



# Waste Management

- Fully embedded solution to manage Shrinkage for  
perishables down to Store Level -

Introduction & Overview

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## **Waste Management** - Fully embedded solution to manage Shrinkage for perishables down to Store Level -

Introduction & Overview



## Fresh logistics

From Grocer to Supermarket

From Dried groceries to Fresh products

From Fresh-out-cold-Mother-Earth to Product differentiation

**Result: Shrinkage rears its head**

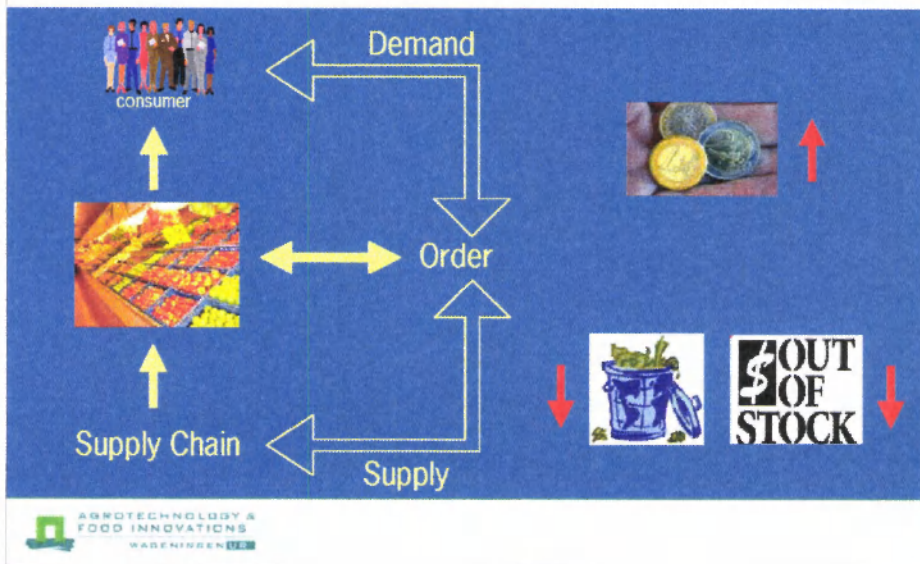
**From Logistics to Fresh Logistics**



In the 1940's, the grocer still occupied an important place. The grocer was specialised in the sale of dried groceries. The upcome of the supermarket brought along an increase in the range of such assortments, together with the upcome of the fresh product segment, followed by the non-food segment. Today, fifty percent of the turnover of supermarkets is determined by the fresh product segment, which is growing at the expense of dried groceries. Fresh is no longer a product from the cold earth, but more and more an imported product processed into ready-to-eat foodstuff.

The concept of shrinkage has only appeared in recent years due to product differentiation. As a result, many products from the fresh segment have been degraded to the waste bins even before they can reach their final destination. The fundamentals of the logistics profession are based on dried groceries while the logistics of fresh products specifically demand another approach, known as 'fresh logistics'.

## Fresh logistics from a Retail-perspective



The aim of fresh logistics is to reduce shrinkage by maintaining an agreeable service level by bringing demand and supply closer to each other. The retailer's shelf is of central importance as it is here that the demanding consumer (top left) meets the supplying chain (bottom left).

By reducing shrinkage, out-of-stock and other chain costs, the turnover and profit can be maximised.



To improve the position of fresh products, many variables have to be managed. From the perspective of the shelf, these variables can generally be put into three categories:

- 1) First, one must have insight into the customer's behaviour, sales variations and price reductions. Specifically for fresh products, the selection behaviour of the consumer in relation to different expiry-codes is important.
- 2) Afterwards, the person who orders has to compromise between fully-stocked shelves (low out-of-stock) and minimum product loss (low shrinkage). The category manager will optimise the assortment in his category.
- 3) Last but not least, the supply chain has to deliver the right products at the right time. Particularly important for fresh products is a good shelf life with minimum throughput time.

