

ASU OPERATIONS MANAGEMENT REVIEW

Vol 2

**Department of Supply Chain Management
Arizona State University**

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PREFACE

Since the genesis of operations management (OM), scholars have addressed managerial topics, emphasizing the relevance of their studies. Such effort has positioned operations management as an academic field renowned for its connection to practice. Given the research direction, the academic community has flourished in terms of the number of scholars, the volume of research outputs, and the diversity of research themes.

While we appreciate advances in OM by previous contributors, we face another challenge today. The continuous development in OM has led to a flood of new knowledge, which cannot be easily handled by a single research entity. In addition, the field has also deepened the depth of new knowledge, making it much more time-consuming to internalize the new knowledge than previously. Furthermore, real-world problems are becoming more complex and emerging more rapidly. These new challenges increase the friction between stakeholders in the field of operations management. Indeed, as we study OM and other relevant subjects, we consistently witness those stakeholders suffer from the burden of learning new knowledge. Despite the arduous learning process while floundering in the flood of cutting-edge knowledge from recent advances in academia, many graduate students often forget the details of the knowledge as they move onto the next stage of their academic careers. Likewise, although professors are the main entity of pioneering knowledge, many of them are repeatedly chased by their hectic schedules and

thus suffer from insufficient time to digest new knowledge. Meanwhile, practitioners frequently feel distant from academic advances because of the entry barrier intensified by far-reaching scientific advances. Looking back at how OM took place and how it contributes to the real world, one might question as to what the OM community should do to address this burden of new knowledge.

The vision of Arizona State University Operations Management Review (AOR) is to channel new knowledge learned by AOR editors to stakeholders of OM. AOR helps supply chain professionals and students understand OM more comprehensively as they explore research ideas and link new knowledge to real-world issues. The editors have provided reviews of recent OM academic papers from top OM journals to simplify research topics so they can be understood by a wider reader base. From the authors' interviews, readers can gather insight into researchers' paper writing and publishing process.

Each editor independently selected and reviewed academic papers published in top OM journals between 2017 and 2020. The journals include *Decision Sciences*, *Journal of Business Logistics*, *Journals of Operations Management*, *Operations Research*, *Journal of Supply Chain Management*, *Management Science*, *Manufacturing and Service Operations Management*, and *Production and Operations Management*. During the Fall 2020 OM doctor seminar, the editors presented their initial reviews of the selected papers. After these

seminar sessions, each review went through two rounds of review and editing through the AOR director. As a final step in the drafting process, the AOR Advisory Board provided feedback on each review.

The content of AOR is divided into several sections. Each section starts with a brief description of the topic area and lists reviewed papers. Each review of its corresponding academic paper consists of a background, key insights, a brief real-world case study, research implications, and points out classical approaches and studies.

We hope AOR contributes to disseminating the OM knowledge in both academia and industry and inspires new developments in the OM field. This volume would not have been possible without contributions from the director, editors, and AOR Advisory Board.

AOR Vol. 2 Advisory Board consists of the following members:

Arash Azadegan (Rutgers University), Xiangjing (Olivia) Chen (Arizona State University), Min Choi (California State Fullerton), Sina Golara (Kennesaw State University), M. Ryan Hatton (Arizona State University), Seongkyoon Jeong (Arizona State University), Jeffrey Ogden (University of North Texas), Zac Rogers (Colorado State University), Annibal Sodero (Ohio State University), Sining Song (University of Tennessee), Tingting Yan (Wayne State University), Yang (Sophie) Yang (University of Texas at El Paso), Eunea Yoo (University of Tennessee), Lina Wang (Arizona State University), Chao Wu (Arizona State University), George Zsidisin (University of Missouri at St. Louis).

DISCLAIMER:

The opinions expressed in the interviews with the lead authors are the authors' own, and do not reflect the views of the editors, director, and the advisory board of AOR Vol. 2.

FRAMEWORK

Each section begins with a brief introduction of the topic and a list of the reviewed studies.

The reviews have the following structure:

Background section explains the motivation behind the research question and why it is important.

Key Insights section summarizes the results of the study and their implications.

Mini Case section provides an example of how this research topic was used in practice.

Remaining Questions section presents related research questions that can be explored by scholars.

Want to Know More? section introduces other relevant studies related to the research topic.

Foundational Classical Studies section lists other academic papers that were used as foundations for the research topic.

References section is the list of cited studies by the AOR editor.

Interview with the lead author(s) has answers to four questions, regarding idea generation, research challenges, future research goals, and ongoing studies.

OPERATIONS STRATEGY, STRATEGIC PLANNING, AND RISK MANAGEMENT

Any organization has three operations planning horizons: short-term, medium-term, and long-term. In general, strategic planning is associated with the long-term planning horizon, considering factors such as market conditions, competition, competitive advantage, etc. Operations strategy is the planning and design of product lines, manufacturing capacity, and supply chain design necessary to accomplish a firm's goals. There are many different types of risks that an organization needs to manage. These include operations risks, such as supply disruptions, demand spikes, production bottlenecks, and other types of risks. Operations managers can use the studies covered in this section to better inform and shape their strategic thinking.

Topics in This Section

What Makes a Business Decision Strategic?

Based on Steen, E. V. D. (2017). A formal theory of strategy. *Management Science*, 63(8), 2616-2636

Theory Research Multi-Sector

How Does Risk Management Affect Firm Performance?

Based on Manhart, P., Summers, J. K., & Blackhurst, J. (2020). A meta-analytic review of supply chain risk management: Assessing buffering and bridging strategies and firm performance. *Journal of Supply Chain Management*, 56(3), 66-87.

Literature Review Multi-Sector

Do Not Just Accept Weather-Based Sales Losses: Hedge Them!

Based on Brusset, X., and J. L. Bertrand (2018). Hedging weather risk and coordinating supply chains. *Journal of Operations Management*, 64(1), 41–52.

Empirical Research Manufacturing Sector

WHAT MAKES A BUSINESS DECISION STRATEGIC?

Based on Steen, E. V. D. (2017). A formal theory of strategy. *Management Science*, 63(8), 2616-2636.

Review by Zhen Chen

Background

Strategy is a topic of interest in the field of business. Firms use strategies to set development orientation, avoid risks and make profits. However, the definitions of strategy in existing literature are mostly descriptive. For example, Andrews (1971) defines strategy as “the pattern of major objectives, purposes, or goals and essential policies and plans for achieving those goals”. These definitions merely describe what a strategy looks like but provide very little guidance on how to use strategies. Without a clear definition, researchers and managers cannot ascertain what factors and circumstances make their decisions strategic. Centering on the questions of what makes a decision strategic and when is strategy most important, this paper proposes a functional definition of strategy.

Key Insights

Strategy is defined as “the smallest set of choices to optimally guide (or force) other choices”. In order to prove that this definition is suitable for formal analysis, the author establishes a game model where participants make their own choices, but the ultimate outcome is affected by everyone’s choice. Building on this definition, the author studies various factors that make decision more strategic. For example, when the optimal decision is more likely to remain changed (i.e., the decision is more stable), the value of strategy will also increase. This implies that firms should build their strategy around slow-changing factors

which are more stable. Besides, strategy should be built more around internal factors if firms are in a volatile environment. These implications make sense since we may find some similar practices in real-world companies. As an example, Amazon could develop their strategy around internal factors such as capacity or resources rather than around external factors such as products sold on their platform (although they are important as well). This might explain why Amazon invests in their delivery network as described in the mini-case. In addition to stability, the author also discusses other factors’ impact on making a decision strategic. For example, the competition between a firm and its rivals. The key consideration in this context is mainly on anticipating and influencing other firms’ actions and reactions. The degree of strategy is therefore measured by the impact of the decisions on competitors or “complementors”. According to the author, a firm’s decisions are more strategic if they will influence its competitors or complementors in a sufficiently, favorable direction. For example, a firm’s decision on whether or not to enter a market is often strategic because this decision prevents other firms from entering.



MINI CASE

AMAZON'S INVESTMENT ON ITS LAST-MILE LOGISTICS NETWORK

Although COVID-19 has brought a negative impact on the performances of many retailers in the U.S., Amazon continues to carry out its plan on logistics, which has been going on for several years. Amazon is building its own logistics network, and they want to deliver more packages directly to the customers without using the services of other logistics companies. Directing and encouraging the investment in resources and capabilities are typical characteristics of strategy. Other examples include how IKEA concentrates on designing

low-cost flat-pack furniture and Walmart, like Amazon, is committed to building its own delivery network. There is no doubt that these companies have benefited greatly from their strategies. So how exactly can they make sure that these strategies will continue to benefit them?

Image Source: Unsplash

Case Source(s): <https://cheddar.com/media/amazon-replacing-usps-with-own-delivery-network>

Remaining Questions

Although reliability and commitment are two dynamic factors that have been discussed, there are other dynamics such as learning or strategy change that can be considered. If participants or the strategist can learn from previous choices, will their behaviors be different from the scenario where learning is not considered? Since strategic decision factors are usually discussed independently, if we integrate these factors into one scenario, will they influence each other? For example, consider the possibility that the focal firm and its competitors can learn from each other's choices, will it improve the focal firm's position?

Want to Know More?

Since strategy is so important, who should be responsible for developing strategy for a certain company? Should the CEO of this company develop strategy by himself, or should he seek help from outside consultants and analysts? The author discusses this problem in another article (Van den Steen, E 2015). He proves that strategy developed by the CEO will lead to both better strategy and execution. Additionally, the author also examines

the interaction of strategist's vision and the strategy he develops. This paper is based on the functional definition of strategy so it will be helpful to further understand factors that influence the strategy.

Foundational Classical Studies

Although the definitions of strategy in previous literature are mostly descriptive, there are still some studies that contribute to foundation of this paper. Andrews (1971) gives a descriptive definition of strategy which is mentioned in the background section of this summary. Although based on experience, Andrews (1971), Bower et al. (1995) and Saloner et al. (2001) discusses the elements that should be part of the strategy. They identify centrality as an important part of strategy. Central decisions have many interactions with other decisions, may even play a role in guiding other decisions and are also analyzed to examine its impact on strategy in this paper. Rotemberg and Saloner (1994, 1995) show the benefits of commitment to strategy, and Ghemawat (1991) discusses the impact of irreversibility and commitment. All of these articles contribute to the factors analyzed in this paper.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. STEEN

**How did you come up with the idea for this paper?**

The idea for this paper grew out of two very practical experiences, both related to teaching. First, more traditional 'definitions' of strategy didn't seem to help students or executives who did not already intuitively understand what strategy was. Second, it also turned out that many statements that we intuitively understand are not strategy – such as 'maximize shareholder value by leveraging our people and processes' – do satisfy these traditional 'definitions.' So, it was clear that these 'definitions' failed to live up to the standards of a real definition. My intuition was that we would get much further if we started from 'what a strategy does' instead of the usual approach of describing 'what a strategy looks like'. And putting that into a formal model led to this paper. It was a nice surprise to see how many results could be derived from this simple starting point, which suggests that it really captures something important. And it keeps on producing new results.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

One real challenge was turning the ideas of 'what a strategy does' into a clean verbal definition. Surprisingly and contrary to what people often think, good verbal theory is inherently a real challenge because of the broad meaning of words. Natural language was simply not developed to do science! This is even more difficult when the underlying concept is not some physical phenomenon but a social one. Another challenge is that the strategy field has a high tolerance for fairly vague ideas and does not always see the benefit of more precise

definitions and theory. (That tolerance for vagueness is in my view the main reason why it is not always taken seriously by other fields of academia. It does not have to be that way, in my view.) That tolerance for vagueness makes it more difficult to get a theory like this one accepted.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

There are always differences on how you would do things. In this case, I'm pretty happy with the theory itself but I feel that I did not always explain it as well as I would have liked to. I'm trying to correct that now through follow-up work.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

I see this work as just a start. There are lots of questions about strategy itself, about strategy formulation, and about strategy execution that need to be researched. And that work has barely started. And then there is of course the empirical side. It takes time for a theory like this to understand the most fertile ways to test its predictions empirically. The most effective tests are often not direct tests ('do companies have some set of core choices and how does it affect their coordination') but indirect ('are strategies for young companies more compact than for mature companies'). The applications in industry come through showing managers the benefits of a 'strategy as core guidance'. That is an ongoing process.

HOW DOES RISK MANAGEMENT AFFECT FIRM PERFORMANCE?

Based on Manhart, P., Summers, J. K., & Blackhurst, J. (2020). A meta-analytic review of supply chain risk management: Assessing buffering and bridging strategies and firm performance. *Journal of Supply Chain Management*, 56(3), 66-87.

Review by Hyunsuk Baek

Background

As the frequency and severity of unplanned and unanticipated supply chain disruptions have been increasing, organizations are paying more attention to supply chain risk management (SCRM). There are two aspects in SCRM: internal constraints and the external environment. To mitigate supply chain risk, firms employ buffering strategies, internally creating safeguards for the risk, and bridging strategies, externally attempting to influence the environment. Since globalization makes a supply chain network span across many countries and the management and leadership vary by culture, organizations need to understand and consider the cultural differences to pursue the universal application of the strategies. Through the meta-analytic review of SCRM studies, this paper shows the positive effect of buffering and bridging strategies and explains why buffering or bridging strategies have different sized effects in distinct regions and cultures.

Key Insights

Buffering strategies reduce the dependency on supply chain partners by transforming the product line with cell manufacturing system, storing slack, and preparing backup supplier resources. Bridging strategies reduce the influence of supply chain variation by establishing close and cooperative relationships and sharing information with

supply chain partners. The close and cooperative relationship can provide resource allocation priority from partners, faster cooperative response and recovery for disruption, and risk-sharing. This research is also concerned with the influence of cultural differences on the impact of strategies, because different societies have different standards for inequality and relation to authority, the concept of self, and ways of dealing with conflict, uncertainty, and ambiguity (Inkeles & Levinson, 1954). The authors, in this research, examine the buffering and bridging strategies' effect on Confucian Asia (China, South Korea, and Taiwan), Anglo (the United States and the United Kingdom), and Germanic Europe (Germany, Austria, and Switzerland), separately. Each cultural region has different effect sizes of the strategies. Both buffering and bridging strategies have positive effects on SCRM and firm overall performance, but the effect sizes are different by cultural regions. To effectively manage the global supply chain, it is important to train employees about other countries' value judgments in business management.



MINI CASE

IMPACT OF COVID-19 IN THE MEAT SUPPLY CHAIN

Shortly after the spread of COVID-19 in the United States, many people went to Costco and Wal-Mart to buy food in large quantities. This panic buying and scarce inputs of products caused the temporary disruption of the U.S. food supply chain. Currently, we can see supermarkets' stocks are replenished because of the resilience of the food supply chain. However, the supply chain for meat became a substantial issue because it showed the problems that occurred within the production supply chain. Even though the supply is abundant in the country, there exists bottlenecks at the limited number of major meatpacking plants in the industry. In this situation, the shutdown of Tyson Foods by COVID-19 brought significantly negative impact on the meat supply chain, and

experts pointed out the lack of flexibility in this supply chain. If retailers had considered SCRM practices, such as sharing information and preparing backup suppliers, the situation would be better. As a result, in late April, President Donald Trump signed an executive order declaring meat processing plants as essential infrastructure and meat plants have reopened.

Image Source: Unsplash

Case Source(s): <https://searcherp.techtarget.com/feature/Exploring-COVID-19-food-supply-chain-disruptions>

<https://www.ucdavis.edu/food/news/is-food-supply-strong-enough-to-weather-covid-19-pandemic>

<https://www.supermarketnews.com/meat/coronavirus-related-food-supply-disruptions-may-be-behind-us-meat-and-produce-could-still-face>

Remaining Questions

These days, the speed of development of technology is fast, so the product life cycle becomes short. This can make buffering resources outdated, and the importance of bridging strategy will be relatively high for fast adaptation in changing environment. In this environment, we should investigate how to apply buffering strategies and bridging strategies simultaneously. The author remarked this stream as industry dynamism. Instead of treating culture difference at a regional level, it could be a good direction to consider the cultural difference at an organizational level. This paper proposed resource-oriented and information-oriented viewpoints to understand buffering and bridging strategies. Can other SCRM strategies, like efficiency and flexibility, to gain a deeper understanding of these environments?

Want to Know More?

As a consequence of the recent U.S.-China trade dispute and COVID-19, research on supply chain resilience and disruption management has started

to receive more attention in the SCRM literature (Pournader et al., 2020). What are the substantial differences between developing strategies (supply chain resilience and disruption management) and more traditional strategies (buffering and bridging)? Currently, big data is becoming more popular in research. The studies of Baryannis et al. (2019) and Pournader et al. (2020) recommend applying artificial intelligence and data mining methods to SCRM research. As researchers start applying these techniques, it will be interesting to see what outcomes emerge.

Foundational Classical Studies

This paper focused on the buffering and bridging strategies and their relationship with SCRM. The framework of buffering and bridging strategies in this paper came from the study of Bode et al. (2011). The procedure of meta-analytic analysis, the main methodology of this paper, is well explained in the book of Hunter and Schmidt (2004). Inkeles & Levinson (1954) and House et al. (2004) describe the influence of the cultural differences on management.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. MANHART

**How did you come up with the idea for this paper?**

I spent many years in industry prior to becoming an academic. In my experience there exists a gap between strategy and implementation of supply chain risk management. Supply chain networks are global which requires trying to integrate plants and optimize processes across multiple countries. The focal firm often struggles when dealing with other cultures. Any work which helps managers to think about those differences can lead to some constructive conversations and new understandings.

Supply chain risk is the subject of great interest today. There have been numerous literature reviews attempting to synthesize results and create new frameworks. I thought a meta-analysis would be interesting because of the unique perspective into a quantitative synthesis. Side by side comparisons can be challenging because of between-study differences. I love how meta-analysis can bridge those differences and summarize unique studies. Meta-analyses are a really good way to take a step back from all of the details and see the bigger picture.

What were some of the difficulties that you encountered for this paper (e.g., subject, topic, data, methodology, revise/resubmit process etc.)?

Some difficulties were due to the environment. A lack of consensus of terminology makes understanding the literature difficult and supply chain risk management is no exception. Most supply chain risk management studies utilize resilience, but some describe it as both a proactive and reactive capability while most measures focus on a quick response. This required consideration of many different terms in the search criteria in order to capture as

much of the phenomenon as possible. This not only resulted in thousands of papers to review but terms to code as well.

Other difficulties were internal to the study. Supply chain risk management is so broad that I had difficulty defining the scope of the project. As I tried to incorporate too much into the paper, each argument was insufficiently supported. This resulted in more revisions than necessary in order to focus the paper. I was very fortunate that the editors and reviewers saw potential and helped me through this process. I think this is the sign of an outstanding journal when you receive constructive feedback.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Of course, hindsight is more complete, and I would change many things. A more well-defined scope would have reduced the workload. To overcome my personal biases, I would get friendly reviews earlier. This is important to literature reviews and key in a growing field. You never know how many other researchers are doing similar work. Completing the project 6 months later could mean that another project made a similar contribution before me. My project would have lost some value. Although you want to have many projects in your pipeline, it is important for your prioritization capabilities to have them spread across various stages.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

I believe the primary question raised from this study is determining the source of cultural differences so they may be manipulated. For example, are Germanic strengths due to hard

to replicate infrastructure or factors something more easily replicated, such as strong trade associations and highly trained buyers? Are Confucian Asia strengths due to hard to replicate social networks built over many years or more replicable negotiation skills resulting in compromise?

Although supply chain risk management studies are increasing, firms continue struggling with disruptions. Buffering and bridging strategies focus on risk in the external environment. Currently I am working on a couple of projects which look at strategies focusing on internal risk factors.

Since I started this project, the world has endured trade wars, Brexit, and a global pandemic

resulting in a re-examination of supply chain network designs. In fact, reshoring initiatives have become trendy. Research has challenged managers to look at the total value contribution in order to consider additional factors which are more difficult to quantify (Gray, Helper, & Osborn, 2020). Longitudinal studies may highlight the longer-term consequences of strategies utilized today such as supplier selection based upon piece price.

Further, the Hunter and Schmidt method of meta-analysis has dominated the social sciences landscape. Are there opportunities we are missing due to limitations of the method?

DO NOT JUST ACCEPT WEATHER-BASED SALES LOSSES: HEDGE THEM!

