LOGILITY

White Paper

Are **Spreadsheets Sabotaging** Your Supply Chain?

Spreadsheet risk is the number one threat to supply chain excellence

Executive Summary

Spreadsheet use pervades every corner of corporate life today. More than 200 million people worldwide use spreadsheet applications and about one-third of people spend more than half their working days using them[1].

Spreadsheets provide great benefit, but also create serious issues. Its easy to get an answer from a spreadsheet but it may not be easy to get the correct answer, given:

- General spreadsheet risk due to the limited accuracy of the tool itself and the risk of data and logic flaws introduced by users [researchers estimate 94% of deployed spreadsheets contain errors, and 90% of spreadsheets over 150 rows contain errors].
- Spreadsheet-related supply chain risks that emerge as the supply chain matures [scalability, integration, fragility, siloing, and others].

Supply chain management teams can find themselves severely hampered by chronic spreadsheet shortcomings when performing mission critical activities such as demand planning, sales and operations planning [S&OP], manufacturing, replenishment and supply planning, inventory optimization, and value chain collaboration.

What are the inherent limitations of spreadsheet applications? What special pitfalls face supply chain teams who force spreadsheets to handle more complexity than they are designed for? This paper explores these questions.

[1]Robert Kugel, Ventana Research, Make Spreadsheet Competence a Priority, June 2012

> **spread•sheet / spred SHet/ noun:**
> 1. an interactive computer application program for organizing and analyzing data in tabular form.
> 2. no way to run a supply chain

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Eventually, the **sheer volume of spreadsheets** used by isolated owner/operators trying to generate actionable conclusions becomes organizationally exhausting.

Where Did All These Spreadsheets Come From?

Most managers know how to build spreadsheets, and the application is on everyones PC, ready to go at a moments notice. Self-trained spreadsheet jockeys, when faced with the problem of organizing data and calculating future requirements, grab the tool they know.

In companies with simple supply chains, a few product offerings, and a small number of customers, sooner or later someone authors a forecasting spreadsheet with a row for each item and columns for time periods, and the Spreadsheet Era has begun. Soon spreadsheets proliferate, driven by:

- Inability of the organizations ERP system to meet the need. ERP supply chain management modules are invariably rudimentary, inflexible, and proprietary. Thus, managers turn to spreadsheets.
- A stop gap urgency to gain control over supply chain data. Before an organizations processes have matured enough to select a robust, reliable, unified solution, spreadsheets look like an adequate response to an immediate need.
- Supply chain stakeholders are driven by a DIY spirit. They naturally seize on any opportunity to create flexible solutions relatively quickly, customized to their own needs, without involving the organizations bureaucracy.

Spreadsheet culture easily spreads into every facet of the global supply chain, without proper security or audit trails, but with an ever-present probability for serious error. Eventually, trying to manage the sheer volume of spreadsheets, trying to generate insights and actionable conclusions within a useful timeframe, and maintaining communication among isolated owner/operators becomes organizationally exhausting.

