

The background of the slide is a photograph of a grocery store's produce section. In the foreground, there are wooden crates filled with ripe yellow bananas and baskets of oranges. In the background, other produce like watermelons and tomatoes are visible, along with blurred figures of shoppers and a shopping cart. The lighting is bright and even.

A FRESH TAKE ON FRESH FOOD FORECASTING AND REPLENISHMENT

SOLVING THE ULTIMATE CHALLENGE OF
GROCERY RETAIL SUPPLY CHAINS

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INTRODUCTION TO FRESH FOOD FORECASTING AND REPLENISHMENT

While most large retailers have already automated forecasting and replenishment for the majority of their products, fresh foods still remain an anomaly. An anomaly with a potential to increase retailers' profits by double digit percentage points. The fast pace of the fresh environment makes it possible to achieve by far the fastest return on investment compared with any other supply chain related optimization activity.

With RELEX we've managed to cut waste and boost profits: stock loss reduced by 40% on average; even more for fresh items, while maintaining more than 99% availability at the same time.

Stockmann, Finland's leading chain of luxury department stores

TO CAPITALIZE ON this potential requires striking a balance between spoilage and availability when automating fresh replenishment and delivering accurate, day level forecasts for every single week of the year. Together, these challenges form what we call "The Ultimate Challenges in Grocery Retail" and will be the key topics of this book.

However, a discussion on fresh foods forecasting and replenishment would not be complete without a look at seasons, promotions and weather so we are going to take an in-depth look at them as well. For the true aficionados, we've added [an appendix](#) of useful case studies and articles with examples of how to truly master your supply chain.

At RELEX, we've been improving forecasting and replenishment processes of grocery retailers for years. With this book, we hope that you can also benefit from the valuable lessons we've learned and start working towards accurate forecasts and automated replenishment of your fresh foods. It's a challenge that's definitely worth tackling.

The challenge and the potential in a single word – spoilage!

FRESH FOODS REPLENISHMENT requires extremely high control accuracy as many items have a shelf life from one day to a week. A solution that works like a dream on the ambient side can fail miserably at fresh. In fresh foods, the risk of increased spoilage or weak availability calls for minimal safety stocks and accurate day level demand forecasts. As a result, fresh automation is often put off.

The huge gross margin impact of spoilage makes the automation of fresh appealing. When done correctly, investments in automation are typically returned in just a few months.

Fresh food forecasting and replenishment automation provide the best business cases in supply chain optimization by a mile.

Four building blocks for success:

KEEPING IN MIND in this fresh foods book we will take you through our 4 building blocks for successful fresh replenishment:

- 1. ACCURATE FORECASTING**
- 2. MANAGING SEASONAL CHALLENGES**
- 3. EFFICIENT DEMAND FORECASTS FOR PROMOTIONS**
- 4. WEATHER-BASED DEMAND FORECASTING**

1. Accurate forecasting

ACCURATE DAILY REPLENISHMENT IS DEMANDING

Let the system take the strain

The short shelf life of fresh foods makes their forecasting and replenishment essential. As sales fluctuate significantly from day-to-day, precision is only possible through day-level forecasting and replenishment parameter calculations.

The following practical building blocks help you increase accuracy.



1. Identify weekly patterns and use them in your forecasts

THERE ARE PEOPLE who always eat pizza on Saturday evenings and barbeque on Sundays. Analyze the data for larger customer segments – e.g. all consumers shopping in one store - in order to discover patterns and identify different shopping habits for each weekday.

Occasionally, it might make more sense to create profiles manually, but generally harnessing automated statistical tests for mining the data profile for each product is more effective in recognizing the demand patterns and assigning the correct proportion for each day.

Tracking and analyzing day-level forecast accuracy alongside week-level accuracy is the best way to identify problems arising from inadequate day profiling.

