of a modular processing technology adopted at the level of the dairy farmer to address the issue of shelf-stability, differentiation and higher incentives. In the context of the case we shall also discuss the dynamics of value chain relationships; sustainability and other differentiating elements that a strategic technology intervention could bring to the table.

The second compartment deals with the subsequent value addition step in the chain which deals with the processing and in a few cases also on marketing and branding elements of the processed products. Strategic priorities at the processing link of the chain could be:

- Flexibility with the products that they process to be able to quickly adapt to the changing consumers preferences
- Offering consumer base with more authentic products with natural ingredients
- Offering better health benefits through the product offerings without altering its key value propositions (such as taste, flavor, shelf-life, convenience etc.,)
- Increasing the sustainability in as many business processes as possible

Once the strategic priorities are defined in the above manner, it is possible to seek for solutions that enable them to address these issues. Within this study, we discuss a technology intervention (Controlled Instantaneous Pressure Drop) which has potential to address several of the strategic priorities defined above. In the process of discussing this case study (in the next section) we will highlight all important elements of the technology and the how it connects with the strategic priorities defined above. At this point, it is important to bring out another important observation which has to do with the usage of the technology. Our claim here is that even in cases when the same technology choice is made with both these approaches, the possibilities to explore and exploit the true potential of a technology is higher with a strategic approach.

The third compartment deals with critical retailing component of the chain. As this step establishes the connection between the product and the consumer it has significance relevance and importance for all the players operating within the food chain. Strategic priorities at the distribution link of the chain could be framed as:

- Enabling convenience and all-time (24\*7) product availability to the consumer
- Enabling product customization possibilities to the extent possible
- Offering a large but complimentary assortment of products
- Creating a two-way interaction with the consumer

Once the strategic priorities are defined in the above manner, it is possible to seek for solutions that enable them to address these issues. Within this study, we discuss a technology possibility which addresses the customization, convenience and all-time availability.

Finally, the 4<sup>th</sup> compartment deals with the technology interventions carried out at the level of the consumers. The core objective of any technology interventions at this level should enable a higher level of customization, greater convenience and a better experience with the product. The strategic perspectives defined in Compartment 3 are quite relevant here as well .

For compartment 4 (at the level of the consumer) we address a technology intervention (of a novel coffee maker) which enhances the customization possibility and offers an enhanced home-coffee drinking experience.

In section 5, we will discuss 4 different case studies, one for each compartment, to test the robustness and relevance of the above framework and also to bring out some observations of strategic relevance.

The following elements (which we will demonstrate much more elaborately within the case studies we are developing) holds true for each compartment of the framework:

- In each compartment, there is a greater need for a better understanding of the market conditions and also there is a greater emphasis on taking responsibility for marketing/distribution
- Each of the approach might alter the type and nature of transactions carried out with their chain partners and creates a greater level of interdependencies with other chain partners. This would enable better alignment of incentives.
- The technology approaches indicated might need a reengineering of marketing/distribution (in essence reengineering of the revenue model) or a minor fine-tuning of their go-to-market at the least

We discuss the above elements in the context of the case studies which we discuss in the next section.

## **5. Case study examples connecting to the framework**

In this section, we deal with 4 different case studies one each for each compartment of the strategic technology choice framework developed in Section 4. For compartment 1 (at the level of the grower/farmer), we address a strategic technology choice approach for the case study within a dairy value chain. For compartment 2 (at the level of the processor), we address a strategic technology choice approach for the case study within fruit and vegetable value chain. For compartment 3 (at the level of the retail/distributor) we address a strategic technology choice which is related with smart vending solutions and we briefly explain the case of customized cupcakes or fresh made pizzas. For compartment 4 (at the level of the consumer) we address a technology intervention (of a novel coffee maker) which enhances the customization possibility and offers an enhanced home-coffee drinking experience. In the next sub-section, we start with the strategic technology choice case for compartment 1.

### ***5.1. Case study 1: Intervention for a dairy value chain at the level of the farm [addressing compartment 1 of the framework]***

Here, in this case we discuss the possibility of market driven value addition possibility which offers a strategic possibility at the level of the dairy farmer within a dairy value chain.