Within these three categories, various variables can be distinguished, some of which are mentioned in the above diagram.



## Project description

## Management summary

### The Business Issue:

- How to achieve a sustainable reduction of waste in perishables (against an agreed service level)

### The scope in ..... :

- Turnover ....: € ....million
- Turnover in fresh products (45 %): € ..... million
- Product shrinkage: (5 %): € .... million

### Ambition level:

- Sustainable shrinkage reduction of 20 %: € .... million / year (against an agreed service level)
- Profit optimisation through quality-related category management



We shall now give a description of the phases of the project, to be followed by a review of available tools.

### Project method:

The approach we have adopted is related to *sustainable* reduction of shrinkage. The concept *sustainable* is used because attention to this problem will give a positive effect only for a short period. The ultimate aim is to anchor this approach in daily company operations. To do so, systems and processes are necessary. A few examples of these are being used in this presentation, such as the shrinkage monitor, the order manager, the supply chain optimiser, the store simulator and the shelf life calculator. These elements can be employed to unravel the concepts of shrinkage and out-of-stock into digestible elements.

What is the potential amount saved?

The targeted level for this approach is a sustainable reduction of 20%, against an agreed service level.

## Background & Objectives

- **Retailer** feels a strong need to reduce shrinkage due to shelf-life expiration for perishables.
- **WUR** has developed means to address this need in general, and is looking for opportunities to package and market these means.
- **IBM** matches the above two through offering value adding services resulting in measurable improvements.

- **WUR & IBM** have entered into a partnership to pilot a total solution for shrinkage reduction with first class grocery retailers and suppliers.
- Components of the solution are:
  - Insight in the actual waste situation... 'shrinkage monitor'
  - Capturing quick wins / low hanging fruit; Proof of Concept
  - Design, develop, implement and run an embedded solution

- Investigate business relevance with retailer / Qualify and validate the chance for success
- Develop a joint proposal / Present to Category & Store management
- Run a joint project (Develop Monitor, Run joint POC, Deliver embedded solution)

## Basic steps in Attacking Shrinkage in Perishables



Define Shrinkage



Take responsibility for Shrinkage



Register Shrinkage



Analyse Shrinkage



Reduce Shrinkage

## Step 1: Define Shrinkage

### Value reduction due to quality deterioration

Example:

# Purchase	# Sales	# Price reduction and discard
4	1	3

$$\text{Shrinkage (purchase value)} = 3 / 4 * 100\% = 75 \%$$

$$\text{Shrinkage (turnover)} = 3 / 1 * 100 \% = 300 \%$$



Shrinkage can be defined in different ways. We refer to shrinkage as value reduction due to quality deterioration.

Shrinkage is also calculated in different ways. The most feasible methods are in relation to purchase value or in relation to turnover. In the latter, the shrinkage percentage can be higher than 100%.

## Step 2: Take responsibility for Shrinkage

- |                       |   |
|-----------------------|---|
| • Category management | assortment, pricing policy, shelf layout      |
| • Replenishment       | unit of order, order time, lead time          |
| • Store management    | quantity ordered, assortment, price reduction |
| • Supplier            | shelf life, lead time, unit of order          |