2. Find the right calculation level for weekday profiles – go low but not too low

IN GENERAL, CREATING individual weekday profiles is based on the system calculating the percentage of the week's sales made on each day of the week. However, the creation of a reliable profile necessitates significant sales of an item at a particular store to provide sufficient data. In practice, SKU-store -level profiling works best for products like tomatoes that sell every day. For more volatile products, you have to aggregate data from across stores in order to arrive at a statistically significant data set.

The simple options for aggregating data are either to
a) combine figures for lines in the same product group (leek and garlic as part of onions) or
b) combine sales for multiple stores in the retail chain.

Regardless of your choice, it's important to aggregate at a level where the demand profiles of the products are quite similar. For example in packed meat, basic products such as ground meat and upscale products such as beef fillet often have quite diverging sales profiles.

As a good rule of thumb, we suggest creating as detailed profiles as possible. Top-level weekday profiling can be improved by splitting larger product groups, for example by price point. Likewise, when aggregating data across a number of stores, it is important to take individual store's profiles into account. In practice, seek the lowest level of profile where you have unbroken sales data for the period.

3. Identify and correct errors in the daily profiles

THE FORECAST FOR normal sales days usually consists of two components – the weekly forecast and the day level split within the profile. Tracking and analyzing day-level forecast accuracy alongside week-level accuracy is the best way to identify problems arising from inadequate day profiling. Looking at the same data at different levels - SKU-store, Product group-Store, and SKU-chain - often helps to discover errors.



4. Build capability for day-level safety stocks

UNFORTUNATELY, FORECASTS ALWAYS contain a margin of error. This principle holds true even if you have calculated beautifully accurate weekday profiles based on the correct level of data aggregation. To account for the margin of error and to reach desired shelf availability, we need safety stocks.

Safety stock levels can be scaled to demand forecasts simply by setting safety stocks in terms of days of forecast demand, e.g. 0.2 days for each day. However, forecast accuracy for each weekday often varies, as sales volumes vary. As a result, safety stocks need to cover those events to maintain the desired shelf availability. It often helps to calculate day-level safety stocks for products with differing day-level forecast accuracy.

Delivery patterns should also be taken into account in safety stock management. In most retail chains, delivery patterns change over the weekend, and more remote stores might only have a few deliveries each week, even for fresh products. In those cases one option is to profile safety stocks differently in the stores where delivery intervals are the longest, as they present the biggest risk of spoilage and availability.

5. Remember that some weeks are special

A RETAILER'S YEAR is full of exceptional sales situations. To forecast baseline sales accurately, you need to isolate promotional and holiday sales from your normal weekly profiles as public holidays greatly change consumption patterns.

In general, there are two kinds of holidays: those that land on the same weekday year after year (such as National Holidays and Easter) and those that don't (such as Christmas and 4th of July). Calculating weekday profiles from historic data works for the former, but in the latter you are probably going to have to adjust forecasts based on for example a store cluster level. Tactics for dealing with both are discussed in more detail in the next chapter.



2. Seasons and holidays

HOW TO MANAGE SEASONS EFFICIENTLY

For most people, holidays mean good company and good food. For supply chains, holidays mean increased demand that usually shifts away from standard items while satisfying the increased demand is more difficult due to the holiday timetables of stores and factories. When volumes are high and the margin for error is low, the risk of running costly errors is tangible.



Achieving accurate demand forecasting for holidays

THE AIM OF demand forecasting is to build an accurate forecast of future demand for each store on a product-day-level basis. For any holiday-season planning, several different kinds of forecasts on different levels are needed, but the store-product-day level demand forecast is still the foundation on which all others should be built.

A simplifying aspect of fresh food seasonal forecasting is that assortment turnover is generally a good deal lower than in most other retail sectors. Usually fewer than 20% of products are new introductions, so most products have a demand history. The highest forecast accuracy is achieved by combining each product's demand history with statistical, seasonal time-series models. Price and assortment role changes are only built in if major changes have occurred for that product compared with previous years.

