White Paper

Optimize food & beverage manufacturing

How to meet peaks in demand

Executive summary.

Fluctuations in demand levels are a challenge faced by most food and beverage manufacturers. The two major causes of peaks in demand are typically seasonality and promotions.

Failure to effectively meet peaks in demand results in poor customer service levels, lost revenue, out-of-stock situations, disappointed customers, and potentially the loss of a major customer.

For resource-constrained organizations, stock building is an effective—but potentially costly—method of utilizing existing capacity to ensure that the right amount of the right product is available at the right time.

To calculate stock-build plans, you need to:

- Ensure that customer service levels and profit are maximized while risk exposure is minimized.
- Retain the available product shelf-life times for retailers.
- Deal with ever-increasing complexity as the number of products and production resources increases.
- Adjust stock builds to the optimal levels for each new promotion, season, and year.

Manual paper-based calculations, spreadsheets, material requirements planning (MRP), and rough-cut capacity planning (RCCP) systems are all limited in their ability to overcome these challenges. Likewise, alternative approaches to meeting peaks in demand—such as new equipment, subcontracting, and third-party warehousing—also have significant limitations in terms of flexibility and the value delivered.

To cost-effectively meet peaks in demand, you need to maximize delivery performance and the profit generated by available capacity. And to do so, you need a stock-building optimization solution that considers real-world constraints and cost implications, so it can generate feasible, cost-optimized plans. You also need a solution that:

- Provides simulations to evaluate potential promotions and identify profitable promotion proposals.
- Supports your business as it changes over time.
- Doesn't require major process changes or resource commitments during implementation.
- Delivers value from day one.

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In this white paper, you'll find out about some of the current methods food and beverage manufacturers use to meet peaks in demand, and about the limitations of these methods. You'll also find out about a better way to tackle this challenge.

Keeping pace with demand.

Retailers run promotions to attract new customers, win back old customers, build customer loyalty, and increase product usage. From your perspective as a manufacturer, promotions can encourage retailers to push a product, and be used to boost sales volumes and clear excess stock. Promotion types include percentage discounts on normal retail prices and buy-one-get-one-free offers. For some food and beverage product lines, a promotion can result in sales increases from 500% to 1,000%.

The food and beverage industry invests huge sums of money in product development and marketing to support promotions. But if promoted products are not on retailers' shelves—and consumers buy other products instead—that spending goes to waste. You must be able to forecast demand so you can minimize—and hopefully eliminate—out-of-stock situations on retailers' shelves, as a high out-of-stock rate represents a great deal of lost revenue for your company.

You can make the most of promotion-driven events by:

- Making better decisions that enhance customer service.
- Reducing unintended discounts necessitated by overproduction.
- Finding the optimal time to plan a promotion.

When product shelf life is more than a week—in segments such as beverages, confectionery, condiments, dairy, meat processing, and other consumer packaged goods (CPG) —the most common approach to meeting peaks in demand with existing capacity is to build stock in advance of demand. But if you start building stock too early or build too much stock, you run the risk of increased waste.

Approaches to meet peaks in demand.

Demand spikes with the seasons—for example, holiday pies for Christmas, burgers and carbonated drinks during the summer, and chocolates for Valentine's Day. Overlaid on these seasonal demand patterns are promotions that vary during the year and can spring up with very short notice to take advantage of market trends or in reaction to competitive pressures.

You can potentially meet peaks in demand with:

New equipment.

Investing in new production equipment to create a capacity buffer is an obvious way of improving service levels, but it's expensive and inflexible. If your product range changes, your equipment may become obsolete long before its capital repayment date. In addition, your total production costs may well increase while your overall resource utilization falls. In short, you run an inherently high risk and could get a low net return.

Subcontracting manufacturing.

On the face of it, utilizing subcontractors appears to be a simple and flexible solu¬tion to meeting peaks in demand. But you may find that it's expensive and complex, because you'll need to plan and manage the subcontractor's production, and ensure that regulations and quality standards are met. Depending on the location of the subcontractor's plant, additional distribution and lead-time costs are likely to accrue, and you could run into major issues obtaining appropriate production capacity exactly when required. Plus, you need to consider the inherent risk in sharing recipe and process information—in some cases, carefully guarded trade secrets—that provide your company with a competitive advantage.

