One Network Enterprises™

Supply Chain Networks: Think Upside-Down

Impact of AI/ML Powered Prescriptive Analytics

What makes your Planning, ERP, Procurement and Transportation system solutions so aggravating to work with when faced with a dynamic and changing business environment? Well, your solution design is "upside-down" as compared to what you are really trying to accomplish. In the paper, we offer a new perspective on decision making analytics, business objectives, and the autonomous supply chain.

By Joe Bellini, COO One Network Enterprises

Most of you probably never wanted to deal with another math class after graduation, but think for a minute about a simple concept - independent and dependent variables. In solution design, an independent variable is our input to the system and the dependent variables are the outputs driven by the independent variable.

Now think about your current solution architecture. Your independent variable is your process design/flow within your business system configuration. In most cases, some level of customization was required in your ERP system in order to harden this process/independent variable in the way you felt would be most productive for your business. This process design is filled with static variables such as various types of lead times in planning, order management, and transportation. Your business process/independent variable then drives the dependent variables that allow it to operate. These dependent variables include demand management, inventory, and capacity across your operations as well as your customers and suppliers.

Of course, the real horror is when you want to adjust these hardened processes based on changing business conditions and you are forced by your software vendor to carry all your customizations through not only upgrades, but also through complete re-implementations ….only to end up in the same mess all over again.

LET'S FLIP THE EQUATION

What if, instead of hardening the process, configuration, and customization of your software solution as the independent variable, we instead **set the outcome of the process as the independent variable**. For example, let's set the independent variable as delivering the right product at the right time at the lowest cost with the highest quality. Wow!

The question is, has technology really advanced to the point where I can drop the ERP albatross of the last 30 years - where I'm forced to make choices that drive inefficiency - or can we now turn the solution architecture upside-down and solve the real problem of highest quality product at lowest possible cost?

Believe it or not, you are already doing this in some areas. Anyone who has any type of artificial intelligence or machine learning (AI/ML) initiative in place has already turned their problem-solving approach upside-down. Prior to ML, we basically had to fine-tune various types of mathematical equations to give us a near optimal result. The independent variables were the math equations and the fine tuning was very situational and problem-type specific.

Let's turn this upside-down and instead of the data as the dependent variable, let's make it the independent variable. This is what machine learning is all about. Here the data defines the relationships and thus the equations. It is a little scary in the sense that not many people really understand the nature of the relationships that are built within ML, but the outcomes speak for themselves.

We have seen variables like forecast accuracy increase 5% to 6% on an absolute basis using ML as compared to traditional algorithmic approaches. A good comparison is putting on a golf green. Would you rather have a little book with all the differential equations of slopes and grains to try and apply to create the best putting line to the hole, or would you rather have another golfer with the same putt go just before you to show you the actual data on how to hit the putt? The data driving the equations is certainly better than the other way around. And this helps explain the success of ML across many industries today. (Why do you think Netflix got so good at recommending movies?)