Based on Brusset, X., and J. L. Bertrand (2018). Hedging weather risk and coordinating supply chains.

Journal of Operations Management, 64(1), 41–52.

Review by Ben Stover

Background

The relationship between weather and sales for a firm has been a popular topic over the years, especially as firms need to have an answer to increasing weather-related problems affecting their sales forecasts. These situations can range from reduced demand for obvious temperature-dependent goods (i.e., sunscreen or winter jackets) to less-apparent goods that can be affected by weather variability (i.e., sales of wool clothing when sheep grazing weather is sub-optimal). Previous literature has emphasized the effects of weather on retail sales to consumers; however, the accompanying effect of upstream manufacturers in the disrupted supply chain has not been highlighted. The main concerns with this latter effect are two-fold. Firstly, due to decreased replenishment orders in the disrupted season and overstocked inventory being carried over to future seasons, the manufacturer's production scheduling could be significantly affected. Secondly, because of these decreased sales and increased carrying costs, the manufacturer could end up bearing the cost of this disruption by not being proactive. Additionally, due to the increasing effect of climate change, weather variability has increased over the years and is projected to continue this way for the foreseeable future. This has led researchers to investigate the effect of being able to predict sales variability based on weather variability and use financial hedging to assist the manufacturer and its supply chain during disruptive times.

Key Insights

The manufacturing firm could evaluate and mitigate weather risk with financial hedging. The paper gives insight into this issue by providing an example of three manufacturing firms: an OEM glow plug producer, a sunscreen producer, and a clothing producer (the OEM firm is emphasized). Using regional temperature data sources, the authors can determine actual anomalies and climate change trends. Based on past consumer patterns, they ascertain a certain temperature threshold to compute the “Critical Days” metric, which corresponds to lower consumer demand. Then, this is used to measure the effect of weather variability on sales variability. Once this relationship is determined, estimated sales losses per month can be calculated and a “weather-value-at-risk” frequency diagram can be constructed to determine how much sales loss is associated with a certain number of critical days. This information will then be used to develop an insurance-based hedging plan to counter these sales shortfalls. Once the manufacturer has this insurance policy hedge set up, they can work with their retailers to implement a plan, where if the retailer encounters multiple months of weather outside of the desirable threshold, they will have the ability to reduce their purchase commitment by a certain agreed upon amount.



MINI CASE

CLIMATE RISK ON THE SEMI-CONDUCTOR INDUSTRY

In a recent McKinsey Global Institute report on climate risk for supply chain, analysts discuss the risks related to specialty supply chains like the high-end semiconductor industry. This industry's main production is stationed in East and Southeast Asia, where major weather variations can make production stability very vulnerable. In this case, they mention that a disruption on the supply end could delay downstream products by up to a year. Additionally, since this is a specialized industry, downstream manufacturers do not have many alternative suppliers and qualifying new suppliers could mean a long and costly redesign process. Further exasperating the

issue, this disruption would extend the already large production backlog for replacement parts. They recommend hedging commodity prices on certain raw materials, engaging in long-term fixed-price contracts with suppliers, and creating closer collaboration between supply chain partners.

Image Source: Pixabay

Case Source(s): <https://www.mckinsey.com/business-functions/sustainability/our-insights/could-climate-become-the-weak-link-in-your-supply-chain>

Remaining Questions

In OEM case, they were able to set up a sales incentive program with their retailers, whereby if the retailer guaranteed a 25% increase from their previous year's purchases, the OEM would compensate the retailers financially during non-ideal weather. However, is this the optimal process to offset sales deviations? In comparison, there are alternative studies on how the manufacturer integrates this hedge with their retail customers. One method is a process where the manufacturer adjusts their price to encourage higher sales and both manufacturer and retailer evaluate their inventory level simultaneously using the same weather variable (Cachon 2004). Additionally, the manufacturer could set up contracts with their retailers that contain future markdown terms (Tsay 2001). Instead of merely looking at prices, some studies also suggested a process where the retailer can return excess inventory at the end of the affected season (Padmanabhan and Png 1995, Pasternack 1985). The manufacturer can also set up a weather-linked rebate system to assist their retailer when unfavorable conditions happen, which has been shown to completely hedge the manufacturer's risk, especially when the retailer cannot purchase their own hedges (Chen and Yano, 2010). Each of these articles give an interesting point of view on the same broad subject. However, it seems like the method in Chen and Yano (2010) provides the most flexibility in the weather data inputs and thus, gives the best generalizability.

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Want to Know More?

This article draws from CIMO-logic (Deyner et al 2008, van Aken et al 2016) to build its methodology using the Context, Intervention, Mechanism, Outcome process, which is a popular approach for developing new conceptual model framework. While the Value at Risk concept has been used in many applications in finance and insurance for some time (Linsmeier and Pearson, 2000), it has only recently been utilized to measure weather risk (Toeglhoffer et al. 2012), especially when in applications related to climate change (Prettenthaler et al. 2016). Brand new research has also looked at weather risk effects and planning for larger markets and their corresponding supply chains in China (Bai et al. 2020).

Foundational Classical Studies

Lazo et al. (2011) provided bases for the direct impact of weather on lost sales, which the authors utilized for the groundwork for the retailer end of their discussion. Davis (2001) and Geman et al. (2005) discussed how weather derivatives were priced and implemented for energy-related markets. Lastly, Barrieu and Scaillet (2010) and Hershey and Breslin (2015) further discussed how weather-based derivatives further developed and became available to markets other than agriculture and energy.



BEHIND-THE-SCENES

INTERVIEW WITH PROF. BRUSSET

How did you come up with the idea for this paper?

This paper's original idea was the result of brainstorming with my co-author back in 2015. We submitted this paper in various forms to 6 different journals before submitting to JOM. The idea has always been the same, but editors and reviewers were not ready to accept it.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The major difficulty has been in finding a proper methodology framework in which to place the research. The fact that both editors and reviewers did not see the purpose, or the power of the research did not help.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

I would have started differently. I would have looked for a proper methodology framework and done a lot more research in the literature about that framework. In this case Design Science Research.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

This research is now being applied in various economic sectors by firms who now realize how much the weather has bearing on their economic results. This includes, hotel and leisure industry, retail and distribution, spare parts in the automotive industry, energy, road maintenance and other local administration operations, etc.

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MANUFACTURING AND PRODUCTION MANAGEMENT

In general, any manufacturing operation faces opportunities and challenges against the backdrop of ever-evolving technological innovations. This includes high/low cost labor markets, raw material suppliers, equipment purchases, etc. With the articles covered in this section, operations managers can learn more about Seru, Industry 4.0, and other related topics in production management.

Topics in This Section

How Can Seru Production (Cellular Assembly) Improve Productivity, Quality, & Flexibility?

Based on Yin, Y., Stecke, K. E., Swink, M., & Kaku, I. (2017). Lessons from Seru production on manufacturing competitively in a high-cost environment. *Journal of Operations Management*, 49, 67-76.

Empirical Research Manufacturing Sector

Industry 4.0: What are the Opportunities and Challenges for Operations Management?

Based on Olsen T.L., Tomlin B. (2020). Industry 4.0: Opportunities and Challenges for Operations Management. *Manufacturing & Service Operations Management*, 22(1), 113–122.

Literature Review Multi-Sector

Methods to Manage Your Less-Than-Perfect Products

Based on Li, R., Xia, Y., & Yue, X. (2019). Scrap or Sell: The Decision on Production Yield Loss. *Production and Operations Management*, 28(6), 1486-1502.

Analytical Research Manufacturing Sector

HOW CAN SERU PRODUCTION (CELLULAR ASSEMBLY) IMPROVE PRODUCTIVITY, QUALITY, & FLEXIBILITY?

Yin, Y., Stecke, K. E., Swink, M., & Kaku, I. (2017). Lessons from seru production on manufacturing competitively in a high-cost environment. *Journal of Operations Management*, 49, 67-76.

Review by Hyunsuk Baek

Background

Many manufacturing companies have chosen to apply offshoring strategies to achieve low-cost sources. However, instead of following offshoring trends, some electronics companies such as Sony and Canon, pioneered Seru manufacturing system because of the innovative industry environment where it has high demand volatility and short product life cycles. Traditional manufacturing systems, such as Lean (Toyota Production System), Agile, and cellular manufacturing (Group Technology, Quick Response Manufacturing) cannot provide firms with enough responsiveness to survive in the innovative industry. However, Seru achieves such responsiveness by dismantling assembly lines and replacing them with swiftly reconfigurable cells, which contain all needed resources, each own inexpensive equipment, and responsible autonomy with highly skilled workers for ordered tasks. To show the benefit and principle of Seru, the authors studied Sony and Canon cases, performed interviews and meetings, and reviewed literature

Key Insights

Sony and Canon have faced the challenge of being flexible in the innovative environment. Toyota Production System model was not appropriate,

since its objective is to reduce the variability. If variability in the system increases, either work-in-process must increase, or capacity utilization must decrease. The paper shows that it is possible to pursue flexibility and efficiency simultaneously. Seru, coping with high demand volatility and short product life cycle, was developed as an alternative and achieved a smooth flow of a wide variety of products and volumes while using resources frugally: balancing between responsiveness and efficiency. How and why can manufacturing under Seru be profitable in a high-cost environment? This study suggests the Theory of Swift, Even Flow (TSEF) as an explanation. The authors present the important concepts of value-added and non-value-added work. By relating the production factors to these concepts, the specific law is “removing work that does not add value improves productivity”. In view of this, Seru produces products in small lots rather than based on the forecast or smoothed demand. Additionally, the paper presents skilled labor as more important in high-cost environments. Skilled workforce is the key to Seru and fortunately, developed countries often have access to large pool of skilled labor.



MINI CASE

THE RESPONSIVE SUPPLY CHAIN OF FAST FASHION AT ZARA

The global fashion retailer Zara, operating more than 6000 stores in over 90 countries, is one of the most popular and successful fast fashion retailers in the world. To follow the fashion trend and customers' preference swiftly, Zara changes its apparel designs every two weeks on average, launches over 10,000 items every year, and performed 12 inventory turns per year. It is no secret that Zara's success can be attributed to the responsiveness of its supply chain. First, Zara produces most of its fashion items within its own factories and are vertically integrated to manage everything in the process from design to distribution. Zara can efficiently control the types and quantities of producing

items, following the demand. Second, Zara utilizes just-in-time manufacturing system to introduce new fashion items during the season. Almost half of the items are launched during the season in response to the fashion trends demanded by sensitive customers. Using this efficient and flexible supply chain, Zara remains one of top global fashion brands.

Image Source: PicJumbo

Case Source(s): <http://blog.cemat.com.au/4-key-facts-about-zaras-supply-chain-success>

<https://edited.com/resources/supply-chain-management/>

<https://www.tradegecko.com/blog/supply-chain-management/zara-supply-chain-its-secret-to-retail-success>

Remaining Questions

In this paper, the authors stress the role of metrics. They propose to evaluate Seru in terms of time-based metrics, such as changeovers, throughput, and dwell. Limitation of Seru should be studied as a future research topic. What happens when unskilled workers are allocated into the cell of Seru? Is a professional workforce a necessary condition for successfully operating a Seru? If it is difficult to locate and hire skilled workers, then is Seru still better than traditional manufacturing systems? In a Seru, the cells must be designed first, then jobs can be assigned. What are some of the important factors to determine the design of the cells?

Want to Know More?

In Industry 4.0, manufacturers must consider applications of innovative technologies such as IoT, 3-D printing, and machine learning. Yin et al. (2018) investigated the modular architecture

of a product and 3-D printing in Lean and Seru production systems. Buer et al. (2018) studied the mapping between Industry 4.0 and Lean manufacturing research. Gunasekaran et al. (2018) examined the facilitating role of big data and business analytics in Agile manufacturing. How would technologies of Industry 4.0 improve Lean, Agile, and Seru manufacturing systems?

Foundational Classical Studies

Narasimhan et al. (2006) and Shah and Ward (2007) summarized Lean and Agile manufacturing systems. The characteristics of cellular manufacturing system was discussed by Wemmerlov and Hyer (1989) and Hyer et al. (1999). The Adler et al. (1999) analyzed the case of attaining both superior efficiency and superior flexibility. If you want to find the theoretical basis of this paper, it will be good to see the work of Hopp and Spearman (2001) and Schmenner and Swink (1998).

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. YIN

**How did you come up with the idea for this paper?**

My research topic during Ph.D. course was cellular manufacturing, an area of using group technology to group dissimilar machines as a manufacturing cell and to assign similar products to a cell for operations. During my research of cellular manufacturing, I noticed that many Japanese electronics use a unique assembly system that is different from traditional Toyota Production Systems (TPS), and manufacturing cells. From 2005, I and a Japanese colleague began to study this new system, named seru production system. The first English paper about seru is a case study of Canon factories in Yin et al. (2008).

What were some of the difficulties that you encountered for this paper (e.g., cases, theory, revise/resubmit process etc.)?

There are many difficulties. But the most difficult matter is the identification of differences between seru production and traditional production systems. To answer this question, we have visited dozens of factories, investigated literature, and matched cases and literature together. The answer is that seru production systems' primary purpose is responsiveness, which is achieved by equipping capabilities of reconfiguration. See Yin et al. (2018) for a comparison between seru and other production systems.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

This study uses empirical case studies, which may be the only choice because new concepts are constructed from on-site production systems.

Based on what you know now, what do you think about the future research directions? Is there any new trend for the manufacturing production system?

The study of production lines (from Ford assembly lines, TPS, cellular manufacturing, flexible manufacturing systems, and seru production systems) is the start point of operations management and industrial engineering. A main topic of supply chain management is matching supplies with demands. Production lines may be the most important supply systems that have been studied so far.

Combinations of three types of buffers are used by production lines to deal with variabilities. These three buffers are inventory, time, and capacity. Most previous studies focus on inventory management. Some studies discuss idle time reductions (e.g., bucket brigades). Very few studies consider capacity buffers. Seru production systems use capacity buffers to respond to fluctuated customer demands. This is a good opportunity for operations management communities.

INDUSTRY 4.0: WHAT ARE THE OPPORTUNITIES AND CHALLENGES FOR OPERATIONS MANAGEMENT?

Based on Olsen T.L., Tomlin B. (2020). Industry 4.0: Opportunities and Challenges for Operations Management. *Manufacturing & Service Operations Management*, 22(1), 113–122.

Review by Rohan Korde

Background

What is Industry 4.0? The first industrial revolution changed the production methods from manual to steam powered mechanical systems. The second industrial shift resulted in electrification, assembly lines, and mass manufacturing. The third iteration led to adoption of computing and automation. The fourth incarnation, known as Industry 4.0 is centered on cyber-physical systems (CPS) and has the potential to break the traditional operations trade-offs among the competitive priorities of cost, flexibility, speed, and quality. This study focuses on goods-producing industries, discusses additive manufacturing (AM, also known as 3D printing), the internet of things (IoT), blockchain, advanced robotics, and artificial intelligence (AI). Industry 4.0 is a synergistic combination of these technologies. 3D printing, for example, is a process that takes a digital representation and produces the physical object layer by layer. This enables the physical "printing" of complex shapes and internal geometries that are difficult to produce in traditional manufacturing. Thus, it promotes flexibility, rapid prototyping, speed to market, and innovation. IoT is a vast array of interconnected sensors coupled with intelligent controllers, that can take actions based on real-time sensor readings. Quality is improved because of the continuous monitoring and advanced alerting mechanisms in

IoT. Collaborative robots or "cobots" can adapt to changes in their immediate vicinity. Cobots work alongside their human counterparts to increase productivity, improve quality, speed and flexibility. AI, in general, means mimicking of human cognitive functions such as problem solving and learning using hardware and software. Predictive Maintenance is an example of how AI is used in manufacturing, which reduced costs and wastage, improves quality of product, and workers safety.

Key Insights

Cost, Flexibility, Speed, and Quality are the main focus areas of any manufacturing operation. With Industry 4.0, there is a potential to dampen the tension between these trade-offs. Additive manufacturing increases flexibility, enables rapid prototyping, increases speed to market, reduces cost of production, and reduces breakeven sales volume. Mass customization is now possible with AM at reduced costs. 3D printers can be installed across different geographical locations (rather than manufacturing in a central factory location), and each 3D printing location can be customized to the needs of each local market. Companies can 3D print spare parts on demand. This reduces inventory, holding costs, and transportation costs. IoT is a revolutionary technology that can improve inventory management, production maintenance,



MINI CASE

DULUX INDUSTRY 4.0 CASE STUDY

How did DuluxGroup, a paint manufacturer in Australia, achieve balance in cost, flexibility, speed, and quality using Industry 4.0? After the Brisbane floods in 2011, DuluxGroup decided to relocate most of its water-based manufacturing from the existing factory at Rocklea in Brisbane to Mickleham, Victoria. DuluxGroup wanted to produce more advanced paint products using an evolving technology in resins with an even greater level of quality and consistency. The challenge: Paint manufacture is traditionally labor-intensive and is batch-made. There are at least 150 recipes, 150+ raw materials, and up to 1200 SKUs. The new factory has 5 fully-automated filling and production lines. It has a total capacity of 50M-70M per year. The plant is operated by 60 staff on two shifts over 5 days. Foodmach, an integration supplier of DuluxGroup, supplied all the depalletizing, conveying systems, robotic orientation, AGV, and laser coding/labelling systems and integrated these systems with other

OEM equipment at the plant. Kevin Worrell, Project Director of DuluxGroup commented "This is considered currently one of the top five Industry 4.0 batch plants in the world at the moment... we couldn't achieve what we needed to achieve if we didn't go down that (Industry 4.0) path". Furthermore, he added "It's allowed us to eliminate a lot of physical labor, it's allowed us to give metrics feedback data - data mining that allows us to improve our recipes...what we're mining out of our recipes now is allowing us to refine them to get more accurate, giving our customers a better product...it will allow our quality control focus to shift. Instead of being at the back end looking after what we've manufactured, it'll be at the front end, looking at raw materials coming into the plant".

Image Source: Unsplash

Case Source(s): <https://openiiot.com.au/dulux-industry-4-0-case-study/>

and worker productivity. Lights-out manufacturing has become a reality across different manufacturing sectors. FANUC, a Japanese robot manufacturing company has been operating as a lights-out factory since 2001. Robots are building other robots at the rate of about 50 per 24-hour shift and can run unsupervised for as long as 30 days at a time. Most of the semiconductor fabrication plants in the United States such as Texas Instruments in Dallas TX, Intel plants in Hillsboro, OR and others, operate continuously with little human intervention. This leads to high productivity, high quality, high speeds, at lower costs. The factory of the future will look very different as inexpensive, configurable, and collaborative robots (cobots) becomes increasing available. Drones are used for inventory counting and inspection of pipelines and wind turbines. This has led to more accurate tracking of inventory and improved worker safety. The cost, flexibility, speed, and quality of various robotic technologies are improving rapidly. Robotic transportation options have the potential to significantly affect supply chain design. At distribution centers and fulfillment centers there has been a significant increase in the use of AS/RS (automated storage and retrieval systems) for materials handling. Amazon uses Kiva robots extensively to store and fetch goods in their fulfillment centers. More robots are planned to be used for order picking and packing to reduce the overall error rates and improve speed and productivity. This results in high volume of processed orders, reduced reliance on human workers, at reduced costs.

Remaining Questions

Rapid advances in computing and telecommunication technology are further accelerating automation. Automation and the future of work is an open area of research. How many jobs and what type of jobs will be lost because of automation? What policy changes are

necessary to train displaced workers to get them rehired? Should industrial robots be charged taxes to make up for the tax erosion caused by automation? Should there be a central foundry of 3D printers, or should there be many geographically distributed locally customized 3D printer locations to manufacture customizable products? What are the implications of fast 5G wireless networks adoption in Internet of Things, especially in the industry setting? Smart Factory, Smart home, Smart car, what are the implications on future jobs? Human capital development is important and must happen at schools and universities across the world. Machine learning and Cloud computing companies like Google and Microsoft should collaborate with universities to set up courses that students take, to learn cutting edge technology. Another question surrounding cyber-physical systems (CPS) is that how does an enterprise secure its systems and prevent malicious cyber-attacks? Although this is primarily an information technology problem, it affects operations directly and hence it is also an OM problem. Cyber-physical systems are responsible for manufacturing a variety of products in a variety of industries. If a CPS is attacked and brought down, then manufacturing operations are severely affected. This is a foundational question that needs a creative solution from IT professionals and operations management professionals.