Third-party warehousing capacity.

Many companies use third-party warehousing to hold and handle stock building. Since you can rent third-party warehousing capacity by the day and square meter, you'd think this is a simple and flexible solution. But while you may find this option useful when you genuinely need warehouse space, you won't get much business value in most cases. Easy access to additional warehouse space encourages excessive stock building, ties up extra capital, has a negative impact on cash flow, and leads to a higher risk of product expiration. By handling stock through an external warehouse, you'll incur added costs and waste, because your risk of product damage and shrinkage will increase. In the end—while third-party warehousing offers flexibility and simplicity—it delivers limited value unless stock levels are optimized against forecasts and order demand.

Production capacity adjustments.

Where labor is low-cost, flexible, and low- or semi-skilled, you may find that adding workers is an attractive option for meeting peaks in demand. However, hiring and training extra labor or changing working patterns is not normally easy in developed countries. Employment laws, labor availability, lifestyles, hourly rates, the cost and time for training, and other administrative overheads all make this option less attractive. Due to the hiring process, you normally need a four- to six-week lead time to plan and add an extra shift. Quality and productivity levels tend to slump while newly hired employees learn to do their jobs. By the time your new employees are up to speed, your demand peak is likely to be over, and then you're faced with layoffs.

But if suitable labor is available, you may want to consider additional capacity when you face substantial peaks in demand—that is, when shelf life is very short and doesn't permit stock building, or when adding capacity is cheaper than building stock.

Stock building.

Stock-build planning is a tactical approach to balancing supply and demand in light of current stock positions. Normally you would do this at the master production scheduling level---that is, before you net requirements, size batches, and generate manufacturing orders in material requirements planning (MRP). By respecting actual capacity levels and backward-smoothing load, time-phased target stock is defined for each planning period. Target stock—consisting of the required safety stock and calculated additional stock—can help you meet a peak in demand that cannot be met by production close to the point of demand.

If you can calculate target stock levels for stock building accurately, you'll get improved service levels, fewer out-of-stock situations, increased revenues, lower overall stock levels, less product expiration, higher resource utilization, and lower production costs.

Stock building vs. capacity adjustments.

Assuming you have a ready supply of suitable labor, your two key decision factors when choosing between building stock and increasing capacity levels are total production cost and shelf life. With medium-shelf-life products (21 days or more), stock building is frequently preferable because this method maximizes resource utilization and minimizes production costs by avoiding additional headcount and overtime payments.

For products with a very short shelf life, you might find that it's sometimes more appropriate to adjust capacity, since you have limited time to build stock and a higher risk of product expiration (see Figure 1). With short-shelf-life products, a mix of stock building and capacity adjustments is usually most effective. Figure 2 shows the suitability of different approaches for meeting peaks in demand depending on product expiration risk and shelf life.