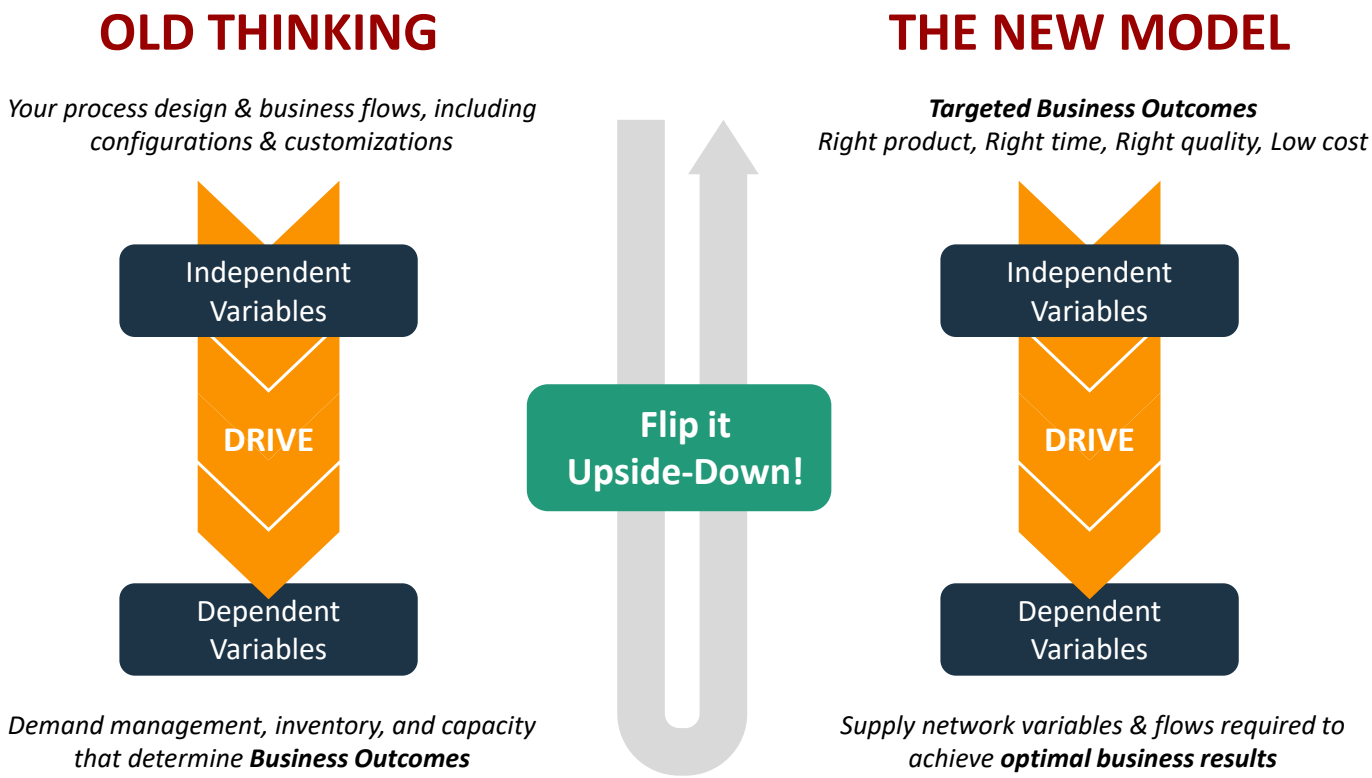
THE POTENTIAL FOR SUPPLY CHAIN NETWORKS

If turning our problem-solving approach upside down and using data to drive great results has been so successful, would it be possible to do this with an entire supply chain network?

Yes, if you were able to deploy a full demand/supply trading network in real time across all trading partners in an industry network - from planning to ordering to procurement to transportation to delivery. Then you would have the foundation to be data-driven rather than driven by static, old data available through legacy ERP approaches. So what's required to make this possible?

Key #1: Apply automatic and autonomous decision-making to the greatest extent possible.

AI/ML and the application of these techniques to prescriptive problem solving provides only half the capability required to



turn your supply network upside down with decisions driven by desired outcomes rather than stale process data. The other half of the capability is provided by a set of robust network-based multi-party software services across demand, supply, logistics, and fulfillment which can be tuned to **operate automatically and autonomously**, based on creating your desired process outcomes.

Once you move to a real-time demand and supply network across all trading partners, you will be able to surface many more problems and issues than you've ever been able to get your arms around in the past. In fact, given the scale of today's supply chains and the number of monthly transactions (in the tens or hundreds of thousands – even millions), companies face volumes that exceed human capacity. So, you'll need to take full advantage of automation technology.

In order to make quick decisions to generate improved business results (rather than remain stuck with increased lead times, inventory and excess capacity), you will want to define decision guardrails and automate decision-making to resolve problems that are within those guardrails, as a normal course of business. In other words, you'll want to automate routine, repetitive decision-making to the greatest extent possible. Great strides are being made by our customers in this area today. This then liberates your staff to focus on higher level jobs and carry out the performance optimization we'll discuss next.

