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Key factors for implementing postponement: case studies from the Brazilian food industry

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Abstract

Postponement strategy has been increasingly used by companies concerned with managing the growing complexity and variety of products, currently required by the market. In this context, this article aims to answer the research questions: what types of postponement are implemented by Brazilian food processing companies? and what are the key factors that promote/facilitate the implementation of postponement in these companies? The results show that the companies have implemented form postponement and time postponement. Also, the key factors that promoted its adoption were grouped in seven dimensions: market, product, process, logistics, supply chain management, leadership and technology.

Keywords: mass customization, postponement, supply chain management

Introduction

One of the challenges of today's supply chains is to respond quickly to increasingly demanding consumers simultaneously wanting customized products and lower prices (Wikner et al., 2007; Graman, 2010). One way to address this challenge is to achieve benefits from economies of scale in manufacturing generic unfinished products, leaving the stage of differentiation to the point where demand is known (Van Hoek et al., 1999). This strategy is known as postponement. Van Hoek (2001) defined postponement as a supply chain strategy of delaying as much as possible any movement and/or final configuration of products.

Alderson (1950) has introduced the initial concept of postponement as a way of ordering the value adding stages within manufacturing and marketing processes. In the late 90's, academics and practitioners raised the interest in the subject. Articles addressing the concept of postponement can be found in different areas such as logistics, production, marketing and, more recently, the supply chain (Yang et al. 2004a).

Despite the increasing attention given to the subject, literature reporting its practical application is still scarce and many of the studies available are limited to theoretical discussions or mathematical modelling and simulation. In addition to this, it is noteworthy that several authors have studied the application of postponement in industries in which the concept is widely applied, such as automotive, clothing, apparel and electronics.

However, very few studies have addressed the feasibility and use of the theory of postponement in the food industry. Only a few references were found that report the application of postponement in the food industry – two articles about European companies applying the concept (Van Hoek, 1997; Van Hoek et al., 1999) and a literature review (Van Donk, 2001). Therefore, there is a lack of empirical research addressing the application of postponement in the food industry.

In this context, the aim of this paper is to investigate the implementation of the strategy of postponement in Brazilian food companies, seeking to answer the following research questions (RQs):

RQ1) what types of postponement have been implemented by Brazilian food companies?

RQ2) what are the key factors that promote/facilitate the implementation of postponement in these companies?

Because the implementation of postponement is still not widespread, especially within the food industry, answers to these questions are relevant in order to provide guidance to companies within the same industry seeking to implement the strategy. A theoretical framework with the key drivers identified from the literature was initially drawn. This was confronted with the drivers found in practice, thus a table of the main drivers of postponement strategy was adapted to food companies. For this, six case studies within food processing companies were carried out. The companies were chosen according to the Brazilian National Classification of Economic Activities (2010), which has most of its products placed in the same class or a segment called “canned fruit and vegetables”. Semi-structured interviews were conducted with executives responsible for the areas of production and logistics in each company.

The next section presents the literature review underpinning this paper, highlighting the definitions of postponement, types of postponement and key drivers for the adoption of this strategy. The drivers identified from the literature were analyzed, sorted and re-grouped into a theoretical framework which is presented at the end of the section.

Theoretical background of the present paper

Definitions and types of postponement

Postponement is a practice that is growing and becoming more disseminated between academics and practitioners. The concept was initially proposed by Alderson (1950) as a way to change the shape, identity or location of products at a time as late as possible within the manufacturing and physical distribution processes. So, delaying the movement of the product was called the “time postponement” and delaying the differentiation of the product was called the “form postponement”.

In 1965, Bucklin added more detail to Alderson’s work by studying the limits of the strategy and creating the opposite concept of postponement, the “principle of speculation”. The principle of speculation consists of terminating operations as soon as possible in the manufacturing process (Bucklin, 1965). Since then, a few studies have addressed the subject, until the late 80's, when the subject was revived by Zinn and Bowersox’s work (1988). The authors proposed that postponement could be classified

into five different categories, four related to changes in product (labelling , packaging, assembly and manufacturing) and the fifth related to time (inventory centralization).