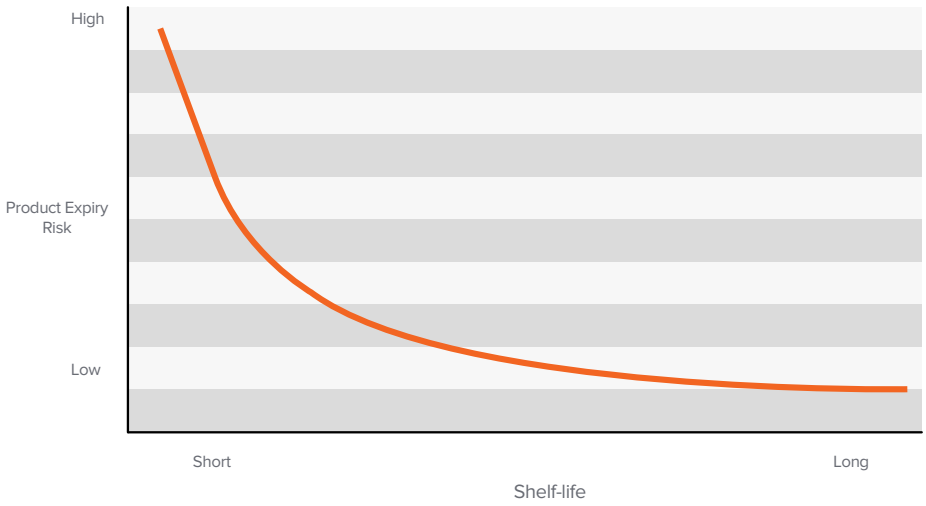

Figure 1. Product expiration risk versus shelf life.

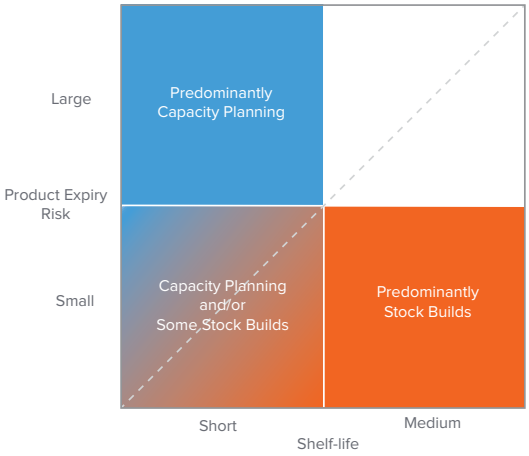

Figure 2. Appropriateness of stock build and capacity planning depending on product expiration risk and shelf life.

Strengths and weaknesses of stock building.

Consider the following positive and negative factors when you're thinking about building stock to meet peaks in demand.

On the plus side, you will:

- Reduce your need for long-term capital investment in equipment.
- Minimize your labor bill by not having to hire and train extra labor, and/or not having to make excessive overtime payments to meet peaks in demand.
- Utilize your existing equipment during otherwise idle time to maximize the profit generated from your available capacity.
- Avoid being tied into large capacity buffers on equipment dedicated to a specific product range.

On the negative side, you will:

- Tie up capital for periods of time. But, you can alleviate this problem by correctly calculating optimum stock levels. Like many companies, yours may have far more capital tied up in stock than is necessary, and the stock you have may be in the wrong product lines.
- Experience negative cash flow during stock ramp-up. But again, this is largely due to excessive stock building of the wrong products.
- Run a higher risk of product expiration than if you produce at the point of demand. However, you can manage this risk by limiting stock building when you anticipate a highly inaccurate forecast for promotions or products.

Alternative methods for stock-build planning.

When you're planning to build stock, you need to ensure that the right amount of the right product is available at the right time. That way, you'll be able meet peaks in demand. You need to:

- Maximize customer service levels and profit while minimizing risk exposure.
- Retain a specified minimum share of the product shelf life for retailers.
- Deal with the fact that calculating stock builds becomes increasingly complex as the number of products and production resources increases.
- Adjust stock builds to the optimal levels for each new promotion, season, and year.

Your challenge is to minimize the amount of time you hold stock and the value of the stock you hold by optimizing stock building. Calculating a ramp-up in stock to meet a peak in demand can appear easy when you consider only one production line and one product. But as you take more lines and products into account, the complexity and required calculation time increase exponentially. In Figure 3, you can see how the calculation becomes more complex when you increase stock-build planning for one resource across a 12-week horizon from two to four to six products. If you increase from two to four products, complexity increases almost 100 times. If you increase from two to six products, complexity increases a staggering 10,000 times. Calculating the optimum or even near-optimum stock-build profile per product becomes very inefficient and error-prone using traditional methods. It is quite common for one or a number of employees within a manufacturing company to be dedicated to stock-build planning full-time or for significant periods of time.

