

# SCMRC LEAD WHITE PAPER SERIES

ADDRESSING THE INDUSTRY'S MOST IMPORTANT SUPPLY CHAIN ISSUES

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## FARM TO FORK: HOW A SUPPLY CHAIN ORIENTATION IS HELPING IMPROVE FOOD SAFETY IN CHINA



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# REPORT HIGHLIGHTS

SCMRC affiliated-faculty are part of an international, interdisciplinary effort to improve food safety, transparency, and traceability in China's poultry supply chains.

The SCMRC contingent is bringing a supply chain orientation to the project. What is a supply chain orientation? (See page 5)

The "Poultry Excellence in China" project involves a "farm to fork" approach that addresses problems ranging from unchecked antibiotic use on farms to unsafe consumer practices. (See page 6)

We examine the five elements that supply chain oriented firms should build and maintain in their relationships with their partners. (See page 10)

*Supply chains exist whether they're managed or not. You have to get a group of people that understand the benefits of managing a supply chain before you can manage it... Supply chain orientation is the worldview that managers need ... before they can manage their supply chain. If they don't have a supply chain orientation, they likely focus on the functions of supply chain management, but don't integrate their supply chain. However, if they have a supply chain orientation - if they see the value of "from the farm to the fork" - they get a competitive advantage.*

- John Kent, Director of Supply Chain China Initiatives, Supply Chain Management Research Center

## INTRODUCTION

China is the world's third largest producer and consumer of poultry, trailing only the United States and Brazil. The Chinese poultry industry's growth is relatively recent and stems from the country's ongoing demographic and economic expansion. Though China's poultry industry has quickly become one of the world's largest, its food safety standards have not kept pace. Certain widespread practices risk exposing consumers to unsafe levels of antibiotic residue and foodborne pathogens such as salmonella.

## BROILER MEAT PRODUCTION BY COUNTRY

Rank	Country	Production (1000 MT)
1	United States	18,262
2	Brazil	12,910
3	China	12,300
4	EU-27	11,560
5	India	4,200
6	Russian Federation	3,730
7	Mexico	3,275
8	Argentina	2,055
9	Turkey	1,900
10	Thailand	1,780
11	Malaysia	1,671
12	Indonesia	1,640
13	Colombia	1,479
14	Japan	1,431
15	South Africa	1,235
16	Philippines	1,210
17	Australia	1,164
18	Canada	1,150
19	Ukraine	962
20	Korea, Republic Of	900

<https://www.indexmundi.com/agriculture/?commodity=broiler-meat&graph=production>

Three representatives of the Supply Chain Management Research Center (SCMRC) are part of an interdisciplinary effort to improve food safety, transparency, and traceability in China's poultry supply chains. John Kent (Director of Supply Chain China Initiatives - SCMRC), Brian Fugate (Department of Supply Chain Management Chair - University of Arkansas), and Ellie Falcone (Assistant Professor of Supply Chain Management - University of Oklahoma) are partnered with representatives from seven University of Arkansas departments and two research centers.

Participating University of Arkansas  
Departments: Agricultural Economics  
and Agribusiness, Biological Engineering,  
Geosciences, Industrial Engineering,  
Information Systems, Poultry Science,  
Supply Chain Management

Participating University of Arkansas  
Research Centers: Blockchain Center of  
Excellence and Supply Chain Management  
Research Center



The project is unique partly because such interdisciplinary collaboration is rare in academia, where a high degree of specialization stands out even in the specialized modern world. This rare cooperation across many fields would offer pitfalls on its own, but the potential hazards are amplified by the ongoing project's international component. The team has members in both the United States and China, two countries whose relationship has recently deteriorated amidst an ongoing trade war and a global pandemic. Nevertheless, the Americans are successfully working with Chinese experts in academia, industry, and food safety research representing five universities, one research institute, and three poultry companies. The team includes roughly twice as many Chinese members as Americans.

Participating Chinese Universities:  
China Agricultural University,  
Huazhong Agricultural University,  
Shenyang Agricultural University,  
South China Agricultural University,  
Zhejiang University

Participating Chinese Research  
Institute: Zhejiang Academy of  
Agricultural Science

The project - "Poultry Excellence in China: Improving Food Safety in Poultry Supply Chains" - is funded by the Walmart Foundation. Though its interdisciplinary and international complexity could have been its undoing, the initial phase that began in Fall 2016 was successful enough that organizers secured funding for a second phase that began in Fall 2019. One factor in that success is the supply chain orientation that Kent, Fugate, and Falcone bring to the project. In this paper we examine how "thinking like a supply chain expert" is helping make the project more impactful and provide an overview of what recent research tell us about establishing a supply chain orientation in your company.