A few years later, Bowersox and Closs (1996) proposed another classification, in which there are two types of postponement. The first is the manufacturing postponement (or form) and the second is the logistics postponement (or time). The manufacturing postponement consists of the production of a basic or standard product in sufficient quantities to achieve economies of scale, while the completion characteristics are postponed until customer orders are received. On the other hand, the logistics postponement consists of maintaining a full line of finished products in a centralized inventory/warehouse. The movement of goods is postponed until customer orders are received. When demand occurs, the orders are shipped directly to retailers or consumers. Pagh and Cooper (1998) combined four postponement strategies for the supply chain in a 2x2 matrix (Figure 1).

		Logistics	
		Speculation Decentralized inventories	Postponement Centralized inventories and direct distribution
Manufacturing	Speculation Make to inventory	The full speculation strategy	The logistics postponement strategy
	Postponement Make to order	The manufacturing postponement strategy	The full postponement strategy

Figure 1 – The P/S-matrix and generic supply chain P/S-Strategies. Source: Pagh and Cooper (1998, p.15)

In the matrix, form postponement is called manufacturing postponement and time postponement is called logistics postponement. The four strategies are developed by combining the manufacturing and logistics postponements. The first two strategies are represented by only one type of postponement, manufacturing or logistics. The other two are formed by the combination of both, called the full postponement strategy, or by the absence of both, called full speculation strategy. Over the years, several authors have also proposed other classifications of postponement, expanding the range of possible combinations of delays in space and time (e.g.: Waller et al., 2000, Cardoso, 2002, Yang et al., 2004b, Garcia-Dastugue and Lambert, 2007, among others).

Postponement implementation: drives and framework

In the postponement literature, many authors have pointed to different factors that influence or facilitate the adoption of postponement, these are called drivers in this paper. Some authors selected the drivers by considering specific dimensions from which the drivers are originated. Van Hoek et al. (1998) selected the drivers taking into consideration dimensions with the following characteristics: (1) process and technology, (2) product and (3) market. On the other hand, Pagh and Cooper (1998) specified drivers related to market size, product, process and logistics. For Cardoso (2002) the most relevant dimensions were product/market demand, technology/production process and characteristics of the logistics system for determining key drivers for the

implementation of postponement. Finally, Sampaio (2003) added the dimension supply chain. Table 1 summarizes the main drivers identified from the literature.

Table 1 – Drivers for postponement implementation

Author(s) (Year)	Drivers
Zinn and Bowersox (1988)	demand uncertainty, product added value, economies of transport; large number of brands and product releases, changes in weight and size of product and a high percentage of ubiquitous materials.
Van Hoek (1997)	processes de-coupling, modularity, technological complexity of the production process.
Pagh and Cooper (1998)	stage of the product life cycle, volume, cost / service strategy, product type, variety, value profile; monetary density, delivery time, delivery , level of instability in demand, economies of scale and complexity of customization.
Twede et al. (2000)	modular products, products that gain volume, weight or value through the packaging, unpredictable demand; large number of variations based on the unique formulation to market, economies of scale.
Chiou et al. (2002)	demand for customization, modularity, product value and product life cycle.
Sampaio (2003)	modularity; product specific formulation, complexity and customization of final product; monetary density, modular processes; overloaded processes, flexible manufacturing processes; buffer strategy, economies of scale, variation in demand, volume, stage of life cycle; delivery time, delivery frequency; collaborative relationship; rapid response from suppliers, proximity to suppliers; sequencing of parts, legislation, training, after-market system, the organization's strategy, commitment, e-commerce, the payment system; equipment suppliers.
Cardoso (2002)	long production lead time, level of customer service, wide variety of products, uncertainty of demand, high value product, a high correlation between sales of products in the same line, level of customization of product, uncertainty lead time, uncertainty in delivery time, short product life cycle, lack of infrastructure of transportation and communication, implementation of government policies, high cost for maintaining inventories, high costs of storage, high cost of transportation/distribution; high cost of order processing, low cost of lost sales, high production cost
Matthews and Syed (2004)	standardized product designs, business process reengineering, inter-functional collaboration, collaboration with customers / suppliers, performance measure, training and change management, IT infrastructure, inter-organizational structure.
Yang et al. (2005)	life cycle of the product, market segment; modularity, IT development, mass customization, standardization, demanding consumers.
Yang et al. (2007)	capacity planning, flexible manufacturing.

Based on the dimensions and drivers identified from the literature, a conceptual framework, which is presented in Table 2, was proposed. The framework consists of seven dimensions identified from the literature as follows: market, product, process, logistics, supply chain, leadership and technology. Once these dimensions were identified, all the drivers from within the literature were analyzed and amalgamated into these dimensions, enabling the generation of the theoretical framework presented in this study.