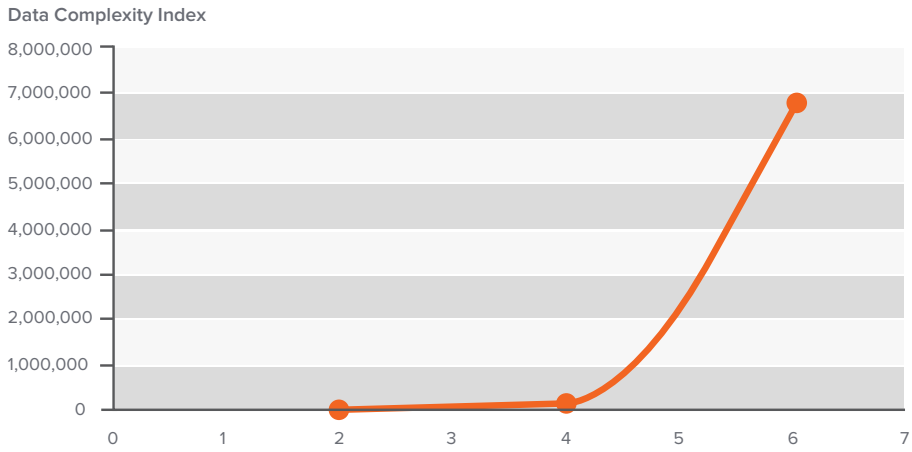

Figure 3. Increasing complexity in stock-build planning on one resource over a 12-week horizon as product numbers increase from 2 to 4 to 6.

For a scenario demonstrating the increased complexity of building stock optimally as the number of planned products increases, see Appendix A.

Due to changing forecasts and product mixes, your optimum solution is going to be different for each year and season. In fact, your optimum solution will be different each time you calculate it, so there is no point in attempting to reuse previous plans. The calculations become even more complicated due to the fact that you need to ensure that you retain the specified minimum number of days' shelf life for the retailer. In addition, you want to minimize stock exposure risk. To do that, you should build stock that you know you can sell while you limit stock building of product lines that are on promotion—in which cases demand is more uncertain. By producing promotional products nearer to the point of demand—once you have more accurate information on the likely promotional uplift—you reduce the risk of overproduction and waste due to product expiration.

Paper-based calculations and their limitations.

A paper-based approach to stock-build calculations becomes very complex, and costly to maintain, once you have more than a handful of products and resources. This is especially the case when promotions are frequent. Any solutions you create manually are likely to be far from optimal, particularly as time moves forward and the environment changes. The working hours required for calculation and the risk of errors are both high, and errors are potentially very expensive. In addition, a paper-based approach doesn't allow you to easily consider shelf-life constraints and manage risk exposure on promotions.

Spreadsheets and their limitations.

While spreadsheets are relatively low cost and have many uses, they are out of their depth when it comes to effectively optimizing stock-build plans. The maintenance and use of spreadsheets becomes highly complex. Building and maintaining a model that combines and optimizes against cost, capacity and shelf-life constraints, and alternative processes in an easy-to-use format is not feasible in a spreadsheet. Spreadsheets are not flexible enough to cope easily with resource capacity changes, new products, recipe reformulations, and process changes, meaning their potential value is limited.

Material requirements planning and its limitations.

Stock-build planning is a tactical management task. You need to carry it out during master production scheduling; that is, before requirements netting, batch sizing, and manufacturing order proposal generation by MRP. That means it's inappropriate to create your stock-build plan at the MRP level. Instead, you need to create an accurate, time-phased stock-build plan that MRP can respect during its netting of requirements, batch sizing, and manufacturing order generation.

Some organizations do attempt to manage stock building with their MRP systems, but this isn't what MRP was designed to do. MRP is a pull-based system that assumes capacity is always available when required and does not consider costs. In an attempt to build stock with MRP, planners manually enter manufacturing orders with a due date significantly earlier than their actual customer requirement date. In many cases, it is pure guesswork. Others rely on external paper or spreadsheet calculations to drive this order entry, but suffer from the limitations discussed earlier.

Rough-cut capacity planning and its limitations.