Spreadsheets proliferate across supply chain functions
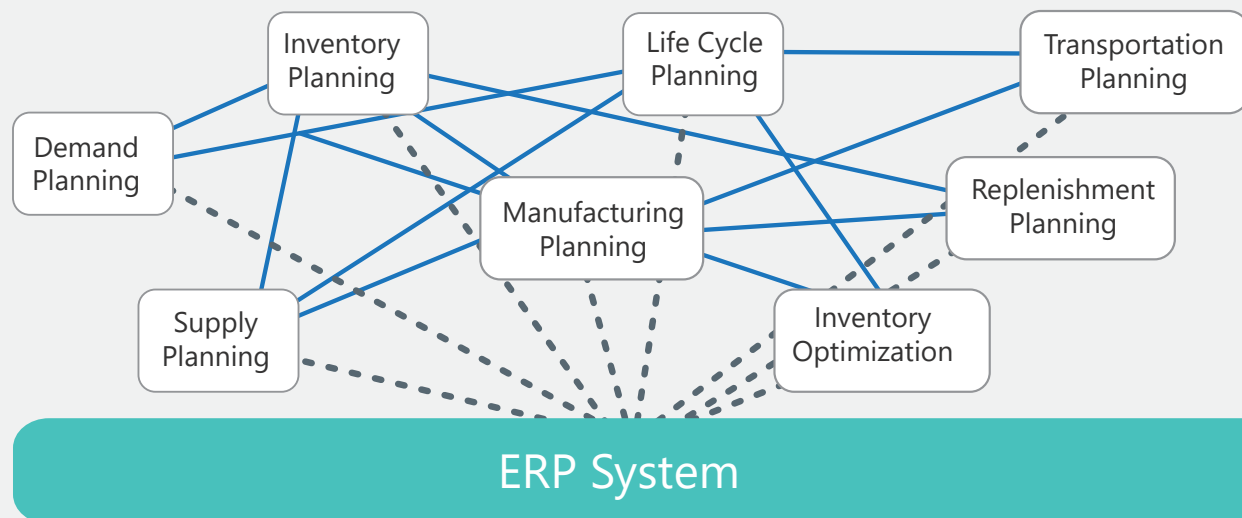
Inherent Problems and Limitations of Spreadsheets

Some problems with spreadsheets are universal, and affect any business that relies on them. A study covering 1,500 people in the UK[2] found that 57% of spreadsheet users had never received formal training on the spreadsheet package they use.

Chronically Prone to Pilot Error
In supply chain management, the impact of a single error can derail a forecast, cause a supplier to ship too much or too little of a particular product, or cause service level nightmares that can lose a customer.

Researchers Powell, Baker, and Lawson estimated that roughly 94% of spreadsheets deployed in the field contain errors, while 5.2% of cells in unaudited spreadsheets contain errors[3]. Coopers and Lybrand found 90% of all spreadsheets comprised of more than 150 rows contained errors[4] and KPMG found 91% of 22 spreadsheets taken from an industry sample contained errors[5].

Compared to these findings, a University of Hawaii study that estimated 20% to 40% of all spreadsheets contain errors is positively upbeat[6].

Clearly, a spreadsheet is only as good as the last person who edited it. Lack of adequate auditing and revision control makes it impossible to determine what, why and when someone changed a cell.

[2]ClusterSeven, Spreadsheet Risk Management within UK Organisations, July 2011
[3]Powell, Baker, and Lawson, A Critical Review of the Literature on Spreadsheet Errors, December 2007
[4]Journal of Accountancy, How to Make Spreadsheets Error-Proof
[5]KPMG Management Consulting, Supporting the Decision Maker: A Guide to the Value of Business Modeling
[6]Ray Panko, Professor of IT Management, University of Hawaii, 2008, 2010

Typical root causes of spreadsheet errors

Logic mistakes	Example: inserting the wrong function or omitting parenthesis in a formula.
Copying formulas	Copying existing equations to new locations commonly changes the cell references, which can be catastrophic if uncorrected.
Overwriting formulas	Accidentally inserting a number into a cell already containing a formula overwrites it and converts the contents of the cell into a constant.
Wrong function used by mistake	Example: the AVERAGE function ignores text and false entries, while the AVERAGEA function sets them to zero.
Bad data input	Example: entering numbers as text causes them to be treated as zero values in formulas, while numbers entered inadvertently as dates create huge numeric values. Omitting data or equations, especially when updating an existing spreadsheets, can also introduce insidious inaccuracies.

Unavoidably Hard to Maintain

When someone authors a spreadsheet layout, they are essentially creating a nonprocedural computer program. Nonprocedural programming offers as many chances for mistakes as procedural programming, yet spreadsheets are rarely checked or tested thoroughly, and are usually rolled out without a formal quality assurance process.

Over time, supply chain spreadsheets often gain features like conditional formatting to flag exception conditions, charts and graphs to display data visually, analysis components to identify trends, and more. Multiple spreadsheets may be linked together in order to feed results upstream and downstream, or to drive high-level business decisions. Each enhancement adds risk, especially if the spreadsheets original design requires major revamping to add the new features.