Want to Know More?

Hofmann et al. (2017) discusses the current status of Industry 4.0 and how it impacts the logistics industry. Industry 4.0 has enabled digitization of supply chain activities and processes. This has enabled companies to get visibility into demand and supply and improve collaboration between supply chain partners using a single platform for demand signals, order management, and goods shipment. Lu (2017) lists a survey on technologies,

BEHIND-THE-SCENES

INTERVIEW WITH PROF. OLSEN

**How did you come up with the idea for this paper?**

This paper was a bit different to usual papers as it was an invited paper for the MSOM anniversary special issue. At INFORMS Brian gave a keynote on Industry 4.0 and I gave one on Agriculture 4.0, so Chris Tang, EIC MSOM invited us to join forces and put something together for the special issue. Originally it was Industry and Agriculture 4.0 but after iterating we just incorporate agriculture in the writing rather than the title.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Since it was an invited paper, it was a quite easy process (other than finding the time) – while it was reviewed, the reviews were quite light, and

the work involved was not onerous (very different to the usual paper experience). Main difficult was finding the time.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Pretty much the same. Although it would have been good to take a deeper dive into the topic – our work was at a very high level.

Based on what you know now, what do you think about the future research directions? Is there any new trend for the manufacturing production system?

That's what most of the paper is about. I think there are clear opportunities for research in this area. Also, we will only continue to see growth in the applications of Industry 4.0.

applications, and open research issues in Industry 4.0.

Foundational Classical Studies

The vertical integration of various components inside a factory to implement a flexible and reconfigurable manufacturing system i.e., smart factory is one of the key features of Industry 4.0. Wang et al. (2016) presents a smart factory framework that

incorporates the industrial network, cloud, and supervisory control terminals with smart shop-floor objects such as machines, conveyors, etc. The smart factory is characterized by a self-organized multi-agent system assisted with big data-based feedback and coordination. This study presents an intelligent negotiation mechanism for agents to cooperate with each other.

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METHODS TO MANAGE YOUR LESS-THAN-PERFECT PRODUCTS

Li, R., Xia, Y., & Yue, X. (2019). Scrap or Sell: The Decision on Production Yield Loss. *Production and Operations Management*, 28(6), 1486-1502.

Review by Ben Stover

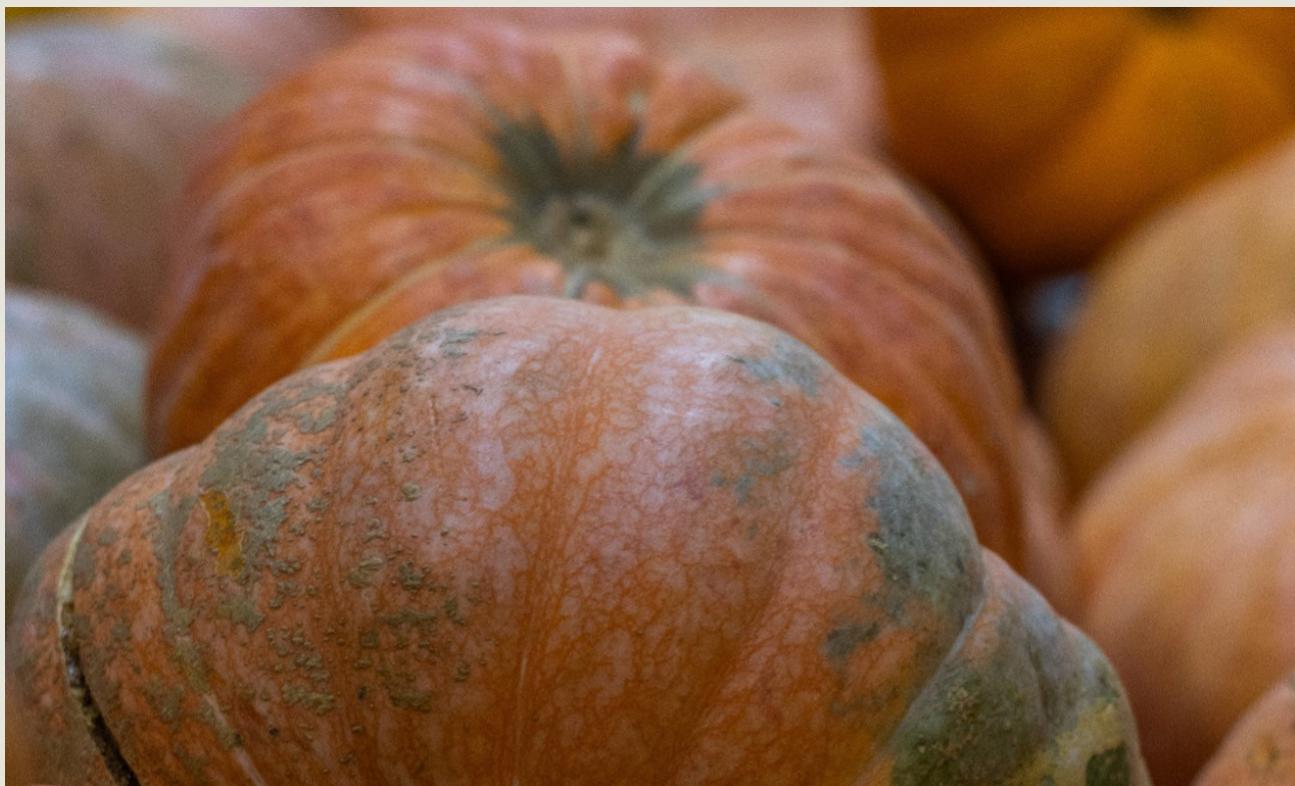
Background

Maintaining a consistent level of quality has been a daunting task for many manufacturers over the years. Under many sales contracts, certain standards are noted to set product expectations from functional requirements to the aesthetic criteria. In the process of adhering to these standards, many manufacturers decide to scrap these “less-than-perfect” items in lieu of risking customer complaints. Much research has been done related to certain industries, like semi-conductors, food production, and clothing markets, which argue that firms can choose to sell these “not-quite-perfect products” (NQPP) in low-end markets. These results have large ramifications linked to the cost and sustainability goals of a manufacturing firm. However, before selling NQPP to the low-end market, a manufacturer needs to consider: 1) Do I have a stable enough yield or balance between acceptable product and NQPP’s (“supply link”), and 2) Can I differentiate my product price enough between the high-end and low-end markets to portray a sufficient product quality difference (“price link”)?

Key Insights

The authors present four scenarios for a manufacturer, assuming that they are producing a stable yield and normally selling to a high-end market at the market-clearing price. The scenarios are as follows: 1) Scrap all NQPP, 2) Sell all NQPP

to the low-end market, 3) Only sell part of NQPP and scrap the rest, and 4) Follow option 3, but compete with another manufacturer who sells exclusively to the low-end market. For Scenario 1, the benefit to scrap is purely based on the comparison of the yield rate to the scrapping cost. The higher the yield in comparison to this cost, the better the profits the firm will reap. However, in Scenario 2, as the relative market size increases, selling will be more beneficial. Consequently, lower relative market sizes and lower willingness-to-pay situations will make scrapping better for the firm. For Scenario 3, low yield or relatively high yield and high scrapping costs will mean exclusive selling, extremely high yield (~100%) will mean exclusive scrapping, and values in-between correspond to the balanced strategy. The final scenario relies mainly on the cost difference between competitors. If it is relatively high, the high-end manufacturer scraps, and the low-end manufacturer sells. If it is relatively low, the high-end manufacturer pushes the low-end manufacturer out of the low-end market and chooses the appropriate NQPP strategy, as explained above. However, if this cost difference is within a certain range, both manufacturers will continue to compete in this low-end market.



MINI CASE

REPURPOSING SCRAP FROM FOOD PRODUCTION

It has been shown that more people, especially millennials, want products that are more sustainable and are willing to pay more for them. However, food waste continues to be a huge problem due to minor defects causing consumers to refuse to purchase them. To convince these consumers, produce product lines like Imperfect Produce and Full Harvest have created specific brands that supply sell "off-spec" (by traditional retail standards) fruits and vegetables. Additionally, larger retail chains have developed their own brands like Peculiar Picks (Kroger) and Robinson Fresh's Misfit Produce (Hy-Vee). Beyond selling this type of produce, other companies have started utilizing this off-spec food source to make

innovative new products, like WTRMLN WTR (uses almost every part of a watermelon), Sir Kensington's vegan mayonnaise (uses liquid from overcooking chickpeas), and Barnana "super potassium snacks" (uses unattractive organic bananas). These applications show that companies in certain markets can not only sell their NQPP's but also sell them at a potential premium over low-end markets.

Image Source: Unsplash

Case Source(s): <https://www.bizjournals.com/bizwomen/news/latest-news/2018/12/millennials-drive-big-growth-in-sustainable.html?page=all>
<https://www.fooddive.com/news/from-trash-to-treasure-upcycled-food-waste-is-worth-467b/555326/>

Remaining Questions

This article focuses on scrapping and selling decisions in particular markets when a manufacturer has yield loss due to a product not achieving a standard. The authors also emphasize a constant willingness-to-pay value in the low-end market. However, is it possible that through marketing efforts, a manufacturer could adjust this willingness-to-pay value? As an example, the fresh produce retail market can sometimes end up with items that are aesthetically less desirable than perfect produce. What if the retailer introduced video training in their produce section portraying the benefits of buying this type of fruit (i.e., sustainability improvements and food waste reduction)? Similar marketing efforts could be translated into other industries with analogous goals.

Want to Know More?

Many other articles have been written on how to develop pricing models when multiple products are sold in the same market and directly compete. Atasu et al. (2008) looked at conditions that affect market share, cost savings, and consumer preference with competing new and remanufactured products. Ru et al. (2015) studies the competition effect between stores and national brands. Li et al. (2017) showed

the effect of pricing in selling to reliable versus unreliable channels. Additionally, other studies have looked at how product diversification can be managed in production. Heese and Swaminathan (2006) investigated how to manage products with different quality levels to reduced production costs when selling to two different markets. Ng et al. (2012) explored how to manage product outputs when higher quality products could be substituted for lower quality products in a market. Aydin et al. (2015) developed a model to manage the sales of new and remanufactured products and maximize both their profit and market share for a specific product line.

Foundational Classical Studies

The authors base their study strongly on the semiconductor industry related to scrapping and selling strategies. Bohn and Terwiesch (1997), Kirsch (2005), Franssila (2010), and Tian (2011) describe how manufacturers in this industry supply products to multiple quality level markets and describe how the yield is controlled as technology develops. Ishibashi and Matsushima (2009) focus on the ability to distinguish customers in different markets, which is utilized by the authors to differentiate their high-end and low-end markets. Demand and pricing models are derived and modified from this study.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. LI



How did you come up with the idea for this paper?

The idea came from a research meeting with a master student of mine who has relevant work experience in semiconductor industry in Singapore.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Building the reasonable/right model and revising process (responding to some reviews that don't understand the model).

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

I would spend more time finalizing the model before running analysis and numerical study.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Future research includes modeling some competition between the high-end and low-end markets that is observed in food (normal fruits and ugly fruits). The competition maybe on price as well as consumer behavior (which is something new). Note that environment-caring consumers, the number of which is growing, may prefer ugly fruits over normal fruits.

SERVICE SYSTEMS AND OPERATIONS

Service operations are in high demand in recent years since a high percentage of the overall GDP is comprised of different service business in the US. This includes businesses covering food services, restaurants, hospitality, call centers, etc. Customer service level and satisfaction are big drivers of operational decisions in service industries. Articles in this section will inform operations managers in service industries about techniques to accomplish their operational goals.

Topics in This Section

How to Improve Customer Routing in Contact Centers?

Based on Noyan Ilk, Guangzhi Shang, Paulo Goes (2020). Improving customer routing in contact centers: An automated triage design based on text analytics. *Journal of Operations Management*, 66 (5), 553–577

Empirical Research

IT Sector

What Is the Impact of Self-Order Technologies on Demand, Employment, & Profits?

Based on Fei Gao, Xuanming Su (2018). Omnichannel Service Operations with Online and Offline Self-Order Technologies. *Management Science*, 64(8):3595-3608.

Analytical Research

Retail Sector

How To Deliver a Great Customer Experience?

Based on Ioannis Bellos, Stylianos Kavadias (2020). Service Design for a Holistic Customer Experience- A Process Framework. *Management Science, Articles in Advance*, 1-19.

Analytical Research

Service Sector

Agility in Uncertainty: Designing Customer Satisfaction

Based on Secchi, E., Roth, A., & Verma, R. (2019). The Impact of Service Improvisation on Customer Satisfaction: Evidence from the Hospitality Industry. *Production and Operations Management*, 28(6), 1329-1346.

Empirical Research

Service Sector

HOW TO IMPROVE CUSTOMER ROUTING IN CONTACT CENTERS?

Based on Noyan Ilk, Guangzhi Shang, Paulo Goes (2020). Improving customer routing in contact centers: An automated triage design based on text analytics. *Journal of Operations Management*, 66 (5), 553–577.

Review by Rohan Korde

Background

Customers expect prompt, high quality service, consistently from companies. How should companies maintain their high-quality service in response to an increasingly large number of customer queries? This is a matching efficiency problem for which categorization and routing are key. Currently, many contact centers categorize different types of problems, and train their agents in these different problem categories. When a customer calls, the customer is matched with an agent. This study is centered on how to correctly and without human intervention, match the customer with an agent based on what the customer has typed in the live-chat text box for their problem description. This is one of the first studies that uses text analysis and analytics to match customers with agents in a contact center setting. A second unique feature about the study is that to tackle the mismatch problem, it focuses on the customer types rather than the agent types or other skill-based routing and staffing. Using numerical experiments based on the simulation of an S&P 500 firm's contact center, this study demonstrates the advantage of their solution over the two most used alternatives (customer choice triage and human expert triage) with an exception. This work has important implications for the use of text analytics and machine learning methods to improve Operations Management practice.

Key Insights

Customer-agent mismatch leads to service rework, operational waste, and customer dissatisfaction. The automated triage design described in this study improves customer routing accuracy and reduces call transfer rates in live-chat contact centers. The text that is entered by the customers holds considerable value in improving the probability of routing the customers to the correct destinations. However, this solution is not appropriate in all situations. Human experts can route customers more accurately at the expense of triage time. If the analytics system takes an average of 30 seconds to triage and if the routing accuracy is less than 94% then it makes economic sense to endure the extra labor and service work needed and switch to human expert triage

Remaining Questions

The focus of this study is on prediction using text analytics and not dynamic routing. Is it valuable to cross-train agents when the automated routing is implemented? Does it make more sense to deepen specialization (add more service categories) or increase diversity (more cross-training) at a contact center?

Want to Know More?

Chu-Carroll et al. (1999) study describes a domain-independent automatically trained natural language



MINI CASE

VERINT SYSTEMS JOINS ASPECT COMMUNICATIONS' PARTNER PROGRAM TO DELIVER STATE-OF-THE-ART INTELLIGENT RECORDING FOR MULTICHANNEL CONTACT CENTERS

Verint Systems Inc. (Nasdaq: VRNT), a global provider of analytics software solutions for communications interception and enterprise business intelligence announced that it has joined Aspect Communication Corporation's (Nasdaq: ASPT) partner program and has enhanced the integration of its ULTRA intelligent recording solution with Aspect's contact server platform. Combined, Aspect's and Verint's solutions allow contact center professionals to monitor and analyze the full spectrum of customer interaction to strengthen customer relationships and sharpen employees' skills. The ULTRA™ solution generates "actionable intelligence" through the collection, retention, analysis, and distribution of voice, fax, video, email, internet, and data communications from customers. Managers can analyze the information gained from monitoring communications and processed in a contact center to determine ways to improve business rules for routing customers to the correct service

agents and effectively managing the customers calls. Elan Moriah, president of Verint Contact Center Solutions commented that "Companies that base their contact centers on Aspect quickly can change rules for handling customers based on understanding weaknesses in their processes and communications that our solution helps expose". Simon Lonsdale, Aspect's Vice President of technology alliances, said that "Verint's integration with the Aspect Enterprise Contact Server allows companies to modify customer routing based on qualitative data. The solution of Aspect's business communications for voice, email, and web combined with Verint's actionable intelligence can provide true ROI based on improved operations of the contact center".

Image Source: Pixabay

Case Source(s): "Verint Systems Joins Aspect Communications' Partner Program to Deliver State-Of-The-Art Intelligent Recording for Multichannel Contact Centers", Business & Technology Editors, Business Wire, New York.

call route for directing incoming calls in a contact center. Routing behavior is trained from a corpus of transcribed and hand-routed calls. Another study by Gans et al. 2007 discusses how a company can use a tiered system for routing calls based on the type of customer. High-value customers are serviced by their in-house operations and the low-valued customers are routed to the outsourced contact center operations.

Foundational Classical Studies

Oliva et al. (2001) is a seminal study about taking a process view of quality management in service

settings. Suhm et al. (2002) shows that about 20% of the callers who made routing selection using the touch-tone-based interactive voice response (IVR) system are not routed to the correct service department. Napolean et al. (2004) propose a theoretical framework for analyzing service quality, which suggests that effective worker training and better system process design are two general mechanisms that improve service quality (or reduce rework) and help achieve higher customer satisfaction.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. ILK

**How did you come up with the idea for this paper?**

This work was motivated by an actual problem that the data sponsoring firm had been experiencing in its operations – i.e., misrouting of its service requests leading to transferred contacts and wasted time and effort. After exploring the transaction record and server log data, we were able to identify this issue and its severity. Next, we surveyed the extant literature and noticed that the majority of existing studies on call center routing focus on routing optimization assuming that the nature of service requests is already perfectly observable. However, our data indicated that this is not the reality.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The most difficult part of the project was to develop and frame the paper within the context of design science research. While the motivating force that initiated the project was practice-driven, a solution that is exclusively tailored to the problem at hand is not a scientific contribution by itself and therefore we received the continuous guidance of the editorial / review team to elevate the generalizability of the solution. Furthermore, given the differences

in the interpretation of design science research across different disciplines, it took us several iterations to adequately position the paper from an OM design science research perspective.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

One of the lessons we learnt from this research was to consider the generalizability and managerial implications of a particular solution at earlier stages of the project, preferably before the implementation of the solution has been finalized.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

With the growing popularity of online communication, many call centers have started to diversify their service operations using technological channels such as social media (Twitter, Facebook, etc.). A natural future research direction is to consider the unique aspects of contact routing and handling operations under such new communication channels.

WHAT IS THE IMPACT OF SELF-ORDER TECHNOLOGIES ON DEMAND, EMPLOYMENT, & PROFITS?

Based on Fei Gao, Xuanming Su (2018) Omnichannel Service Operations with Online and Offline Self-Order Technologies. *Management Science* 64(8):3595-3608.

Review by Zhen Chen.

Background

Self-service systems have been widely used in banks, retail stores and other industries. Many scholars have proved its impact on customer behavior and the profitability of firms. For example, according to Campbell and Frei (2010), the use of online banking is positively related to customer retention. As for restaurants, the adoption of self-order technologies has just started, and there is limited analytical research on this specific topic. As a result, although some benefits of self-order technologies have been recognized, there are still questions about their wider application. On the one hand, people are concerned that restaurants will replace human workers with ordering machines, thus increasing job cuts. On the other hand, it's very important for restaurants to understand which type of self-order technologies is more profitable as these technologies requires substantial investment. Based on these observations, this paper studies the impact of self-order technologies on customer behavior, restaurants' capacity, and restaurants' profit.