While rough-cut capacity planning operates at the appropriate level for stock-build planning, it too has a number of limitations. Rough-cut capacity planning only highlights resources that are overloaded, and then leaves it up to you to decide how to manually adjust the master production schedule in an attempt to redistribute the load. Shelf life isn't automatically considered, and you don't get any advice on which products you should use to build stock. Plus, rough-cut capacity planning doesn't consider alternative processes for producing a product and the cost impact of these processes. For example, you can't simulate the cost consequences of holding stock versus increasing capacity through overtime or by introducing an extra shift.

In short, while rough-cut capacity planning can show you where you have a capacity constraint and where you may need to consider building stock, it does nothing to help you calculate the optimum stock-build profile.

The above analysis has shown that current methods of planning stock builds are ineffective and inefficient. It is clear that a new approach is required to achieve optimized stock builds.

Infor Food & Beverage with Stock Build Optimizer.

To optimize stock building, you need a new approach. And with more than 1,000 food and beverage manufacturing customers, Infor™ understands the challenges you face. You'll be able to maximize delivery performance and the profit generated by available capacity with Infor Food & Beverage's Stock Build Optimizer, which—unlike traditional MRP systems and spreadsheets—considers real-world constraints and cost implications. As a result, it provides you with feasible, cost-optimized plans, as well as simulations that evaluate potential promotions and identify profitable promotion proposals.

With the Stock Build Optimizer, you can:

- Ensure that the stock you build retains sufficient product shelf life for retailers.
- Handle calculation complexity and data volumes better than with other approaches.
- Adapt to changes as they take place within your business.

- Improve your customer service levels and lower your supply costs.
- Lower your overall stock levels to free up capital for investment, cut your stock-handling costs, and reduce warehouse space requirements.
- Incur less unplanned overtime and express transport.
- Make better use of your existing equipment, labor, and space.

If you're currently attempting to calculate stock building with paper- or spreadsheet-based calculations, you won't need to undergo a major process change with the Stock Build Optimizer, which is easy to implement and use.

Conclusion.

As a food and beverage manufacturer, you're faced with the challenge of meeting peaks in demand due to seasonality and promotions. Given the industry's low margins and retailers' demands for high customer service levels, you need to meet these peaks in an effective and cost-efficient manner.

Stock building is one of the best methods for meeting peaks in demand, particularly in situations where you have some available shelf life, and the labor market is expensive and lacking in flexibility. The stock-build approach offers you the opportunity to exploit periods of spare capacity without incurring additional labor costs. But as you saw earlier in this paper, current methods of calculating stock-build plans are inadequate.

You can overcome the limitations of current systems and methods for calculating stock-build plans with Infor Food & Beverage and the Stock Build Optimizer. You'll get optimum stock-build plans that allow you to meet peaks in demand while respecting the constraints and rules of your business. You won't have to make any major process changes or resource commitments, making the solution low-risk.

Optimum stock-build plans help you maximize customer service levels, keep stock on retailers' shelves, and avoid wasting money on promoting empty space. By reducing overall stock levels and ensuring your stock has a more cost-effective product mix, you'll be able to:

- Free up capital for investment.
- Improve your return on capital employed and minimize risk exposure.
- Cut your stock-handling costs and reduce warehouse space requirements.
- Waste less product, because you'll have less damage and product expiration.

Plus, by optimizing your existing capacity to build stocks effectively and efficiently, you'll incur less unplanned overtime and express transport costs. Ultimately, that means you'll make better use of your existing equipment, labor, and space to generate more profit.

Appendix A.

Stock-build scenario.

A small food manufacturer has three product ranges: A, B, and C. Two product lines are within each range. The shelf lives, production costs, and capacity requirements of the products are shown in Table 1.