## SUPPLY CHAIN ORIENTATION

John Kent and Brian Fugate learned about supply chain orientation from their mentor, the late John T. Mentzer of the University of Tennessee. In a seminal 2001 article, Mentzer and his co-authors - all of whom were current or former Mentzer students - defined the concept.

*Supply Chain Orientation is ... the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain. Thus, a company possesses a supply chain orientation if its management can see the implications of managing the upstream and downstream flows of products, services, finances, and information across their suppliers and their customers. From this definition, a company does not have a supply chain orientation if it only sees the systemic, strategic implications in one direction.<sup>1</sup>*

- John T. Mentzer et al. in "Defining Supply Chain Management"

Mentzer and company portrayed supply chain orientation as a management philosophy one must possess *before* they can effectively manage supply chains. However, they also noted that successfully implementing that philosophy requires "cooperation across several companies directly connected in the supply chain." When multiple supply chain partners share a supply chain orientation, they coordinate their efforts in the name of efficiency and mutual benefit for all involved, including upstream and downstream partners as well as the end customer. Without a shared orientation across multiple firms, Mentzer and his co-authors suggested<sup>2</sup> that a single firm with a supply chain orientation "may implement individual, disjointed supply chain tactics such as Just-In-Time delivery or Electronic Data Interchange," but they are essentially going through the motions of supply chain management rather than engaging in actual supply chain management.



<sup>1</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2001.tb00001.x>

<sup>2</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2001.tb00001.x>



Others have further developed the concept of supply chain orientation since Mentzer and his students outlined it in 2001. Scholars - including Mentzer himself, in 2004<sup>3</sup> and 2010<sup>4</sup> - have worked to refine the concept, quantify it, and illustrate its benefits. But even after various peer-reviewed articles and PhD dissertations have built on Mentzer's initial work, the core concept remains unchanged. Supply chain orientation is a management philosophy that involves viewing supply chains from end-to-end, accounting for both upstream and downstream supply chain partners. John Kent, Brian Fugate, and Ellie Falcone are bringing that philosophy to the interdisciplinary China food safety team.

## INITIAL DOUBTS

Since many supply chain managers are likely unfamiliar with the concept of supply chain orientation, it is not surprising that some of the SCMRC team's future collaborators from other disciplines were initially skeptical of the value such an orientation could bring to the project and hesitant to include supply chain experts on the interdisciplinary team. Kent recalls that one colleague's doubts persisted even after the grant was awarded and the two embarked on a two-week long trip through China to meet with Chinese team members. While the two reached an uneasy peace by the end of their two-week trip, other team members remained unconvinced of the need to adopt a supply chain orientation. By the end of the project's first two-year phase, they saw the importance of a "farm to fork" approach.

## FARM TO FORK

One major food safety issue the team is addressing is the presence of high levels of foodborne pathogens at various points in China's poultry supply chains. Over 70% of food poisoning incidents in China are caused by pathogenic bacteria, primarily Salmonella.

Another safety concern is the presence of high levels of antibiotic residue in some poultry, due to the largely unmonitored use of antibiotics on Chinese farms. The issue is important because humans who consume high levels of antibiotic residue from poultry can develop central nervous system toxicity, tendon toxicity, and other disorders. Unchecked antibiotic use can also produce deadly antibiotic-resistant bacteria.

<sup>3</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2004.tb00170.x>

<sup>4</sup> [https://www.researchgate.net/publication/235281872\\_A\\_Framework\\_of\\_Supply\\_Chain\\_Orientation](https://www.researchgate.net/publication/235281872_A_Framework_of_Supply_Chain_Orientation)

To help their colleagues effectively address these problems, the SCMRC contingent set about integrating a “farm to fork” worldview into the project. While many of the team’s veterinarians and scientists were inclined to focus on testing antibiotic and pathogen levels in samples taken from farms and processing plants, Kent, Fugate, and Falcone pushed them to expand their focus to cover supermarkets and wholesalers as well. The supermarkets are particularly important, since consumer practices in the markets pose some of the highest risks in the Chinese poultry food chain. Falcone - who was born and raised in China - notes that the Chinese poultry processing plants she has visited employ world-class sanitation practices, but the supermarkets are a different story. While American shoppers are accustomed to buying prepackaged, processed meat with relatively little variance between pieces and packages, Chinese consumers expect a more hands-on, personalized experience. “It’s hard for a Westerner to comprehend how dramatically different the whole environment of” a typical Chinese supermarket is from that of its American counterparts, Falcone says. She goes on to describe bustling supermarkets where customers scoop live fish from tanks, give butchers detailed instructions on how they would like their meat prepared, and sometimes forgo plastic gloves as they sift through unwrapped fresh and frozen chicken parts in open-topped display cases and ice trays. The team is especially focused on raising awareness of the dangers of the ice trays. Temperature variances in the ice trays - combined with consumers’ practice of touching the unwrapped raw chicken to inspect its firmness - bring increased risk of foodborne illness. From the SCMRC team’s perspective it would do little good to address pathogen problems on the farms and in the poultry processing plants, only to have that processed meat contaminated in supermarket ice trays before reaching the consumer’s home.