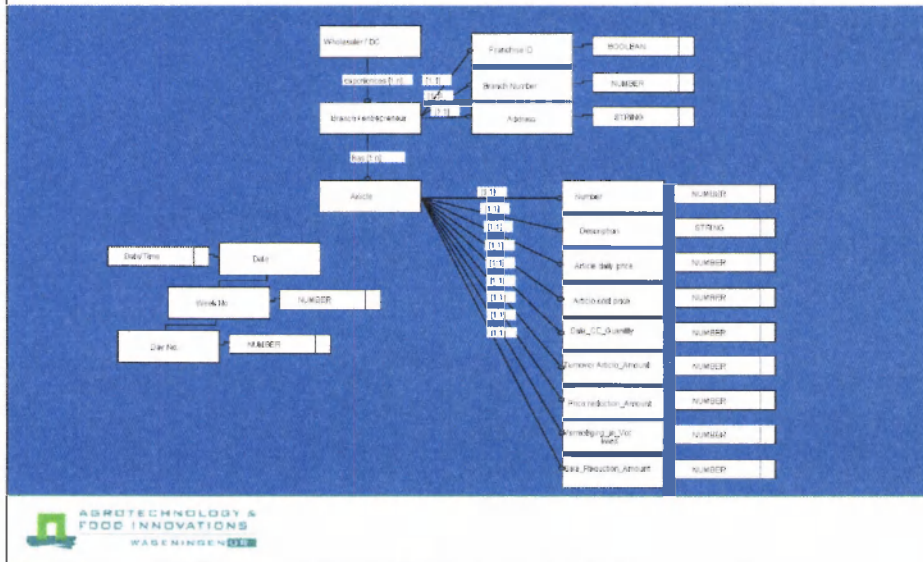
### Who is/are responsible?

**Describe this responsibility in terms of turnover, profit, shrinkage and OOS.**



In step 2, the core question is who is/are responsible for the extent of shrinkage and out of stock (OOS). One cannot rule out the existence of opposing interests. It is also possible that the responsibility within the organisation is greatly divided, making it difficult to pinpoint and manage the sources of shrinkage. Whoever is responsible, this is an important area to pay attention to.

### Step 3: Register Shrinkage



In step 3, one determines how to register shrinkage. Three elements are differentiated here, namely: branch particulars, products and time. This results in a closed bookkeeping system. If information - such as price reductions - are absent, it would follow that insight in e.g. price shrinkage would not be easy to obtain. A well-designed registration procedure is therefore of great importance for determining the shrinkage per article, per branch and per unit of time.

### Step 3: Register Shrinkage

Nummer	NUMBER
Omschrijving	STRING
Artikel Dagprijs	NUMBER
Artikel Kostprijs	NUMBER
Aankoop_CE_Aanta	NUMBER
Omzet_Artikel_Bedrag	NUMBER
Afprijsing_Bedrag	NUMBER
Vermenging_in_Verhoud	NUMBER
Netto_Kooping_Bedrag	NUMBER

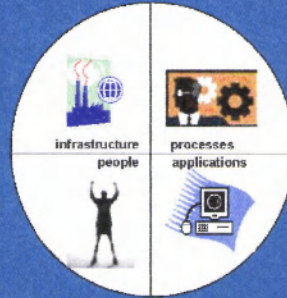
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## Step 4: Analyse Shrinkage

**Analysis** → **By the shrinkage monitor!**

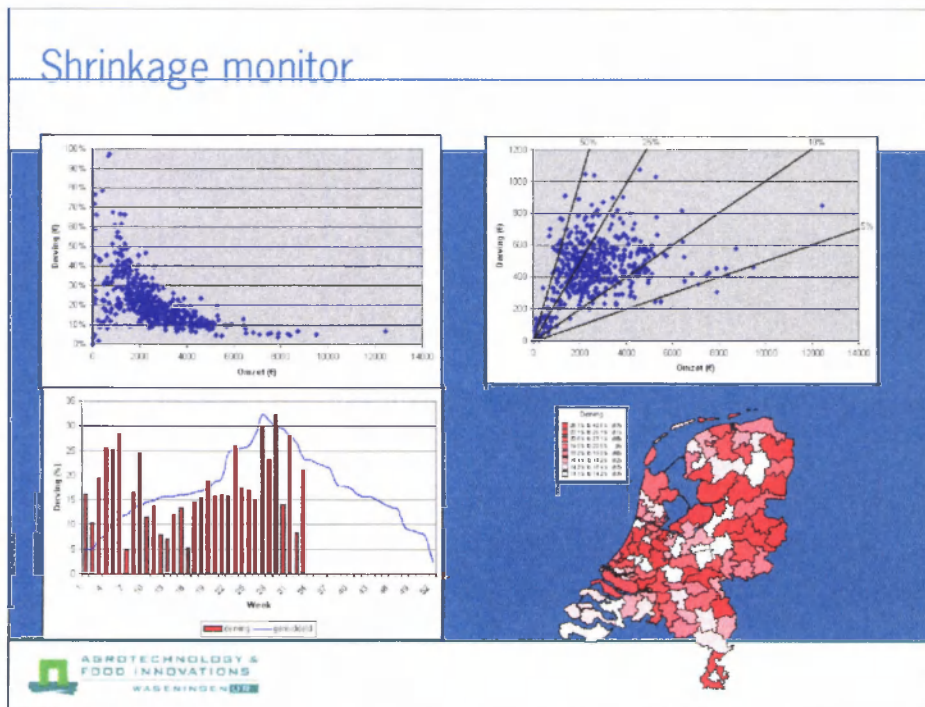
- Let's make sure the monitor is an integral part of the toolbox of those who are responsible for waste
- Integrate it with existing applications and infrastructure



