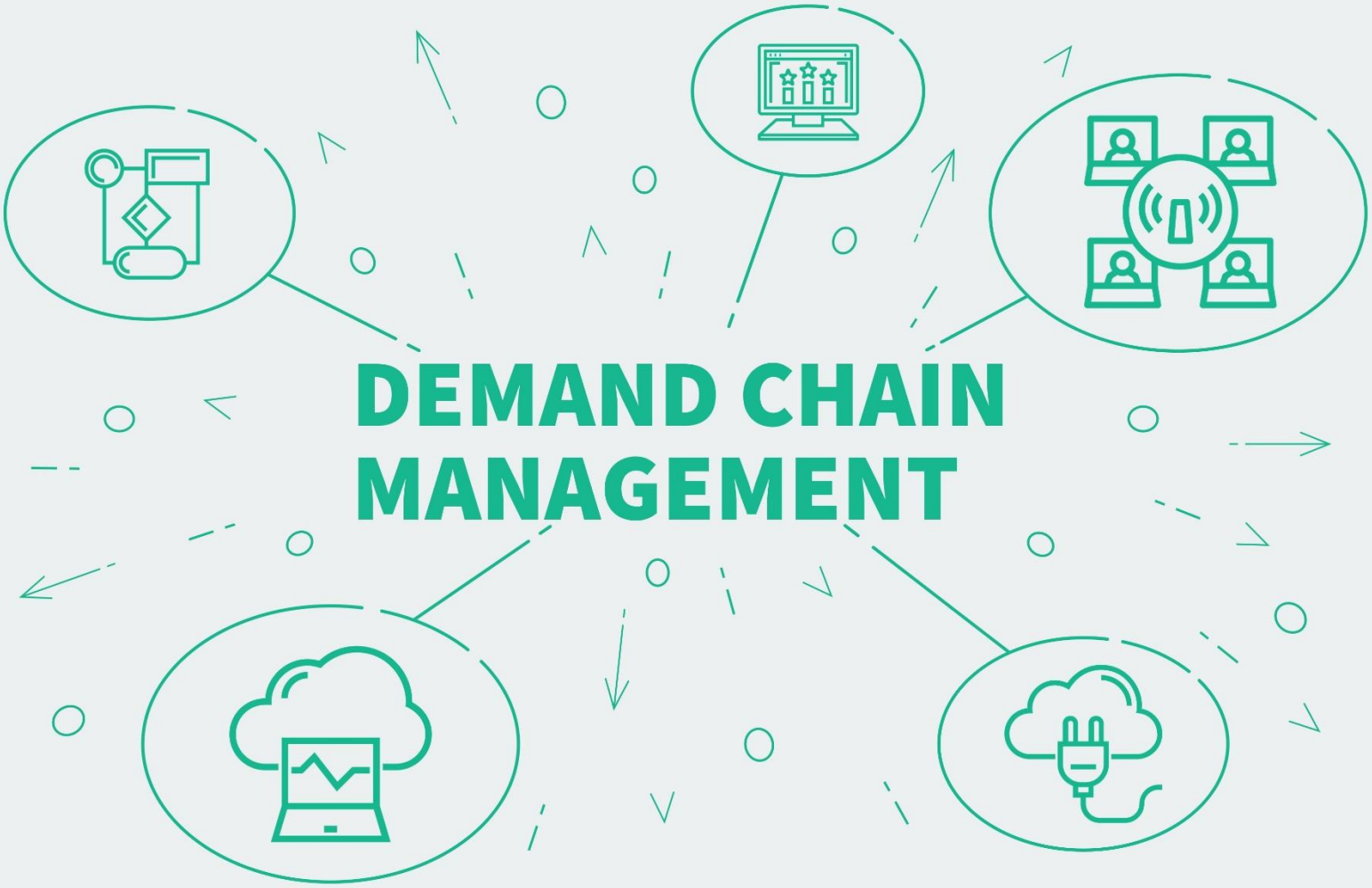
Demand Forecasting
2018



RJB TECHNOLOGY
Smart Custom Software Development

The Continuing Evolution of Tanpin Kanri

RJB participated in the original project that first brought Tanpin Kanri demand forecasting to western convenience retailers in 2001. State-of-the-art handheld terminals with color touch screens provided all of the relevant information and communication capabilities to store staff. By applying Tanpin Kanri to reduce out-of-stocks and make the categories more friendly to local stores and local consumers, stores were able to boost profits by as much as 10 percent and inventory turns by a remarkable 40 percent (CRM Magazine, October 2001).

Our Background

RJB participated in the development of multiple demand forecasting suites, beginning with a solution based on 7-Eleven Japan's very successful "Tanpin Kanri" method. In addition to application of very strong demand forecasting techniques, our solutions focus on simplifying, and reducing the training and effort required to use Demand Forecasting in a competitive retail world. While many demand forecasting solutions focus strictly on brick and mortar operations, RJB extends those solutions to the "Long Tail" common in many e-commerce retail operations in today's market.

This article is a brief overview of our experience and capability. We hope you will find it useful. For more information, or for advice on your demand forecasting project, don't hesitate to get in touch.