On the supply side, quality management and lack of product differentiation offers substantial business side challenges to the dairy farmers such as:

- a. *Quality management*: Milk is a highly perishable product known to be vulnerable to fast growing micro-organisms leading to substantial shelf-life challenges. Short product shelf-life leads to substantial product rejection and loss in revenues for the farmers
- b. *Undifferentiated product*: Raw milk is an undifferentiated product and hence does not guarantee assured demand or margins offering continuous business challenges at the level of the dairy farmer

However on the demand side, globally there is a growing consumer demand for value added products with assured quality and safety dimensions.

The above indicated supply vs demand side dynamics offers a very good platform for a dairy farmer or a group of them to think of creating a differentiated and market driven offering. Below, we present the approach to making this possible.

**Strategic objective to be realized:** “Enhancing the shelf-stability of milk and creating differentiated offering to stay relevant to the market developments”

#### **Technology choice:**

An innovative and modular technology which can enable the transformation of raw milk into value added products can be a very good solution to overcome the supply side challenge and meet the demand side requirements at the same time. The technology is designed to collect, store and cool the raw milk until enough is available for pasteurization. After pasteurization / homogenization it can pack the milk into sachets thus enhancing the shelf-stability of the raw milk and offering quality and safety to the product. Furthermore, the technology offers extra options to make yoghurt/curd with cup filling machines and can also perform cheese production. Adoption of this technology moves value added dairy processing down the value chain as it can process capacities ranging from 5000LPH (liters per hour) (120,000 liter/24hr day) to 10000LPH which is exactly the production output of a medium scale dairy farmer (in the Netherlands) or a group of farmers in tropical countries (such as India).

#### **Impact on the chain and partnerships:**

An intervention such as a modular dairy processing technology at the level of the farmer can impact the value chain in the following manner:

- It reduces the need for high margin, low value adding middlemen who trade on the perishability of raw milk. For any downstream player to exist within the chain he has to add significant value especially in creating better products of market relevance
- The emphasis of chain partnerships will be to create better distribution methods to enable better market information to the milk producers and enabling more efficient means to reach out to the consumers
- This structure creates more interdependencies creating a better alignment of work and incentives

#### **Competitive dimensions of strategic relevance**

The modular processing technology facilitates higher levels of value addition for smaller quantities and more importantly as per market requirements. This ability to process smaller quantities pushes

the value addition further upstream. This increases shelf-life, reduces wastage, improves overall quality and increases the price realization for the upstream players. More importantly, such technology intervention has the potential to increase the profit margins of all value adding players in the chain. As all the value chain players are better aligned with the market and consumer requirements, it enables continuous innovation and business continuity.

In the next subsection we deal with a case study which relates with technology intervention at the level of the processor within a fruit and vegetable chain.

### ***5.2. Case study 2: Intervention within the fruit and vegetable value chain at the level of a processor [Addressing the second compartment of the framework]***

This case study deals with technology intervention within the fruit and vegetable chains and here below we present the supply and demand side dynamics:

1. Fruit and vegetable value chains on the supply side experience the following dynamics that have a direct impact on the realized revenues and profitability;
  - a. Fruit and vegetable production experiences excess supply than demand during peak harvesting periods. This reality combined with shorter shelf-life of the products makes it difficult and expensive not only to store but also to transport over longer distances leading to non-profitable price realizations for the growers.
  - b. The downstream of the fruit and vegetable chain (wholesale and retail) demand aesthetically appealing uniform products. This leads to a substantial leftovers (up to 25% in some cases) of edible products
  - c. The primary and seconding processing of fruit and vegetables also leads to a substantial quantity of perfectly edible fruit and vegetable leftovers
2. The relevant demand side dynamics can be summarized as below:
  - a. There is an increasing demand for novel and pure fruit and vegetable products (such as fruit and vegetable snacks)
  - b. Consumers are keen to have more natural and healthy fruit and vegetable ingredients in the convenient meal choices they are making (such as ready meals, soups, cereals etc.) forcing industrial producers to scout for better ingredients for their product offerings
  - c. There is an increasing demand for extracts (such as plant fibers, essential oils and anti-oxidants) to be used in food and pharmaceutical applications

The above indicated supply and demand side dynamics offer substantial possibilities for value creation with the currently available fresh produce supply. When done in a strategic manner and in proper collaboration, it leads to substantial value creation for all players within the chain and the technology possibility chosen within this case enables to do so.