Step 4 is the analysis phase. The shrinkage monitor is adapted to obtain insight into the actual level of shrinkage at article and branch levels. The following is a description of the shrinkage monitor.

## Shrinkage monitor

- Insight into *shrinkage and out-of-stock* at product and store level and over time
- The influence of selective shopping of the *consumer*
- The relation with sales and sales variation
- The relation with the *Assortment*
- Influence of *sales*
- Entrepreneurship, store management
- Packaging and quality (*shelf life*)
- Replenishment (service level, unit of order)



Collecting data is one side of the coin; transforming this data into information is the other. WUR had developed an application to transform shrinkage data into practical information. The model we will use zooms in from category to item level, and from store to formula level. The advantage of this method is that insight into the roots of the shrinkage process can be obtained. As it often happens, shrinkage is a phenomenon which does not occur uniformly, and one can go so far as to observe that 80% of all shrinkage can be attributed to 20% of the stores (Pareto). The shrinkage monitor can show us for which stores and which products there is most room for improvement.

The diagram at top left shows shrinkage as a function of turnover. Each dot represents a store. It is clear that as turnover increases, shrinkage decreases. The differences in %-shrinkage among the stores at the same turnover can be directly seen. In this example, shelf display is the same for all stores. What can be the cause of such shrinkage differences among stores?

To find out the answer, one has to knock at the doors of specific stores. By using the monitor, it is easy to group stores into, e.g. postal codes (diagram at below right) average floor areas, as well as other groupings. The diagram at below left shows shrinkage as a control element in management reports, including comparisons with previous periods.

The effect of an implemented improvement measure can be made directly visible with the shrinkage monitor.

