The Best of Zest

2018

A Collection of Our Most Popular Blogs

The Zest Labs Blog is a source for information and perspectives on the fresh food supply chain. In case you missed them, here's a compilation of our most popular blogs from 2018.

In 2018, the Zest Labs Blog provided a timeline for what was topical in the fresh food supply chain industry. Google Analytics details which blogs most resonated with our readers. Our analysis reveals a few interesting trends. In the "Best of Zest" we offer you highlights from the year and some hints of things to look for in 2019.

Food Technology Is "So Hot Right Now"

New food-related technologies, particularly blockchain for the fresh food supply chain, are hot topics. At the start of 2018, there were articles in the press on virtually a daily basis touting the blockchain for the fresh food supply chain as the "next internet." Suppliers and retailers alike were wondering if they'd already missed the boat and rushed to explore how blockchain for the supply chain can impact their business.

It was not until this spring that I spotted a news article claiming blockchain for the food supply chain was never going to work – the first skeptic, at least in my daily purview of industry news – which turned out to be the start of a gradual cooling trend around blockchain. As a result, people started asking good and legitimate questions and, as Gartner would term it, the hype cycle moved to the "trough of disillusionment." Thus, coverage of blockchain became more even-handed as the industry began to realize there was indeed something "there" though more study would be needed. In 2019, those studies (and more trials) will proceed.

Apart from blockchain, a number of new AgTech solutions hit the market as the fresh food industry began to realize access to data and its accompanying insights could significantly help with post-harvest processes and operations. But, again, what do these post-harvest agriculture technologies – from imaging to coatings – have to offer? Do they prevent waste? Progressive suppliers and retailers are interested in discovering how food technology can help their business – before their competitors show them how.

A Perfect Storm Drives Supermarket Metamorphosis

2018 has been a year of almost unparalleled upheaval in the industry, particularly for food retailers. The impact (or fear) of Amazon buying Whole Foods fully sank in – at least to the point where most grocers began to rework their strategies to keep up in the new competitive landscape. Further increasing the competition, Aldi and Lidl were offering discounted, quality food, including produce. Even Dollar General started talking about fresh produce. All in all, plenty of competition to go around.

Then there's the growth of new business formats including online shopping for groceries (including produce and meats – generally unheard of before 2018), click-and-collect, delivery and meal kits (both in store and delivered). The entire shopping experience has changed.

To survive and thrive in this new competitive arena, every grocer will need to rethink their business strategy. One area they're considering is cutting costs and improving efficiency in their fresh food supply chains. For example, some traditional grocers, such as Kroger, have upped their game with investments in companies like Ocado and other partnerships that impact food distribution.

Gen Z Are the New Millennials

Always a popular topic among baby boomer-heavy management teams is how to market and sell to millennials. While we're still trying to figure that out, we're now seeing that this may be

passé, and we should now be thinking about Gen Z – the digital natives. Will they even go to a grocery store? Will they buy non-organic produce?

2018 is and was a year like no other; that's part of what makes the AgTech and fresh food industries so interesting right now. There's a lot going on when it comes to customers, buying habits, supply chains and food technology. I hope the Best of Zest helps bring the highlights of 2018 into focus. 2019 should be even more exciting.

And now to the "Best of Zest 2018" …

DO SHELF-LIFE EXTENDERS PREVENT FOOD WASTE?

As produce suppliers and grocery store chains face increased competition and reduced margins, they turn their attention to finding ways to reduce fresh food waste.

About *12 percent of fruits* and *10 percent of vegetables* are wasted at the retail store, according to the NRDC. If one out of 10 heads of lettuce or clamshells of strawberries are being tossed because they spoiled prematurely, that's a lot of money going to waste that significantly impacts profitability.

A Variety of Approaches
A number of approaches to address this problem have come to market but **most of them don't try to solve the problem at its source** or they create greater issues across the supply chain.

Approaches like…

Coatings
Dipping or spraying a coating onto a product has been shown to help extend shelf-life on some types of produce, the most common example cited being avocados. By sealing the product with the coating, oxidation and respiration

Coat Your Berries?

are slowed, extending shelf-life. There are, however a number of challenges associated with coatings including:

- The impracticality for certain types of produce like lettuces and other leafy greens where it isn't feasible to apply a coating. You can't effectively seal a head of romaine lettuce or spinach leaves, for example.
- Applying coatings to field-packed produce such as strawberries, lettuces or row crops would require a labor-intensive change to the field harvesting process as new equipment and steps would need to be managed in the field. With labor already in short supply, this makes them difficult or impractical to apply.