Key Insights

In addition to the advantages self-order technologies can bring to restaurants, the authors also study the impact of these technologies on restaurant's workforce levels. This is one of their

main contributions to literature on self-service technologies. The authors consider three scenarios: no self-order technology is used, online self-order technologies only and offline self-order technologies only. They show that, in addition to the obvious benefits to restaurants, self-order technologies can also benefit consumers who use them, and even indirectly benefit those who don't. This is mainly because self-order technologies help reduce restaurants' front-end costs and make them more willing to expand their back-end capacity, which can reduce waiting time for all customers, including those who don't use these technologies. This also answers the much-discussed social question of whether self-service technologies will lead to the replacement of human workers by machines, thereby increasing unemployment. According to the authors' analysis, while the implementation of self-service technologies in places such as banks does lead to this replacement, self-order technologies in restaurants does not necessarily result in job cuts. As restaurants will be more willing to expand their back-end capacity, their total workforce levels may instead increase. Finally, the authors examine how restaurants should choose a self-ordering service that is suitable for them. Online self-order technologies can significantly reduce customers' waiting time, so a restaurant should apply online self-order technologies if most of its customers are



MINI CASE

USING ONLINE ORDERING TECHNOLOGY TO OPTIMIZE FAST-FOOD ORDERS

Many restaurants saw their revenues plummet during COVID-19 because people don't want to risk getting infected by eating in restaurants. In this context, drive-thru has made more contributions to the restaurants' revenue. Customers can pick up their meals without getting out of the car. They also do not have to wait because they can place orders at home in advance through websites or mobile apps. Then they can set a pickup time or just wait for notifications from the restaurant, after their meals are ready, they can drive to the restaurant, pick up the meals and drive straight home seamlessly.

This approach has already been used by some fast-food restaurants to reduce the cost of front

end, but it is not easy to popularize ordering apps and websites. During COVID-19, the number of people going to restaurants dropped significantly, but it may also be a good opportunity for restaurants to promote their own ordering apps and their self-order technologies.

Image Source: Unsplash

Case Source(s): <https://www.restaurant-hospitality.com/limited-service/resy-s-latest-partnership-aims-bring-fine-dining-drive-thru-october-event-la-new>

<https://www.forbes.com/sites/aliciakelso/2020/09/03/burger-king-unveils-a-new-restaurant-design-to-meet-consumer-habits-changed-by-covid-19/?sh=359d73222b15>

sensitive to waiting. Otherwise, it should apply offline self-order technologies. Besides, there is a positive relationship between customers' income level and their wait sensitivity (Campbell and Frei 2011, Propper 1995), so restaurants can make choices based on the income level of their target customers.

Remaining Questions

In the article, the authors consider only the three scenarios mentioned in the key insights, but in the real world, it seems that there are other factors that can affect restaurants' implementation of self-order technologies. For example, fast food restaurants such as KFC have offline self-order machines installed in the restaurants and are also widely promoting their online ordering apps, where customers can order in advance and then pick up their food when passing by. However, according to the conclusion in the article, fast food restaurants aim at the lower end market, so they should first consider applying offline self-order technologies. Therefore, can we learn anything from these lower-market-oriented restaurants that are also promoting online self-service technology? Can firms better understand which technology they should be promoting first, and when the time is ripe enough for them to promote the other one? Besides, the use of online self-order technologies seems to be uncommon for a restaurant whose focus is on in-restaurant dining, regardless of its target customer's sensitivity to waiting. Therefore, one possible research direction would be to examine in more detail the factors that influence a restaurant's choice of self-ordering technology. Additionally, for restaurants that focus on in-store dining, it seems possible to implement online self-order technologies similar to Starbucks that allows customers to order in advance and set an arrival time, so they can start their meal directly upon arrival without waiting. But as far as

I know, very few restaurants are currently taking this approach, is there an explanation for this phenomenon? For example, maybe customers who are tech-savvy are less likely to sit in a restaurant for dinning.

Want to Know More?

Buy online and pick up in-store (BOPS) is another new form of self-service, which also allows customers to place an order in the online channel and then pick it up in the offline channel. Gao and Su (2017a) examine the impact of BOPS on a retailer's inventory management. Although similar to online self-order technologies, the research on BOPS concentrates on inventory and product management.

Online self-order technologies can reduce customers' waiting time, but they usually have limited accessibility among customers. So how to make the accessibility of online self-order wider is a question of interest to firms. Luo et al. (2013) examine how temporal targeting and geographical targeting influence the mobile promotion, which may provide implications for firms to promote their self-order technologies.

Foundational Classical Studies

Mendelson (1985) and Chen and Frank (2004) study queueing systems where customers are sensitive to waiting. For more related articles, Hassin and Haviv (2003, Chap. 8) provide a thorough review on this stream of literature. These are the basis of the model in this article.

Since the adoption of self-order technology is still in the form of pilot programs for many restaurants, there is currently little analytical research. For empirical studies, Susskind and Curry (2016) examine the influence of customer-facing technology in full-service restaurants, they

prove that the introduction of tabletop devices had a positive effect for most customers. Similarly, Tan and Netessine (2016) show that the use of

tabletop technology can improve the sales and sales productivity

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. GAO

How did you come up with the idea for this paper?

I was intrigued by the increasing popularity of Starbucks' mobile ordering app. Lots of my friends were using it to order drinks and I thought it was an interesting business model. The idea of the mobile ordering app is similar to the in-store pickup delivery option offered by some omnichannel retailers, which happened to be the topic of another paper I was working on at the time. In that paper, I studied the impact of buy-online-and-pick-up-in-store (BOPS) on a retailer's inventory management. In contrast, in a service system (such as a quick service restaurant (QSR)), the key issue is the speed of the service, which is also one of the key reasons why many people prefer to order and pay using Starbucks' app. How should a service provider manage its capacity after the implementation of an online self-order system? With this research question in mind, I started this project. As I learnt more about the QSR industry, I found that there was another type of self-order system: in-store kiosks. So, I broadened the scope of the research by considering both online (e.g., mobile ordering apps) and offline (e.g., kiosks) self-order technologies.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Self-order technologies have been widely adopted in today's QSR industry, and therefore

there could be enough data to study their impacts on different restaurants. I hope the theoretical results in my paper could be tested empirically in the future. Hopefully, some new insights could be generated on how to effectively use the various kinds of self-order technologies in the QSR industry.

Although I only focused on the restaurant industry in this paper, I think the idea of integrating both online and offline channels to provide consumers with seamless service can have much broader applications. There are many other types of service systems that can be benefited by the implementation of omnichannel strategies. For example, in the healthcare industry, patients can receive some initial diagnosis online and then go to a hospital for further treatment (if necessary); this kind of e-visit system has been adopted by many health care providers (especially during the current pandemic). Another example is the hybrid teaching mode adopted by many schools during this pandemic; specifically, many college students are currently taking their classes in both online (via zoom) and offline (in classroom) settings. It would be interesting to study the impacts of the integration of online and offline channels in the healthcare and education industries.

HOW TO DELIVER A GREAT CUSTOMER EXPERIENCE?

Based on Ioannis Bellos, Stylianos Kavadias (2020). Service Design for a Holistic Customer Experience-A Process Framework. *Management Science, Articles in Advance*, 1-19.

Review by Ning Ma

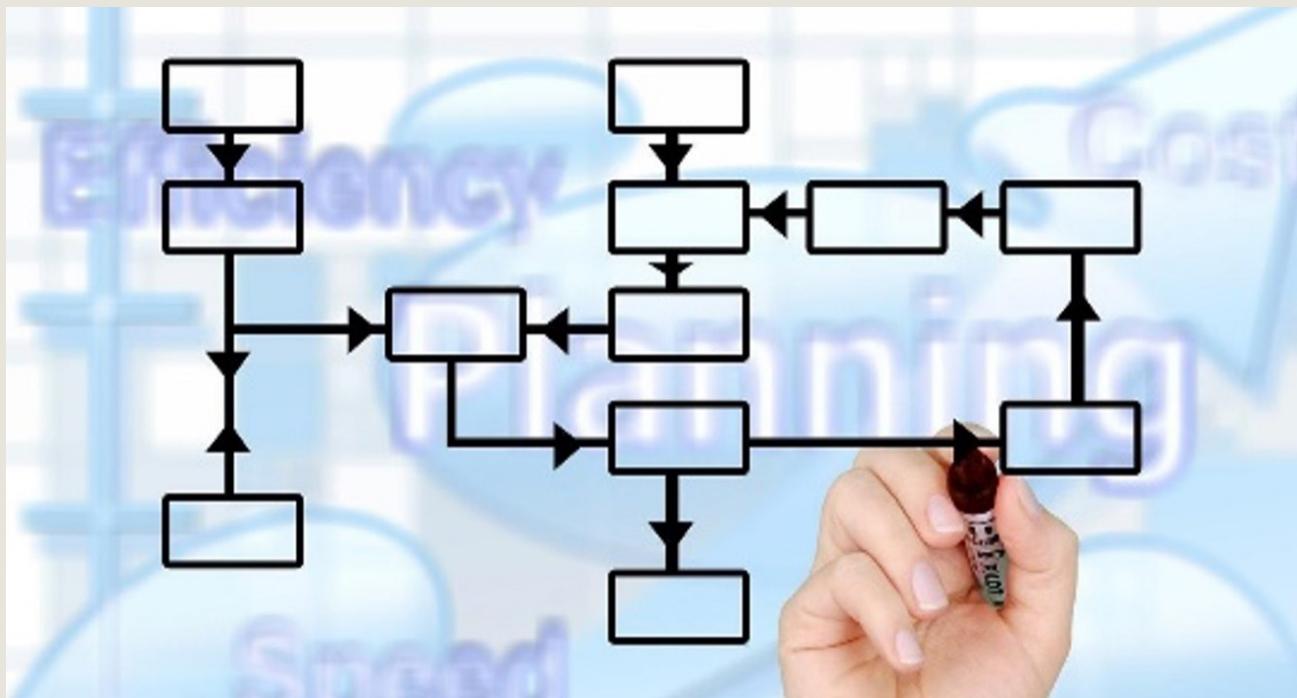
Background

Since 1996, Amtrak has engaged with IDEO, a California-based design firm, to conduct the first service design project. In 2001, Livework in London became the first design firm to focus exclusively on service design (Fayard et al. 2017). In recent years, there has been an increase in the number of firms specializing in the design of services. Researchers have investigated the design of service processes on three key dimensions: 1) the allocation of effort across the service stages, 2) the sequencing of the stages, and 3) the level of interaction between the provider and the customer at each stage. With respect to the provider's effort allocation, past literature has neglected the interdependence between service stages. However, to analyze a general service structure, it is necessary to consider interdependencies of the experiences as well as different service steps. This paper aims to address the stage of service design with predetermined sequence with interdependencies. A unique feature of this paper is the separation of functional and experiential value, which allows for a more concrete evaluation of the value of effort allocation across stages.

Key Insights

The service provider should pay attention to three factors: the technical investment, the holistic coupling of the process and the step types (i.e., routine or nonroutine). The provider's effort at a

service step may be determined by the characteristics of other steps of the service process, even if the experiences at these steps do not directly depend on each other. Thus, the effort determined at a step needs to consider the holistic customer experience throughout the service process, even when that step seems to have no direct interaction with other steps. When providers are considering whether to spread out the effort across steps or placing emphasis on certain steps at the expense of others, they should first investigate the types of the steps and then the way that the experiences at two steps relate to each other (i.e., a positive experience at one step is more likely to be accompanied by a positive or negative experience at the other step). The provider should spread out the effort across the steps in two scenarios: 1) the step types are identical, and they are inversely related, 2) the step types are different, and they are directly related. On the contrary, the provider should emphasize certain steps in the two remaining scenarios: 1) the step types are identical, and they are directly related. 2) the step types are different, and they are inversely related. For example, consider two nonroutine steps A and B, where there is an inverse effect between them. The provider should not only increase the effort invested in A but also in B. Furthermore, service designers could improve the performance of a step not only by adjusting that step's effort allocation but also by adjusting the effort allocation of the immediately adjacent steps around it. For highly interdependent



MINI CASE

PATIENT JOURNEY APP HAS BEEN DEPLOYED ACROSS ONE OF THE LARGEST ORTHOPEDIC CLINICS IN GERMANY

Patient Journey App allows health care professionals to update their patients with the right information at the right time through interactive push notifications patients are informed of the next steps in their treatment pathway. Since the beginning of 2019, one of the largest orthopedic clinics in Germany-Rummelsberg Hospital has applied this app to ensure patients are fit enough to prepare, undergo, and recover from orthopedic surgery. Dr. Kranzer from the hospital thinks highly of the app as it has improved the level of patient care and compliance at the hospital. "The application is a reliable companion - before, during and after the operation. We see a huge added value for the patient. Soft skills are becoming increasingly important in the healthcare sector". Although the journey mapping process produces a continuous and holistic view of how well an

organization is performing with a customer, it remains unclear how this visualization can be used to derive actionable guidelines that the service designer can follow to establish a successful service offering (Fayard et al. 2017). These service adjustments of organizations are mainly derived from the experience of the designers. Currently, Dr. Kranzer looks to the future of the app: "Other hospitals within the Sana group are also becoming aware of our app, which is great". Therefore, with the possible future application of journey mapping, what are the potential guidelines of service designers in designing service systems that build upon the customer journey concept?

Image Source: Pixabay

Case Source(s): <https://patientjourneyapp.com/>
<https://patientjourneyapp.com/rummelsberg-hospital>

systems like themed restaurants, to improve the whole experience across stages, the provider should not only invest a specific effort input in a certain step like theme-related decorations but should keep tracking other steps like design of food.

Remaining Questions

This paper generates insights into how to allocate effort by quantifying the holistic coupling of the experiences across the different steps. More challenges pertinent to the design of services could be considered in the future. Considering systems with incentive mechanisms that stimulate employees to provide more customer-friendly services, and systems with coworking (Tan and Netessine 2019), the customers' experience could be directly impacted. Relaxing some assumptions may create more realistic insights of service design. For example, involving more cost structures such as economies of scales in the optimization question of effort allocation, instead of the current deterministic cost structure, the allocation strategy may differ a lot. When there exist competitors, the provider's effort allocation would be affected by competitive pressure such cost, reputation, and service speed, thus the allocation strategy could also be changed in order to fit in such competitive situation.

Want to Know More?

Instead of focusing on a high-level service system design, what should a provider do when it is focusing on improving specific types of service design interventions? Tong et al. (2016) studied the effect of innovations that reduce the service time at the base service stage of a two-step service on the overall service quality and congestion. Arora et al. (2017) studied the portfolio and service design problem for resource-constrained non-profit organizations that aim to maximize their social. In many service systems, the

sequence of events can be altered. Thus, investigating the optimal sequence will directly affect the outcome of a service process. Dixon and Verma (2013) studied sequences within time-elapsing service bundles by offering a service bundle, either as a series of connected episodes or as a convenient way to purchase several separate events. They show that sequence effects do indeed play a significant role in determining customer repurchase of subscriptions. Martinez-de-Albeniz and Valdivia (2019) studied how the sequence of exhibitions can be adjusted to maximize the museum's attendance by characterizing the optimal schedule.

Foundational Classical Studies

Although there has been a broad scope of study of the design of multistage service processes, emphasizing a holistic approach and focusing on empathy toward the end user (Fayard et al. 2017) are commonly applied in service designs (Brown 2009, Bitner et al. 2008). These are the two pillars that underpin the value of the customer journey in this paper. More specifically, one of the key dimensions of the service design problem is the allocation of provider's effort, which is closely related to this study. Historically, Soteriou and Hadjinicola (1999) are the first to determine the optimal budget allocation across different service stages. This line of work was extended by considering multiple factors and by investigating under different system settings (Soteriou and Chase 2000, Bellos and Kavadias 2019). This article is based on several previous analytical models, including the first-order ante-dependent transition model that characterizes part of the structure of interdependencies (Gabriel 1962) and the mean-variance approximation model that characterizes customers' utility (Levy and Markowitz 1979, Kroll et al. 1984).

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. BELLOS

**How did you come up with the idea for this paper?**

My undergraduate studies were on Mechanical Engineering, so I have an inherent appreciation for good designs. Interestingly, it was during a Ph.D. seminar on New Product Development that I took as a doctoral student at Georgia Tech that I started to realize that "design" is primarily associated with tangible products. If you go online and do a search for terms like "best design" or "design awards," most of the results will be for gadgets, hardware, and chairs, lots of chairs! So, I started to think, if most developed economies are primarily service economies, how come the notion and practice of service design do not appear to be more mainstream?

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Service design is an exciting research area that is rich in managerial challenges. For this reason, choosing what to prioritize, especially within the confines of an analytical model, was challenging. But the review team was instrumental in helping us set the priorities and decide what to focus on, what to leave for future research, and, overall, how to introduce the novel elements of our work.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Over the past few years, service design has attracted strong research interest and

increasingly more pieces are being put together in this puzzle.

In my view, there is an opportunity for researchers and service providers to further study the role of the employees, both frontstage and backstage, in contributing to the overall customer experience. Although a customer may go through a series of service steps and interact with several employees s/he evaluates the service holistically. How do you ensure that all employees provide a consistent experience that reinforces each other's efforts? Also, the process-based view of services may reveal opportunities for service providers to identify the steps in this process where it makes the most sense to collect feedback from the customers and, based on that, decide when/where to take corrective actions.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

In one of my current projects, we also subscribe to this process-based view of services and customer experience, and we evaluate whether the extent to which the service provider controls the service process can credibly signal service quality. Said differently, think about service providers offering one-stop shops vs. providers focusing only on limited/specific parts of the overall customer journey. What are the signaling implications? Do customers interpret one design as indicative of higher/lower quality than the other?

AGILITY IN UNCERTAINTY: DESIGNING CUSTOMER SATISFACTION

Based on Secchi, E., Roth, A., & Verma, R. (2019). The Impact of Service Improvisation on Customer Satisfaction: Evidence from the Hospitality Industry. *Production and Operations Management*, 28(6), 1329-1346.

Review by Ben Stover

Background

In the service industry, everyone is reminded of the adage: “The customer is always right”. Regardless of exact validity of this statement, it is still important for service-driven firms to be agile as customer situational demands can vary. To fulfill these kinds of demands, front-line service workers must be allowed a certain level of improvisation in their customer interactions. Recent service industry research has emphasized the requirement that these firms maintain processes that produce a high level of reliability, consistency, and flexibility in serving their customers’ needs. In that sense, the measurement and nature of this degree of improvisation is important and thus, the authors created a new construct called Serv-IC (service improvisation competence). It is defined as “the ability of a service firm’s employees to deviate from service delivery processes and routines to respond in a timely manner to unforeseen events using available resources.” To fully understand the effect of this new idea, three questions must be asked: 1) How should process standardization be balanced with customer variability, 2) What types of behavioral and psychological factors affect the linkage between target customers and service design and offerings, and 3) What effect does customer expectation have on the balance between standardization and customer satisfaction?

Key Insights

Drawing on the experiences of hotel front-line workers, the authors develop multi-item measurement scales: people-related (both employees and customers) and infrastructure-related (processes, communication, design, etc.). From a people-related perspective, they find that customer-perceived empowerment not only directly improves customer service and improvisation, but also helps indirectly improve the effect of design strategy on improvisation. From an infrastructure-related perspective, the authors found that an emphasis on design offerings resulted improved design strategy and directly enhanced customer satisfaction. However, the main finding of this article is that standardization can be used to minimize unnecessary improvisation when solving customer demands but increasing standardization beyond a certain point will cause employees to rebel and improvise more. This is due to the intersection of the desire to reduce customer experience variability while compensating for variability generated by customers. Maintaining a level of standardization below this “rebellion” inflection point is important for reducing unnecessary employee mental strain that could lead to turnover. It also emphasizes the need for managers to analyze the complexities that could accentuate this problem. In addition to employee effects on standardization, the authors found that if customers have a lower expectation of



MINI CASE

FLYING THE UNCERTAIN SKIES

During the past year, COVID has severely restricted travel and airlines are one of the industries that have been significantly affected by it. Because of this, airlines have had to reevaluate their service model to compensate to new restrictions (i.e., masks, social distancing, increased cleaning, etc.) and variability in customers that fly. This can mean adjusting their refund and rescheduling procedures to allow customers more freedom with their plans and make them more willing to purchase tickets. Recently, United Airlines, American Airlines, Delta Airlines, Alaska Air, and Hawaiian Airlines did just that, removing ticket change fees, to bring back customers, even though it will mean losing considerable fee revenue. With corporate

mask and cleaning mandates, enforcement of these policies will sometimes land on the flight attendants, where they must balance non-compliance with the needs of other passengers. Specifically, Delta Airlines has moved their design strategy to thinking about the "emotional space" of passengers and worrying about if the passengers feel safe flying.