Whenever new products are introduced to your holiday product portfolio, automatic reference picking can be used to let your supply chain management system pick a product with a similar demand history. We have previously achieved good results by using very basic data such as choosing a median demand product from a certain product group and price range as a reference. Well thought out basic rules work in almost all cases ex-

cept those where huge marketing campaigns propel the sales of a product. Such cases require manual planning.

The seasonal sales patterns of new products are usually borrowed from the product group of the reference product. The basic demand volume is taken from the product itself and demand for the upcoming season from the aggregate group. After picking a reference product, the demand forecast is allocated to individual days using day profiles. Day profile calculation is straightforward for most holidays and can easily be done following the instructions laid out in the previous chapter.

Christmas however, is often quite a different tale. In 2018 Christmas Eve falls on a Monday. The next time it will fall on a Monday will be 2029, 11 years later. The overall market, as well as local conditions, can change a lot in 11 years. The best solution for Christmas is to let the system forecast day-level demand according to set or calculated day profiles. However, a good Forecast Analyst can usually increase the quality of the forecast by adjusting it based on their professional expertise.

To achieve the best results, review and modify the forecast using several different groupings such as:

- ▶ **PRODUCT-STORE LOCATION TYPE (URBAN, RURAL)**
- ▶ **PRODUCT GROUP-STORE**
- ▶ **PRODUCT-CHAIN**

The modification of forecasts on different levels is robust when the disaggregation of changes is transparent and understandable. For instance RELEX supply chain management systems, forecast reviews and updates can be done by any logical grouping. The system disaggregates the manual forecast reviews based on the relation of current forecasts, and clarifies the change history.



3. Promotions

THE ART OF SUCCESSFUL PROMOTION MANAGEMENT

Price promotions play a dominant role in profit generation and in driving consumer behavior. The tendency of promotions to pump up sales volumes and affect the sales of other product lines puts great stress on the supply chain, especially on the forecasting and replenishment of fresh foods.

Without further ado, here are the basic principles to successfully incorporating promotion forecasting and replenishment into your fresh foods supply chain planning processes:

1. **MAINTAIN PROMOTION INFORMATION**
2. **INCLUDE PRE-ORDER INFORMATION**
3. **LET THE SYSTEM perform**
4. **REVIEW AND ADJUST**
5. **COLLABORATE**
6. **EXECUTE**
7. **REVIEW**



1. Maintain promotion information and forecast variables in the forecasting system

IN ORDER TO be able to accurately analyze past promotions and to forecast future ones, all relevant promotional data should be collected. Knowing when a promotion took place and which products were included, is a starting point. The most successful companies have also collected data on promotion types, discounts, promotional displays, as well as advertising campaigns for a long time. All of this data comes handy once you implement a supply chain management system that can use this information. This data is usually readily available for any currently running promotion but it can be challenging to find data for promotions that were run two years ago.

2. Include logistic information for initial quantities

IT USUALLY TAKES some time to set up a promotion in a store, so the stock used to build the promotion display needs to be delivered early. Companies managing successful promotions, usually decide how many days before the presentation begins they want the goods to arrive (1–3 normally), and set a presentation level (a % of forecast) with which they will do the initial fill. As a lesson, remember to include presentation levels and delivery dates for pre-orders.

3. Let the system calculate the promotion forecast for consumer sales as well as the order forecast

WITH THE PROMOTION variables and the delivery plan in place, it is time to let the system do the heavy lifting. For our customers, we calculate an SKU-store sales forecast and a delivery plan for the goods on promotion. As discussed earlier, the quality of the forecast depends on the quality and quantity of the data available. In an ideal case, the rich historical data can be used to calculate how different factors – price, display, other actions – impact sales and the price elasticity of each product. This information is then used to construct a very accurate forecast.

RELEX has not just given us the ability to factor the type of promotion (i.e. three for two) into forecasts but it does so on the basis of how that type of promotion has affected similar products. Its computational power also gave us the ability to cache history and be outlet-specific, factor in the ranges which will vary store to store, the percentage discount and, crucially, the fixture the promotion stands on.