After convincing team members to expand testing to include supermarkets and wholesalers- which required a few contentious, though respectful discussions - Kent found that the China based graduate assistants had been instructed to purchase samples exclusively from Walmart. Given that the project is being funded by the Walmart Foundation, it is perhaps understandable why they focused on Walmart’s retail locations. However, Kent insisted that the project needs to cover multiple retailers in order to have the greatest impact and adhere to the greater philanthropic intentions of the Walmart Foundation to improve food safety in all food supply chains in China. He also emphasized the need to procure samples that have been stored in various ways - refrigerated, frozen, and in open ice trays - in order for the team to definitively prove that the ice trays are more dangerous than other methods.

Team members went on to test 13,492 samples from multiple farms, processing plants, distribution centers, and retail markets during the project's first phase. Testing continues during phase two. The initial tests produced concrete evidence of the dangers involved in displaying chicken in open ice trays, among other findings. Team members also demonstrated the efficacy of two types of portable biosensors that rapidly detect pathogens and antibiotic residue in poultry. The team's phase one findings have been shared with Chinese poultry industry representatives through workshops and seminars. The team also plans to share their findings with the broader Chinese public through a food safety cartoon advertising campaign that will be disseminated via streaming video, social media, and supermarket displays. The advertising campaign is critical since Falcone notes that Chinese consumers have access to relatively little information about the country's food safety problems.

In addition to bringing a supply chain orientation to their team, Kent, Fugate, and Falcone are involved in work that should help better integrate that orientation into Chinese poultry supply chains in general. As a prerequisite for effective supply chain management, a supply chain orientation requires one to understand where their firm fits into the larger supply chain. This requires awareness of both upstream and downstream supply chain partners. In multiple visits to Chinese poultry plants, Kent found such awareness decidedly lacking. He recalls multiple meetings where he asked poultry plant managers to describe their supply chains. The process generally went smoothly until it reached the point where processed chicken left the plant.

***The executives would point out the window and say "See those trucks over there? Those trucks are leaving our facility and going to the wholesale market." And we'd say "Which wholesale market?" The response was "There are 500 or 600 of them. We don't manage our product after it leaves here...It's too complicated."***

- John Kent

Such a lack of transparency and traceability poses problems in the event of a foodborne illness outbreak that needs to be quickly traced back to its origin in order to implement an effective recall. To help address these problems - and make China's poultry supply chains more efficient overall - the SCMRC contingent is helping create a software dashboard that will allow managers to visualize every step in their firm's supply chain. In keeping with the project's interdisciplinary nature, the dashboard includes dynamic risk assessment models developed by the team's industrial engineers. The dashboard includes data from all points in the supply chain, including temperature, location, salmonella, and antibiotic residue levels.



## DASHBOARD MEASURES

- Farm Data
  - Biological Systems (Air, Water, Soil)
  - Salmonella and Feed
  - Location, Temperature, Humidity, Ammonia
- Production Data
  - Temperature, Salmonella and Residue
  - Location
- Transportation Data
  - Temperature, Pick-up & Delivery Times
  - Location
- DC Data
  - Temperature and Salmonella
  - Location
- Retail Data
  - Temperature, Social Media & Salmonella
  - Location
- Model Output
- Environmental Data
  - Temperature
  - Humidity



## PHASE TWO

Ultimately - over the course of the project's first phase - Kent, Fugate, and Falcone showed their interdisciplinary colleagues that a "farm to fork" supply chain orientation could add significant value to the project. Kent notes that one previously skeptical agricultural professor has proactively included members of the SCMRC in a subsequent grant dealing with food safety in the Chinese pork industry. "Many members of the research team and industry partners can now explain a supply chain orientation very well," Kent says.

The project's \$3.2 million second phase began in Fall 2019. As one might expect, the coronavirus pandemic has complicated matters. Some of Kent's American colleagues have expressed gratitude for the foresight he showed when - citing safety concerns - he suggested cancelling a January 2020 group trip to Wuhan, China. "I think that's where I gained [their] trust the most," Kent laughs. Though the pandemic has brought unforeseen obstacles, Kent and others have been able to continue working with their Chinese partners using the WeChat app and Zoom. "Communication is the strength of our team," Kent says.