As more users interact with the spreadsheet, there is a need to control read/write access based on user roles, something SCM solutions offer but spreadsheets don't.

One leading maker of OEM-compatible imaging supplies used spreadsheets to drive product replenishment. A mistake in a formula related to one of their critical raw materials caused them to order 4 times more toner than intended. To deliver the quantity on time, the vendor changed its process, leading to quality problems that were not discovered until the product was shipped to customers. The company recalled $4 million worth of cartridges and replaced $8 million of toner. One spreadsheet error cost $12,000,000.

Vulnerable to Single Points of Failure

A spreadsheet often reflects the work of essentially one person. If that person leaves the company or changes jobs, that spreadsheet becomes an unsupported single point of failure. If there are multiple spreadsheet authors around the supply chain organization, then there are multiple potential single points of failure.

Dangerous single points of failure should not be allowed to exist in any tool that influences mission critical decisions driving company operations. Better to adopt a best-of-breed supply chain software solution that is maintained and regularly enhanced by a dedicated team of developers.

Major Spreadsheet Problems in Supply Chain Management

Every time you turn to a spreadsheet to handle some aspect of supply chain management, you open up a can of risk.

Real-world supply chains have management challenges that cannot be adequately addressed by a spreadsheet approach challenges such as variable lead-times, unpredictable demand, suppliers who miss due dates, production lines or outsourced sites that don't always cooperate, multiple streaming sources of data each with its own impact on dynamic global business objectives.

Unlike spreadsheets, supply chain management solutions comprehend factors such as the availability of resources, the capacity and optimal utilization levels of equipment, and the most cost-efficient positioning of inventory, with annotation capabilities to record why each change was made to the plan. A best-of-breed SCM system avoids major spreadsheet drawbacks such as:

For any task in which more than six people use a spreadsheet more than six times, the business needs an alternative.

— Ventana Research

The Scalability Problem

Not only do todays complex supply chains require businesses to anticipate market changes and respond quickly to real-world events, there are an ever increasing number of users who need to share data, and a growing volume of SKUs to plan for. According to Chainlink Research, spreadsheets provide some capability for users to be creative and think though some ideas. For simple tasks, and for businesses with small SKU counts and low complexity, they might work to a degree. But they just don't scale.

For even mid-size supply chains, a proper database with built-in rules for structuring data, maintaining data integrity, and developing audit trails is far more suitable.

Other issues related to scale include the growing size of demand and supply planning hierarchies, which cover huge numbers of items, from SKU-location to product categories. Multiple forecast models are needed to best predict demand for each life cyle stage of every product and market. Planning accuracy should be measured over multiple time intervals [three months for sales, 18 months for finance, six to 24 months for supply planners, etc.]. This is well beyond the capability of spreadsheets.

The Functional Isolation Problem

Even organizations that place their spreadsheets on a central server cant ensure that collaboration behavior takes root across functional silos.

Most organizations using the spreadsheet approach find that each department, geographical location, or even individual worker may be relying on a separately managed and maintained spreadsheet. When crucial supply chain activities like demand management, inventory management, production scheduling, supply and replenishment operations, and transportation planning are all performed in isolation with the results expressed in parochial terms, no ones numbers ever seem agree with anyone else's. This creates a Supply Chain Tower of Babel where one department doesn't know what the others are doing. Sharing information is cumbersome, translation is difficult, and collaboration is discouraged.

To the extent that spreadsheet reliance increases isolation, it works against collaboration initiatives and demand-driven processes like sales and operations planning. One of the first steps in any S&OP project should be to evolve away from departmental spreadsheets toward a unifying supply chain management solution that provides one accurate model of the supply chain and one set of facts based on up-to-the-minute data.

The "Supply Chain Tower of Babel" defeats collaboration.

The ERP Integration Problem

Planning tools must exchange information such as inventory levels, orders, supply-side information, and more with the company's existing ERP system. The reality is that data loading into spreadsheets is always a non-real-time, manual process, very slow and prone to data entry errors.

Best-of-breed SCM solutions provide template-assisted integration tools that streamline set-up time and minimize implementation costs.