Andrew Rafferty, IT and eCommerce Director, Booths

4. Review the forecasts and compare with previous promotions

FORECASTS ARE USUALLY reviewed for two reasons; to check accuracy and to ensure capacity. The accuracy of the calculations is checked by comparing the forecasts to previous promotions and commercial targets. The review is done at a higher level, usually chain or store cluster level. Modifications can be done at higher levels and then cascaded back down to SKU-store level.

5. Collaborate with suppliers to ensure capacity and availability for fulfillment

IN A STANDARD supply chain, the order forecast is used to ensure the availability of supply chain capacity and products for the promotion. Sometimes the collaboration is extended beyond forecast data to the promotion data itself. The sales impact of different promotion variables in different types of stores can then be reviewed in collaboration with business partners in order to develop more effective promotions.

6. Execute to plan and demand

LIKE ANY OTHER replenishment, promotion replenishment execution is based on forecasts and actual demand. If the promotion period is extended, it is important to update the promotion forecasts based on actual sales and also to follow-up how the promotion replenishment performs.

7. Review success

IT IS IMPORTANT to review how successful the promotion was and how well the supply chain coped with the demand. **The key metrics to best assess a promotion include:**

- ▶ **OPERATIVE SUPPLY CHAIN KPIS** – How can the performance of the supply chain be improved?
 - Service levels
 - Forecast accuracy and bias
 - Spoilage and end inventory
 - Impact of different factors such as price and display
- ▶ **COMMERCIAL KPIS** – How can the profits of promotions be increased?
 - Sales and sales increase by quantity and by monetary value (considering possible discounts)
 - Gross profit

Typically, KPIs are reviewed not just for individual promotional products but also for applicable product groups. Especially for commercial KPIs it is crucial to consider the aggregated effects across a product group to assess whether the positive effects of a promotion were offset by reduced sales of other products.

The more important promotions are for your sales, the more important it is to include them in your forecasting and replenishment processes. As one of our customers put it – ‘improving promotion forecasting is a virtuous circle’. Better promotion forecasting leads to better planned promotions using better data, which helps forecast subsequent promotions more accurately.



Cannibalization & Halo effect

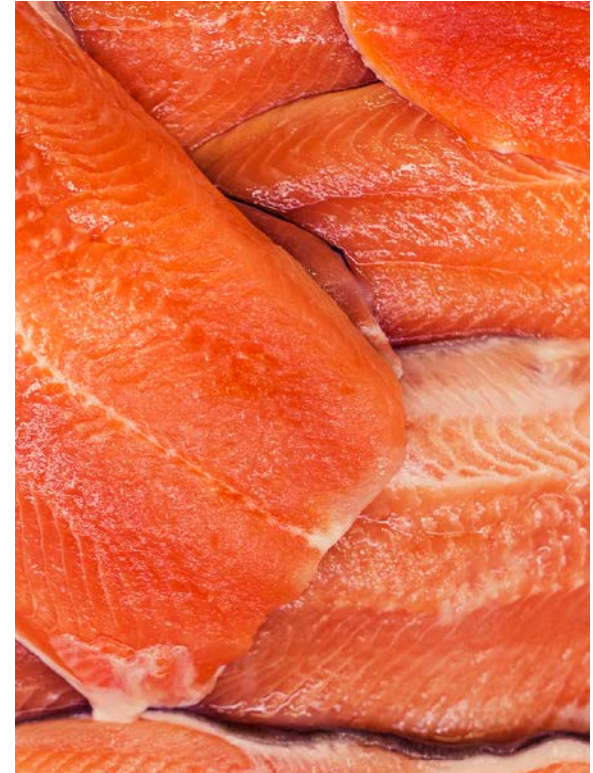
WHEN DISCUSSING PROMOTIONS one should not forget the counter-effect, i.e. cannibalization. Selling more of one product often decreases the sales of other products in the same category. Typically, this isn't a big issue with dry goods as selling less for a few days results in only slightly increased stock levels for the next couple of days. With fresh food however, the risk is real. Sudden drops in sales rates could lead to increased spoilage, which quickly eats all the profits of the promotion.