The food manufacturer plans capacity and stock building based on the forecast for the next 12 weeks. In our example, the manufacturing process is very simple, with only a mixing resource and a packing resource. The resource capacities are as follows:

Product	Shelf life	Production lost per case	Capacity req mix (mins)	Capacity req. packing (mins)
A1	90 days	5.00	2.7	6
A2	90 days	8.00	2.7	6
B1	20 days	6.00	1.8	4.2
B2	20 days	6.00	1.8	4.4
C1	40 days	7.00	4.1	1.8
C2	40 days	10.00	.1	1.8

Table 1: Shelf life, production cost, and resource capacity requirement per product.

The manufacturer supplies the above products to two customers. In a given period, the total demand is as shown in Figure 4, with demand for all products peaking at the same time.

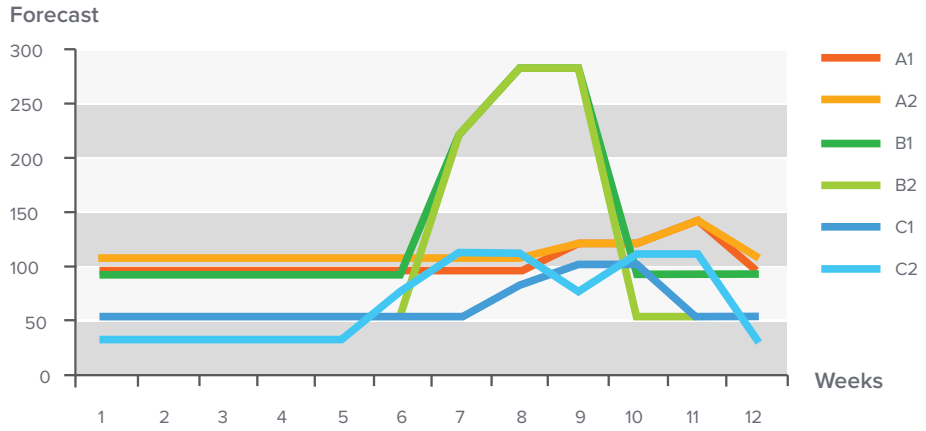

Figure 4. Demand forecasts for the six products over a 12-week period.

Even in this simple scenario with a very limited number of products, calculating the optimum or even close-to-optimum stock-building scenario becomes a highly complex problem.

Either one or both resources will be overloaded at times, and the chain reaction effect—combined with costs and shelf life constraints—make the stock-build calculation difficult.

Stock Build Optimizer uses linear programming, which is a mathematical technique for identifying the optimum solution to such a problem space.

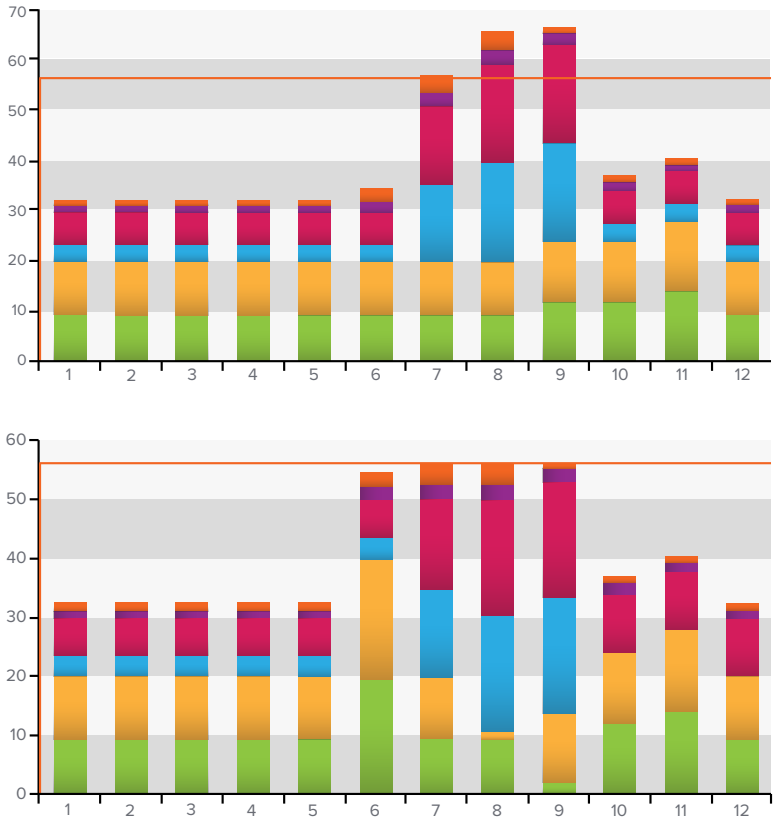

Figure 5. Ideal loading for packing line (top) and feasible loading on packing line considering available capacity (bottom). Each color represents load generated from a product or group of products.

