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Article

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Class: DEHCFT4
Date: 29/06/2023
Advisor: Marinus van Haaften
Study: Horticulture & Agribusiness
Target group: Trade journals
Readers: Professionals from FORQLAB

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Introduction

Kenya is the eleventh-largest exporter in the world and the seventh-largest producer of avocados worldwide. For the Netherlands, Kenya is also an important main supplier country. In Kenya's avocado export market, approximately 15% of the avocado waste occurs between the farm and the consumer (Snel et al., 2021). However, the actual volume of market losses (both wholesale and retail) is significant but poorly understood (Snel et al., 2021). Companies that imported avocados from Kenya are interested in the potential of applied research to reduce waste and improve the quality of this part of the production chain. The objective of this research is to find out: What factors make fresh avocados imported from Kenya unconsumable in the supply chain part from wholesale to retail in the Netherlands?

Methodology

First, a literature review was conducted. Factors investigated in the literature were modified based on information provided by interviewees. Based on the findings of the literature, two online interviews were conducted with Dutch avocado wholesalers who imported Kenya avocados, as well as three face-to-face interviews with Delft supermarket managers. Inholland Yammer was used to conduct an online survey. The questionnaire was completed by 110 people in the role of consumer. The likelihood ratio for the chi-square test and Kendall's tau-b were used in IBM SPSS 26 to investigate the significance and extent of the impact (McHugh, 2013). The analysis employed a 95% confidence interval.

The iceberg model shows how observable events, underlying patterns, supporting structures, and mental models can be abstracted from a situation or organization (Trubetskaya, Scholten, & Corredig, 2022). By using an iceberg model, people can know which problems happened on which level.

The current situation of unconsumable fresh avocados

- 5~6% of imported avocados cannot be sold, with variations depending on season and country of origin. May, June, and July are typically months of global overproduction and oversupply.
- Very few avocados remain unsold on supermarket shelves according to supermarket managers. Only about 2% of the avocados delivered to supermarkets were deemed unsellable. However, wholesalers estimate that 10% to 15% of fresh avocados in supermarkets went unsold and became inedible.
- Supermarkets send avocados with external damage but intact interiors to food banks.
- Wholesalers send avocados that can't be sold as fresh fruit to other industries, such as avocado oil production.

The patterns leading to (unconsumed) fresh avocados

On the pattern level, it involves identifying patterns, trends, or recurring themes that emerge from the surface-level observations. It requires a deeper analysis to recognize the connections and regularities.

- Oversupply: Wholesalers import too much during certain seasons. The surplus caused storage facility shortages, preventing avocados from being stored at optimal low temperatures before ripening. Handling large volumes quickly increased human error. Sorting, packing, and storing errors can occur under pressure to process and distribute avocados efficiently. Errors increase avocado waste.

- Internal & external damage: Low transportation temperatures or nutrient deficiencies can darken or gray the avocado's interior. Retailers return avocados for poor quality, often due to internal diseases that were undetectable by machines and developed during transport. Most of the store's waste is caused by a delivery issue that bruised avocados, making them unsellable.

- Failed to ripe: Fresh avocados with a dry matter content lower than 21% are likely to fail in ripening. Within the avocados placed in ripening facilities, approximately 5% are wasted due to variations in ripening rates, with overripe avocados rendering them unsuitable for consumption.

- Wasted as samples: A minimal proportion of imported avocados (less than 0.1%) remain unconsumed because of rigorous quality inspections for firmness and dry matter.

- Late delivery: Delayed avocado deliveries may be rejected by retailers, and during the time to return them to the warehouse, avocados may be ripe, making them unsuitable for sale. Logistics waste accounts for 2%–3% of avocado waste.

- Improper organizing: Improper organizing can contribute to human errors, such as incorrect labeling and packaging, which in turn can lead to higher return rates.

- Improper display: Consumers don't always pick avocados underneath the shelf. In the supermarket, if the avocados underneath were not well-arranged or appear less fresh compared to the ones on top, customers may perceive them as less appealing and choose avocados from the upper layers instead.

- Wrong storage condition: The best storage conditions for fresh avocados, especially for ready-to-eat avocados, should be in refrigerators, while most of supermarkets only put them under room temperature.

The structural factor behind (unconsumed) fresh avocados imported from Kenya in the supply chain from wholesale to retail in the Netherlands

At the structural level, the emphasis switches to the underlying systems, structures, or processes that underlie the patterns and trends that are visible.