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What is Tanpin Kanri?

"...it is proving to be a world-class model of customer-centric retailing..."

"Tanpin Kanri" or "management by single product", is an approach to merchandising that considers demand on a store-by-store and product-by-product basis. Pioneered by 7-Eleven Japan, it is proving to be a world-class model of customer-centric retailing. It empowers store-level retail clerks to tweak suggested assortments and order quantities based on local factors related to a store such as trends, seasonality, promotions, events, day of week, weather, and more.

"...the system placed too much burden on store staff who were not used to making ordering decisions..."

While the original Tanpin Kanri systems continue to be extremely successful in Asia, the identical model didn't entirely make the transition to the West. Questions were raised about placing extra burden on store staff who were not used to making ordering decisions that they had formerly relied on suppliers to make. Some felt that the focus of Tanpin Kanri really lent itself more to ordering of Perishable and Daily Fresh items, and not so much to Non-Perishable items - this due to its focus on Just-in-Time (JIT) inventory replenishment. North American convenience stores did only about 10% of their sales in fresh categories in 2001, but more recently that number has increased to 20% - still short of the 40-45% sales of fresh items in Japanese convenience stores.

Some adaptations for the North American market were made, and today 7-Eleven manages 8 to 10 stores in a group from a central distribution centre. A unique inventory of products for each store coupled with different kinds of store layouts provides the knowledge for 7-Eleven to roll out a growing portfolio of community sensitive locations (Real Estate News Exchange, April 2013).

Modified Tanpin Kanri

"...it was necessary to reduce the effort of ordering to the absolute minimum, and introduce new E-commerce related features..."

The brilliance of the Tanpin Kanri forecasting method is the incorporation of local factors that influence store sales - such as weather, promotions, product selection, and customer feedback - into the forecasting and ordering system. Keep in mind that Tanpin Kanri was implemented in the 1990's in Japan, at a time when store level forecasting was very primitive. Hat's off to Toshifumi Suzuki, chairman and CEO of Seven-Eleven Japan for inventing the concept of incorporating local factors into product selection and inventory control - it was a stroke of genius. In today's world, e-commerce has become a significant retail factor in addition to brick and mortar stores. It changes how we analyze purchasing patterns and the factors that affect them, and in some cases how we control inventory. For Tanpin Kanri to apply to both brick and mortar stores, and to e-commerce stores, some changes are necessary.

What is the Order Cycle?

Before launching into a discussion of Modified Tanpin Kanri, it's important to understand the Order Cycle. In order to keep customer service levels high, and reduce stock outs, techniques must be introduced to model ordering patterns and optimize inventory costs. When considering service levels, the concept of lead time is important. Lead time is the latest time that an order can be placed with a suppler through to the moment when the inventory becomes "on-hand" and available for purchase by a customer. This time can be broken down into:

- Supplier Lead Time - The time from the supplier's receipt of the order to the time the order is delivered to the retailer.
- Order Lead Time - This lead time applies only to made items e.g. cakes. The time from the receipt of the order for ingredients/components by the retailer to the time the item is made.

Made items introduce a manufacturing time, which can be a sub-component of both order and/or supplier lead times. A retailer might be selling cakes which are ordered by ingredient from suppliers (flour, sugar etc.), but made on-site when orders are placed by customers. This introduces an order lead time, since the cake is not on-hand inventory until it is made. Similarly, suppliers might have to make an item upon receiving an order from the retailer - this is factored into the supplier lead time. Shipping time can also factor into supplier lead time. A product shipped overseas from international locations can introduce additional shipping time of several weeks, as well as customs and immigration time.

"Order cycles are often overlapping i.e. a retailer order to a supplier is placed while a previous order is still "on order"..."

The above discussion describes a retailer order cycle, from the time that an order is placed, through to the point where the inventory is on-hand and may be purchased by or shipped to the customer. Order cycles are often overlapping. For example, a retailer order to a supplier is placed while a previous order is still "on order" i.e. it has not yet been received from the supplier. This means multiple quantities must be considered when formulating an order: 1) current on-hand, 2) current on-order, 3) minimum display (brick and mortar only), and 4) forecasted demand between the order date and the ***next-next delivery***. Note: with overlapping order cycles, the ***next delivery*** is from the retailer's previous order, while ***next-next delivery*** is for the retailer's current order.

In point of fact, the schedule of retailer orders to suppliers is usually determined by the supplier delivery schedules. A given supplier might deliver only Monday and Wednesday. Given that schedule, lead times as discussed above need to be incorporated into the retailer ordering schedules to determine when the order must be placed (i.e. the "order date") to get the shipment on a particular date. Overseas orders might take several weeks to ship, and only ship once a month on a given date. By working backwards using the lead times, the order date can be established. Then the demand forecasting process can calculate the demand between the order date through to the next-next-delivery. Once that demand is established, the order can be placed. A final note is the observance of calendar days versus business days in the scheduling. Public holidays, for example, can affect the calculation of order dates and/or delivery dates.