In Figure 5, the upper graph shows the ideal load in the factory if there are no capacity constraints.

The lower graph shows the smoothed load incorporating stock building.

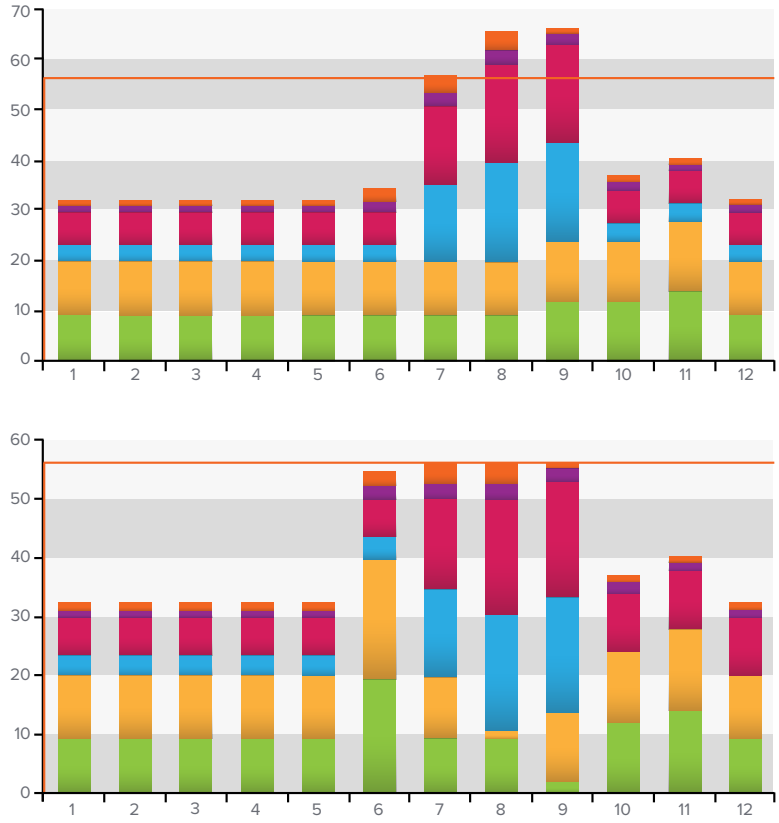

Figure 6. Ideal loading for packing line (top) and feasible loading on packing line considering available capacity (bottom). Each color represents load generated from a product or group of products.

In Figure 6, you can see the optimum stock-building plan for the scenario described above. Given the situation, this is the most cost-effective stock-building profile to maximize customer service levels and profits. Stock is built primarily on products A1 and A2. These product ranges have a long shelf life. A small amount of C1 stock is built in one period. C1 has a medium shelf life. In this example, no more than 100 cases of each product were allowed to be held in any period, in order to manage risk in the best way possible. At this point, you can also identify whether there are any profitable promotion opportunities by running a special second optimization. This generates a list of products that you could profitably promote at either normal price or at a specified discount, allowing you to become more proactive and approach your customers with suggested promotions that would be of mutual benefit. That means you'll no longer have to accept promotion requests in the dark without knowing whether you can meet the forecast demand, or whether the promotion will be profitable. Most likely, you already have all the data required for the above optimizations in your enterprise resource planning (ERP) system, and can easily extract it. The output from the scenarios is a list of time-phased stock levels. These time-phased stock levels are normally transferred back to the ERP system for use in the MRP netting for order generation.

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