## Step 5: Reducing Shrinkage

### Traditional way

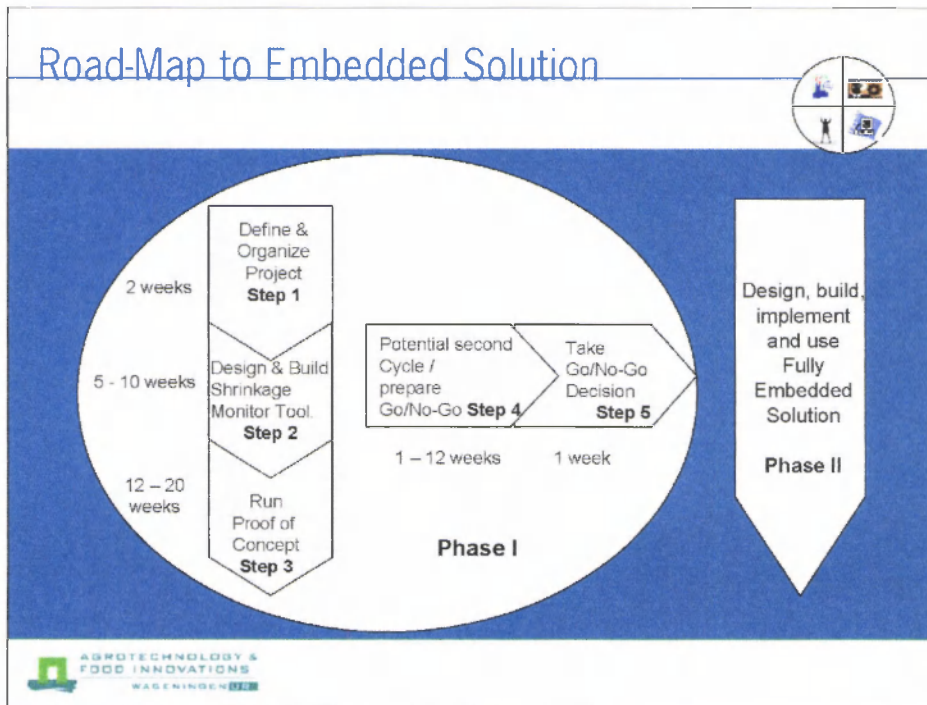
- Analyse reports generated by the Shrinkage Monitor
- Identify potential interventions
- Prepare & select interventions
- Implement interventions
- Re-run the monitor
- Evaluate and develop results, lessons learned, recommendations

### Alternative way

- Analyse reports generated by the Shrinkage Monitor
- Identify potential interventions
- Prepare & select interventions
- Prepare simulation model
- Run simulation model
- 'Re-run the monitor' on simulated effects
- Evaluate and develop results, lessons learned, recommendations

In step 5, the method to be adopted to reduce shrinkage will be described. After the analysis phase, the most promising areas will be defined and worked upon first. Results of the interventions can be monitored with the shrinkage monitor.

The difference between the traditional method and the alternative one lies in the application of simulation models in the latter. The use of simulation models makes it highly possible to evaluate the effects of the various solutions quickly. By simulating a situation beforehand, the risks during actual introduction can also be minimised. The chapter on simulation tools will describe examples where models would be used to simulate complete situations.



- This proposal describes **Phase I in the road to an 'embedded' solution** (i.e. a solution that is fully integrated in the day-to-day processes, regular organisation, standing application & infrastructure environment, regular reporting & award cycle).

This Phase I ('Proof of Concept') has 5 steps:

- The project will start with a short (2 weeks) project-definition.
  - Next, the Shrinkage Monitor tool will be developed from demo to production version (design & construction).
  - Then, a first 'improvement cycle' will be run as a test or 'Proof of Concept' (selected category, selected stores).
    - The reports generated by the Shrinkage Monitor will be analysed.
    - Potential interventions will be identified.
    - Interventions will be prepared and selected.
    - Interventions will be implemented.
    - Reports to monitor the effects of the interventions are generated and analysed again.
    - An evaluation report will be generated (results, lessons learned, recommendations).
  - The outcome of this first 'improvement cycle' will determine whether or not a second test cycle is required before a final go/no-go decision will be taken.
  - As the final step in this Phase, the Proof of Concept will be concluded with a decision whether or not to make this approach part of the regular operating model.
- Phase II (Roll out of the fully embedded solution) will be based on **(1) the shrinkage monitor, (2) best practices for waste reduction, (3) interrelation with customer service and OOS-management, (4) continuous improvement approach.**

## Partnership with IBM

- Perishables
- Simulation
- Category mgt
- Supply chain mgt
- Business Intelligence
- Project mgt
- Change mgt
- Organisation & Process design

Leading the way in the project method is the interrelation among the four elements - infrastructure, applications, people and processes. From our position in Wageningen-UR, a partnership has been entered into where all four elements can be well represented. The chosen partner is IBM because IBM is an organisation which attaches much importance to innovation and science, as can be seen in its tradition of having produced several Nobel Price winners. Within this cooperation, Wageningen-UR provides the knowledge of fresh logistics while IBM is more specialised in business intelligence and matters relating to organisational aspects and project management.