- The still-unknown, actual shelf-life of the product. Even by extending the product's shelf-life with a coating, there's still an inherent mystery its remaining freshness. You still don't know when it will spoil.

Hyperspectral Imaging
Hyperspectral imaging and photo analytics may reveal the current condition of the product, but not its previous history, handling or rate of aging. Again, this method does not convey the product's remaining shelf-life. You only get a snapshot of the current condition of the product. If it experienced mishandling further up the supply chain, it may be aging at a much faster rate than if it was properly cooled and handled. You just don't know.

Pulping and Visual Inspection
Pulping and visual inspection are ways of identifying lagging indicators of freshness. That is, if you can look at a strawberry and see that it's spoiling, well, it's too late. And, these visual spoilage cues occur late in the supply chain – too late to do anything about preventing the waste.

Controlled Atmospheres
Controlling the atmosphere around a product can be helpful. Managing ethylene is critical for handling bananas, for example. But not all produce reacts to ethylene. Controlled atmosphere environments (rooms or containers) can be of value but they still don't tell you the condition of the product and they can be expensive.

Not Bad, Just Not Complete
There's nothing inherently wrong with using any of these approaches except that they don't focus on addressing the **cause of food waste**.

The primary cost of food waste has to do with harvest conditions and the impact of time and temperature on the product from the moment of harvest.

Our research has shown that most of the impact occurs within the first 48 hours after harvest as a product sits in the field too long or if there are issues with cut-to-cool time or pre-cool efficiency. If a pallet of produce has to wait several hours to be cooled, it can lose several days of shelf-life.

You can't tell the remaining freshness by looking at a product. So, you may have one pallet with ten days of shelf-life and another with fifteen. If you coat both products, for example, you may extend the shelf-life, but you still won't know what the remaining shelf-life is for each pallet.

What's the Solution?
To monitor and manage the handling and condition of the product, IoT sensors are unparalleled sources of information and require very little labor to apply and collect data. When you apply predictive analytics to that data, from the time of harvest, this enables an accurate estimate of the actual remaining shelf-life of the product. We can know if a

pallet of strawberries has 12 or eight days of shelf-life. With that knowledge, we can then ensure each pallet is shipped with sufficient freshness to meet the retailer's requirements – preventing and eliminating waste.

This approach, which is what is used by Zest Fresh, can be applied to all manners and types of fruits and vegetables – from berries to leafy greens and row crops, whether they're packed in the field or at the packing house – and it doesn't impact the work and flow of the post-harvest supply chain as data collection and analysis is autonomous.

This approach can also be viewed as complementary to many of the shelf-life extension approaches described above. That is, Zest Fresh can work with products that are coated to know what that "extended shelf-life" value actually is or be used in controlled environment containers and provide growers, suppliers and retailers with the freshness insights they need to prevent waste at its source.

You can read more about Zest Fresh and proactive shelf-life management.

GROCERS ARE TURNING TO ARTIFICIAL INTELLIGENCE

If you care about food, these statistics from a recent Progressive Grocer article Grocers Embrace AI to Optimize Supply Chain might alarm you:

- 43 percent of grocers are challenged by lack of real-time inventory visibility
- 48 percent of grocers rate their forecasting technology from very poor to average
- 43 percent of retail supply chain professionals say their technology can't keep up with business demands

These are flashing red lights – with the above data illustrating significant problems within the fresh food supply chain – problems that lead to food waste, dissatisfied customers and reduced product margins.

Here's what's alarming: Without visibility into their supply chain, grocers tend to enter a cycle in which they overstock, prompting over correction/compensation, resulting in understocking and thus bringing them back around again.

For example, if a grocer receives a pallet of strawberries at their distribution center and doesn't know the berries have only four days of remaining freshness, they may hold it for a few days and send it to stores where it then spoils on the shelf. Out of stock and fielding disappointed customers, they order more, maybe even too much, also resulting

in the surplus of produce spoiling on the shelves. It's an unsustainable roller coaster of a ride.

Money down the drain. Waste in the landfill.

Applying Artificial Intelligence to the Supply Chain
Fortunately, grocers are taking steps to address these challenges. In fact, many grocers (half) are turning to artificial intelligence (AI) to transform their supply chain operations. The Progressive Grocer article states:

"One in three of [grocers] surveyed claims to have incorporated AI capabilities into his or her supply chain, and one in four is working toward that goal."