Image Source: Pixabay

Case Source(s): <https://www.wsj.com/articles/airlines-fight-for-passengers-in-weak-travel-market-11599483601>

<https://www.wsj.com/articles/what-its-like-to-lead-customer-experience-at-an-airline-during-the-pandemic-11599559200>

a service firm's offerings (in this case having lower star ratings), there will be a larger improvement of customer satisfaction with increasing improvisation. On the other hand, with service firms that have higher ratings, there will be less of an improvement with increasing improvisation. This result portrays a good reminder that, in the service industry, exceeding customer expectations can be critical for improving customer satisfaction.

Remaining Questions

The authors have mentioned that they have certain limitations in their model results due to experimental design constraints they imposed. These are related to the need to further improve/validate many of their inferences using laboratory research methods, adding more data sources than just single, self-reported replies, and expanding this type of research to other sectors and countries (to determine cultural effect). However, there are also other issues related to customer-related construct measurements in their model. Specifically, the questions that were asked to hotel employees were only indirect measurements of customer satisfaction and customer-induced uncertainty constructs. This could cause issues with how these results are compared how actual customers interpret their service experience. Future work could incorporate questions to both hotel employees and customers to more accurate relationships between these constructs. It could also provide a better measurement of customer-induced uncertainty as it did not have a significant effect in the final model.

Want to Know More?

Previous service industry research has focused on translating many production and manufacturing methods into the service industry related to reducing variability in the customer experience (Fitzsimmons et al. 2014, Stewart and Chase 1999). However, Roth and Menor (2003a) argued that there are subtle, but significant differences in the service industry, where adapting to customer variability improves this customer experience. Building upon this work, Karmarkar and Karmarkar (2014) add that customers do not just react to the end-product of a service but also to their experience through the process. They further add the importance of compensating for "individual tastes" when designing your service processes. Shalley and Gilson (2017) also provide interesting input related to the balance between standardization and creativity when it comes to designing service processes.

Foundational Classical Studies

The authors idea of Serv-IC is built the idea that improvisation can improve service delivery outcomes by working to compensate for customer variability through creative, customized, and quick resolution methods (Cunha et al. 2014). They also utilize research related to experiential service operations (Palmer 2010, Voss et al. 2008, Zomerdijk and Voss 2010, 2011) to build on previous experience-based design choices and service concepts, which is also used to build their service design strategy construct along with Karmarkar and Karmarkar (2014).



BEHIND-THE-SCENES

INTERVIEW WITH PROF. SECCHI

How did you come up with the idea for this paper?

As significant aspects of service delivery are increasingly automated or moved online, the remaining interactions between customers and service employees are becoming even more important to develop an authentic rapport between service providers and customers. In this context, the ability of frontline employees to adapt to customers' needs and individuality can play an important role. Yet, service research and practice (with some notable exceptions) appear to be focused on the creation of scripts and somewhat rigid processes, in the face of proliferating anecdotes of customers complaining about such rigid approach to process design and implementation. The analogy with performing arts, mainly music, readily came to mind. The ability to adapt the performance to the moment (i.e., to improvise) requires specific training as well as a different approach to process design and implementation. Do service businesses develop a specific improvisation competence in the same way? Does this competence lead to better performance?

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The literature on organizational improvisation is vast and has been applied to services in several contexts, but most of it relies on case studies and a qualitative approach. Only a handful of papers attempted any type of measurement and there was no comprehensive effort to operationally define and measure the construct. Operationally defining the construct in a way that accounts the breadth of the concept while providing the necessary specificity for measurement development was a major

challenge. The measurement development alone took over one year.

One significant challenge in this type of research resides in finding the right balance between parsimony and comprehensiveness in the development of the model. We wanted to account for the diverse array of organizational and operational factors that influence the behavior of service employees to give us a full picture. As a result, our structural model resulted quite complex, and it was very difficult to make it converge to a solution. In the end, we had to sacrifice modelling second order constructs in the full model and ended up averaging first order components.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

The resources available when this research was conducted limited the options available in terms of study design. Ideally, we would have liked to have a more deliberate sampling strategy (possibly some sort of stratified sample) and multiple respondents for each hotel in the sample. This would have allowed us to go beyond the exploratory nature of the study and make some inference. For the same reason, a small replication in a different industry would have been ideal.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

The major implication of this work for practitioners is that the relationship between process standardization on paper and actual employee behavior is not straightforward. Creating more detailed and binding scripts can have adverse effects, both on customer perceptions and on employee behaviours.

Some world-class organizations (most notably, Ritz-Carlton Hotels) have become more aware of this and revised long-standing employee guidelines to allow more flexibility. However, the full realization of the benefits of service improvisation requires a concerted effort that goes beyond process design and comprises training and hiring practices, as well as placing the required resources in the hands of employees. This points to an important area of future research, which is to estimate the costs associated with service improvisation.

The most intriguing finding of this research program is the non-linear relationship between

process standardization and employee improvisation. We have repeatedly observed that there is a group of services in which high process standardization coexists with a high degree of improvisation, and that their performance is varied. This suggests that our measurement might not capture the full range of dimensions of process standardization. There might be different ways to standardize service processes, which might lead to different outcomes. Understanding in more detail the dimensions of service delivery process design and their relationship with service performance is a fertile area of future research.

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INVENTORY MANAGEMENT AND PRODUCTION PLANNING

Managing production and inventory for perishable goods is very different from that for non-perishable goods. The articles in this section address issues and potential solutions to manage retail perishable goods. For the retail industry, inventory makes up a considerable percentage of the firm's total assets. Hence, it is important for operations managers to understand how to better manage production as well as allocation of finished goods inventory.

Topics in This Section

Reducing Expiration Waste in Retail Supply Chains

Based on Akkas, A., Gaur, V., & Simchi-Levi, D. (2019). Drivers of Product Expiration in Consumer-Packaged Goods Retailing. *Management Science*, 65(5), 2179-2195.

Empirical Research Retail Sector

How Do Strategic Customers Influence Inventory Decisions?

Based on Yang Zhang, Benny Mantin, Yaozhong Wu (2019). Inventory Decisions in the Presence of Strategic Customers: Theory and Behavioral Evidence. *Production and Operations Management*, 28(2), 374–392.

Analytical Research Retail Sector

How to Eliminate Backroom Inventories in Retail Operations?

Based on Cuneyt Eroglu, Brent D. Williams, Matthew A. Waller (2018). Using the Pack-and-a-half Rule to Eliminate Backroom Inventories in Retail Operations. *Journal of Business Logistics*, 39 (3), 164–181.

Analytical Research Retail Sector

REDUCING EXPIRATION WASTE IN RETAIL SUPPLY CHAINS

Based on Akkas, A., Gaur, V., & Simchi-Levi, D. (2019). Drivers of Product Expiration in Consumer-Packaged Goods Retailing. *Management Science*, 65(5), 2179-2195.

Review by Ben Stover

Background

Balancing inventory and demand in retail stores has always been an important task for many different industries. However, for many products in the consumer-packaged goods (CPG) markets, waste from items that are unable to be sold can be significant. Additionally, many of these products have effective shelf-lives, where the product is no longer legally usable or less desirable to consume. Manufacturers and retailers have been trying to determine the cause of the large amount of expired goods and to remedy the problem. Previous literature has focused on analytical approaches which have led to optimal inventory policies based on maintaining consumer demand while reducing costs and improving freshness of perishable items. This paper utilized a large data set from a large CPG manufacturer (referred to as AlphaCo) to empirically analyze the effect of inventory decisions on expiration costs. This data set was from 2011 and contained deliveries, returns, warehouse inventory, product deployment, and shelf-life and case size of many of their products. Specifically, they investigated the effect of manufacturer packaging (case size), product lifetime after production (supply chain aging), marketing/sales influence (manufacturer's sales incentives), retailer rotation procedures (replenishment workload), and contractual inventory stipulations on retailers (minimum order rules) on product expiration.

Key Insights

The authors found all the above variables were significant predictors of changes in amount of expired goods. For case sizes, this means that SKU's that have more individual units per package will cause more expiration waste than smaller ones. The authors saw significant savings (\$5.59M) when certain SKU case sizes were reduced from 24 to 12. However, they also mention that there could be a significant capital expenditure to adjust the manufacturer's packing equipment to make this change. Related to age of product after production, the forecast error in warehouse shipments (difference between actual and forecasted projections) was used to estimate this metric and they found that as this variability increases, so does the amount of expiration. This was found to be especially important to products with very high supply chain age (>27 days), where a reduction of 9 days of inventory holding produces about \$3.55M expiration cost savings. When it comes to ordering specifics, they found that as the percentage of products that have a minimum order quantity increases at a retailer, the expiration costs also increase. The authors found that eliminating these stipulations can save around \$3.4M in expiration costs but should be done only if either the benefit outweighs the higher transportation costs related to more shipments or the manufacturer can work with the retailer to reduce their frequency of shipments. For sales initiatives, they found that if the initiative



MINI CASE

HOW IMPORTANT ARE EXPIRATION DATES?

Per a USDA estimation, Americans throw out about \$162 billion in food every year, both at the retail and consumer level. However, much of this waste is due to the misinterpretation of the wording placed on food packaging. For example, the "sell by" date on a package is more related to the retailer stock rotation timing than it is to the consumption safety of the product. Similarly, "use by" dates are determined by manufacturers as the product's peak quality point and that after that point, the product will lose quality but will still be safe to consume. At the same time, most of these labeled date values are very situational, where they can change drastically based on temperature, moisture, and product acidity. In this manner, the storage and travel time of a product can

affect the relevance of these safety dates and could require more standardization between the manufacturer and retailer. The struggle for these manufacturers is trying to balance the safety of the consumer with efforts to manage their retail supply chain, which usually leads to higher expiration waste. More work is currently being done from a governmental regulation side to better standardize these safety dates, but many times it falls on the consumer to determine if their food has expired.

Image Source: Pixabay

Case Source(s): <https://theconversation.com/how-do-food-manufacturers-pick-those-dates-on-their-product-packaging-and-what-do-they-mean-60591>

corresponds to a short shelf-life product, they should either be eliminated or significantly reduced. This is partly due to aggressive product placement and in-store displays as compared to how long the product can effectively be sold to the public. By removing these, the savings translated from \$4.5-17.0M, depending on product volumes. In general, the authors acknowledge that this analysis could be biased toward very large CPG manufacturers that have more control over their product distribution. However, they mention for smaller manufacturers it is equally important to maintain good supply chain coordination with their retailers and work through these problems together.

Remaining Questions

The authors mention the debate between manufacturers and retailers related to the root cause of expired product waste. Future empirical research could incorporate data analysis on the moderating effects of changing supply chain visibility and buyer-supplier relationship factors (i.e., relationship duration, retail market intensity, etc.) As the authors mention, the importance of this collaboration would be critical to the success of smaller manufacturers, which could tie back to the above relationship. Other research could also look at the difference between products that have regulated shelf-life (i.e., baby food) and others that are mostly because of aesthetic purpose (i.e., packaged meat). In this case, regulated products might have less variance in expiration as compared to non-regulated products due to more rigid quality

requirements. Reverse logistics and extended producer responsibility could also be investigated for perishable retail products, where certain sensitive products have planned outcomes and are funneled into other applications after a certain amount of unused supply chain age.

Want to Know More?

Broekmeulen and van Donselaar (2019) also discuss a similar situation where retail data is used to measure how supply chains can reduce waste and improve freshness of perishable products using retailer data. The author of this article also looks at a model that portrays the effect of shelf space setup procedures and how they can be adjusted to optimize product expiration (Akkas, 2019).

Foundational Classical Studies

As was mentioned before, there are many analytical articles that relate to optimal inventory policies. Nahmias (1975) and Fries (1975) build a cost-minimization model that emphasizes that policy can change over time and is related to the age distribution of the inventory. Ketzenberg and Ferguson (2006) look at models that capture the net benefit effect of sharing inventory and replenishment information by both manufacturer and retailer. The authors also build off empirical techniques from retail operations literature (DeHoratius and Raman, 2008; Fisher et al., 2009).



BEHIND-THE-SCENES

INTERVIEW WITH PROF. AKKAS

How did you come up with the idea for this paper?

I stumbled upon the problem when I was a PhD student. My advisor (David Simchi-Levi) and I were discussing potential research projects. In particular we were discussing the problem of order inflation when there is limited supply. He asked me if that happens at Pepsi, where I worked prior to joining the PhD program. I was not aware of such a problem there. That week, someone I knew from a CPG company was visiting MIT for some event and we met for coffee. I asked him if he is aware of order inflation problems in the CPG world. He said, "oh yeah, that happens with innovation (new) items. It creates so much waste – millions and millions of dollars' worth of waste." That rang a bell for me. As soon as I came back to my office, I Googled "waste" and "CPG", and bingo, I found that it was such a big problem that there was even a dedicated industry conference to the topic of *unsaleables*. I ended up going to this conference and I decided that I wanted to work on this problem for my PhD. Analyzing the drivers of product expiration was a natural choice to focus on initially, since at the conference I found that everybody was blaming each other as to why waste occurs.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

I had different difficulties at different stages of the project. First, I had to convince my industry collaborator that they needed to work with me on this topic even though they had just completed their own waste project when I approached them. My contact (the person I met at MIT) was not the decision maker since his organization was not in charge of waste. But he

was still very helpful by introducing me to the right people, so I had the chance to hear what they had to say about the waste problem. I used that information to craft a research proposal. My argument was that their waste project was useful to understand waste due to damage, but their results were inconclusive for waste due to expiration, which is where the MIT project was going to come in. It worked; they even gave me funding.

During the project, the main difficulty was with processing the data. I had too much data, but too much of the same data. I did not need that much statistical power. It was taking forever to process the data and run the jobs. I ended up working with a randomly drawn sample. Even the sample was too big.

Another major difficulty was with some of the statistical procedures, which did not exist in R at the time, so I had to code them myself, which took a lot of time. For example, there was no function for a zero-inflated-binomial model. I found a paper that was using the EM algorithm to solve the MLE for the zero-inflated-binomial model, so I implemented their method. Also, for the other zero-inflated models we evaluated, there was no function to compute clustered standard errors. I had to code them myself too.

Further, computation of the supply chain aging variable was perhaps the most difficult and computationally intensive. It required a variety of data, including mapping the entire supply chain for each product, and collecting data for inventory levels and shipments of the product in each link of the supply chain for the entire year. All of this data resulted in a single number for supply chain aging for each product-warehouse!

Determining the functional form to use for modeling case size and demand rate was another technically challenging part of the project. We experimented with many different functional forms to ensure the robustness of our results.

I of course had difficulties with the review process too. The reviewers thought we had granular data (which we did not) that we were not taking advantage of, for example by conducting a time-series analysis. Doing time-series analysis is not feasible with this problem mainly because it is not possible to link deliveries and returns; plus, I don't think that it adds value. It was also not clear what the source of their concern was, yet one of them mentioned seasonality. I worked really hard to overcome this obstacle since I was afraid that this issue was going to cause us to get a reject in the next round. So, I asked for additional time-series data from my collaborator and did some analysis with it that did not take us anywhere. I wrote a long explanation in the response letter as to why it was not feasible to take the route of time-series analysis. Vishal liked my argument; he even said, "this is the best response document I have seen." It must have satisfied the referees too, since we did not get a reject in the next round. We put all the related analysis in an appendix in the paper. To partially alleviate their concern, we added the seasonality variable in the model.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

There are really not a lot of different paths to take with this project in terms of analysis. Given the dataset we had and considering the complexity of the problem, I believe we did consider and exhaust all alternatives, between what we thought of and what the referees asked for. Other than the analysis, perhaps, I could have worked with a smaller sample from the

beginning or used Stata instead of R. That would have sped up the analysis quite a bit.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Practitioners can use econometrics and data analytics to identify the significance of different factors that contribute to the waste problem and assign priorities to each factor to create a road map to alleviate the problem. This would be an improvement on what they are generally doing, which is conducting surveys (which are subjective) and generating data summaries such as the SKUs, regions, or markets with the most waste (which do not provide actionable insights).

As for future research, our study highlights a number of areas that require further studies. Consider case sizes. A large case size helps reduce handling cost, but it may cause expiration. So, there is a trade-off here, which means it can be optimized. That could be a research project. It is important to consider complexity implications in this problem. It may be useful to coordinate and jointly determine case sizes across several SKUs within the same product category. Consider the 2-liter soda category. You have many flavors and brands in this group, like Pepsi, diet Pepsi, Sierra Mist, Mountain Dew, Mountain Dew Code Red, cherry flavored caffeine free diet Pepsi, etc. Independently optimizing case sizes for each of these flavors with different demand rates may increase complexity in operations. For example, these items are put in a shell when transported to retail stores. Different case sizes mean that you need to keep inventory of different sizes of shells, but we know that commonality helps with risk pooling in operations. That is something to consider.

Another promising future research topic is sales incentives and their impact on overselling and waste. I do have a paper on this. In that study, I determine optimum return penalties to charge

the salesforce for expired items and examine the conditions under which they lead to a win-win outcome for the environment and for profits.

Aging of inventory in the supply chain is another complex issue that requires further in-depth analysis. There are many reasons as to why supply chain aging occurs. To name a few, batching, inventory issuing rules, and unsynchronized product launches increase the flow time of inventory in the supply chain. This is an area that I am working on as well.

My paper focused on product expiration generated at retail stores. Future studies can examine waste generated at farms, in manufacturing, in packing, and at the consumer. There are also other types of waste, such as

discontinued or damaged products, which can benefit from research studies. Consider product damage. Ironically, sustainable packaging reduces the amount of plastic in the package, but it makes products more vulnerable to damage as they move in the supply chain. Business innovations that address food waste would be another promising angle to explore. For example, baby carrots are a solution to a food waste problem; irregular shaped and sized carrots were not selling, so a farmer in California came up with the idea of baby carrots.

Generally, people are becoming more aware of the food waste problem. And, hopefully, more research will be done in our field on this important topic.

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HOW DO STRATEGIC CUSTOMERS INFLUENCE INVENTORY DECISIONS?

Yang Zhang, Benny Mantin, Yaohong Wu (2019). Inventory Decisions in the Presence of Strategic Customers: Theory and Behavioral Evidence *Production and Operations Management*, 28(2), 374–392.

Review by Ning Ma

Background

While the conventional newsvendor framework gives optimal inventory decisions, empirical studies have revealed that, in practice, decision-makers tend to place orders that deviate away from the optimal order and towards the mean demand. Researchers explain that while considering markdown pricing and strategic customers (i.e., customers who prefer to wait for sales), retailers stock less, take smaller price discounts, and earn a lower profit. This paper provides another explanation for the order deviation – reference dependence. The authors develop a behavioral theory of reference dependence, showing how a retailer should manage inventory with strategic customers, and discuss whether the traditional pull-to-center bias remains.

Key Insights

This paper uses a normative model and laboratory experiments to study order bias in the presence of strategic customers. Strategic customers prefer to wait for a discount in the future sales period rather than conduct a purchase in the current selling period. Thus, the retailer needs to decrease the inventory

level as the proportion of strategic customers in the population increases. This can induce strategic customers to purchase earlier at the full price. When unit cost is low, the retailer tends to order below the newsvendor optimal inventory level and places the order quantity closer to the mean demand. In contrast, when the unit cost is high, the order quantity tends to be above the optimum and closer to the mean demand. These two settings confirm the well-established pull-to-center bias. However, with the presence of strategic customers, there may exist a pull-below-center effect in a low-cost setting due to the retailer's reference dependence, i.e., the retailer's psychological cost overstocking tends to outweigh that for understocking significantly. Further, the number of strategic customers in the market impacts the degree of the retailer's ordering bias. As the proportion of the strategic customers increases, the pull-below-center bias is alleviated under the low production cost, while the pull-to-center bias is strengthened under high production cost. Therefore, with relatively low production costs, as the number of strategic customers increases, the order is closer to the optimal ordering quantity.



MINI CASE

DOES BLACK FRIDAY INCREASE OR DECREASE PROFIT?