Key #2: Apply the power of prescriptive analytics to optimize performance.

Even more interesting is what is happening with AI/ML-based prescriptive analytics. If we truly have a solution architecture where the independent variable is the outcome we want to achieve, then we need to be able to adjust every other variable in the network (within reason) to give us our desired result. Rather than adjusting variables like lead time, inventory, and capacity to the old levels which led to poor performance in the past, the AI/ML overlay now drives the entire network to achieve optimal operating performance while also achieving the targeted outcomes.

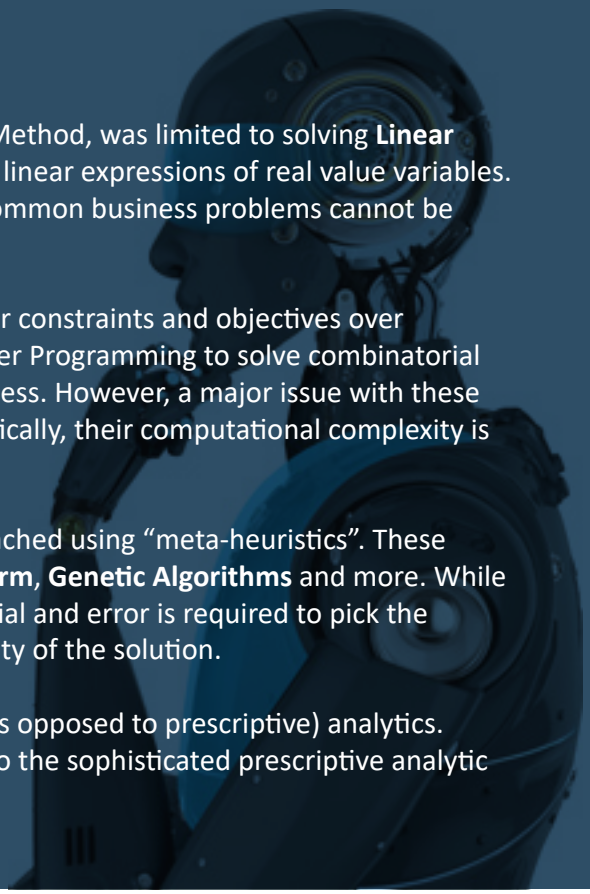
The only real way for you to know if an overall architecture can truly turn things upside-down (as we did with ML for algorithms) is to check the workbench capabilities of the software solution. If the software can "really and truly" treat all variables in the system as dependent and driven by the desired outcome, then **the problem-solving workbench will offer a multitude of solution options for each and every problem in the network**. Let this be a litmus test as you evaluate your platform options.

For example, a multi-echelon supply network problem can be solved in many different ways including adding shifts, expediting, allocations, postponement and more. In fact, certain problems can have 4 or 5 different solutions involving many different parts of the supply network, each having a different business effect on the network outcome.
An AI engine can rank these choices based on setting various business strategies for market share vs. revenue vs. margin generation vs. customer service vs. resiliency, etc. However, there are many other variables that planners, schedulers, distributors, shippers, operators, and manufacturers may also want to consider when choosing a problem resolution in the workbench – and the workbench makes it possible.

The types of problems that are elevated to the advanced workbench are those "outside the guardrails" of the normal course of business that we set for autonomous problem-solving – and so are highly material to business outcomes and optimal performance. These problem-solving workbenches provide **a unique opportunity for companies to differentiate themselves** when it comes to exceeding customer expectations, increasing service levels, and gaining share, while at the same time driving cost improvements and margin growth.

"Upside-down, outcome-driven solution designs will become the new normal for business operating and trading networks in all industries over the next 10 to 15 years."

PRESCRIPTIVE ANALYTICS: METHODS



The original prescriptive analytic optimization method, the Simplex Method, was limited to solving **Linear Programs** where the constraints and objectives could be modeled as linear expressions of real value variables. While a breakthrough at the time, this is still very limiting as many common business problems cannot be expressed using this formulation.