A related effect to cannibalization is the so-called halo effect, where increased sales of one item increase the sales of others too. A typical example would be hamburgers; a promotion of burger patties is likely to increase the sales of burger buns as well.

The massive assortments many grocery retailers hold constitute another challenge. It's not unheard of that in e.g. ground meats you have 15 different items, 5-7 of which are promoted every week. Understanding the dependencies between all these products is difficult. In fact, it can even be irrelevant. If a handful of items in a category are promoted all the time, the cannibalizing effect is actually built in to the baseline demand of all items in that category.

Selling more of one product often decreases the sales of other products in the same category.

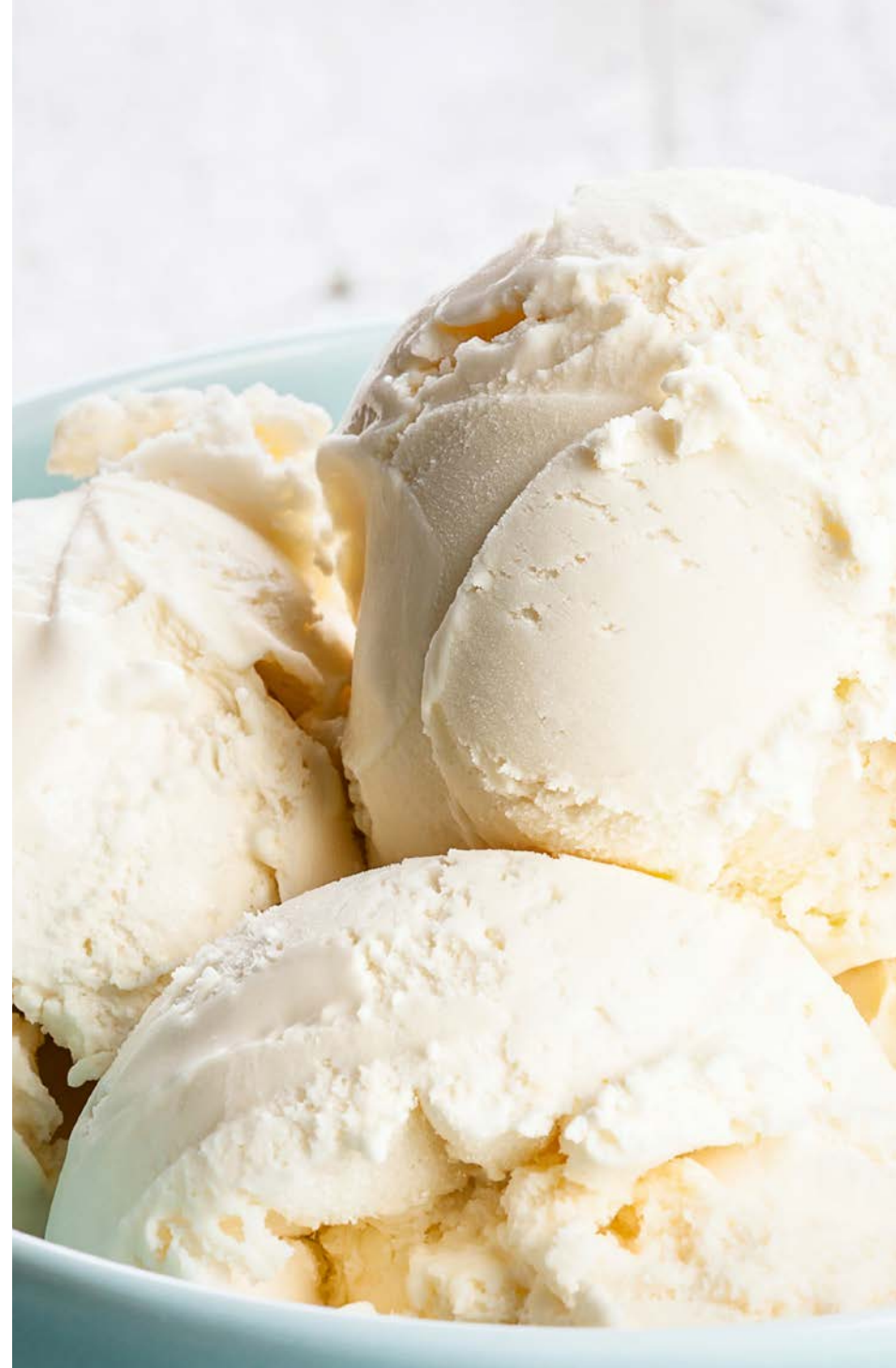
Adjusting forecasts for cannibalization is sensible especially when the assortment is limited. The forecasting itself is complex, but not difficult – the logic is exactly the same as with promotional uplifts, only this time the impact is negative. If you are using an advanced model that can factor in price elasticities and promotion displays etc., then promotions or discounts of related products are just an additional factor in the equation. The challenge is in understanding the links between items. You need to understand if the cannibalization and halo effects take place within a category or within larger group of products.