The benefits are worth the effort. A supply chain management solution can incorporate many streams of data [orders, shipments, inventories, bills of materials, manufacturing costs, etc.] from existing systems around the company, and provide a degree of supply chain optimization far exceeding anything that can be accomplished with spreadsheets. SCM applications increase service levels, minimize inventory, improve planning efficiency, handle demand uncertainty and supply volatility, manage product life cycles for maximum profitability and availability, and drive fact-based S&OP decisions.

The Fragility Problem

To perform integrated supply chain planning, companies must connect multiple groups within an organization [from planning and operations down to supply chain and procurement]. Global supply chain management requires extending supply chain visibility to the outside world [i.e. suppliers, customers, etc.] to increase the speed of activities from asset recovery to recycling.

When functional groups attempt to feed information [such as demand forecasts] to the spreadsheets of other functions [such as supply planning] the chain is only as strong as its weakest link. Linked spreadsheets become cumbersome to maintain. The information conduits flowing from one sheet to another enable cascading error conditions that can prevent users from obtaining critical results on time. The probability that a link in the spreadsheet chain is bad increases the single-point-of-failure problem exponentially.

The Slow Time-to-Decision Problem

Spreadsheets don't serve up key trends and exception conditions on a silver platter. It takes much longer to gather, assess, and evaluate information held in spreadsheets. Manual spreadsheet data updates are followed by manual examinations to spot issues, and a reporting phase, all of which takes time.

Spreadsheet chains are only as strong as their weakest links.

Lacking real-time alerts triggered by exceptions to target value ranges for key performance indicators, supply chain managers are forced to manually monitor hundreds or many thousands of items. They can literally spend all day perusing spreadsheets for signs of trouble, big and small.

Executives shouldn't have to get their picture of whats going on through batch status reports in Microsoft Excel or PowerPoint, nor should they have to request frequent custom report runs to answer questions [reports that must be manually generated by supply chain practitioners with other pressing demands on their time].

With spreadsheets, the risk is 100% that critical out-of-balance conditions will be missed or major deviations detected late. Crucial business decisions should be based on real-time access to up-to-date supply chain data, and management reaction times should be driven by automated alerts that let planners prioritize efficiently and manage by exception.

How Spreadsheets Fall Short In Multiple Supply Chain Disciplines

Demand Planning/Forecasting

Demand planning is a dynamic, collaborative process. Spreadsheets make it onerous or impossible to establish a repeatable cadence, an efficient month-by-month process. Actual demand data must be manually entered into a spreadsheet, rather than automatically fed from operational systems. Spreadsheets lack support for collaboration with suppliers, do not provide wide visibility to inventory at all locations, and can't run robust what-if analyses that are crucial to handling uncertain demand over a time horizon of many months. Spreadsheets are really only suited to static demand rather than the dynamic demand signals found in real world markets.

Because forecasts are, by definition, not perfectly accurate, it is crucial to measure the system-generated forecast, planners forecast, and customers forecast against actual data. Demand planning systems measure forecast accuracy using mean absolute percentage error [MAPE] and weighted MAPE [WMAPE] over several intervals [one month, three months, and 12 months are the most common horizons].

A best-of-breed planning solution provides multiple forecasting models [even handling difficult statistical challenges involving low and lumpy demand signals] with the ability to switch among models easily.

SCM systems can maintain separate forecast hierarchies for each department, with each hierarchical stack containing forecasts at the SKU-location level up to the product family, category, or customer level. A high-level forecast is statistically more accurate than individual components, so disaggregating the forecast down the hierarchy can improve accuracy at every level.

