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ARKIEVA WHITEPAPER

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Supply Chain Planning: Is it time to move on from Microsoft Excel?

Introduction

Microsoft Office Excel (Excel) spreadsheet software is the predominant application of choice for businesses starting supply chain planning applications. Whether by design or by necessity, it retains a large part of its market share well beyond the startup stage; in fact, some estimates attribute 50-70% of the total supply chain planning market to Excel. Its strengths include low cost (it is perceived as free since it is part of the Microsoft Office suite), ease of use, versatility, universal availability, good basic functionality, and being a known commodity.

Excel's most important advantage is that it enables experimentation and tinkering, valuable tools for those managing the planning process. In planning, the ability to do rapid-fire experimentation on various possibilities is very important. It should be noted, however, that Excel poses serious limitations when compared to more robust and full-featured software applications designed specifically for advanced supply chain planning.

This white paper explores the pros and cons of Excel usage, offers guidelines for deciding when Excel is useful and when an organization needs to graduate to an advanced planning solution.

Excel: the obvious choice in the beginning

Imagine a small manufacturing company selling a few products to a few customers that has acquired an order-taking software to keep tabs on transactions and due dates. As complexity increases and the need for planning accelerates, someone creates a simple spreadsheet with products in one column and time periods shown across the columns. In such a spreadsheet, a planner copy/pastes or types in the actual history in the historical months and then begins to type projections in the future months. Some high level assumptions about capacities (the company can make and sell roughly 7000 units per month) allow planners to quickly see whether they are above or below the acceptable amount. Excel's rich feature set

allows them to customize it to their liking. A colored cell here, a sub total there, and voila, they have a planning spreadsheet in operation. Everyone (which at this stage might only be a couple of people) opens the same spreadsheet on a shared drive, and planning becomes a collaborative operation. Every month, all that needs to be done is to copy/paste the new data and keep planning the future months. Towards the end of the year, it can get a bit more exciting when deciding to add the next year's months, but the process remains manageable over all.

Excel can also assist in developing the company's planning processes in the early stages as well as create internal planning disciplines. Because of the easy availability of Excel and its relative simplicity, such a spreadsheet can appear almost overnight. It could even take a name of its own such as Jane's spreadsheet (with Jane being the creator of the spreadsheet, of course).

In such a scenario, every aspect of planning is within Jane's grasp. For example, it's easy to make a copy of the spreadsheet, change some of the numbers, and compare the results to do a what-if scenario. Time passes, and the company adds to its business (a new plant, new products, etc.); the planning worksheet gets expanded either by adding new rows of data or by adding new worksheets. For example, two different worksheets might be used to plan the East Coast and the West Coast operations.

Excel is excellent when it comes to a data-based personal productivity tool. As long as the planning process remains personal, no other tool comes close to what Excel can provide for the small cost of a few lost evenings for Jane!

Generally well-known shortcomings

There are certain well-known shortcomings of Excel-based applications. They are not the main thrust of this white paper, but they are listed here for completeness.

- The server crashes and the planning spreadsheet is lost. This concern can be mitigated by keeping backups of the spreadsheet. However, there can be a significant time loss if the saved copy is not the most current one because of the need to paste the new information into the spreadsheet again.
- Jane wins the lottery or finds another job. Few companies have a backup trained and ready to take over.

- Problems can occur when integrating with other systems (upstream or downstream). Though Excel now has connectivity tools that allow connections to a variety of data sources, it is one of the least known and used features, resulting in stale data. Sometimes, linked data sources change and the planner has to adapt their excel spreadsheet as the data source may not even be aware of the link.
- Keeping the spreadsheet data up-to-date takes considerable time. This is not limited to copy/paste; a majority of the time it involves retyping of the data from one system to another. This is probably one of the biggest flaws. Should your planners spend their time planning or updating data onto spreadsheets? Absent the above-mentioned integration, Excel tools force users to do more data management and less decision making and anticipating business conditions.
- Since spreadsheets are easy to create, each department could start its own. This could result in different plans across different departments within the same company. This is especially problematic if the sales and operations departments operate from different plans.
- The spreadsheet may have errors. A 2008 study at the University of Hawaii found that "errors in spreadsheets are pandemic." It added, "In general, errors seem to occur in a few percent of all cells, meaning that for large spreadsheets, the issue is how many errors there are, not whether an error exists." Since the average spreadsheet contains thousands of information-bearing cells, a "few percent" may translate into dozens of errors. In many non-critical applications, these errors may be considered a reasonable tradeoff for the affordability and ease of use offered by Excel spreadsheet software. However, when the errors result in serious supply chain miscalculations, the costs can be devastating. Some examples can be seen here and here. For instance, a miscalculation in the quantity of a key part can produce a domino effect causing a delay in assembling the final product. This then causes missed production deadlines, resulting in lost orders, rush shipping charges, and damage to the company's reputation.
- It is difficult to grow Excel grow into other types of analysis. For example, Jane wants to view trends across many types of products and then find which ones are significant outliers for further review. This is not always possible, or at least it is very cumbersome in Excel because the business has to settle on a few key attribute-based views.
- It takes too much discipline to maintain a rolling planning horizon in an Excel spreadsheet. As a result, most planning spreadsheets have an "accordion" time horizon. Periods decrease to three