According to the National Retail Federation (NRF), 37.8 million people shopped in stores on Thanksgiving in 2019; just a day later, on Black Friday, when retailers offer steep discounts, 84.2 million people shopped in stores. Such a phenomenon is a typical example of strategic customers' purchasing behavior. These customers are willing to postpone their purchase expecting additional markdowns in the near future. According to a report, 94% of female shoppers in the U.S. say they rarely or very rarely buy clothing if there is no discount involved in the purchase. In 2019, Black Friday witnessed \$7.2 billion in digital sales in the U.S., which is up 14% over the prior year. Salesforce says global sales hit \$20 billion as other countries participate in Black Friday sales, even if they do not have a U.S. Thanksgiving holiday.

However, some retailers are susceptible to the impact of the save-sale-shop phenomenon. For instance, during Black Friday in 2014, British retailer Argos was hit hard. Despite a 45% increase in transactions on the day, sales were flat in the preceding weeks, resulting in lost profits. Therefore, with the existence of strategic customers, retailers can optimize their inventory decisions to keep their business booming during major markdown periods.

Image Source: Pixabay

Case Source(s): <https://info.zimmermarketing.com/blog/are-you-training-your-customers-to-wait-to-buy-your-product-cheaper>

<https://www.thebalance.com/what-is-black-friday-3305710>

<https://www.theguardian.com/business/2015/jan/15/black-friday-argos-homebase-sales>

Remaining Questions

This paper assumes that both the retailer's ordering quantity (i.e., inventory) and the customer arrival information are public knowledge. However, customers may not know the retailer's inventory level, and this may drive customers to purchase immediately. This effect could cause variance in how retailers leverage their strategy. Another factor is the perception of strategic customers. What if only a proportion of strategic customers will come back to the store? The retailer should make the decision more carefully, given not all strategic customers will resume their purchasing. Instead of predetermined price trajectories, the customers may only know the list price but not the exact future markdown, and the sales price can also be endogenous with a period's demand. Therefore, the retailer's inventory decision should be adjusted under such a price setting.

Want to Know More?

Many papers examine various behavioral aspects of strategic customers in revenue management. Song and Zhao (2017) consider a newsvendor system with strategic customers who are boundedly rational, and by formulating a game for interaction between strategic customers, they show conditions of the unique equilibrium. Hariss et al. (2020) consider consumers' quality perception and purchase decisions based on an ex-ante expectation of a future markdown. The retailer can be better off if he pre-announces and commits to a markdown strategy, eliminating the negative effect on sales of customers whose quality perception decreases with the markdown. Du et al. (2015) study strategic

customers with risk preference and decreasing value and address a single-period joint inventory and pricing decision problem. Yamini (2020) provides a summarized review on behavioral newsvendor ordering decisions, and Kremer et al. (2017) focus on dynamic pricing with strategic customers.

Foundational Classical Studies

The base model of this paper is a simplified version of Cachon and Swinney (2009). Cachon and Swinney (2009) study three types of consumers: myopic consumers, bargain-hunting consumers, and strategic consumers. They find that retailers stock less, take smaller price discounts, and earn a lower profit if strategic consumers are present compared to the case where no strategic consumer exists. They also evaluate the value of the quick response, which is much greater for the retailer in the presence of strategic consumers than without them. Reference dependence has been well investigated in the decision-making literature. Ho and Zhang (2008) utilize it to study how the fixed-fee policy in pricing contracts affects a manufacturer-retailer channel's market outcomes. Ho et al. (2010) propose a behavioral theory to predict actual ordering behavior in multilocation inventory systems with reference dependence. Hardie et al. (1993) discuss the implications of a reference-dependent view of consumer choice for modeling brand choice. Lastly, the pull-to-center bias, which is a central finding of the newsvendor behavior, has also been widely studied (Bostian et al. 2008, Chen et al. 2013, Ho et al. 2010, Kremer et al. 2010, Ren and Croson 2013, Schweitzer and Cachon 2000, Su 2008).



BEHIND-THE-SCENES

INTERVIEW WITH PROF. MANTIN

How did you come up with the idea for this paper?

The interactions between sellers and strategic buyers—those who may hold back their purchase in expectation of lower future prices—is a fascinating domain. Earlier literature focused predominantly on the seller's pricing decisions. Over time, it became clear that pricing is only part of the story and inventory plays a major lever in the seller's decision making when interacting with strategic buyers. We were curious to explore whether sellers can make the right inventory decisions while testing these decisions in a lab setting: if they order too many units, they may stimulate consumer waiting, thereby selling the units at a lower price, whereas if they do not order enough units, they may face unsatisfied demand. Indeed, a challenging trade-off.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Facing ongoing challenges is a natural aspect of research. Maybe this is one of the reasons we actually keep carrying it out – many of us simply like the challenges. In this particular research, we have encountered diverse challenges, such as finding access to behavioral labs and recruiting subjects, resolving analytical difficulties, co-authors relocating between continents, and so forth. Probably the most challenging endeavor we faced was the request from reviewers to integrate subjects as buyers in the behavioral experiment. In our original submission, buyers were automated, but we ultimately had to devise an experimentally feasible setting allowing for interaction subjects who played both the roles of buyers and sellers, keeping in mind that number of buyers is uncertain.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Our behavioral result extends the classic pull-to-the-center effect. This effect suggests that sellers exhibit consistent biases in such a way that their ordering quantities are pulled towards the center of the demand distribution. Our research generalizes this result. The presence of strategic buyers reduces the seller's ordering bias when the cost is low but amplifies this bias when the cost is high. Accordingly, several questions emerge. The first is whether one can develop a set of incentives to resolve these biases. It may sound trivial but coming up with incentives that change with the unit cost and the proportion of strategic consumers is far from straight-forward. This leads to the second question: can we easily assess the proportion of such strategic consumers? Existing literature proposes some methods, but we still need to refine to understand the scope of such behavior in practice. Lastly, consumers may—and do—change over time. Some are becoming more oblivious to price changes whereas others become more sophisticated as they can rely on online tools to help them track prices and decide how to time their purchase to take advantage of possible future price drops.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

In academia, we often carry out our studies in isolation to identify core insights. However, in practice, there may be additional dynamics that interfere with the price trajectories. As actual demand may increase or decrease over time, prices may accordingly change and fluctuate, quite dramatically at times, thereby

raising a question: do these changes influence the demand price elasticity. To address this question, we have collected airfare and sales data to assess this impact empirically. In another project, we consider consumers' wait-or-buy decisions in the context of production cost learning and government subsidies. In

such markets (e.g., solar panels and electric vehicles), the production cost decreases over time as more units are produced. This, in turn, gives consumers an incentive to wait, but then governments can step in and offer subsidies. What are the optimal subsidy mechanisms to maximize social welfare?

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HOW TO ELIMINATE BACKROOM INVENTORIES IN RETAIL OPERATIONS?

Based on Cuneyt Eroglu, Brent D. Williams, Matthew A. Waller (2018). Using the Pack-and-a-half Rule to Eliminate Backroom Inventories in Retail Operations. *Journal of Business Logistics*, 39 (3), 164–181.

Review by Rohan Korde

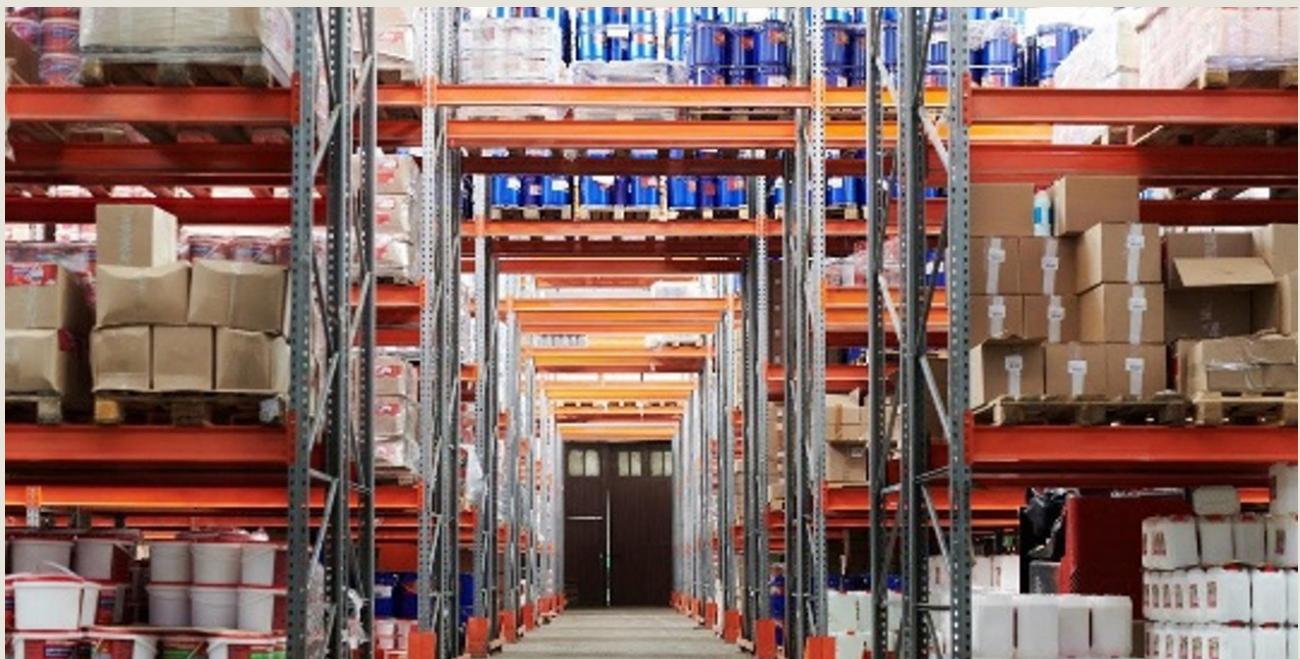
Background

Operations managers of retail stores want to minimize the backroom inventories for good reasons. First, holding inventory in two locations (shelf and backroom) increases labor costs because shelves must be restocked from the backroom between supplier deliveries. Second, when shelves are not instantly restocked from the backroom, it is possible to have an empty shelf when there is inventory in the backroom. A customer may see an empty shelf and forgo the purchase. Third, store inventories must be tracked at two locations, which complicates the monitoring and management of inventories, and this can cause inaccuracies. Thus, a retailer may want to use the entire retail floor to display inventories and avoid backroom storage as much as possible. "Pack-and-a-half" is a well-known heuristic in the retail industry to accomplish this, which recommends that the allocated shelf space for a product should be 50% more than the case pack quantity in which the product was delivered. This paper attempts to evaluate the merits of this policy and explore alternative criteria for shelf space allocation. There is an active stream of research that examines the dependencies among inventory management, shelf space allocation, store operations, and consumer behavior (Murray et al. 2010; Tsai & Huang 2015; Zhao et al. 2016).

This study contributes to this research stream by highlighting the importance of case pack quantity in retail replenishment, as well as store operations and shelf space allocation.

Key Insights

This study provides an analytical framework for assessing the implications of a given case pack quantity on the retailer's profit and shelf space allocation. The first insight is that for any retailer operating in highly competitive segments with low gross margins, the pack-and-a-half rule can have adverse financial implications. The second insight is that case pack quantity plays an important role in a retail supply chain. The most effective modification to the pack-and-a-half rule was to divide the SKUs into two groups according to the case pack quantity (this is the single criterion) and then apply a multiple of 1.5 (pack-and-a-half) to the smaller case pack quantity SKUs and a multiple of 1.25 (pack-and-a-quarter) to the larger case pack quantity SKUs. With double criteria (this is used to find a combination of criteria that performs better than each criterion individually), the most effective modification was to divide the SKUs into two groups (based on top quartile rule) using case pack quantity and percent carrying cost (two criteria) and then apply a multiple of 1.5 and 1.25 to the two groups.



MINI CASE

THE SHELF-CONNECTED SUPPLY CHAIN: STRATEGICALLY LINKING CPFR WITH S&OP AT THE EXECUTIVE LEVEL

Instead of shipping product in response to demand signals from the retail store shelves, consumer goods manufacturers continue to ship products from their plants and distribution centers in quantities based on store orders and related historical data. Fred Baumann, Vice President of Industry Strategy at JDA Software, commented that "there is a great opportunity to formally bridge and integrate the shelf planning and demand management function within a manufacturer. It is common for category management teams to allocate space on the shelf by a historical demand average and some corresponding rule of thumb parameters such as case pack-and-a-half. As manufacturers transition to retail shelf driven forecasting, they can apply these time-phased forecasts to the

way shelf space is allocated more effectively. Measuring demand variability at the shelf can also drive more intelligent space-allocation decisions. The execution and implementation of a store-level reset can have a dramatic impact on the corresponding time-phased order plans that are executed to the manufacturer. Next generation software providers (like JDA Software) have recognized this link and have formally integrated store-level forecasting and replenishment to planogram management and execution".

Image Source: Pexels

Case Source(s): Baumann F. (2011). "The Shelf-Connected Supply Chain: Strategically Linking CPFR with S&OP at the Executive Level". *The Journal of Business Forecasting*, 29 (4), 21-28.

Remaining Questions

Is case pack quantity a good predictor of average demand? Are manufacturers willing to deliver products in different case pack quantities to different retailers? Under certain circumstances it can be prohibitively expensive for manufacturers to customize the case pack quantity for all their customer retailers. If both answers are true, then retailers can request different case pack quantities and then apply the pack-and-a-half rule. On the other hand, if the manufacturers cannot ship different case pack quantities to different retailers, then the next questions are: can retailers improve their profits by simultaneously considering the modified pack-and-a-half rule and other factors such as actual demand and store location? The same product in different stores might sell differently. Can retailers optimize their shelf allocation strategy, and profits, by analyzing these factors and other related factors? Lastly, by how much, on average, is the backroom inventory reduced after applying the modified pack-and-a-half rule?

Want to Know More?

Eroglu et al. (2011) investigates the direct and interaction effects of shelf space, case pack quantity, and consumer demand on self stockouts

(i.e., stockouts at the shelf level when inventory is available in the backroom of a retail store). The results indicate that shelf space and case pack quantity have direct effects on shelf stockouts. Furthermore, evidence is found for interactions among shelf space, case pack quantity, and customer demand. Though many retailers adopt simple heuristics (such as pack-and-a-half) for shelf space allocation, this study suggests that such heuristics tend to overestimate or underestimate shelf space requirements when consumer demand is ignored. This suggests that managers should allocate shelf space for SKUs based on not only case pack quantity but also consumer demand.

Foundational Classical Studies

Two seminal studies were published in the 1980s: Corstjens and Doyle (1981) and Zufryden (1986). Corstjens and Doyle (1981) modeled demand as a function of the shelf space allocated to that product and it also considered cross-space elasticities (i.e., a product's demand was a function of not only its own shelf space but also the shelf space allocated to other products in the assortment). Zufryden (1986) extended Corstjens and Doyle (1981) by studying the influence of multiple marketing mix variables on consumer demand.

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Int

BEHIND-THE-SCENES

INTERVIEW WITH PROF. EROGLU

**How did you come up with the idea for this paper?**

This paper is a continuation of my research stream on inventory management in the retail industry. As a junior assistant professor, I was encouraged to focus my research on one or two specific areas. When you go up for tenure, you want to be "known for something." One of the research areas I chose to focus on was about management of inventories in a retail industry. There were two reasons for my choice. First, shelf inventories are very important for retailers and there are a lot of interesting practices in the field. This way, my research would have real world implications. Second, inventories have been studied for the most part in a manufacturing setting where inventories are typically stored in a single location. However, retailers hold inventories in shelves and backrooms. Furthermore, shelf inventories stimulate demand whereas manufacturing inventories do not. Therefore, there are a lot of novel issues to investigate.

This particular paper considers "the pack-and-a-half rule". This is a widely used shelf inventory management practice that has not been investigated in the academic literature. Even though many retailers use this practice, there was no academic work that assessed financial effects of this practice. Using optimization, simulation, and statistical methods, I have explored the effects of the pack-and-a-half rule for products with different price, cost, and demand characteristics..

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

As a researcher, I like tackling a research question from multiple angles using multiple methodologies. A single methodology will take you only so far. I think there is a lot of value in multi-method research. That said, the review process for a multi-method paper can be more challenging compared to other papers. Most reviewers are trained in a single methodology and when they encounter an unfamiliar methodology, they sometimes get confused. But this is to be expected in multi-method research.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

I would like to share a mistake that I made during the review process. I hope that young researchers can avoid the same mistake. Reviewer typically make a lot of comments about a paper. However, an associate editor highlights the most important few issues. It is vital to address the few issues raised by the associate editor. Sometimes, a researcher can get lost in all the minor issues raised by reviewers and fail to address the issues raised by the associate editor to the fullest extent.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

The traditional brick-and-mortar retail industry is undergoing major changes as it responds to threats from e-tailers, like Amazon, and others. Furthermore, current pandemic has posed major challenges for retailers. As such, there are a lot of interesting topics to explore as the retail industry evolves.

BUSINESS ANALYTICS, FORECASTING, AND DEMAND MANAGEMENT

Although physical retail stores are still around, e-commerce has taken a larger share, especially during the COVID-19 pandemic. Omnichannel has become a priority for most retail businesses because of the flexibility and convenience offered to their customers. Due to the growth of omnichannel, forecasting and demand management have become more challenging to address customer needs. These articles provide different strategies to aid manager's decisions using econometric and machine learning models.

Topics in This Section

Balancing the Use of Both Human and Computer-Based Decisions in Determining Retail Demand

Based on Kesavan, S., & Kushwaha, T. (2020). Field experiment on the profit implications of merchants' discretionary power to override data-driven decision-making tools. *Management Science*, 66(11), 5182-5190.

Empirical Research Retail Sector

Do Retail Store Locations Affect Revenue?

Based on Glaeser, C. K., Fisher, M., & Su, X. (2019). Optimal Retail Location: Empirical Methodology and Application to Practice: Finalist–2017 M&SOM Practice-Based Research Competition. *Manufacturing & Service Operations Management*, 21(1), 86-102.

Empirical Research Retail Sector

Want to Make Flash Sales More Profitable?

Based on Victor Martinez De Albeniz, Arnau Planas, and Stefano Nasini (2020). Using Clickstream Data to Improve Flash Sales Effectiveness. *Production and Operations Management*, Early Access, 1–24.

Analytical Research IT Sector

BALANCING THE USE OF BOTH HUMAN AND COMPUTER-BASED DECISIONS IN DETERMINING RETAIL DEMAND

Based on Kesavan, S., & Kushwaha, T. (2020). Field experiment on the profit implications of merchants' discretionary power to override data-driven decision-making tools. *Management Science*, 66(11), 5182-5190.

Reviewed by Hyunsuk Baek

Background

Historically, local knowledge of store managers is important to firms' profitability. However, data-driven decision making (DDD) becomes increasingly feasible as firms accumulate vast amount of information about customers and sales. As the performance of DDD improves, it is unclear whether it is still useful to incorporate discretionary power of store managers. This paper empirically examines the financial implication of merchants' discretionary power to override DDD and identify conditions under which overriding DDD can be valuable.

Key Insights

The authors found that the automated decision making with DDD without the store manager's input is 5.77% more profitable. On average, DDD tools, with the availability of big data and advanced analytics skills, perform better than intuitions of human managers. However, private information held by store managers can be valuable for products that are in growth stage since these products have higher demand uncertainty and less historical data than those in mature and declining stages. In these cases, the store manager's discretion power increases margin by 23.01%.

Remaining Questions

This paper analyzes the financial benefit of DDD tools. In practice, firms also need to consider non-monetary perspectives, such as the relationship with store managers. Such relationships are important under operational exceptions, for example, disruptions or sudden local demand changes. If store managers cannot intervene or override DDD, then managers can be resentful and not taking appropriate actions when emergencies arise. Given that possible behavior, we can think of an interesting research question: How do centralized DDD tools influence the motivations and behaviors of store managers. The complementary or competitive relationship between store managers and DDD would continue to be an issue in the future.

Want to Know More?