While we haven't discussed minimization of inventory costs yet, it should be noted that the process described above is a Just-in-Time (JIT) inventory control process, which by its very nature minimizes inventory costs and reduces stock outs. This process becomes more complicated when we get into a discussion of slow sellers.

Now let's move on to a discussion of Modified Tanpin Kanri, as it applies to both brick and mortar stores, and e-commerce stores.

Brick and Mortar Stores

For brick and mortar retail operations, RJB adopts the approach that store staff must be able to process most orders with a single click of a button! The alternative of running the system from a distribution center typically requires localized distribution centers because it necessitates frequent visits to the supported stores. With some new

"...automated capability to determine on a product-by-product basis which local factors affected sales!"

features the system must be able to incorporate the same type of Tanpin Kanri factors, but instead use them to create a fully automated prediction/hypothesis and order. Store staff are still fully informed about local factors affecting ordering patterns, but they need only confirm that the stated on-hand inventory is correct - and click - the order is created!

This requires the introduction of some new features to the Tanpin Kanri model - namely the automated capability to determine on a product-by-product basis what local factors affected sales! In 2003, the best option to do this was through statistical correlation - today we have the additional possibility of machine learning. Our original prototype of Modified Tanpin Kanri, which was completed in 2004 using classical statistical correlation, showed the promise of this approach. There are two completely new automated steps/changes in the Modified Tanpin Kanri process:

- Automated analysis of historical POS T-log data using classical statistical correlation produces Tanpin Kanri "factors" on a product-by-product basis. These factors are combined into a "product rule" that describes all forecasting factors affecting the product.
- Product rules (containing factors) from the previous steps are used daily to create a prediction/hypothesis for future sales on

both a product-by-product basis, and a Macro Evaluation Level (MEL) group. A MEL group is a set of products whose sales are correlated with each other in some way. For example, hot dogs and hot dog buns typically sell together. Similarly, product categories, such as "ice cream", can have correlated sales, because increased sales of one brand often means decreased sales of another. Through the use of MEL groups we can "balance" predictions on the group against the individual predictions for each product in the group, providing better forecast accuracy. MEL group balancing rules are created to resolve discrepancies between product level forecasts and MEL group forecasts.

With these new steps, combined with other data such as vendor delivery schedules and order and supplier lead times, an automated order is produced daily (by vendor) for each product that is in the system. The store staff reviews the generated orders by:

- Either approving the order, which tacitly confirms that the on-hand inventories assumed by the system is correct OR
- Correcting the assumed inventories where needed e.g. due to write-offs - the order quantity will be re-generated in this case OR
- Correcting the order in rare cases where the product forecast was in doubt.

"...we achieve the minimum amount of effort for store staff to process an order...while gaining insight into local factors affecting the order..."

Naturally, other variables such as vendor minimums, case quantities, etc. are incorporated when generating orders for given order cycle. What we achieve is the minimum amount of effort for store staff in processing an order. What we gain is exact insight into store inventory at the time of order placement, as well as local scrutiny and agreement with local factors that go into forecasting the product demand.

E-commerce Stores

E-commerce introduces new factors into the demand forecasting equation, necessitating further adaptations to Tanpin Kanri:

- The "Long Tail" implies slow sellers that must be modeled differently than products that compete for physical shelf space
- Competitor price shopping is practiced more often by customers
- Methods for gathering customer feedback are different than for brick and mortar stores
- Many e-commerce sites are distributors for at least some of their products, and therefore their suppliers carry the inventory

The Effect of the Long Tail

The Long Tail is a fact of life in many e-commerce operations. This typically results in slow sellers. Whether these products are inventoried by the retailer, or not, inventory must ultimately be carried somewhere e.g. the supplier. In order to keep customer service levels high, and reduce stock outs, ***special*** techniques must be introduced to model ordering patterns and optimize inventory costs.

There a number of techniques for modeling and forecasting slow sellers, including:

- Empirical model
- Poisson model
- Croston's Model
- Bootstrap Model

These methods model service levels, as well as inventory carrying costs. For further information on these methods involving a case study see Determining the Inventory Policy for Slow-Moving Items: A Case Study

The Effect of Competitor Price Monitoring

Competitor Price Monitoring (CPM) is a valuable tool for e-commerce, not only with regard to setting pricing and pricing policies, but also with regard to demand forecasting. Through the incorporation of a CPM program and a related CPM forecasting factor, demand forecasts can be improved with consequent positive impact on carried inventory and reduced stock outs.

Gathering Customer Feedback

One of the central tenets to Tanpin Kanri is utilization of customer feedback, in addition to other local factors, to gain insight into purchase patterns and innovations for product selection. In addition to e-commerce product reviews and suggestions, search relevance metrics can be gathered from a retailers e-commerce site that provide customer feedback. This additional feedback can be used to upgrade the relevance of products in the store.

Helping Suppliers Manage Inventory

With a sophisticated demand forecasting system based on Modified Tanpin Kanri, retailers can provide advanced projection information to their suppliers that will help them manage their inventory. This information can even be used to negotiate volume discount pricing, and facilitate other cost management strategies for the supplier such as human resourcing.

For more information, or for advice on your e-commerce or demand forecasting project, don't hesitate to get in touch.