Example of a forecast hierarchy
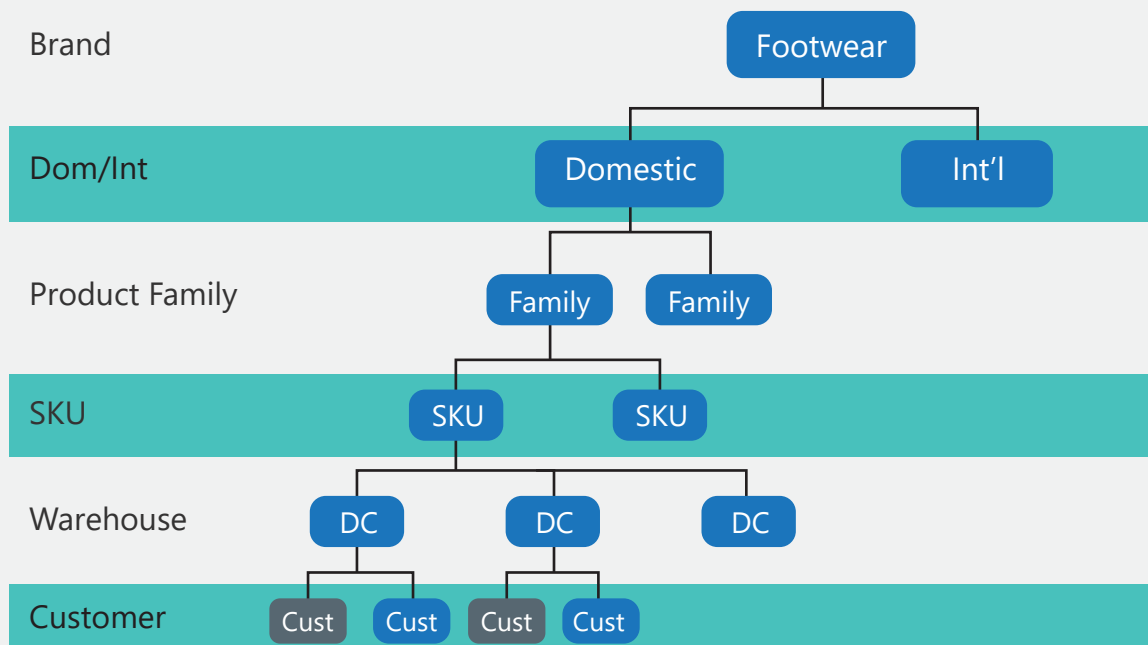
Inventory Management

Using spreadsheets to plan stock levels and calculate inventory replenishment leaves critical inventory optimizations out of the equation. Safety stock levels may be calculated using pre-built basic formulas such as moving average and standard deviation, but planners will not have the ability to see the entire supply and demand relationship, or take into account interactions between sites in the supply chain that cause inventory buffers to grow unnecessarily large.

When safety stock is calculated by a best-of-breed supply chain application, managers gain visibility to inventory levels company-wide, set appropriate inventory targets, and right-size buffers to minimize excess safety stock while meeting or improving on desired customer service levels.

Supply and Manufacturing Planning

Spreadsheets are not able to model a realistic supply chain planning network through accurate demand tracing and simultaneous sourcing. Dynamic real-time sourcing evaluates production, storage and transportation constraints to optimize complex sourcing and production decisions. Real-time alerts let supply planners prioritize and address high-impact issues more quickly.

Spreadsheets are not able to model a realistic supply chain planning network through accurate demand tracing and simultaneous sourcing.

In the manufacturing plant, product mix has a significant impact on total throughput, so capacity is never a straightforward number. Spreadsheets must include formulas and matrix calculations to accurately project future capacity usage, again turning planners into programmers.

In addition, fulfillment planning models such as Available-to-Promise, Capable-to-Promise and Profitable-to-Promise are beyond the scope of spreadsheet applications.

Sales and Operational Planning [S&OP]