Table 2 – Drivers for postponement implementation grouped by dimension

Dimension	Factors
Market	demand uncertainty, variation in demand, demand for customization; market segment, exigent consumers.
Product	product type, price, brand and product releases, variation in size, weight change, specific formulation of the product, modularity; standardization, interchangeable templates, sequencing of parts, complexity and mass customization; life cycle; stage of the life cycle.
Process	modular process, flexible manufacturing processes, complexity, technological process, business process reengineering, planning capacity, economy of scale, cost of production, lead time, processes de-coupling.
Logistics	inventory cost, storage cost, cost of transportation / distribution, cost of lost sales, transportation infrastructure, customer service delivery time, delivery frequency, resupply lead time uncertainty.
Supply Chain	cross-functional collaboration, collaboration with customers / suppliers, supplier's quick response; sequencing of parts; government policies, training and change management, performance measurement.
Leadership	Organizational strategy and commitment.
Technology	e-commerce; infrastructure for information technology.

Findings

This section describes the results of the case studies in enterprises from the manufacturing segment of canned fruits. The research design required that the cases were selected from the domain of food processing companies in Brazilian industry, which were applying at least one type of postponement. Aiming at literal replication, the majority of the products of the selected companies should be for the canned fruits and vegetables markets. Due to confidentiality, the three companies processing orange juice were named S1, S2 and S3 and the companies processing tomatoes were named T1, T2 and T3. Companies S1, S2 and S3 are among the four largest producers of orange juice in Brazil. Companies T1, T2 and T3 have in common the production of tomato-based products and are among the six largest producers of tomato-based products in Brazil. The main characteristics of these companies are presented in Table 3.

Table 3 – Characterization of companies participating in the research

	S1	S2	S3	T1	T2	T3
Main products	frozen concentrated orange juice (FCOJ); Not from concentrate orange juice (NFC)	FCOJ	FCOJ; NFC	tomato-based products	Tomato and guava-based products	tomato-based products, canned vegetables
Sites in Brazil	4	3	3	1	3	1
Number of employees	1700	1800 (non-harvest period)	400 (non-harvest period)	350	960	1300

		3000 (harvest period)	3000 (harvest period)			
Product destination	98% for external market	99% external market	95% external market	Not known	12% external market	8% external market

Application of postponement by the companies

Based on the results from the case studies, it was possible to verify that time and form postponement have been applied by the companies. In the orange juice processing companies, the steps of extracting juice from the orange are made by processing companies (companies S1, S2 and S3) for stock and for the unique formulation of two main types of juice produced by these companies: frozen concentrated orange juice, and not from concentrate orange juice (ready to drink). The product is then delivered to the customers, the majority of whom are located overseas in the case of the orange juice processing companies.

After the product reaches its destination, it is then customized, usually by the client responsible for final processing and distribution of the finished product. It is during this customization that some final manufacturing activities are performed, such as mixing of different types of juices, also known as the blending process, dilution, addition of components responsible for flavour and aroma of the juice, and adding packaging and labelling. All these activities are postponed and performed only when the demand is known.

In the tomato-based product companies, the tomato is pre-processed, turned into pulp, and remains stored as a semi-finished product until demand is better known. Based on the specifications of recipes and demand for certain type of final product (puree, paste, sauce, etc.), this pulp is then transformed into the final product (derived from the tomato). In company T2, this same process is carried out in order to produce derivatives of guava (guava jam, guava in juice, guava in syrup, among others), and also includes the postponement of the final product.

Although the six companies have implemented form postponement, it can be observed that this takes place in different activities and stages in the supply chain. For orange juice processing companies, the final manufacturing activities, such as dilution, addition of flavour and aroma components, packaging and labelling are only performed downstream in the supply chain by bottlers located overseas. For tomato-based product companies, these activities are often performed within their own factories. The concept of postponement is still the same, although in these companies all the manufacturing activities are executed by the same company, delaying only the moment when the differentiation takes place.

Regarding the time postponement, the six companies are applying this type of postponement for all types of products within the companies, including orange juice, tomato and guava-related products. Thus, the different types of products are kept in warehouses located in production units (or sites) of the companies and are transported to their destinations (bottlers, for processors of orange juice, and to distributors, supermarkets and other distribution channels, in the case of producers of guava and tomato-based) only after receiving the customer's order.