4. Weather

HOW TO FACTOR IN WEATHER IN YOUR FRESH FOOD DEMAND FORECASTS

Taking weather into account is one of the main challenges in forecasting the demand of fresh foods. For most grocery items, weather creates an asymmetric risk. If freezers haven't been filled to the brim with ice cream when a heat wave strikes, sales are lost. However, if the freezers have been filled but the forecast is wrong and the expected increase in demand fails to materialize, stores will have higher ice cream stocks for a while. Eventually they will sell out and the impact of lost revenue is small.



WITH FRESH FOOD the game is far more important due to the high risk of spoilage. Filling up your barbecue meats for a great summer weekend which is cancelled by torrential rains will show massively in your next week's waste figures. On the other hand, if you fail to recognize the good weather, the potential sales boost is not realized.

Weather dynamics

WEATHER HAS TWO major effects on consumer behaviour:

1. People are more likely to go out more on a beautiful day, increasing the overall traffic and sales at the store level.
2. Buying patterns are affected by weather, different products and product groups have different responses to weather changes.

The impact of weather on overall grocery store traffic is most obvious during the summer. A beautiful summer day can easily boost shop traffic by 5–10%, while a cold rainy day has the opposite effect.

The degree to which demand responds to the weather can differ considerably according to location and market type. Larger stores tend to feel the impact of a warm weekend more than smaller ones.

Weather effects also have a zero-sum counter-part. When people go out to do their shopping on a beautiful day, they stock up for the rainy days. In part, weather only shifts demand. Secondly, when sales of products that respond positively to warm weather go up, people tend to spend less on other products.

Responses to the weather differ depending on the day of the week as people behave differently when it's good weather on the weekends and holidays. Prolonged good weather also desensitizes consumers - the more beautiful days there are, the less people feel the need to make an event of them. When separating out normal weekday variation from demand, the sales response to weather is typically reasonably uniform throughout the week.



LET'S NOW LOOK at a few simple steps that you can take in order to start improving your forecast quality by taking the weather into account.

How do I model weather impacts in my forecasting?

BEARING IN MIND the various ways we've noted that weather can affect demand, there are a number of factors that need to be taken into account when adding weather modeling to your forecasts:

1. Impact of store-location. Not surprisingly, weather models should be location-specific. Obviously, weather varies by location, but stores also differ by their behavior. For instance, store format has an impact (inside a mall vs. corner shop). Some stores are just more weather-sensitive than others, perhaps because they are next to a tourist destination or the beach. Competent weather models should automatically take this information into account.