The cornerstone of any successful S&OP process is analyzing information gathered from various areas of the organization. Spreadsheets have significant limitations when it comes to sharing information, creating what if scenarios and helping management teams understand the full sweep of the business.
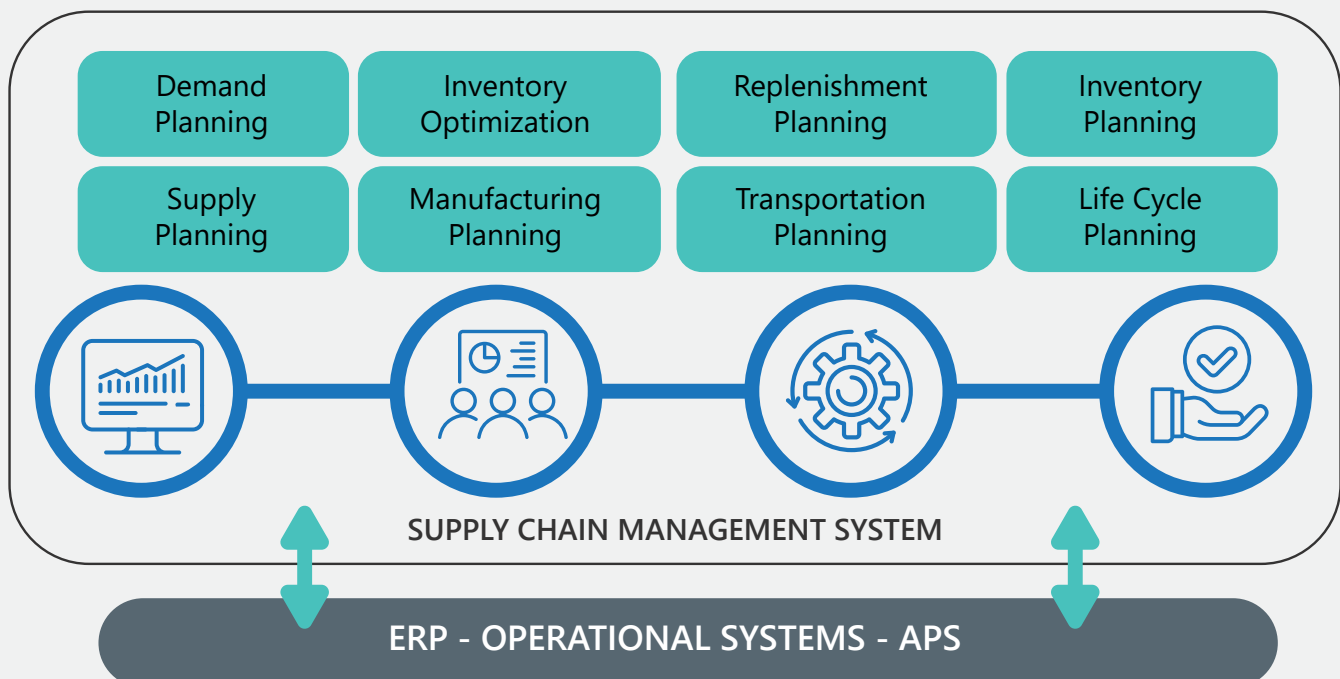
One of the overriding imperatives for the monthly S&OP meeting is to bring stakeholders together to have one version of the truth not set them at odds with each other over a cacophony of competing spreadsheets from each department.

Activities like statistical forecasting and requirements planning are based on intensive mathematical calculations. What-if analysis creates competing scenarios based on certain assumptions. Generating, comparing, and contrasting these scenarios quickly is essential to support better business decisions.

Building a long-term S&OP process on a foundation of function-specific spreadsheets is a recipe for failure.

Building a long-term S&OP process on a foundation of function-specific spreadsheets is a recipe for failure. Only a comprehensive supply chain management system can convert function-specific data to information, refine that raw information into actionable intelligence, and support confident strategic business decisions.

Best-of-breed SCM solution unites functional teams

Demand Planning	Inventory Optimization	Replenishment Planning	Inventory Planning
Supply Planning	Manufacturing Planning	Transportation Planning	Life Cycle Planning

SUPPLY CHAIN MANAGEMENT SYSTEM

ERP - OPERATIONAL SYSTEMS - APS

Moving Beyond Spreadsheets: A Real-World Example

One shoe company supply chain manager described their style-by-warehouse forecasting regime as a complex nightmare, with 450 pages of spreadsheets to go over every month.

The litany of problems included error-prone manual data entry, limited forward visibility, unreliable information, no tracking of changes or why they were made, no collaboration with sourcing and manufacturing teams, and forecasts that were four weeks out of date when shared.