Nguyen et al (2018) provide a good literature review on where and how to utilize big-data analytics in supply chain management. Choi et al. (2018) investigate big-data analytics techniques and examine their strengths and weaknesses. Both Shi et al. (2016) and Gah-Yi Ban (2020) propose data-driven approach to inventory management. Luo et al. (2020) studied the effectiveness of AI chatbot and found that undisclosed AI chatbots are



MINI CASE

BMW GROUP SETS OUT CODE OF ETHICS FOR THE USE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is now at the center of innovation in many companies. BMW Group also actively utilizes AI to analyze customers, develop products, and manage employees and processes. BMW group wants a contribution to AI technology innovation, as well as the ethical issues of using AI. To build trustworthy AI, BMW group has developed and refined seven basic principles: 1) human agency and oversight, 2) technical robustness and safety, 3) privacy and data governance, 4) transparency, 5) diversity and fairness, 6) environmental and societal well-being, and 7) accountability. BMW group monitors decision making of AI by human

employees who can override those decisions. It also pursues to develop robust AI which has the safety standard to decrease the risk of unintended output and errors, and continuously assess, report, and mitigate the risk. AI has a lot of potential in operation management. However, since there still exists the possibility of unintended consequences from AI application, it is essential to regularly monitor and maintain it.

Image Source: Unsplash

Case Source(s): <https://www.greencarcongress.com/2020/10/20201013-bmw.html>

as effective as proficient workers, but disclosed AI Chatbot reduces customers purchase probability.

Foundational Classical Studies

Before DDD tools emerged, many firms utilized the decision support system (DSS) to assist store managers. Like this paper, Sharda et al. (1988)

empirically examined the effectiveness of DSS. Cachon et al. (2000) is a suitable reference to understand the importance of sharing in inventory management. Bertsimas et al. (2006) present a mathematical framework to solve optimization problems with limited information.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. KESAVAN:

How did you come up with the idea for this paper?

The observation that managers tend to override decision-making tools was from my days in the industry (about 20 years back). At that point, it was not clear whether those managers were improving profits or making it worse. When I connected with the senior VP of the retail chain (who had also worked in the same company as I did) studied in this paper, we agreed to examine whether merchants in this company were also overriding the decision-making tool and if so, what the profit implications were.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

As it was a field experiment, it was time-consuming to work with the retailer. It took nearly 3 years before the experiment was executed. Otherwise, there were not too many issues.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Same.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

In this paper, we show that automation leads to higher profitability compared to giving managers discretionary power to override the tools. In follow-up work with the same retailer, we investigate if we can restructure human-algorithms interactions to do even better than automation.

DO RETAIL STORE LOCATIONS AFFECT REVENUE?

Based on Glaeser, C. K., Fisher, M., & Su, X. (2019). Optimal Retail Location: Empirical Methodology and Application to Practice: Finalist–2017 M&SOM Practice-Based Research Competition. *Manufacturing & Service Operations Management*, 21(1), 86-102.

Reviewed by Hyunsuk Baek

Background

This research was motivated by Buy-Online-Pick-Up-In-Store (BOPS) fulfillment method of an online grocery retailer. The focal retailer, instead of opening brick and mortar stores, regularly parks delivery trucks at convenient pickup locations in high-demand areas to deliver orders to customers. Previous research has studied location with space or time dimensions, such as competitive facility location problems with given demand and cannibalization effect models, and dynamic location problems with time-variant factors. In contrast to the previous literature, the article addressed a spatiotemporal location problem to determine where and when pickup trucks are located, and empirically estimated both spatial and temporal cannibalization effects. Furthermore, to appropriately predict the sales at potential locations, the authors proposed a combined machine learning and econometric model, where the estimated variables are entered into an integer model to maximize revenue.

Key Insights

This article showed how to utilize data to improve the traditional optimization models applicable to business practices by combining econometrics and machine learning. The authors found that predicting the expected revenue only by a machine learning model is not accurate. The reason is that machine

learning does not consider the causal relationship between the revenue of a target location, the number of adjacent operating locations, or opening times of the target location. This led to biased training direction in the model. The performance can be improved by incorporating the econometric model. The article shows a comprehensive data-driven approach to solving a location problem with optimization, econometric, and machine learning techniques.

Remaining Questions

What are advantages and disadvantages of the parked location operation compared to operating normal delivery service, in terms of customer demand, satisfaction level of the service, and operation cost. How does this affect the managerial decision-making process? In the article, the random forest machine learning prediction error, which the authors selected, produced surprisingly good result. There seemed to be little room for improvement, such as increasing prediction accuracy and reducing gap between in-sample and out-of-sample prediction errors.

Want to Know More?

These days, omnichannel retailers offer BOPS options to their customers. Gao et al. (2017) and Jin et al. (2018) have studied the profitability and feasibility of BOPS. The focal retailer of this



MINI CASE

DHL'S CROWDSOURCED DELIVERY EXPERIMENT

As e-commerce and omnichannel market has grown, the customers' requirement for quick and flexible delivery and the daily volume of parcel shipments has skyrocketed. Crowdsourced delivery is one of the alternatives to resolve this situation. It utilizes the networks of local, non-professional couriers, or individuals, for last-mile deliveries to customers, like car-sharing applications. In 2013, DHL experimented with the MyWays platform to facilitate last-mile deliveries with crowdsourced drivers in Stockholm. After ordering a product, the customer could enter the desired time and location for the delivery. The package was registered at one of DHL's

collection locations and became visible to all MyWays drivers. Drivers could decide which parcel they would like to transport. The location of DHL's collection facility and the parcel's price might be the important factors that drivers use to decide on specific packages. These days, many companies, such as Amazon, Walmart, and Macy's utilize crowdsourced delivery using different types of platforms.

Image Source: Unsplash

Case Source(s): https://www.dhl.com/en/press/releases/releases_2013/logistics/dhl_crowd_sources_deliveries_in_stockholm_with_myways.html#.X5QKmxKg9Pa

article utilized regularly parked delivery trucks instead of brick-and-mortar stores. How could we transform ordinary BOPS to be more innovative and profitable, like this focal retailer? Govindarajan et al. (2017) studied inventory management of brick-and-mortar stores, which address both brick-and-mortar and online demand in omnichannel environment. As brick-and-mortar and online demand share the inventory in a supply chain network, the logistics also becomes more complex. A fleet of trucks can deliver products either between a warehouse to a brick-and-mortar store or between

a brick-and-mortar store to customers. Which design would be preferred and minimize the cost?

Foundational Classical Studies

Krarup and Pruzan (1983) reviewed single plant location problems (SPLP). Their study analyzed the structure and properties of SPLP by relating to the set-covering and partitioning problems and approximate algorithms. The textbook by Daskin (2013) introduced and explained the classical facility location problem. The textbook by Bishop (2006) is a good reference for beginners who want to study machine learning.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. GLAESER:

How did you come up with the idea for this paper?

After I moved to Philadelphia for my PhD program, I began using an online grocery service that just launched in the area. As a customer, I quickly realized that the online grocers would face many operational challenges and new opportunities that traditional grocers would not, and I wanted to find research questions to help them. When I approached my advisor, Professor Marshall Fisher, about my interest, he reached out to his industry connections and soon after, we launched a project with an online grocer. The research question itself came from our retail partner – their location managers were trying to improve the pick-up location configuration all the time yet even the most experienced managers sometimes chose to operate in locations that do not end up resulting in sufficient sales. We asked ourselves how we could help them identify the best pick-up locations using the data that they provide.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The biggest challenge was to establish the academic contribution during the revision process. I believe this frequently happens to researchers working on industry collaborated projects – oftentimes, the most impactful solution to the industry partner is not necessarily the most academically sophisticated solution. Given that our project worked very closely with the online grocer, some reviewers found our final deliverables too specific and too practice-focused with insufficient academic contribution. We were very fortunate to be selected as a finalist in the MSOM practiced-based competition and

very grateful that the editor and the associate editor saw our unique contribution.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

I would have tried harder to launch a well-designed field experiment to validate our algorithm and result. Trying to implement a formal field experiment once we have moved onto another research question with the industry partner was very difficult.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

I believe there are still many unanswered questions regarding operations of online grocery businesses. Having access to much more granular customer data, such as what customers searched compared to what they ended up purchasing, opens up a huge opportunity to improve its operations with respect to product assortment, display, and promotions. In addition to understanding customer behavior, as companies' business models change, new questions emerge: Consider Amazon Fresh and the question of which zip-code to offer delivery services. Now that Amazon has acquired Whole Foods Market, the answer to this question likely changed significantly.

I am currently working on a project with our collaborator on understanding the implications of offering home delivery in addition to pick-up. The company presumed that the two service models would cannibalize each other, but interestingly enough, we find that they affect each other's sales asymmetrically.

WANT TO MAKE FLASH SALES MORE PROFITABLE?

Based on Victor Martinez De Albeniz, Arnau Planas, and Stefano Nasini (2020). Using Clickstream Data to Improve Flash Sales Effectiveness. *Production and Operations Management*, Early Access, 1–24.

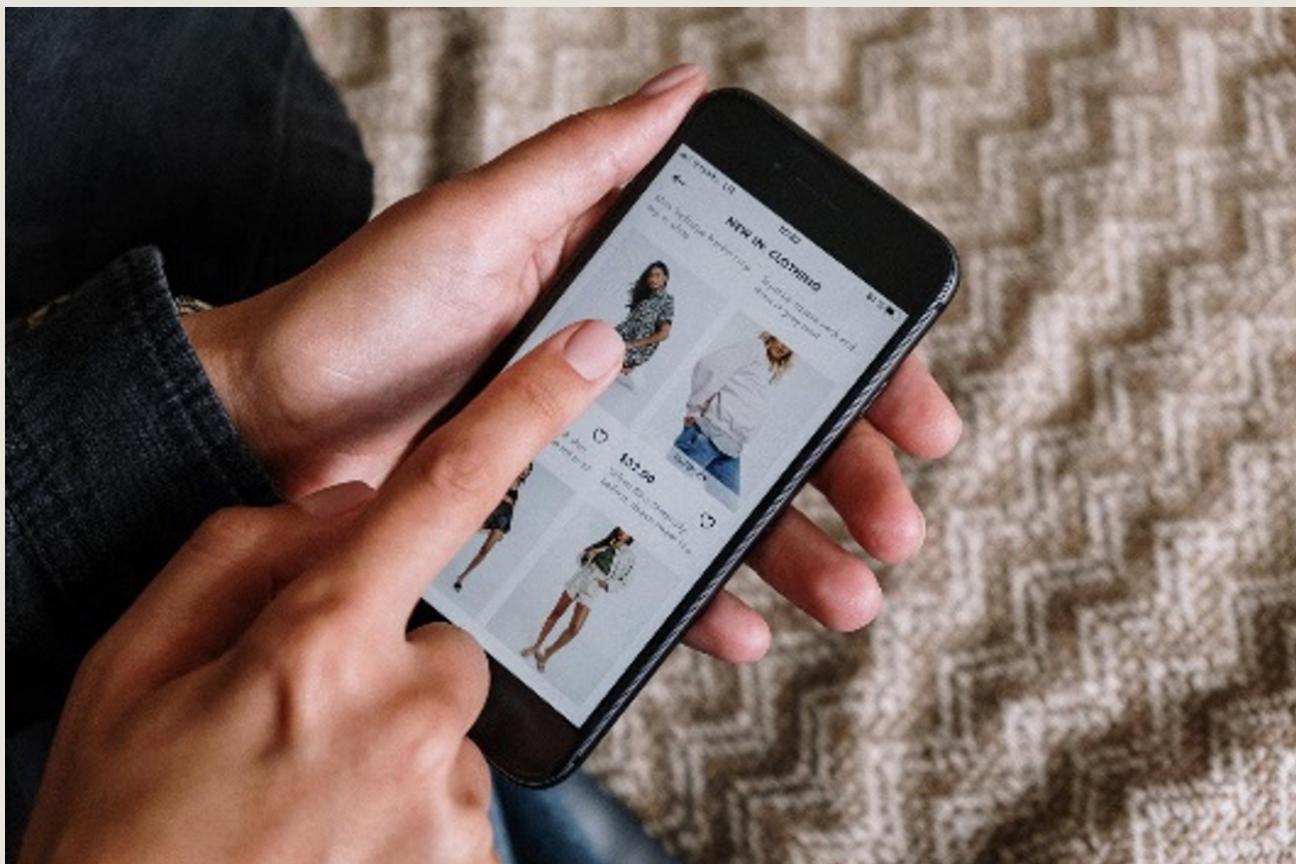
Review by Rohan Korde

Background

Say Gucci just ran a fashion campaign for their summer collection. At the end of the campaign many products were sold at premium prices. However, there were other products that did not sell. How would Gucci get the most from these unsold products? The answer is flash sales using retail website such as Vipshop in China, Vente Privee in Europe, or Rue La La in the United States, among others. Flash sale is when an online retailer sells a set of items for a limited time at a steep discount. The only degree of freedom in such flash sales is price, but due to the short time windows, the prices are not adjusted during the selling campaign (when the proposed demand model is not used). The purpose of this study is to build a demand model at the SKU level and suggest prices after a short period of time during the flash sale that can improve profits. Before the customer buys the product online, the customer clicks around the website to discover what products are for sale, and their listed prices. These early clicks are used by a hierarchical model to learn and to improve demand forecasts and recommend adjusted prices to better match supply and demand. Because the model is hierarchical it provides insight about customer behavior inside the shopping funnel. This improves the forecast accuracy and allows the retailer to learn faster and with fewer click data.

Key Insights

First, the hierarchical model developed in this study includes many fixed effects (campaign fixed effects and product fixed effects). This makes it possible to learn quickly from new products, and as a result improves prediction accuracy. Second, the hierarchical model uses aggregate clickstream metrics which provides a balance between granularity, simplicity, and tractability. The model is validated with real data from a flash sales retailer using hourly events for three years. Hence, besides a modeling contribution, it makes an empirical contribution by documenting the breakdown of uncertainty in the sales of fashion goods in the different shopping process steps, and the predictable elements of demand, and specifically those related to the life-cycle for short selling windows. Third, the decomposition of the hierarchical transitions provides us with valuable information about customer responses to the different elements related to a product. The strength of this model is that it can distinguish the effects of campaign design (was the campaign attractive? if not promote it more) from the effects of product features (was the price adequate? if not, run pricing optimization) and from the effects of product display (was the product considered? if not, images or placement can be changed).



MINI CASE

RUE LA LA EXEC: PRIORITIZE MOBILE TACTICS BASED ON CORE BUSINESS GOALS

Rue La La, a leading flash sale online retailer, jumped into mobile in 2009 with a mobile web site and began launching apps in 2010. According to Gabbi Buerman, mobile product marketing manager, 90 percent of non-desktop traffic comes from an iPad or iPhone, and 50 percent of all traffic comes from mobile and tablets in general. At the end of the day, Rue La La wants consumer to visit their sites frequently and convert in the easiest way possible. "There is a serious increase in cross-channel shopping",

Ms. Buerman said. "We want to make sure that each device has something unique to offer, and some sort of added value to the customer. Never sit back and relax. Keep testing, keep optimizing, keep pushing the envelope."

Image Source: Pexels

Case Source(s): <https://www.retaildive.com/ex/mobilecommercedaily/rue-la-la-exec-prioritize-mobile-tactics-based-on-core-kpis>

Remaining Questions

This study delivers a model that can quickly learn about product performance by observing a few hours of clickstream data. These early clicks can be used to improve demand forecasts. This improvement is valuable because the retailer can adjust prices to better match supply and demand and can deliver higher revenue. Can this model be extended to other similar hierarchical problem domains such as brick and mortar retail shopping? Within the context of the shopping funnel, is it possible to examine other factors such as product display, product visibility, inventory availability, and fulfillment lead times? In addition to the existing model parameters, can customer purchase history be used by the model to further improve the prediction power of the model? Those customers with an established history of shopping on flash sales, can additional discounts be applied only to such loyal customers?

Want to Know More?

Ferreira et al. (2016) uses machine learning techniques to forecast sales and perform price

optimization at Rue La La. The main difference between this study and Ferreira et al. (2016) is that this study used site visits while they used sales metrics within a single campaign. Anderson et al. (1992) and Train (2009) provide excellent reviews of multiple-choice models most of whom rely on the availability of data that match individual characteristics to the products they purchase.

Foundational Classical Studies

This study is similar to most of the previous economic literature - Berry et al. (1995), Bresnahan (1987), Feenstra and Levinson (1995) - which estimates product demands from product-level data. Raudenbush and Bryk (2002) points out that hierarchical models are particularly suitable for a fine-grained decomposition of the different sources of data variability, allowing for high flexibility in the inclusion of conditional information. Arora et al (1998) was one of the first to introduce the hierarchical modeling approach in the context of consumer behavior.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. MARTINEZ DE ALBENIZ:

How did you come up with the idea for this paper?

We collaborated with an online retailer that had to take thousands of pricing decisions every day and had no demand forecast in place, hence no way to assess the risk of pricing too high vs. too low. This led us into developing an advanced model using all the available clickstream information (new in the literature).

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The data was huge, so we had to develop a hierarchical approach (new in the theory) to

take advantage of the wealth of data without getting lost in complexity.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Probably similar.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Online retailers are sitting on very rich information, research should investigate how to exploit it to make better operational (assortment, inventory, pricing) and marketing (customer segmentation, promotions, display) decisions.

QUALITY MANAGEMENT AND PROCESS IMPROVEMENT

In addition to the core operations, quality management and process improvement play an important role toward firm operational efficiency and profitability. There are many established process improvement methodologies, such as Six Sigma and Lean, that companies can adopt and modify to achieve their desired goals and targets. The articles in this section provide examples of how operations managers can identify and address quality issues in their manufacturing process and supplier network.

Topics in This Section

How to Facilitate Effective Process Improvement Implementation in New Contexts such as Product Development?

Based on Shawn T. Collins and Tyson R. Browning (2019). It worked there, so it should work here: Sustaining change while improving product development processes. *Journal of Operations Management*, 65, 216–241.

Empirical Research Multi-Sector

Information Sharing Effect on Inventory Decisions

Based on Clottee, T., & Benton Jr, W. C. (2020). Sharing Quality-Distribution Information for the Selective Assembly of Intermediary Components in the Automotive Industry. *Production and Operations Management*, 29(1), 174-191.

Empirical Research Manufacturing Sector

Do Greater Distances Between Suppliers in Automotive Supply Chains Affect Product Quality?

Based on Bray, R. L., Serpa, J. C., & Colak, A. (2019). Supply chain proximity and product quality. *Management Science*, 65(9), 4079-4099.

Empirical Research Manufacturing Sector

HOW TO FACILITATE EFFECTIVE PROCESS IMPROVEMENT IMPLEMENTATION IN NEW CONTEXTS SUCH AS PRODUCT DEVELOPMENT?

Based on Shawn T. Collins and Tyson R. Browning (2019). It worked there, so it should work here: Sustaining change while improving product development processes. *Journal of Operations Management*, 65, 216–241.

Review by Rohan Korde

Background

Process improvement programs (PIP) are organizational initiatives intended to improve the efficiency, effectiveness, and consistency of work. Lean and Six Sigma are examples of process improvement programs. Such programs are applied across different contexts such as manufacturing, service operations, and product development (PD). Operation managers often wonder whether a PIP that worked in one context would work in another context. This study examines this question through the lens of organizational change theory, a theory that Kurt Lewin developed in the 1940s. This theory suggests that for an organization to change it must go through three stages - stage one is unfreeze, stage two is change, stage three is refreeze. Extant literature has studies about PIP in the manufacturing context but not on PIP in the PD context. This study fills this gap.

Key Insights

A PIP implementation will be less effective at a firm when the management has not articulated it as an employee priority. If the tools used to gather data do not identify clear and adequate gaps between the

current and the desired state, then the mandatory PIP will be less effective. When the incentives and disincentives are not clearly conveyed, the appropriateness of the change message is diminished. Therefore, planned flexibility to adopt the PIP principles will improve employee views of their appropriateness, thereby increasing the effectiveness of the PIP. Tailoring the PIP principles to new contexts such as PD will improve adoption and increase its effectiveness. Emphasizing long-term benefits without short-term wins is not effective, since it creates perceptions of gaps between symbolic and substantive success, reduces personal benefit, and this reduces the effectiveness of the PIP. Mandatory PIP implementation that emphasizes meeting externally imposed deadlines will limit employees' commitment to the PIP principles and reduce its effectiveness.