or four towards the end of the year and then increase to fifteen or sixteen to include the next year. This is not good for planning.

Signs that Excel is inadequate

When an organization is in its early stages, Excel's limitations are likely to be outweighed by its convenience and affordability. Unfortunately, as the organization grows, these limitations become more serious. The above-mentioned shortcomings of Excel applications are enough for some companies to look for a best-of-breed software solution from the market. However, some companies feel that their organization has reached a stage where it has become impossible to plan due to some of complexities listed below.

- **Amount of data complexity:** As business grows, the data grows. (The business that grows in volume and revenue with little or no corresponding increase in data intensity is a possibility but remains rare). Increased data intensity adds complexity to the planning operation. For example, the products or customers have increased, or new attributes need to be summarized in future data (for example by a key ingredient or a key market characteristic).
- **Multiple users complexity**: Over time, the company hires more sales reps to sell to different markets. These reps know the most about the forecast because they are closest to the customers. Depending on the organization, one of two things might happen. First, the reps email Jane with the latest information which she types into the spreadsheet; second, the sales team agrees to update the numbers themselves. Both approaches are risky. In the first, errors creep in as typing mistakes. In the second, Jane has to worry about controlling access to different rows of data in the Excel spreadsheet. If she cannot program this logic, then she has to rely on the reps to type only into data rows assigned to them. Again, typing mistakes happen: It's even possible for a business, which mails spreadsheets around for input, to lose track of version control and submit the wrong spreadsheet to corporate headquarters for the annual budget. Finally there is this question: who controls the need for new product/customer combinations required for new forecasts?
- **Data security complexity**: This is also caused by multiple users; data access might need to be limited by users. For example, a sales representative should see only her own data, possibly forcing the demand planner to create multiple spreadsheets with subsets of data. This again increases the risk of errors.

- **Business-conditions complexity:** Two customers buy the same product under different names (and prices) for confidentiality and/or profitability reasons. The supply planner needs to see the consolidated data, but the demand planning team still wants to have the customer-level detailed view for forecasting. To enable this, Jane must now use advanced Excel features, which she may or may not know how to do.
- **Planning process complexity**: Management might insist on updating the spreadsheet with all open orders so that planners have a view of what is already committed. On the one hand, Jane can copy/paste or type in the information, a tedious and error-prone process. On the other hand, Jane can figure out how to do the programming to read the data from source, but this is prone to programming errors as well as higher cost in terms of Jane's time.
- **Mathematical complexity**: Capacity is no longer a straightforward number because the product mix has a significant impact on the total throughput. Now Jane has to do matrix calculations to accurately project the capacity usage in the future. At the very least, this requires programming via formulas, thereby increasing odds for errors. As the spreadsheet becomes more complex, errors in data and calculations are more difficult to uncover.
- **Scenario- or uncertainty-based complexity**: The company needs to evaluate various what-if planning scenarios based on certain assumptions. The complexity arises not from the need to run these scenarios (which presumably can be done via multiple copies of the spreadsheet) but rather from the need to compare and contrast these scenarios and then to be able to make decisions based on the comparison. Any changes in data content in one scenario also need to be copied into all the spreadsheets.
- **Everything-is-connected complexity**: As businesses get more complex, most decisions have consequences in other areas. For example, a start-up company has enough capacity to meet all demand; a mature company, however, might have to make decisions on whom to short, based on profitability and other less tangible measures (such as a strategic account or a loss leading sale). This process requires an optimization-based tool, or at the very least, an engine that does these multitudes of calculations in a loop.
- **Cost-of-failure complexity**: If the business is simple enough that the mistake made today can be corrected tomorrow, then the solution is easy. However, if the mistake made today leads to being stuck with the wrong inventory for a long time, then a more complex planning paradigm is needed, one requiring detailed checks on all projected inventories. In some ways, this is an offshoot of the amount of-data-based complexity.

In addition, there are business requirements that cannot be attempted in an Excel-based application because of the amount of work required.