- Overwhelmed management: Important tasks may be neglected, leading to problems such as quality issues and an increase in human errors, which also influences the communication between different parts of the supply chain. Especially during oversupply periods.

- Inefficient logistics and planning: Avocado production outpaces demand growth, leading to unsold inventory and reduced profitability.

- Imbalanced supply &demanding: Avocado production had increased by 15% to 20%, while the demand in Europe had only risen by 5% to 8%. Growers sold lots of avocados due to high farming costs. To balance supply-demand, wholesalers offered promotions to boost sales. To avoid unsold inventory and maintain profit margins, retailers avoided accepting excessive avocados. Due to supply outstripping demand, the avocado supply chain struggled. Growers and wholesalers suffered financial losses when avocados were spoiled. Growers also struggled to get stable returns on their investments due to supply-demand dynamics.

- Lack of communication: Growers desire to maximize profit caused wholesaler-grower conflict. These issues caused inaccurate inventory forecasts, but they were fixable. Supply-and-demand control depended on retailers. Postponing orders while searching for new customers could help wholesalers manage excess stock. Improved retailer-wholesaler communication helped ripening processes. Adjusting the ripening process based on consumer demand improved avocado quality, shelf life, and spoilage.

- Preference for RTE: Approximately 40% of all avocados were categorized as ready-to-eat (RTE).

RTE avocados have a shorter shelf life compared to unripe avocados. Also, RTE avocados require higher proficiency in ripening techniques, making it more prone to failures when ripening them to the desired ready-to-eat maturity, thus resulting in more wastage.

The mental factor of (unconsumed) fresh avocados imported from Kenya in the supply chain from wholesale to retail in the Netherlands

Mental factors refer to the conscious or subconscious assumptions, beliefs, and values that individuals hold about a system (Maani & Cavana, 2007).

- Profit first: Both wholesalers and retailers frequently put short-term financial success and inventory control ahead of thinking about the long-term effects of waste and its effects on the environment and society. The profit-first mentality prioritized profit and on-shelf availability over waste reduction and sustainability. Wholesalers and retailers stocked more products, even if they expired or were not sold, to ensure availability.

- Consumers' perfectionism: Even with a taste guarantee, avocado buyers who value appearance are less likely to buy subpar avocados. Despite knowing the best-before and used-by dates, people who prefer good-looking avocados are unlikely to buy sub-optimal ones. However, if a guarantee is offered, consumers who think appearance is somewhat important will buy sub-optimal avocados. Respondents who do not prioritize avocado appearance as very or somewhat important are more likely to "Be sure to buy it" when a quality guarantee is provided. Those who don't care about appearance don't seem to care about buying.

- Lack of knowledge: People familiar with best-before and used-by dates were more likely to buy sub-optimal avocados in the past. Those unaware of these dates are less likely to buy. Knowing the best-before date increases the likelihood of buying suboptimal avocados.

- Consumer's buying experience: Individuals who buy avocados more frequently are more likely to have purchased avocados in sub-optimal conditions. If more than 35% discount can be provided for sub-optimal avocados consumers are more willing to buy them. Avocado promotions influenced consumer purchases, according to wholesaler interviews. Promotion timing also mattered. When they got paid, consumers bought avocados more often. At the end of the month, consumers may have had less disposable income, making promotions less profitable.

Picture 1 depicted the conceptual model of fresh avocado waste, presenting a visual summary of the research findings. The model represents various stages of the avocado supply chain. The blue boxes indicate instances of waste occurring at the wholesale level (including the importers), while the yellow boxes represent waste occurring at the retail level. The green boxes indicate waste occurring at both the wholesale and retail levels, while the red boxes signify waste resulting from consumers' behaviour.
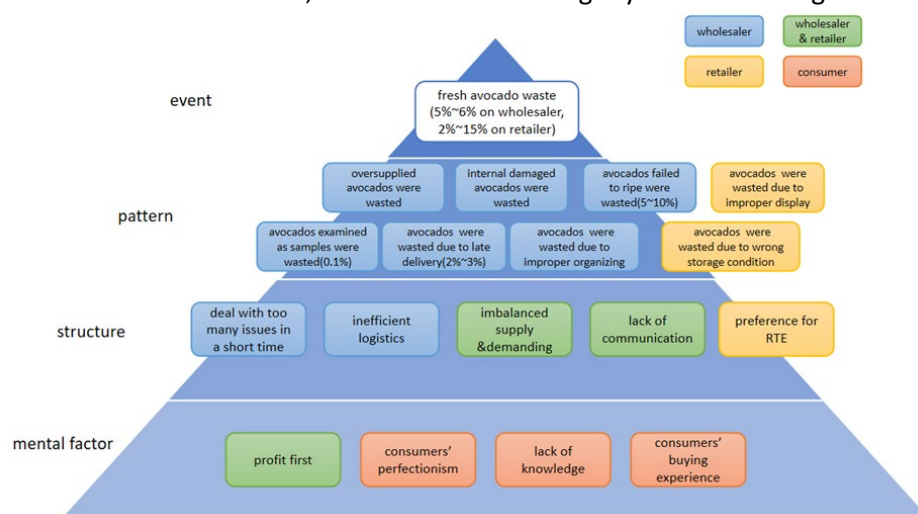
Picture 1 Avocado waste iceberg model