2. Variations between product (sub) groups. Providing that you have sufficient sales and weather data, it is possible to identify a unique weather response for a product at various hierarchy levels. However, if this approach is disproportionate in scale to the available data or potential benefit, common sense and studying historic sales patterns combined with weather observations can take you a long way.

3. Timing. An intense heatwave mid-March is a different matter than in mid-June. Advanced models should include time of the year as a parameter.

4. Weather parameters. Which factors should you consider when forecasting based on weather? Obviously the temperature, but also the beauty of a day, measured with sunshine hours, cloud coverage or rainfall. Relative metrics can also be useful: the first beautiful day of the summer has a different impact than the 10th in a row.

Once you have addressed these considerations, sales data can be de-weatherized and a clean baseline sale can be produced. The final step is to model back the upcoming weather forecast to the baseline sales forecast.

However, before going into advanced quantitative methodology, we should take a step back. When discussing product-group segmentation, studying past observations of sales against weather can provide valuable insights and be used to adjust forecasts. This is especially rel-

evant for special events or holidays such as Memorial Day or Labor Day when sales of things to throw on the grill generally rocket, and where the exact date varies from one year to another. In order to carry out effective forecasting, weather information needs to be input to the supply chain planning system.

Remember to prioritize. You could spend an endless number of days and nights improving the sales forecast by using additional data, but you should start from the biggest benefits and then continue fine-tuning only as long as it brings results. For instance, start from summer products with short shelf lives. When your summer weather forecasting is working well you could create responses for other scenarios, such as extreme weather events.



KEY TAKEAWAYS FOR BETTER FRESH FORECASTING AND REPLENISHMENT

1. Accurate forecasting

THE FIVE PRACTICAL building blocks to help you increase planning accuracy are:

1. Identify weekly patterns and use them in your forecasts
2. Find the right calculation level for weekday profiles – go low but not too low
3. Identify and correct errors in the daily profiles
4. Build capability for day-level safety stocks
5. Remember that some weeks are special

2. Seasons and holidays

FOR SUPPLY CHAINS, holidays mean increased and shifted demand. Any holiday-season calls for different kinds of forecasts on different levels, with the store-product-day level demand forecast acting as the foundation on which all others should be built. When introducing new products, automatic reference picking can be used to let your supply chain management system pick a product with similar demand history.

3. Promotions

IMPROVING PROMOTION FORECASTING is a virtuous circle: The more important promotions are for your sales, the more important it is to include them in your forecasting and replenishment processes. All relevant promotional data should be collected. Use your data, and let your SCM system perform. Trust the order forecast and use it to ensure the availability of your supply chain capacity. Review your data.

4. Weather

WEATHER HAS TWO major effects on consumer behaviour:

1. People are more likely to go out more on a beautiful day, increasing the overall traffic and sales at the store level.
2. Consumer buying patterns are affected by weather, different products and product groups have different responses to weather changes.

Successful weather-based optimization requires utilizing these facts to your benefit. Remember to prioritize. Start from the biggest benefits and continue fine-tuning only as long as it brings results.



Appendix

BLOG POSTS:

- ▶ Saving money and feeding Canada
- ▶ Zero spoilage or the perfect availability
- ▶ How to master fresh foods supply chain capacity planning

CASE STUDIES:

- ▶ Case Booths Supermarkets: Cool innovations in Supply Chain management
- ▶ Case Stockmann

ARTICLES:

- ▶ Less work, better forecasts
- ▶ Suomen Lähikauppa looks to cut waste on fresh food

MORE ON PROMOTIONS:

- ▶ Better promotion management in 4 steps





**IS YOUR FRESH FOOD FORECASTING
AND REPLENISHMENT AUTOMATED?**

**We have helped grocery retailers and
wholesalers to master their unique challenges
- indeed the more complex the environment,
the bigger the impact of RELEX.**

**Start improving your company's profitability
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