#### **Strategic objective to be realized:**

“Creating additional market value out of fruit and vegetable products”

#### **Technology choice:**

Controlled instantaneous pressure drop (**CIPD**) is the technology choice that enables several strategic competitive elements. CIPD technology is a "high temperature-short time" HTST treatment, which

requires vacuum & steam generation mechanisms, treatment chamber, chiller and all the electronics/automation for industrial scale production. The CIPD (also known as DIC) process aims to expose the product for a few (5-15) seconds to a high temperature (under 200°C and depending on application), under a pressure from 1 to 6 bars. The treatment vessel, pressure and the heating are generally ensured by steam. Then, they are very quickly cooled – Instant Pressure Drop (achieved in less than one second), towards low pressure (lower than 50 milli-bars). This cooling is due to an auto-vaporization of a part of product's water, generally coupled by a "controlled" expansion of the product.

### **Impact on the chain and partnerships:**

**CIPD** technology described above has the potential to decouple the value addition into two independent steps carried out at independent locations and different time frames as indicated below:

- The critical step of handling the wet (fresh) products can be carried out with a conventional hot-air drying technique. Moreover, this step can easily be added to the existing sorting and packaging facilities of the grower enabling him with a possibility to better match his supply with demand.
- The innovative second step is a **CIPD** technique/process, which can enable the production of natural and pure ingredients (sliced/grounded and decontaminated) to suit the requirements of different industrial (cereal, ready meals, bakery & confectionary) applications.

The above indicated production flexibility enables distributed processing (most of the moisture removal can be carried out close to the source) enabling greater level of market responsiveness and better alignment of incentives.

### **Competitive dimensions of strategic relevance**

Some of the critical differentiating and sustainable elements can be summarized as below:

- **Pure processing:** Using the CIPD process products can be 100% natural (and crispy) with zero additives
- **Sustainable processing:** Through CIPD processing product cells remain intact ensuring perfect rehydration and water holding capacity
- **Clean processing:** CIPD processing fulfills all international standards related to microbial contaminations
- **Flexible/Smart processing:** The CIPD process enables the processing of the fresh produce in a decentralized and distributed manner. In essence, the excess fresh products can now be processed very close to the grower. Furthermore, it enables flexibility to use the same technology for multiple processing applications such as texturing, extraction in addition to drying.
- **Economic processing:** On economic fronts the CIPD technology competes with that of Freeze drying which requires double the capital expenditure and up to 25% of more energy

resources. In essence, CIPD enables at least 25% of cost advantage without impacting the quality when compared with the status-quo competition.

In the next subsection we deal with a case study which relates with technology intervention at the level of the distribution channel.

### ***5.3. Case study 3: Technology Intervention at level of the retail [Addressing the third compartment of the framework]***

Retail is a very critical component of a food chain as it connects the product with the consumer and hence can influence consumers purchasing decision not only through the products they carry but also through the experiences they are able to create within their retailing environment. Consumer's busy life styles combined with their increasing purchasing power are influencing the consumer's product preferences, buying behaviors and retailing experience expectations in a big way. However, globally most of the current retail formulas are price driven and hence focusing on efficiency and standardization which is in conflict with the consumer's preferences which are towards customization, convenience and anytime availability. Hence, technology interventions which can enable customization, convenience and anytime availability have a potential to offer competitive advantage at the level of the retail.

#### **Strategic objective to be realized:**

"Enabling customization, convenience and anytime availability at the level of retail"

#### **Technology choice:**

Smart vending technologies which incorporate the developments within the ICT (internet and communication technologies) and the field of robotics enables the consumers not only with customizable possibilities, but offers convenience and most importantly a differentiating buying experience. Smart vending technologies are tried with different products in several countries as pilot cases with encouraging results. Vending machines preparing freshly baked products at a low price have been developed to serve consumers 24/7. Customers have the possibility to make their preferred choice. After mixing the ingredients, pizzas or cupcakes can be made on the spot. Within several minutes time the freshly made product can be taken out of the vending machine in a handy box or package.