Drivers for postponement implementation in the companies

Based on the theoretical framework that comprises the drivers for the application of postponement identified from the literature (Table 2), interviewees were asked to classify the contribution of each driver within a scale (4 – very high; 3 – High; 2 – average, 1 – low; and 0 – not applicable) and also if there were others drivers they

would like to include. In trying to answer the second research question of this paper, Table 4 presents key drivers for the application of postponement according to the answers of the respondents of the research within the companies investigated.

Table 4 – Key-factors for implementing postponement.

Dimension	Factor	Company					
		S1	S2	S3	T1	T2	T3
Market	Demand uncertainty	3	2	3	2	3	4
	Demand variation	2	2	2	2	3	2
	Demand for customization	3	3	3	3	2	3
	Market segmentation	2	2	2	2	2	2
	Exigent consumers	0	1	0	2	1	2
	Customers concentration (external market)	4	4	4	0	0	0
	Adoption of strategy by competitors	3	4	4	0	0	4
Product	Type of product (seasonality)	4	4	4	4	4	4
	Price	2	2	2	2	2	2
	Brand and product versions (different)	3	3	4	3	3	4
	Product size variation/package	3	3	3	3	3	3
	Variation of product weight (increase)	4	4	4	3	3	3
	Specific formulation of the product	3	3	3	2	2	1
	Specific peripherals	0	0	0	0	0	0
	Modularity	0	0	0	0	0	0
	Standardization	3	3	2	3	3	2
	Interchangeability	0	0	0	0	0	0
	Sequencing of parts	0	0	0	0	0	0
	Complexity and customization final	2	2	2	3	2	3
	Life cycle	1	2	2	3	3	2
	Validity	2	3	3	3	3	4
State of life cycle (maturity)	1	1	2	2	1	2	
Process	Modular Process	0	0	0	0	0	0
	Flexible manufacturing processes	2	2	1	2	2	1
	Technological complexity of the process	1	1	1	1	1	2
	Business process reengineering	0	0	0	0	0	1
	Capacity planning	1	2	3	2	2	2
	Economies of scale	2	2	3	2	2	3
	Production costs	4	4	3	4	4	4
	Lead time	2	2	2	2	2	2
	Process de-coupling	2	2	3	2	2	2
	Process technology	0	0	0	2	3	2
Logistic	Cost of stock	3	4	4	4	3	4
	Storage cost	3	4	4	4	3	4
	Cost of transportation/distribution	3	4	4	4	3	4
	Cost of lost sales	2	2	2	2	2	3
	Transport Infrastructure	2	2	2	2	3	2
	Customer service	2	2	2	2	2	2
	Delivery Time (30 to 40 days)	3	3	3	2	2	3
	Frequency of delivery	2	2	2	2	2	2
	Uncertainty resupply time	1	1	1	1	2	1
	Forms of packaging of the product	4	4	4	3	4	4
Supply chain	Inter-functional collaboration	2	2	2	2	2	2
	Collaboration with customers/suppliers	2	2	3	1	2	1
	Suppliers' quick response	0	0	0	0	0	0
	Government policies	0	0	0	0	0	0
	Training and change management	0	0	0	0	1	0
	Performance measurement	1	1	1	1	1	1

Leadership	Organizational strategy	2	3	2	2	3	2
	Commitment	3	3	3	3	3	3
Technology	E-commerce	0	1	1	0	1	0
	Infrastructure of Information Technology	3	3	3	3	3	2

It is noteworthy that the measures outlined in grey in Table 4 are measures added by respondents of the interviews of the case studies that were not previously identified in the literature. As it can be seen in Table 4, seasonality was the only factor cited by all respondents as having very high contribution to the adoption of postponement. Seasonality of supply is a peculiar feature of the manufacturing segment of canned fruit and vegetables that make postponement an essential strategy for the survival of companies in this sector. Just like orange, tomato and guava (also processed by company T2) are seasonal products, requiring pre-processing of these products during the harvest period to meet out of season demand.

Despite the seasonality factor being considered as one of the main reasons for postponing some activities, it is not the only one. Other drivers, though not pointed out by all companies, were also identified as major factors in the adoption of postponement. In descending order of number of enterprises that have classified these drivers as having a very high contribution, we can highlight the following: cost of production and forms of packaging the product, transportation cost, inventory cost and cost of storage, concentration of customers abroad/overseas, adoption of the strategy by competitors and changes in product weight, demand uncertainty, brands and product releases, product shelf life. Some of these drivers need further explanation and are discussed as follows.