Retailers believe AI's strongest potential to improve supply chain management is with the quality and speed of planning insights.

When it comes to improving the management and visibility of the fresh food supply chain, AI – when combined with the right data – can optimize reduction of waste associated with overstocking and understocking and even improve delivered freshness.

Freshness Management is Key
Certainly "AI" is popular across the technology industry. In fact, some companies have changed their name to incorporate "AI", as if that demonstrates their value. However, AI is merely a tool, albeit a very powerful one. What's important is understanding how to apply it with a clear objective in mind.

To utilize AI to optimize visibility of the fresh food supply chain and reduce waste, *freshness management* is critical. Freshness management provides grocers with the ability to know the actual remaining shelf-life of a product they're receiving at their distribution centers to improve planning and inventory management and reduce waste.

By appropriately utilizing AI, machine learning and predictive analytics to know the actual remaining shelf-life of produce, grocers can more accurately plan for when and where to send it. As a result, there are fewer "surprises" because guess work (often based in inaccurate visual inspections) is taken out of the equation. This smooths out the bumps in inventory management and improves supply chain visibility.

But You Need the Right Data
The insights gathered from an AI-based system are only as good as the data that goes *into* the system and helps build and tune the models. For far too long, the fresh food industry has *assumed that all produce harvested on the same date will have the same amount of freshness and shelf-life.* This is simply not the case.

Changes in freshness and shelf-life begin in the field when produce is harvested. If you assume that all pallets are identical, you will continue experiencing issues with delivered freshness and you won't solve the problem. Simply put, that assumption will result in a "garbage in, garbage out" result.

Instead, you need to know the freshness capacity (or maximum shelf-life) of that strawberry, as well as data about the condition of the berry from the time it's harvested. By combining that data (best collected with autonomous IoT sensors throughout the supply chain) with machine learning and predictive analytics, we can accurately determine how long that produce will last. This enables grocers to improve inventory management and produce freshness while reducing costs and waste.
Learn more about how artificial intelligence, machine learning and predictive analytics power Zest Fresh to improve the fresh food supply chain.

WILL BLOCKCHAIN SOLVE FOOD SAFETY CHALLENGES?

The adoption of blockchain among growers and retailers is a positive development for all AgTech companies. It provides an opportunity for growers to embrace technology that can help organize their data and provide new insights for addressing pre- and post-harvest challenges. However, for the adoption of any technology to be successful, there must be proven value to the customer. If growers and retailers don't benefit from a technology, such as blockchain, it likely won't be embraced. Blockchain, like most technology, must deliver real value to all constituents – growers, shippers and retailers – to be successful.

The romaine lettuce E. coli outbreak this spring put the value of food safety in stark relief. The industry needs a better way to both prevent and manage food safety incidents. Recent announcements related to leafy greens, which include romaine lettuce, open the door for a better way to manage food safety incidents using blockchain technology by quickly and reliably identifying the source of retail food. As claimed, a blockchain-based traceability platform, such as the IBM Food Trust, would be a significant step forward for the industry to provide the consumer with a quick and reliable way to determine the source of their food.

Building on Existing Standards: PTI as a Foundation
Adopting blockchain technology to support produce traceability can be built on the good work accomplished by the Produce Traceability Initiative (PTI) completed some years ago. While PTI provided the data for source-level traceability, it did not provide a convenient and reliable way for consumers to access that data. A blockchain-based solution can extend that approach by providing a service to consumer mobile apps that access that same data and do so in a standardized and trusted way. Combining PTI information (i.e. supplier GTIN, location, harvest date, lot number) with purchase order and shipping information (i.e. ASN) provides the basis for all the information required for this approach. As a result, consumers would be provided with access to the information necessary to reflect the source of the product they scanned. This would help manage food safety incidents by consistently identifying product determined not to be affected – such that unaffected product could be sold and consumed with confidence.

The Higher Goal: Prevent or Minimize Food Safety Incidents
There is a higher goal worth pursuing, which is to try to prevent or minimize food safety incidents. Zest Labs promotes a proactive approach, using the same blockchain technology, but incorporating the data related to preventative measure such as regular testing of harvested products as well as key agriculture items such as irrigation water. Most processed foods (such as bagged salads) are required to provide a HACCP (Hazard Analysis and Critical Control Points) plan that reflect the steps a processor takes to manage product contamination risk. The Critical Control Points can be reflected in tests that check for potential contamination and proactively validate product safety. Adding this type of preventive data into a blockchain traceability solution provides the same fast communication for stopping the distribution of "at risk" product by distributors, retailers and restaurants – before the product reaches the consumer.