It remains to be seen whether present circumstances will require the extension of the project's planned Fall 2021 end date. Regardless, Kent is optimistic that the international, interdisciplinary team - united by both a shared supply chain orientation and a desire to improve food safety in China - will enjoy continued success.



## DEVELOPING A SUPPLY CHAIN ORIENTATION IN YOUR COMPANY

Three years after defining “supply chain orientation” in 2001, John T. Mentzer and a co-author from that paper – Soonhong Min - further developed the concept. They [outlined five elements](#)<sup>5</sup> that supply chain oriented firms should build and maintain in their relationships with their partners: trust, commitment, cooperative norms, organizational compatibility, and top management support. When all firms in a supply chain exhibit the elements of a supply chain orientation, they should all enjoy increased efficiency and profitability. Below, we examine those five elements and what recent research tells us about developing them within your company.

Min and Mentzer define trust as a combination of credibility and benevolence. Credibility is the belief that a supply chain partner stands by their word. Benevolence consists of interest in a supply chain partner's well-being, willingness to accept short-term dislocations, and refusal to take unexpected actions that could harm a partnered firm. [Trust is closely related](#)<sup>6</sup> to **commitment** - “an implicit or explicit pledge” that a supply chain partner is dedicated to the alliance long-term. Research shows that communication and information sharing are critical to the formation of both trust and commitment. Specifically, [willingness to share sensitive information](#)<sup>7</sup> on future product development plans, costs, and supply/demand forecasts can go a long way toward forming trust and commitment. In the case of the Chinese poultry project, the SCMRC team repeatedly traveled to China and John Kent spent around 100 days each year in the country before the pandemic. These trips demonstrated their commitment to the project, provided ample opportunities for communication and information sharing, and helped build trust with their Chinese colleagues.

<sup>5</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2004.tb00170.x>

<sup>6</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2004.tb00170.x>

<sup>7</sup> <https://www.emerald.com/insight/content/doi/10.1108/BIJ-11-2019-0517/full/html>



The SCMRC team's frequent interactions with their Chinese colleagues –both in person and virtually - also helped establish **cooperative norms**. Cooperative norms are the perception that supply chain partners will work together to achieve individual and mutual goals<sup>8</sup> while avoiding unexpected actions that might harm the partnered firm. Research suggests<sup>9</sup> that the frequency of transactions between buyers and sellers helps enhance cooperative norms, so managers should interact with partnered firms often.

The “Poultry Excellence in China” project has succeeded partly because the participating universities and research centers are all committed to improving food safety in China. The organizations’ shared vision helps override whatever differences might exist between members of the international, interdisciplinary team. Organizational compatibility covers the corporate culture and management techniques of partnered firms.<sup>10</sup> It overlaps with top management support to an extent, since a firm’s leadership helps determine its culture and management techniques. A firm must have a clear sense of what it values before it can seek out compatible supply chain partners. Interestingly, research suggests<sup>11</sup> that strategic and cultural compatibility go a long way in determining technical compatibility and how successfully partnered firms are able to integrate information sharing systems.

The SCMRC team has received abundant support from the leaders of the Walton College, University of Arkansas, and Walmart Foundation. This support has been critical to the project’s success. **Top management support** includes leadership and commitment to change.<sup>12</sup> Researchers have outlined four managerial archetypes whose presence in a firm’s leadership help determine how successfully it manages its supply chain. The supply chain thinker looks beyond their company’s borders, “focusing on the supply chain processes and exploits the whole supply chains conditions, design, and opportunities as a result of this wider view.” The relationship manager develops, maintains, and assesses the benefits of continued alliances with partnered firms. The controller’s “main task is to measure, follow up, and control measurements in the company and in the supply chain.” The fourth archetype - the organizer for the future - is always looking for new opportunities to adapt to ever-changing market conditions and reap the benefits of doing so. Notably, it is possible for an individual to embody more than one<sup>13</sup> of these archetypes.

<sup>8</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2004.tb00170.x>

<sup>9</sup> <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1745-493X.2008.00045.x>

<sup>10</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2004.tb00170.x>

<sup>11</sup> <https://doi.org/10.1016/j.indmarman.2012.09.002>

<sup>12</sup> <https://onlinelibrary.wiley.com/doi/abs/10.1002/j.2158-1592.2004.tb00170.x>

<sup>13</sup> <https://www.emerald.com/insight/content/doi/10.1108/09590551011016331/full/html?fullSc=1>

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*The Supply Chain Management Research Center (SCMRC) at the Walton College of Business connects industry, faculty and students to LEAD the supply chain of the future. Together, we: Learn, Engage, Address, and Develop all things supply chain.*

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