One typical error involved adding new products to the spreadsheet but forgetting to bring the subtotal up to the top. The new products were therefore not included in the forecast at all.

Attempting supply chain optimization in spreadsheets turns planners into software programmers.

Moving to Logility delivered many benefits, including:

- Automated data flows for inventory changes, orders, etc. from ERP and other sources into Logility in flat files
- Individual real-time views customized to stakeholders [finance, sales, suppliers] preferences regarding items, styles, and other characteristics
- Attribute-based, hierarchical views for sales, marketing, and finance
- Forecast creation in three days versus 2+ weeks, including multiple forecasts for locations around the world fed automatically into the ERP system
- Support for 18 month rolling demand plan
- Alerts show visibly how the forecast is holding upmanaged by exception
- Better data and more granular data for everyone
- Weighted mean absolute percentage error [WMAPE] dropped by 15%
- Data export for key suppliers completed in three minutes rather than many hours. Reporting time cut from hours to minutes

Supply chain team members now spend their time as analysts, not data manipulators, getting accurate information faster and using their time more wisely.

Conclusion: Best of Breed Solutions Save Companies from Spreadsheet Risk

Spreadsheets proliferate throughout the supply chain organization for several reasons, including weak SCM capabilities in ERP systems, disjointed stop-gap measures to get control over supply chain processes, and do-it-yourself attitudes in organizations that have not matured enough to adopt best-of-breed SCM solutions.

Relying on spreadsheets to perform supply chain management involves a host of pitfalls. Spreadsheets are extremely prone to pilot error, with over 90% of deployed 150-row sheets estimated to contain errors. They are hard to maintain over time, and create dozens of single points of failure, any one of which could derail supply chain success. Specific drawbacks include:

- **Lack of scalability:** Spreadsheet results can be unreliable when working with large datasets and complex calculations. Beyond inherent spreadsheet limitations, the size of product portfolios and breadth of supply chain scope can quickly outgrow any spreadsheets ability to keep up.
- **Functional isolation:** Silo'd spreadsheets within departments create a supply chain.
- **Tower of Babel** in which sharing information is cumbersome, translation is difficult, and value chain collaboration is impossible.
- **Lack of ERP integration:** Data loading is a slow, error-prone manual process, and real-time automated ERP-to-spreadsheet synchronization is impractical.
- **Fragility of spreadsheet networks:** The spreadsheet chain is only as strong as its weakest link. Data conduits linking worksheets can cause cascading error conditions.
- **Slow Time-to-Decision:** Crucial business decisions should be based on immediate access to up-to-date supply chain data. Real-time alerts and management by exception are crucial capabilities needed to handle dynamic supply chain corrections.
- **Inability to Optimize:** Optimizing supply chain elements such as inventory levels, production schedules, and demand plans requires the application of sophisticated algorithms that are simply not available in spreadsheet applications.

Top Ten Spreadsheet Risks

1 **Error-prone**

2 **Hard to maintain**

3 **Many single points of failure**

4 **Poor "what-if" analysis**

5 **Not scalable**

6 **Tower of Babel isolation**

7 **No ERP integration**

8 **Fragile platform**

9 **Slow time-do-decision**

10 **No SCM optimization**

Don't wait for a disastrous spreadsheet error or a decision based on out-of-date information to devastate your competitiveness, public reputation, or bottom line. Supply chain teams can seek a comprehensive SCM solution that prevents spreadsheet risk from threatening their commercial well-being.

About Logility

Accelerating the sustainable digital supply chain, Logility helps companies seize new opportunities, sense and respond to changing market dynamics and more profitably manage their complex global businesses. The Logility® Digital Supply Chain Platform leverages an innovative blend of artificial intelligence [AI] and advanced analytics to automate planning, accelerate cycle times, increase precision, improve operating performance, break down business silos and deliver greater visibility. Logility is a wholly owned subsidiary of American Software, Inc. [NASDAQ: AMSWA].

To learn how Logility can help you make smarter decisions faster, visit www.logility.com.

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