While field-packed products such as romaine lettuce are not currently required to maintain a HACCP plan, providing a means to proactively manage downstream product would encourage this type of testing for all products. Zest Labs embraces this methodology and incorporates critical test result data directly into its blockchain data set to promote this proactive approach to help prevent or minimize food safety incidents.

But First, Let's Get the Data Right
How product data is captured is a significant factor in determining how reliable the data stored in the blockchain will be. Manually-entered data may be incomplete or unreliable due to entry errors and can be labor intensive and error prone. If inaccurate, incomplete or falsified information is entered into the blockchain, the integrity and value to its subscribers is lost.

So, in order to make a blockchain system effective data integrity needs to be addressed through the use of automated IoT sensors that can accurately, autonomously and securely collect and enter data into a blockchain (or other system). This eliminates paper-based, manual and labor-intensive processes and reduces costs for growers and shippers and can provide significant additional benefits.

Returning Value to Growers, Shippers and Retailers
Each user wants to see direct value in any technology or solution they use, as this reinforces the decision to add or change their current approach. Adding a blockchain-based solution for food safety is no different. As such, defining how to use blockchain technology in a way that returns direct value to growers, shippers and retailers is key to successful adoption. We have identified the consumer benefits related to food safety – both in preventing or minimizing incidents and reliably identifying the food source. For growers and shippers, the product data captured in the blockchain can provide significant insights into operational efficiencies and product quality and shelf life.

Zest Labs has already demonstrated that value, providing significant improvements in both operational processes and key product characteristics. The retailer can also benefit by improving the quality and shelf-life consistency of received product. The lack of this information is currently costing retailers' significant profit, as waste and markdowns reduce their product margins. Zest Fresh provides all of these benefits to each constituent, while embracing a proactive approach to helping prevent and minimize food safety incidents.

Dealing with Multiple Blockchain Platforms
Finally, blockchain technology will have multiple platforms, each with distinct advantages and some disadvantages. While it is too early to predict which solution will be the predominant one, it is clear there will be multiple platforms that require support across the industry.

For instance, while the IBM Food Trust embraces Hyperledger Fabric, others see advantage in Hyperledger Sawtooth. Then there is the CoCo framework from Microsoft (which is Open Source), and Amazon Web Services support for multiple open source frameworks.

Since growers and shippers need to sell to multiple retailers or restaurants, and they won't all be on one blockchain platform, the safe choice is to select a solution that supports all of the blockchain platforms through an abstraction layer. This is the Zest Labs approach, and it future-proofs the grower shipper investment into blockchain technology without delaying the decision to adopt a solution today, realizing the significant added value to operations and food safety.

Zest Fresh and Blockchain Support

Our Zest Fresh solution includes support for blockchain and uniquely offers a combination of proven operational benefits to growers, reduced food waste for retailers, and full blockchain traceability. We also believe the market will need to support multiple blockchain networks. In fact, we believe most growers will want a solution that supports multiple blockchain networks as their customer base will span these different networks – such as IBM, Amazon, Microsoft, and others.

The Zest Fresh approach has built-in flexibility to interface to multiple, current and future blockchain platforms. The benefit to growers is that they would implement Zest Fresh once, gain operational benefits and be compatible with all food blockchain networks. It's just simpler, safer and more cost-effective. You can read more about Zest Fresh and Blockchain in our white paper and in this ChainLink Research report.

MILLENNIALS WANT TRUE TRANSPARENCY

If you're a grower, manufacturer or retail grocer, you shouldn't be thinking about me. I'm a baby boomer. Yes, I can spend a lot of money (just ask my wife), but my buying habits are outdated and, if you continue to solely gear your business towards my generation, you're going to have problems – and very soon at that.

As of 2016, the millennials surpassed the baby boomers and they are now the largest demographic buying group in the USA with over 75 million members. Millennials have a very different approach to the way they eat, research and shop for food. According to a recent article in *Forbes*, "millennials will only interact with brands that are open and transparent, stand for more than their bottom line, and address environmental and socioeconomic issues in the community." In other words, millennials not only want, but expect true transparency from the brands they interact with. If you can't deliver on that, they'll look elsewhere.