Since then **Integer Programs** have expanded the scope to cover linear constraints and objectives over integer variables. **Discrete Optimization** are a generalization of Integer Programming to solve combinatorial optimization problems. These provide a large increase in expressiveness. However, a major issue with these methods is that they are computationally "hard" to solve. Mathematically, their computational complexity is described as being NP Complete or NP Hard.

Due to this, many discrete optimization problems can only be approached using "meta-heuristics". These include **Simulated Annealing**, **Tabu Search**, **Ant Colony**, **Particle Swarm**, **Genetic Algorithms** and more. While these algorithms can model many types of optimization problems, trial and error is required to pick the appropriate one. Further, there are no guarantees regarding optimality of the solution.

Finally, **Machine Learning** has proven highly effective at predictive (as opposed to prescriptive) analytics. They are also used for simple prescriptive analytics or as an input into the sophisticated prescriptive analytic algorithms mentioned in this paper.

DECISION MAKING WORKBENCHES

- **Inbound Supply Planning, Order Forecast Collaboration, and Load Building**
- **Order Promising & Available-to-Promise**
- **Logistics Planner**
- **Real-Time Asset Tracking**
- **Expediting Inbound Orders**

What makes these advanced workbench capabilities unique? Unless you have a real-time view of the end-to-end business network, other solutions from other providers can't offer the same decision-making options because they don't have access to the same data across the network. This means the range of choices will be incomplete or inaccurate, or both, resulting in sub-optimization and poorer performance relative to competitors.

Further, once a decision is reached, you need the ability to execute decisions operationally and in real time, if necessary. After all, knowing the best choice without the ability to execute is really no choice at all.

AVOID THE TRAPS

Don't be fooled by software vendors pretending to have this advanced analytic capability through a slick user interface or a common data warehouse. This goes to the core of treating **every single business variable across your supply network as dependent, accessible, and changeable based on your targeted outcomes**.

And don't fall into the trap of letting your software solution provider lock you into process configuration and customization that will then drive poor performance and rigidity for your business. Instead, turn it upside-down with an AI-powered real-time demand and supply software network that will let you set the business outcomes you want to achieve, and provide you with a series of prescriptive workbenches across demand, supply, logistics, and fulfillment that will optimize your decision-making based on targeted outcomes.

Upside-down, outcome-driven solution designs will become the new normal for all business operating and trading networks in all industries over the next 10 to 15 years. Don't get left behind. Please contact us to learn more.

About the Author

Joe Bellini is Chief Operating Officer at One Network Enterprises. Joe's experience extends across some of today's leading technology companies, including General Electric, HP/EDS, Brooks Automation, IRI, R1 and Oracle. Joe was granted patents in Supply Chain Planning and is the co-author of the business strategy book, "The Real-Time Enterprise." Joe holds degrees in Mechanical Engineering, Applied Mathematics and Statistics, is an alumnus of Harvard Business School, and is certified in Artificial Intelligence and Machine Learning from the MIT Sloan School.

ABOUT ONE NETWORK

One Network is the intelligent business platform for autonomous supply chain management. Powered by NEO, One Network's machine learning and intelligent agent technology, this multi-party digital platform delivers rapid results at a fraction of the cost of legacy solutions. The platform includes modular, adaptable industry solutions for multi-party business that help companies lower costs, improve service levels and run more efficiently, with less waste. This SaaS and aPaaS platform enables leading global organizations to achieve dramatic supply chain network benefits and efficiencies across their ecosystem of business partners. One Network offers developer tools that allow organizations to design, build and run multi-party applications. Leading global organizations have joined One Network, helping to transform industries like Retail, Food Service, Consumer Goods, Automotive, Healthcare, Public Sector, Defense and Logistics. To date, more than 75,000 companies have joined One Network's Real Time Value Network™ (RTVN™). Headquartered in Dallas, One Network also has offices in Japan, Europe, and India. For more information, please visit www.onenetwork.com.

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