#### **Impact on the chain and partnerships:**

Smart vending technologies will demand different kind of partnerships with the chain partners. Some key elements are:

- Replenishment and inventory planning of products and ingredients have to happen through a demand pull rather than through an inventoried push based approach that is normally followed within a conventional retail set-up. This would require a different kind of supply and logistics partnerships which should be both lean and agile. Furthermore, such an approach would create greater interdependencies with other partners in the chain leading to stronger chain partnerships

- The effect will not just be on the business processes as indicated above but could also influence the product offering in several ways. For example, smart vending could offer possibilities to use more natural ingredients within the products which might mandate a supply base that is focused on delivering quality and differentiation rather than volume
- As technology plays a key role in delivering the product and the experience to the end-consumers, it is important that these machines are delivering the highest possible service level. To fulfill this objective, special service contracts have to be worked out with technology partners to ensure a fool-proof delivery

### **Competitive dimensions of strategic relevance**

The key competitive element of this technology intervention is that it not only meets the consumer needs but also offers a differentiating retailing experience for which consumers are willing to pay a premium. Also, it enables the retail organization to offer differentiated and innovative products. As this is still in its infancy the economic competitive elements are a work-in-progress.

In the next subsection we deal with a case study which relates with technology intervention at the level of the consumer.

#### ***5.4. Case study 4: Technology intervention at the level of the consumers [Addressing the fourth compartment of the framework]***

As indicated in case study 3, consumers are more and more seeking for customization and new experiences with their food & drink consumption moments. Hence, businesses can leverage on this component and create inventions which could drastically change the ways consumer makes his food consumption choices.

#### **Strategic objective to be realized:**

“Enabling customization and a differentiating consumer experience”

#### **Technology choice**

Here, we discuss a coffee making technology intervention which enables the consumers to begin their coffee experience with fresh (unroasted) coffee beans. Traditionally, harvested coffee beans have to undergo roasting and grinding before the grounded coffee could be used. Mostly, grounded coffee is used at the level of the consumer for having their coffee experience. There are however some exceptions to the above case in which machines can start processing the coffee beans by roasting it on the spot. This can lead to a better coffee consumption experience. These machines are relatively expensive and mostly used at the level of the food service (restaurants, bars, office canteens etc.,) usage rather than at the consumer level.

A new coffee maker made by Bonaverda Coffee Inc. is a technology targeted for the consumer which can do the personalized roasting before the grinding and coffee making. Hence, it adds an additional level of customization (roasting) and most importantly offers a fresher coffee experience. The visualization of the roasting process gives an extra dimension in addition to smell and taste.

### **Impact on the chain and partnerships**

The new coffee maker intervention indicated above can have a game-changing effect on the chain partnerships and the responsibilities for different players in the chain. Some key elements are brought out below:

- The raw coffee bean which is a commodity starts to become the point of differentiation. This gives the coffee farmer the opportunity to become market driven, gain better returns and invest in quality and differentiation
- The number of links between the coffee farmer and the consumer can be reduced thus enhancing the efficiency in the chain and hence distributing value to the key players of the chain

### **Competitive advantages of strategic relevance**

- For the consumer it enables a longer, fresher and tastier coffee experience
- For the farmer it provides a better market visibility and fair incentives
- Such a technology intervention can have create a better economic value for all the value adding players of the chain

In the next section, we present the conclusions and offer some starting points for further research.

## **6. Conclusions and suggestions for further research**

This study demonstrates that a strategic approach to technology choice could enable product differentiation, competitiveness and agility to businesses operating within the food and agribusiness sector. All food and drink businesses independent of their positioning in the chain could leverage on the developed framework to adopt a strategic approach to their technology choice. Also, the cases discussed within this study demonstrate the applicability and robustness of the framework in enabling a technology choice which is strategic.

The suggested approach to the technology choice as indicated within this study leads to differentiated products which could pose considerable challenges at the level of marketing and distribution. Hence having a complimentary and relevant marketing & distribution strategy is critical to the technology choice to become strategic and hence this study opens up substantial scope for research on the marketing front. Although, we discuss the subject of technology choice in the specific context of the food sector, it should be relevant for most business sectors and hence there is considerable scope to test the applicability of this framework to the dynamics of other sectors.

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