- Need to implement a collaborative process for demand planning where various groups are updating the forecast (sales reps, marketing, sales managers, demand planners, etc.)
- Need for aggregation and disaggregation of user inputs on the fly
- Need for flexibility to view and edit data at multiple levels
- Need for engines to do recursive calculations
- Need for realignment of product and customer names as they evolve or get acquired
- Need for netting open orders from the forecast before sending it to the schedulers
- Need to incorporate other streams of data such as inventories, bills of materials, and manufacturing costs
- Need to assimilate an acquired company's data into planning
- Need for speed in re-planning: Today, most businesses need to have a trigger-based dynamic planning, which requires a planning system that quickly goes through the steps of planning if the appropriate condition is breached.

In companies with above mentioned complexities and needs, planning with Excel forces the planners to focus primarily on the next big issue. There is only a skeleton planning process in place. The people themselves are the only thing between the company and the next disaster. As people get rewarded for putting out the "fire", it creates a culture that is even more focused on fire-fighting. Very often, this means there is no real planning in the business.

The Next Step: Moving up to a RDBMS-based planning application

If you decide your firm has outgrown the Excel-based planning application, what is the next step? Most companies go for a best-of-breed advanced planning and scheduling (APS) application, based on a relational database management system (RDBMS). Examples of RDBMS include Microsoft SQL server, Oracle, and DB2. Ideally, these systems provide a way to deal with the complexities described above on the RDBMS end of things. At the same time, these solutions should still be easy to use and integrate with the user's desktop.

These applications gather data automatically from other systems throughout the organization not only at a preset frequency but also on demand, and they hold it on a centralized server where it may be accessed by many users. More importantly, they offer true business functionality, including specialized support for a wide range of supply chain processes, including inventory management, manufacturing, and value chain collaboration. They also provide multiple security levels, allowing access based on roles.

RDBMS-based applications are not included with the purchase of a laptop; at the same time, most large companies have a few SQL servers running as part of their enterprise systems. These applications can provide business value far exceeding their cost. Compared with Excel, for example, solutions based on relational database management systems offer significant advantages:

- **Visibility:** Compared to Excel, an RDBMS based system does a better job of sharing data across users. Data visibility is greatly improved along the supply chain and in the various groups such as sales, operations, finance, commercial, etc.
- **Safety:** In Excel, any unsaved data may be lost if a system crashes. Databases write data to the hard drive immediately and are usually backed up at a corporate level.
- **Volume and speed:** High volumes of data bog down Excel; RDBMS applications routinely manage high volumes of data.
- **Related data:** Storing related data together in a single table or spreadsheet is unwieldy and invites errors. Databases easily link tables of related data, such as customers and their orders.
- **Future Growth:** A RDBMS system is a foundation to further extend the supply chain processes because it enables other advanced tools like planning and scheduling.
- **Alerts:** These enable rule-based alerts, which can be emailed to users, thereby making them aware of the problem sooner and enabling quicker corrective action.

By leveraging the functionality of an RDBMS-based APS application, a company's decision makers can immediately detect data and mapping errors. In addition, they can see how data relates across attributes. Finally, they can detect patterns within the data itself, to make better-informed decisions about overall processes and individual projects.

The best time for your company to switch

Managers deciding to move to an RDBMS-based APS system should take several factors into account. First, they should carefully evaluate the time and risk involved in sticking with the spreadsheets. Second,

they should weigh the opportunity costs of making their most experienced planners crunch numbers when the planners should really be thinking of multiple possible scenarios and ways to deal with them. Third, the tendency of human beings to resist change and stick with a known entity (the Excel spreadsheet in this case) should also be factored in. Finally, management should evaluate the complexities as they currently exist, as well as the complexities in the near future.

Deciding to switch from a home-grown Excel application to a vendor-provided APS tool is not easy. For starters, many people and departments (including planners and other users, IT personnel, and management) need to be convinced. Next, the timing also needs to be right. A manager who thinks that the business has outgrown Excel-based tools might still need to wait for the right political and economic climate. For example, the disruptions caused by a natural or a market event might make the case for a change, or, the arrival of a senior executive with experience in these types of applications might also tip the scale. On the other hand, a major global initiative to upgrade the company's ERP system might call for patience.

The supply chain planning field is poorly understood and undervalued in many companies because it deals with future and uncertain data, and this makes many people uncomfortable. Further, supply chain organizations sit between two very powerful organizations (sales and operations) and try to manage the strong gravitational pull of both. For these (and many more) reasons, top management is often wary of investing in supply chain planning systems. Once you have decided to move to an RDBMS-based system, recognizing these realities increase the odds of getting your project(s) approved. Perhaps the best advice is to pick a system that can be implemented incrementally; the benefit of the first deliverable may well pay for the whole project.

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