Conclusions

Structural and mental factors are the main factors that make fresh avocados imported from Kenya unconsumable in the supply chain from wholesale to retail in the Netherlands.

- Unsold inventory and waste in the avocado industry on structural level have resulted from unbalanced supply and demand dynamics, as well as inefficient logistics practices. Avocado production has grown faster than demand, contributing to the problem.
- Delays in container deliveries have caused avocados to ripen in transit, exacerbating the problem.
- Inadequate communication throughout the supply chain has hampered inventory forecasting and ripening process coordination.

For mental factors,

- The profit-first mentality of the industry has prioritized short-term financial success and inventory control over waste reduction and sustainability.
- Consumer behaviour has also contributed to waste, as evidenced by a focus on avocado appearance and perfectionism, and a reluctance to accept suboptimal avocados.
- A lack of knowledge about best-before and used-by dates.
- The amount of waste generated has also been influenced by factors such as the consumer purchasing experience and the frequency of avocado purchases.

Using Porter's value chain, Picture 2 demonstrated where wastes occur in wholesaler organisation, Picture 3 demonstrated where wastes occur in retailer organisation, as well as partially displaying the amount of waste at various positions. By checking each stage of the value chain, these images provide a comprehensive understanding of where waste occurs and offer insights into the magnitude of waste at various positions.

Wholesaler	Inbound logistics	Production/operations	Outbound logistics	Marketing and sales	Customer services
Primary activities	• purchasing fresh avocados form Kenya • checking the samples • sending avocados to ripening facility	• quality check • grading • ripening • packaging	• sending fresh avocados to buyers • managing warehouses • organizing transportation logistics • coordinating with retailers	promoting and selling avocados to potential buyers. The wholesaler may engage in marketing activities such as advertising	• offering prompt support • handling customer inquiries and complaints • providing information on avocado quality, availability, and pricing
Wastes	• oversupplied avocados were wasted • avocados examined as samples were wasted	• internal damaged avocados were wasted • avocados failed to ripe were wasted(5~10%) • avocados were wasted due to wrong packaging(minimal waste)	• avocados were wasted due to late delivery(2%~3%)		

Picture 2 Porter value chain for wholesalers

Retailer	Inbound logistics	Production/operations	Outbound logistics	Marketing and sales	Customer services
Primary activities	• purchasing avocados from wholesalers • sending avocados to their supermarkets	• quality check • putting avocados on the shelf • checking the inventory level	• distributing avocados to customers • managing inventory levels • ensuring timely restocking of avocados	• advertising, creating attractive displays, and running promotions or discounts to encourage avocado sales	• assisting customers in finding avocados • answering their queries • addressing any concerns or complaints
Wastes	• avocados were wasted due to late delivery(2%~3%)	• avocados were wasted due to wrong storage condition		• stalled avocados were wasted(2~15%)	

Picture 3 Porter value chain for retailers

Recommendations

Wholesalers and retailers should work together to improve avocado supply chain communication, supply and demand, and waste. The industry aims to optimize avocado distribution and supply high-quality avocados by improving communication, aligning supply with demand, and educating consumers. These steps will reduce waste and improve avocado production.

For further research, surveys should include students and other demographics. Interviewing supermarket managers from various Dutch regions would yield valuable insights that could be applied to a larger population. The results would be more representative and applicable if more people participated. Retailers should investigate Direct Profit Profitability and the contractual relationship between growers, wholesalers, and retailers.

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