# Simulation Tools

Product description

## Product description

### Order manager

Can be employed to improve ordering (manually) and to facilitate automatic delivery by the development of an algorithm

### Supply chain optimiser

Instrument used to optimise links in the process

### Store simulator

Instrument which can simulate logistics processes at store level, including the shopping consumer

### Shelf life calculator

Instrument which gives insight into the shelf life of fresh products



The following is a review of available tools for strengthening the position (profit, sales) of fresh products.

### Available tools:

During the proof of concept - an extremely interactive phase for those involved - a workshop will be carried out to locate the most successful scenarios. Generally, 20% of the articles are responsible for 80% of the shrinkage, out-of-stock, sales and margin. Such a focus (Pareto) will therefore enable results to be achieved fast and effectively.

By developing improved scenarios and quantifying the effects, choices can be made in a follow-up phase. The choices would then be subjected to more in-depth examination and thereafter be implemented. Simulations play an important role in this matter so that the operations, with their already existing heavy workloads, would not be overloaded. Since little fieldwork can be carried out during the research, simulations would be used to bring out reality and find out the effects of measures taken. Simulation would also minimise risks during actual implementation.

Products which can be used are, for example, the order manager, supply chain optimiser, store simulator and the shelf life calculator. These products will now be elaborated upon one by one.



## Order manager

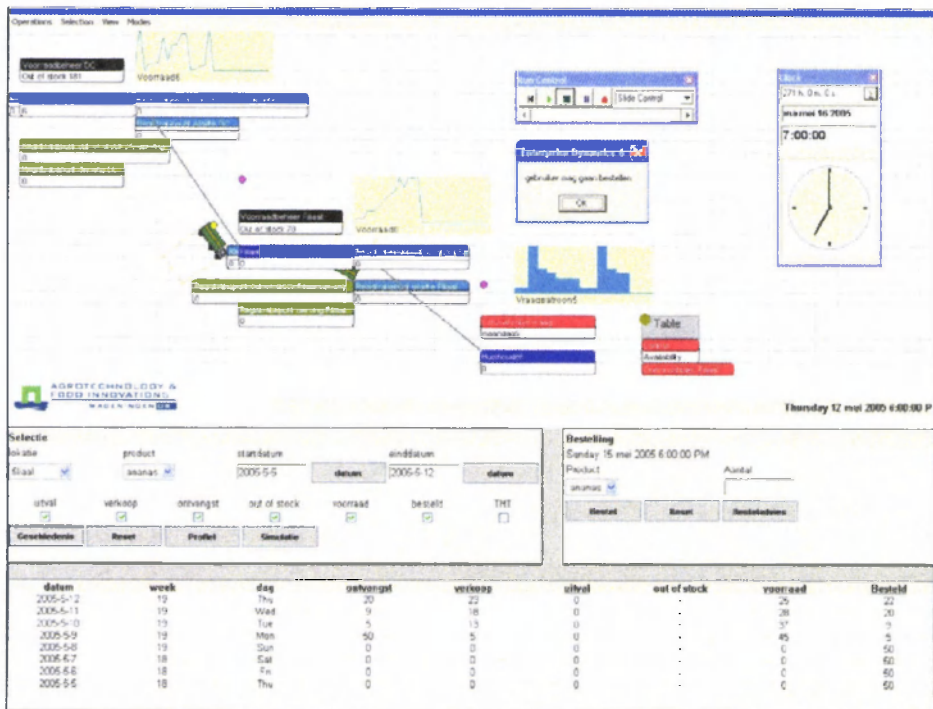
- How much, how often and how soon do I have to order?
- What is the optimum replenishment level?
- Automatic delivery routines
- Order trainer (Coach)
- Influence of shelf life and ordering based on shrinkage and OOS
- Influence of selection behaviour of the customer
- Influence of sales evaluation



One reason often named as a cause of shrinkage is the incorrect ordering of products at store level. Ordering is no easy task, given the product quantities and the workload. The order manager can be used to assist in the ordering process. In this simulation tool, order algorithms can be developed and optimised. These order algorithms can be used for automatic delivery or for providing ordering advice.