And millennials know where to go to get information. According to research from Label Insights, 76% of shoppers go online to seek out information when they don't find what they're looking for on a product's label. Additionally, 56% of millennials use their smartphone to look up product information while in the store. Why? Because they're interested in what they eat, they want more information than ever before, and they value transparency. Label Insights' research indicates that "nearly all consumers – 94% – are likely to be loyal to a brand that offers complete transparency. Transparency

is ranked the highest in a list of factors that motivate consumers to be loyal to a brand. And once a consumer has switched to a brand in favor of increased transparency, he or she is more likely to remain loyal long term." Consumers will even pay more for products that offer complete transparency and information about the products you sell.

But how can you provide them with product information if you don't have it? When it comes to perishable products, technology can help.

Because consumers expect foods like fresh produce and seafood year around, supply chains have become extended and increasingly complex. Growers, manufacturers and retailers can provide "true transparency" throughout the entire fresh food supply chain to establish the history of the product from harvest or manufacture to retailer to ensure authenticity, quality, food freshness and safety. Accomplishing this requires all members of the supply chain to have access to every link in the chain so that everyone involved – including consumers – can have complete visibility into where food came from, and if it has been handled and distributed correctly.

Using IoT sensors throughout the supply chain to track and monitor authenticity, proper processing and handling can help provide true transparency. There's significant value in collecting origin and quality-focused data on its own, but analyzing, applying and making it broadly available is where the benefits accrue. As such, blockchain is rapidly emerging as an important enabling technology to utilize IoT data and make it completely transparent, delivering security and trust across the supply chain. But, blockchain should be viewed as a foundational technology and not a solution in-and-of itself. The combination of blockchain and IoT data enables growers, manufacturers, distributors and retailers to collect and share data with consumers as well as improve decision making throughout the supply chain—thereby providing those millennial customers with the data they're craving.

For example, IoT sensors can collect data about fresh produce from the time it is harvested. You can collect insights on the field, the conditions and the processing and handling steps from field to distribution center to retailer – including end-product freshness – and then provide that information to your customers. Similarly, you can track the authenticity and handling of fresh meats and seafood, even if it is coming from the other side of the globe and make that information available.

Keith Knopf, president and COO at Raley's, says that "consumers' expectations related to transparency are only going to continue to rise. Brands that haven't yet explored how to approach transparency can no longer ignore it."

As millennials continue to become the dominant customer demographic, retailers are only selling themselves short if they don't give the customers what they want—data.

WANT TO IMPROVE YOUR GROCERY MARGINS? TAKE A LOOK AT YOUR SUPPLY CHAIN

The retail grocery industry has never been more in flux. Amazon's purchase of Whole Foods transformed the landscape as the online giant planted its foot squarely in the food segment and cut prices, forcing other grocers to follow suit and kicking off a price war. Newer market entrants like Lidl and Aldi are further forcing down prices. Changes in trucking laws relating to electronic logging devices (ELDs) are likely to drive the cost of shipping and goods higher. Then there's the issue of the increasing scope of e-commerce with curbside pick-up and delivery models, with InstaCart seemingly partnering with everyone and Target purchasing Shipt. It's almost the perfect storm.

What's the immediate impact of this on retail grocers? They are all trying to control prices to win business in this hypercompetitive market – and margins are feeling the squeeze.

So—isn't this going to have an impact on the customer? A recent *Wall Street Journal* article, Grocers Absorb Rise in Food Prices to Keep Customers From Straying (subscription required), reported that, while food *costs* are increasing, *consumer prices* aren't. The article states that, while the food portion of the producer-price index went up 3.5% annually in November, consumers paid just 0.6% more for groceries. This is the widest spread in the two numbers seen in more than three years.

This means that grocers are trying to figure out how to manage shrinking margins while retaining customers. They're trying to cut costs. Some are fining suppliers for late or incomplete deliveries. This isn't a viable long-term solution by the way.

Analysts say they expect retailers' margins to suffer if they keep this up. Ryland Maltsbarger, associate director of the Agriculture Pricing and Purchasing Service at IHS Markit, says that "Grocers will have to cut more costs to absorb the expense. They are having to get much better at negotiating with their suppliers. They are going to have to go after them."

Why not work with the suppliers instead of "going after them" …especially if by working with them you can cut costs?

Working with suppliers, especially when it comes to fresh produce, can really have an impact on ROI. According to the NRDC's updated report Wasted, about 10-12% of fruit

and vegetables are wasted at the retailer – tossed in the garbage or perhaps recycled. In either case, it is profit margin being tossed into the dumpster. It doesn't have to be that way.