The development of new forms of storage and packaging of products, such as in bulk (for orange juice) and aseptic bags (for tomato-based product companies), has ensured the isolation of the products from the environment, enabling their preservation for a longer period of time, better ways of storing and transport of products, as well as the conservation of their natural flavour. These factors have promoted the application of postponement in these companies.

In relation to drivers such as costs of production and logistics (transportation cost, inventory cost and storage cost), increased weight of the product after processing the final product, and different brands and versions were also identified as the main facilitators and drivers for the implementation of postponement in the companies. With postponement in certain activities in the production process of orange juice, for example, companies could reduce the volume of products being transported and the logistics costs, such as: cost of inventory, storage, transport, delivery time, among others (logistics dimension). Additionally, the risk of obsolescence of storing the final product is higher than the same risk when considering semi-finished/unfinished product. The same can be observed with tomato-related products.

The concentration of customers overseas and the adoption of the strategy by competitors were also cited, mainly by orange juice processing companies, as having a very high contribution to the adoption of postponement. The orange juice processing companies apply the concept of postponement due to the possibility of focusing on their core business, which is the acquisition of oranges, their processing and transformation into frozen concentrated juice, leaving the activity of re-processing, final manufacturing and distribution, which is not their core business, to other manufacturers in countries where the product will be consumed. The adoption of the strategy by competitors was cited by companies S2, S3 and T3, because when these companies have started their operations, their main competitors have already adopted the postponement strategy. Thus, they also adopt the strategy needed to keep the company competitive in the market.

There are also drivers that, even though they are highlighted in the literature, do not apply to the food companies investigated in this research and were, therefore, not pointed out, such as: legislation, specific peripherals and modular, interchangeable templates, sequencing of parts and others.

Conclusions

This study aimed at examining the practice of postponement, particularly within companies in the food industry, an industry in which the research and publications on the subject are scarce. The purpose of this study was to investigate the implementation of postponement and identify the drivers for the adoption of this strategy in food companies. To meet these objectives and answer the research questions, an effort was made to survey the existing literature on the subject, covering the postponement literature published within the last 60 years. Additionally, a multi-case study was conducted of six companies within the food industry. The results of the case studies show that both types of postponement have been adopted by the companies, i.e. form postponement and time postponement. Also, the key drivers that promoted and facilitated the implementation of postponement in these companies were identified.

By comparing the theoretical framework with the empirical evidence, a reference framework was developed grouping the key factors into seven dimensions: (1) market, (2) product, (3) process, (4) logistics, (5) supply chain management, (6) leadership and (7) technology. Among the factors classified as having a very high contribution, the following factors can be highlighted: supply seasonality; production cost; package development; transportation, inventory and storage costs; concentration of overseas customers; adoption of the strategy by competitors; demand uncertainty; and changes in product features (weight, brand, product variety, and product shelf life). Additionally, the factors classified by the companies as having high, medium or low contribution to the implementation of postponement should also be considered by food companies that want to implement this strategy. It is noteworthy that the factors considered relevant to the implementation of postponement in the reference framework are those identified from literature and also new factors identified through empirical data. Among the new factors are: the concentration of overseas customers, the strategy adopted by competitors, process technology and package development.

In addition to further discussion on the issue and verification of its application in companies of food industry, this work presents three main contributions. First, by presenting a theoretical framework for implementation of postponement, which can and should be suitable for different industry sectors. Second, by verifying the suitability of this conceptual framework to food processing companies, and the presentation of information that provides subsidies for the implementation, consolidation and evaluation of postponement in these companies. Finally, this research provides improved knowledge about the use of postponement in food companies, which may promote the increasing flexibility of food supply chains, leading to a better meeting of customer requirements.

Although few publications reported the application of postponement in the food sector, the implementation of postponement is increasingly common among companies in this sector, particularly in the manufacturing segment of canned fruits. Additionally, it can be verified that postponement may offer more than the operating conditions to meet the individual needs of consumers quickly and at low cost. The adoption of this strategy has also transformed the relationships between companies. Its implementation can lead to delegating activities of differentiation and/or moving to other members of the supply chain, as seen with the orange juice processing companies.

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