The tool can also be used in the training of ordering fresh products.

The order manager directly indicates the effect of order behaviour on shrinkage and OOS.



Example of the order manager in which the bottom screen is visible to the user, and the top screen indicates how the chain is implemented in the model.

## Supply Chain Optimiser

- What is the influence of consumer behaviour and sales variation?
- Choices: the classic inventory system, cross docking, or direct delivery?
- Where should I locate my DC's and what should their set-up be?
- What shelf life should I demand from my suppliers?
- What is an attainable lead time?



The supply chain optimiser represents a logistics optimisation tool which can be used to calculate chains. This tool allows various improvement scenarios to be quantified. For example, what is the financial effect of extending the shelf life with one day? Will the returns justify financing a technological improvement (e.g. gas packaging)? Even location issues can be handled. This tool is also capable of linking logistics processes to the quality progress of fresh products. For example, the effect of environmental influences in the chain can be judged more appropriately. The desired shelf life can also be established, which will then lead to decisions concerning technological aspects.

In short, many logistic issues, in combination with quality progress, can be answered by using this tool. The simulation can be set up specifically to handle strategic considerations and to work them out in detail before these are adopted in practice.

## Supply Chain Optimiser

### Simulation package

- Chain-wide
- Quality progress
- Chain - product - combinations

### A mirror to reality

- Optimum chain design
- To judge situations before they are implemented in practice



The Supply Chain Optimiser is specifically set up for fresh product chains by simulating the product's quality progress.

## Store Simulator

- How do I equip my shop?
- Shelf allocation (footage, stock)
- How large should the shop's storage area be?
- When do I replenish my shelves?
- How many cashiers should be employed?
- When and to what extent do I have to reduce the price?
- How can I tackle the selection behaviour?
- How should I store the product?



The store simulator is a simulation tool which takes the logistics process to the level of the pushcart. Elegantly put, the work processes of the tool begin with the behaviour of the customer. This means that logistic processes at branch level can be zoomed in.

This product can be used to tackle issues with extremely diverse characteristics. Issues such as: how do I equip my shop, up to how to influence the consumer's selection behaviour.

The tool is also suitable for optimising the effect of shelf space allocation, e.g. for fresh products. Such allocation can influence the stock levels and in so doing, also the OOS and shrinkage situation. Questions concerning price reductions can also be best answered with this tool. The simulation is carried out based on existing information which has been put into databases.

## Shelf life calculator

- What is the shelf life of my fresh product?
- How does product shelf life progress in time?
- Extent to which environmental conditions can affect shelf life (packaging technology)
- Insight into potential for improvement of the shelf life
- Insight into how to make product shelf life flexible
- Applicability of RFID for fresh products (RFID+) and of packaging which can prolong product shelf life



One of the important scenarios where shrinkage can be reduced is to improve the product quality, thus prolonging the shelf life. This tool quantifies the concept of shelf life to make it a parameter towards which one can intentionally steer.

What effects do environmental conditions or packaging concepts have on shelf life in the chain? What improvements can be potentially achieved by prolonging shelf life? How can shelf life become a logistics parameter comparable to lead time? Can RFID assist me in this? How about packaging (modified atmosphere)? These and other questions can be answered using expert knowledge.

The expert knowledge around packaging technology is intensively present in Wageningen-UR; expert knowledge is also encapsulated in other products developed. The tools vary from palmtop applications to extensive web applications.