One reason so much food is wasted is that it is not properly handled and managed in the supply chain. Temperature variations impact the remaining shelf life of the produce from harvest to the retailer. From our experience with growers and retailers, one-third of the produce delivered to retailers doesn't have enough remaining shelf life to make it to the consumer because it lacks sufficient freshness. As it sits on the shelf, it goes bad, forcing retailers to cull it and toss it.

Much of this waste can be avoided. Technology today allows us to dynamically calculate the remaining shelf life for each pallet of produce from harvest to distribution center to the retailer to maximize value and freshness. By working with suppliers, we can track and monitor the handling and quality of each pallet from the field and enable the seamless matching of the retailer's freshness needs with the actual produce freshness.

This means that the produce retailers receive has sufficient shelf life for the retailer and consumer and waste is dramatically reduced – by up to 50% or more. This directly benefits retailers' profit margins.

So, if you're trying to cut costs and improve margins, consider starting in your produce department by reducing waste. Not only will your margins improve, but you'll also be providing your customers with fresher produce that keeps them coming back to your store.

HYPED UP? BLOCKCHAIN, THE FRESH FOOD SUPPLY CHAIN AND WHY A HYBRID MODEL IS BEST

It's hard to match the hype of a major event like the Super Bowl, for example, but blockchain is giving it a shot. You can't go a day without a story about blockchain in the trade and business press. Some companies have even changed their name to include the word "blockchain," without even having the technology to back it up.

Despite all the hype, blockchain merits a discussion and serious consideration as the upside benefits for its use and application in the fresh food supply chain is significant.

But, at this point, is blockchain a technology looking for a problem to solve, or a way of solving or improving the solution of a known problem? And, how does implementing blockchain relate to your existing business processes? Can or should blockchain replace your current systems or is a hybrid model the best?

It's prudent to find ways to apply blockchain to address known business issues, as this will significantly improve its chances of being successful. And there are many solid use cases that exist in the food fresh supply chain today. Food safety and traceability are often cited as a place to start but ensuring food freshness can also benefit from the intelligent use of blockchain technology.

An article published by ChainLink Research discusses how food traceability and freshness can also be managed by networked SaaS solution without the need for blockchain. However, the author, Bill McBeath, states that "recording the various transactions, HACCP steps, and temperature readings onto a blockchain can add trust and additional capabilities to the system."

In addition to discussing applications of blockchain solutions, the article identifies several key things to consider before you begin on your blockchain-enabled journey:

- It's essential to put the right data into the blockchain to achieve true transparency, as one of the main benefits of blockchain is enabling all relevant parties to have access to the data. There's immense value in collecting quality-focused data on its own, but analyzing, applying and making traceability, food safety and food quality data broadly available is where the benefits really start to multiply.
- It's important to have a blockchain agnostic architecture. There are many different blockchains today and no industry standard and, as with the Super Bowl, it's too soon to find out who the winners and losers will be. Betting exclusively on one may prevent you from working with companies in your supply chain that use another.
- Understand the role of public versus permissioned blockchains. For supply chain use cases, a permissioned blockchain may make more sense.
- Know the difference between blockchain-enabled Smart Contracts and off-chain automation in your existing business applications. While utilizing smart contracts in a blockchain may be feasible, it may not be the most cost-effective approach to solving your business needs.

This leads to the question of whether or not you should abandon your existing SaaS-based approach in favor of a blockchain approach. The answer is no. Each brings advantages to the game. McBeath states that, ultimately, hybrid systems combining SaaS and blockchain models will prevail. He states:

> "Blockchain technology alone cannot provide freshness, safety, provenance, and recall capabilities. That requires data and capabilities from outside the

blockchain. It seems the best emerging approach will be a hybrid consisting of 1) a centralized networked SaaS platform providing economical scalability and deep algorithmic and process capabilities, combined with 2) blockchain and smart contracts for transparency and validation. Blockchains are attractive because of their ability to create a shared, trusted single-version-of-the-truth between trading partners. However, a networked SaaS platform can provide a shared, trusted single-version-of-the-truth at a much lower cost."

The ChainLink article delivers a very comprehensive and compelling perspective on blockchain, separates today's hype from today's reality and presents a navigable path forward. It provides a solid perspective on where to start when considering your blockchain project. Download your copy of the Chainlink Research article.

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