## Shelf Life Calculator



Prestatie index over de meetperiode vergeleken met de referentie. → Prestatie index wordt berekend over de meetdagen. → Temperatuurprofiel in de tijd over een specifieke meetdag.



Disk met software inclusief kwaliteitsverloopmodel voor vers product.



Datalogger.



Meetsnoer



To obtain insight into the shelf life progress of the product in the chain, the fresh-chain-performance-index has been developed. This index is determined by registering the time and the temperature of goods in the chain and then linking these to quality decay of the product. The registration takes place with modern and very small sensors which can also save these measurements. By using a Palmtop-computer, the data can be read and made product specific. This is done by using quality decay models. The result is an index which indicates how the quality of, e.g. meat, tomatoes, bananas, cheese, yogurt, etc. could degrade as a result of temperature and duration of time spent in the chain.

The shelf-life calculator makes the actual shelf-life of a product-chain combination objective. Afterwards, one can determine if an investment in shelf-life prolongation would give the desired advantages. Insight into the latter can be obtained with the already mentioned supply chain optimiser.





## RFID<sup>+</sup> - a future initiative -

### RFID<sup>+</sup>

This is RFID with extra information about fresh products, e.g. shelf life



- Name
- Location
- How are you?

### Aim

To reduce shrinkage and OOS by better stock control



- ID (barcode)
- Location
- Shelf life

The world is becoming smaller and more complex - the former due to increased mobility; the latter due to product differentiation. All of these is determined by how we live. The cell phone is, among others, used to communicate who and where you are and how long it would take for you to reach your destination.

This same phenomenon is happening in the logistics of products. We are not longer satisfied with the barcode, nor with information which says who I am. We also want to know where my product is, who has produced it and with which source materials. In short, tracking & tracing is a growing necessity. Technology such as RFID can fulfil this necessity, but has it painted the future or do the developments keep changing the painting? One of the most frequently asked questions in a conversation is "how are you?". Due to the enormous increase of fresh articles, it is becoming more important to also ask such a question concerning these products. What is the quality of fresh products that are delivered to me; in other words: how much time do I have to sell this product? This is a question that the retailer has to ask himself if he wants to tackle his shrinkage problems.

With RFID<sup>+</sup>, one can ask the product how it is doing, (i.e. concerning its quality) at any desired moment. We refer to RFID<sup>+</sup> as the sum of logistics and quality. By attaching, e.g., a temperature sensor to an RFID tag, both temperature and time profiles can be communicated. Such RFID tags already exist.

# Track record

## Track record

- Packaging of fresh products:
  - Hendrix Meat Group and Laurus;
  - Introduction of packaging for shelf-life prolongation at Super de Boer and Edah
  - Logistics advantages of a later expiry date; less shrinkage, adjustment time
  - Influence of consumer behaviour (Last In First Out as opposed to FIFO) on fast-moving (e.g. minced meat) and slow-moving (e.g. shoulder cuts) meat products
- Vers-pan:
  - Hessing Groenten, CoopCodis, Bakker-Logistiek and The Greenery
  - Reduction of shrinkage and out-of-stock by logistics optimisation: e.g. shorter throughput time, improved planning and prolonged shelf life
  - Applicability of FEFO (First Expired First Out) in logistics; in other words, management based on shelf life

To give an impression of the track record of A&F, a number of project descriptions have been added here.

## Track record

- Bio-varken:
  - Organic pork chain from the Groeneweg to Albert Heijn
  - Shrinkage for organic meat is high in comparison to normal meat, due particularly to the low turnover rate of organic products.
  - The effects of various measures are quantified before the best scenario which can be applied in practice is tested in an actual pilot.
- Reduction of product loss in the fresh cut vegetables chain
  - Fresh cut vegetables from Groentehof to Jumbo supermarkets
  - Reduction of shrinkage by prolonging shelf life
  - A decision support model has been developed to calculate the effects of an undertaking (packaging, conditioning, throughput time) in relation to the remaining shelf life and shrinkage

## Contact details

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