Remaining Questions

To make a PIP effective and successful in a PD context, what changes are necessary to the PIP before the PIP is applied? What procedures can be followed to identify changes that are needed in the PIP in a PD context to ensure its success? Under what circumstances does a PIP apply equally well to other contexts without



MINI CASE

UNIVERSITY OF WA DEPLOYS NINTEX PROMAPP TO ACCELERATE PROCESS IMPROVEMENT

University of Western Australia (UWA) has embarked on the deployment of Nintex Promapp to support long-term continuous process improvement across all its faculties and operations. Processes and procedures are currently being documented in the university's finance, HR, brand marketing, and recruitment teams and will roll out across campus management thereafter. Nintex Promapp is also supporting faculties with distinct requirements such as the faculty of Health and Medical Sciences, with service delivery in podiatry, dental clinics, and rural medical placements, where the tool will help refine process hierarchies and associated documentation for coaching staff. Emma Bailey, Continuous Improvement Manager at UWA's Office of Service Delivery said "other benefits of using Nintex Promapp

include the ability to easily move process hierarchies from a high-level process to a really detailed instruction. The platform enables you to see links across processes and identify processes marked up for action. This will deliver a high-performance culture that is values-led, collaborative, open, and ultimately supports all our centralized and remote staff¹. The university predicts that long-term benefits from process management will include improved internal and external service by being able to provide transparency around specific processes.

Image Source: Pexels

Case Source(s): <https://www.itwire.com/deals/university-of-wa-deploys-nintex-promapp-to-accelerate-'process-improvement'.html>

many modifications? Can we document different PIPs that are successful in different contexts such as high-volume assembly line manufacturing versus a low volume PD manufacturing? This can enable operations managers to choose and pick those PIPs that are most relevant to their context. For instance, Lean and Six Sigma PIPs are generally successful in a high-volume manufacturing context. These PIPs don't work well in a low volume manufacturing context such as PD and hence should not be used in the PD context without customization. To create PIPs that are successful in PD, one has to identify the bottlenecks and/or problems that are specific to this particular PD environment, and then create PIPs to solve these problems. This will improve the odds of success of such PIPs in PD contexts. Could social-technical congruence or behavioral agency theory be applied to conceptualize PIP implementation effectiveness? Do the boundary conditions apply to an inter-organizational process improvement context?

Want to Know More?

Canato et al. (2013) and Canato et al. (2014) discusses the successful adoption of Six Sigma process improvement program in a product development context at 3M. These finding are similar to the findings from the current article which

show opportunities to adapt process improvement programs to a product development context, and the potential challenges with its implementation. Popular guidelines for change invite managers to minimize resistance by encouraging employees' participation, involving them in the design of new organizational structures and systems, and ensuring preliminary consensus through negotiation. Directive intervention does not lead to long-lasting cultural changes.

Foundational Classical Studies

According to the "thesis of transference" Womack et al. (1990), operations managers in diverse contexts share a common set of problems. Hence they should be able to share a common set of solutions to those problems. Canato et al. (2013), Canato et al. (2014), Danese et al. (2017), and Lillrank (1995) point out that a successful process improvement program can create expectations that the same practices will work again, elsewhere. Hence managers are often directed to implement specific practices by prescribed deadlines with expectations of success. These expectations limit managers' flexibility to allow their employees to contextualize solutions for specific situations and challenges. Rather, managers must mobilize resources within their organizations to comply with the imposed expectations.

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BEHIND-THE-SCENES

INTERVIEW WITH MR. COLLINS AND PROF. BROWNING



How did you come up with the idea for this paper?

Shawn: I discovered the idea of transference through discussions about appropriate technology while I was an undergraduate student in mechanical engineering. It opened my eyes to the general question that forms the title of the paper: How do we know that what worked in one place will work somewhere else? Early in my professional career I learned about Lean and Six Sigma. This was in the aerospace industry during the late 1990s, and there was a big push to adopt those principles in domains like engineering design. When I started my graduate school research, one area of interest was in connecting the dots between the ideas of transference I'd been exposed to while thinking about appropriate technology with some of the OM implications in a context like DevCo. I knew Tyson because we were both involved with the International Council on Systems Engineering (INCOSE). When I reached out to him about collaborating on this paper, he was kind enough to agree.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Shawn: It's one thing to produce a deliverable for an industry sponsor and a dissertation committee. Turning that deliverable into something that's fit for academic publication is an exercise in transference with its own challenges! We had several iterations with editors and reviewers who asked us to clarify how the specific instance of PIP implementation at DevCo was relevant for a wider academic community. I leaned heavily on Tyson's experience both as someone who had

made the transition from industry to academia and as someone who was familiar with the process of publishing in a top academic journal. The other big source of iterations was the question of how much research attention Lean and Six Sigma deserved. Neither construct was new, and the reviewers wanted a clear explanation of the academic value proposition for the paper. It took some work to articulate that answer, and also to find the final "home" for the paper at *JOM*. One thing that helped with final acceptance at *JOM* was other recent work showing evolving conclusions at places like 3M. We were able to place our *JOM* paper in the context of that OM/OB (organization behavior) landscape.

Tyson: Shawn's absolutely right that it took a long time and many iterations to get this paper into its final form. We must have rewritten it ten times over nine years (not all for *JOM*). Earlier versions of the paper had been rejected by a couple of other journals, but their comments nevertheless helped guide us towards drawing out the main points and presenting them more clearly. One of the big challenges with qualitative research is presenting it in a clear and convincing way. I had successfully published other qualitative papers, but each brings its own challenges. We both learned a lot along the way.

Shawn: The paper took several years from initial discussion about writing it through final publication. There were times when I got discouraged about the iterations. Tyson patiently encouraged me that this was common when publishing in top-tier journals, and not to give up. The final paper in *JOM* was much

better than the first draft we submitted. If you are doing work like this, it's okay to feel tired and discouraged during the review cycles. Hang in there. It's hard work, but there is a great sense of satisfaction when your perseverance pays off.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Shawn: There is always a breadth versus depth tradeoff. Looking as deeply as we did at DevCo meant giving up potential opportunities to look more broadly at MultiNat or elsewhere. You must pay very close attention to questions of internal and external validity. For topics like PIP implementation, the case study method that lets the researcher also be a practitioner is valuable because it gives you visibility of realities that can supplement some of the standard quantitative methods like multi-site surveys. It can sometimes feel like the industry sponsor and the academic community are two different masters one is trying to serve. I think I would make the same decision about this research project if I had to do it again, but it would have been helpful to understand some of the tradeoffs and inherent tensions a little better before I jumped into it.

Tyson: We learned a lot along the way about how to describe and present the research. I'd certainly want to do it again, knowing that it would likely proceed much more smoothly with our hard-earned knowledge about how best to describe and present it.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Tyson: Process improvement, including Lean and Six Sigma (and whatever new approaches become more popular in the future), plays a key role in making organizations more efficient, effective, and profitable. However, like giving a kid a knife and asking him or her to do heart surgery, it's easy to misuse the tools and mess things up. More subtle challenges emerge when methods and tools that work well in one part of an organization are blindly applied in different parts. This assumption often made by executives, that "it worked here, so it should work there," remains a challenge to overcome, and process improvement methods and tools are just one example. Within that area, the particular challenge of making projects—especially complex product development projects—more efficient and effective is still a big one. In other research as well, I've always found that the techniques of Lean and Six Sigma don't directly transfer from the improvement of ongoing, repetitive operations—where they've been shown to add value—to complex, novel, one-time projects. Attempts to make a direct transference have always run into problems. I think there is a lot more work needed to clarify all of these problems and their causes. Moreover, what are the best techniques for process improvement in the context of complex projects? These are certainly questions that the *Journal of Operations Management* has an interest in exploring.

INFORMATION SHARING EFFECT ON INVENTORY DECISIONS

Clottee, T., & Benton Jr, W. C. (2020). Sharing Quality-Distribution Information for the Selective Assembly of Intermediary Components in the Automotive Industry. *Production and Operations Management*, 29(1), 174-191.

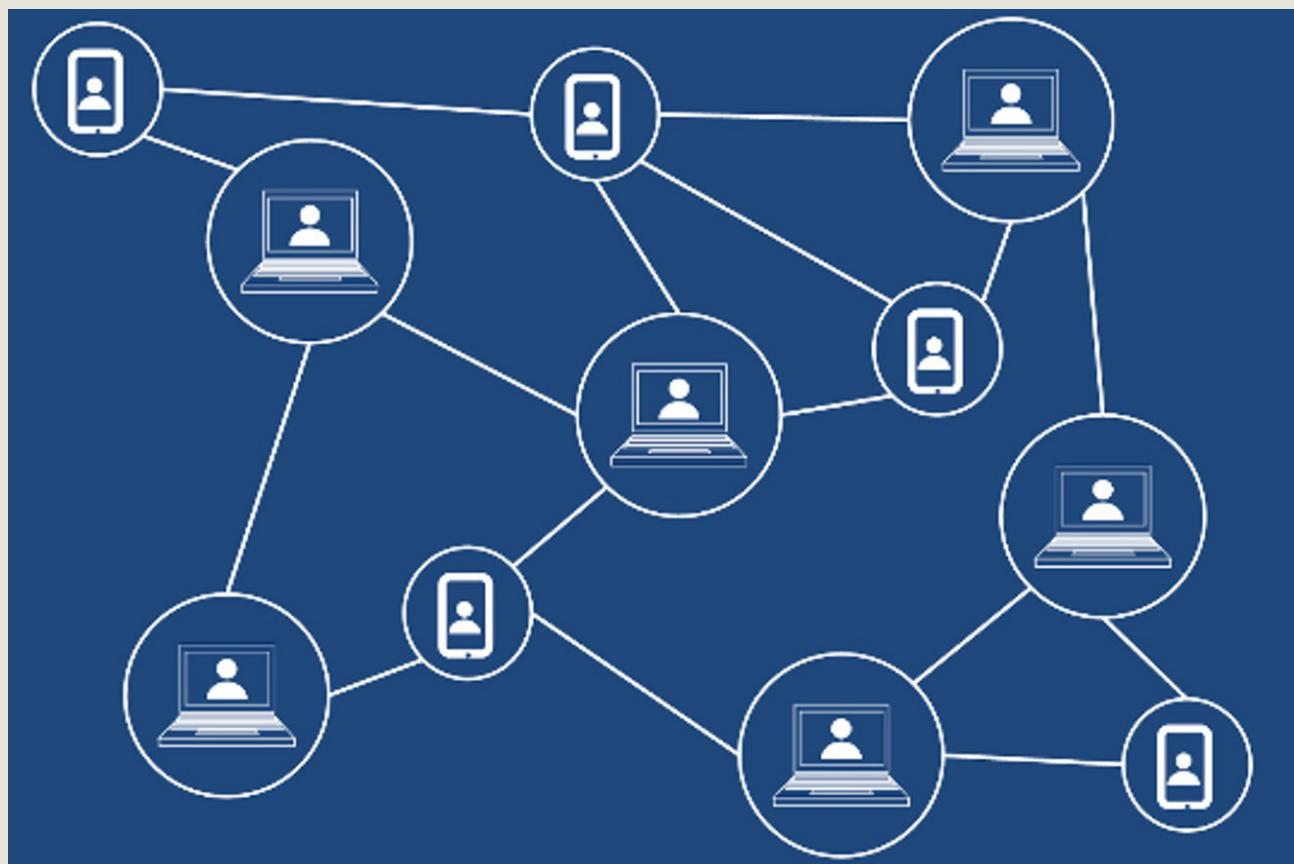
Review by Ben Stover

Background

Information sharing is a critical part of supply chain resilience and robustness. In certain cases, it can be the difference between networks that survive through crises and those that fail. For high-precision manufacturing industries, product variation between assembled parts can cause considerable inventory waste and could result in customer issues from stock-outs. To solve this problem, these manufacturers adopted a matching process to better align certain parts with others to improve the fit of the final assembled product. Generally, this is called selective assembly and the process is called Fixed Bins with Selective Assembly (FBSA). The main issue with this process is that it requires the manufacturer to stock more of each type of component to reduce mismatching. To resolve this issue, the authors suggest another process, which uses an intermediary component that is cheaper, to reduce this inventory risk cost and better account for component dimension variations. This process is called Fixed Bins with Selective Assembly of an Intermediary-component (FBSAI). Even though this process utilizes a cheaper component to help with assembly variation, it can still incur excess inventory costs. The authors attempt to show the effect of process information sharing by the matching component supplier and how this affects the manufacturer's inventory costs.

Key Insights

The authors utilize a Monte Carlo Markov Chain (MCMC) predictive model and historical dimensional data from a Honda manufacturing plant. This data corresponded to an engine assembly process, where Honda produced the engine block, an outside supplier produced the crank shaft, and a third supplier produced the bearing ring that matched the two components. The authors found that when the process variance was shared, the inventory costs were higher than if no information was shared. Due to the lack of understanding of the process mean, the prediction ranges were much wider and thus, more inventory spending is required to compensate. Sharing both the process mean and variance gave the best improvement, followed by sharing just the process mean. The authors also found that the number of component bins affected the possible inventory savings. In this case, two bins were ideal for the information sharing savings, while with three bins, there were minimal savings differences between sharing situations. For assembly-based manufacturers, sourcing lower-cost, intermediary components can offer a significant cost improvement, while further improvement can be earned when the component supplier provides complete quality data from their production. Ultimately, the manufacturer will have to convince their component supplier to provide this information by offering some contractual incentives.



MINI CASE

REDUCING VULNERABILITIES THROUGH SUPPLY CHAIN COMMUNICATION

In the fast-paced situations facing many industries, firms need to communicate with their suppliers and buyers to effectively manage and adjust for different changing trends. Over the recent years, Industry 4.0 has been a driving force in how firms design infrastructure and resilience into their processes. One specific part of Industry 4.0 is edge computing, which utilize IoT devices to gather real-time data and only sends necessary data to a cloud center. This kind of infrastructure requires significant management of security and data governance but has the possibility to reduce communication

barriers in sharing demand and quality data with other supply chain partners. By improving the efficiency of this communication, all parties can make sure they are sending and receiving the correct information, which can provide better supply chain resiliency during certain disruptions.

Image Source: Pixabay

Case Source(s): <https://www.smartindustry.com/blog/smart-industry-connect/mitigating-supply-chain-vulnerabilities-in-the-wake-of-covid-19/>

Remaining Questions

The authors discuss the effect of part dimension information on controlling inventory costs in assembly manufacturing. Further investigation could look at the effect of supplier disruption or unexpected demand changes on the production effectiveness at different levels of quality sharing. This increased supplier communication could positively improve the production resiliency during such disruptions. Additionally, instead of a one-way transfer of tolerance information from supplier to manufacturer, if the manufacturer communicated more specific quality distribution of their process, could the supplier optimize their process to better suit demand and provide more reason for collaborative improvements?

Want to Know More?

An important part of this article is related to interactions between an assembly manufacturer and certain critical component suppliers. Agrawal et al. (2017) provides a good foundation of many of

the benefits and difficulties of relying on suppliers to support an automobile manufacturing process. Matching assembly components is also a critical part of this process and Liu et al. (2013) highlight the usage and supply quality effects of the FBSA improvement technique.

Foundational Classical Studies

Tan and Wu (2012) provide a background of different types of selective assembly techniques, including FBSA. They utilize a similar MCMC predictive model to optimize the number of bins and minimize quality costs associated with component part mismatches. Babai and Dallery (2009) introduce a method that uses demand forecast volatility to predict usage of intermediary components and maintain safety stock of these parts, which is adopted by the authors. Milner and Kouvelis (2002) offer analyses on how information and operational flexibility can improve the inventory decisions of a manufacturing firm based on different scenarios.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. CLOTTEY:

How did you come up with the idea for this paper?

The idea came from one of my coauthors who's also my advisor, my academic advisor on my dissertation, and in one of his MBA classes. One of his students mentioned that they had some issues with inventory at a Honda engine plant in Anna, OH. Those inventory issues had to do with what they called "selects", which later we found out was just selective assembly, although they did it in an unusual way to how selective assemblies are normally utilized. So, my coauthor brought on a PhD student for these projects, and then he thought that maybe forecasting might help them with their inventory management. Then he reached out to me because I had some expertise in forecasting, and so that's how I ended up on this project, even though I didn't know much about selective assembly. We realized that if they forecasted the parts they needed and held safety stock based on those forecasts, which was just the traditional way of setting safety stock, then they could significantly reduce their safety stock level if the forecasts were accurate. We started looking at what information they had access to try and improve the accuracy of the forecast, and that's what led to talking about quality distribution information and how that affects selective assembly.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

One of the difficulties we encountered was the size of the data. This consisted of 12 months' worth of part measurements that we could use to try and estimate our forecasting model. However, they also were constituted of hundreds of thousands of measurements of parts that they

got in the past 12 months. What we needed was a summary of those measurements, so we calculated the mean and standard deviation for all shipments in each month. Once you take the mean and standard deviation of these hundreds of thousands of parts for each month, you only end up with twelve data points. So, we had twelve data points to try and create a forecasting model, which was as accurate as possible. This drew me to using a Bayesian approach, where, with the size of that kind of data over the 12 months, this approach would be one of the few ways that would give me an accurate model. About a year into the project, the PhD student that was doing the analysis decided he wanted to do something else for his dissertation, so I had to jump in and basically debug the code and rewrite large portions of it to get it working so that the analysis could be performed.

After our first submission, one of the first feedbacks we got with you know why we were using this method, and would we have gotten different results if we had used a different method. Therefore, we had to show that the Bayesian method was because of the data and the most applicable for this situation. To do this, we had to dig to find a justification that did not involve the Bayesian methodology to show that you could still get a similar result. The way we did that was utilizing some theory concerning creation of prediction intervals, which helped me explain that this is what the Bayesian method was producing.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

I think when we started off with this project, we really were focused on achieving things for Honda. So, we're really looking at, OK, what

was their problem and how can we fix it? And so, a lot of the decisions we made were based on that.

First, if you've got a research topic based off a consultant project, you may start off really focused on trying to help the company, but you know, as you get dive deeper, you find there may be bigger issues than was originally understood. Fundamental issues that are not only specific to that company, but problems that others had experienced. In this case, we had this fundamental question we were looking at in terms of if your supplier only gives you some information, even though they only required to provide you some information about the shipment that they're going to ship to you, and not all. The bigger question was, what type of information should you solicit from them? That came up because of us. We were just looking at one information that we needed to improve forecasts and therefore reduce costs. If I had to do this again, perhaps I might have looked at more sources.

Looking at the bigger picture, I asked, what are all the sources of information that Honda could get access from their suppliers on or prior to shipment that might enable them to be able to do things better? And, in fact, in discussing it with Honda, they mentioned that the forecasts were useful in helping them reduce costs related to how much inventory they had, but more importantly, the forecast could help them to better calibrate their equipment to match the

specs of the parts arriving from suppliers. This was an expensive thing to do, so they didn't want to go down that road unless they had absolute confidence in the forecast. But this showed that if they received credible information, they could do bigger things than just trying to forecast and reduce inventories.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

I'm working on a project there where we're looking at safety tolerances in the Selective Assembly context. Specifically, what kinds of information does a manufacturer or an assembler like Honda have access to for making some of these decisions? I can see myself doing future research in different areas in terms of how they're utilizing these things and trying to figure out you know which information is more important than others, like what I did with Honda. It might be useful to partner with colleagues in the engineering department to see you know if they have some more insights into these situations. This could be related to what information to solicit from an external supplier that would just make things easier from a manufacturing standpoint. Also, what might be the implications for whether it's designing stuff for re-calibrated equipment or modifying internal processes. I think a big need for further research in that area, so that's what I see myself doing in future.

DO GREATER DISTANCES BETWEEN SUPPLIERS IN AUTOMOTIVE SUPPLY CHAINS AFFECT PRODUCT QUALITY?

Based on Bray, R. L., Serpa, J. C., & Colak, A. (2019). Supply chain proximity and product quality.

Management Science, 65(9), 4079-4099.

Reviewed by Hyunsuk Baek

Background

Manufacturing companies prefer close proximity to their suppliers' factories because this proximity reduces costs related to monitoring, collaboration, and fixing problems. By decreasing the shipping distance, it can also reduce the potential damage during shipment of parts. For those manufacturers that value close proximity to their suppliers, this can help build positive relationships from supplier investments and can increase their chance of being selected by these manufacturers. Previous literature investigated the trade-offs between labor costs and distance for buyers and suppliers in the automotive manufacturing industry. Other studies have looked at trade-offs between flexibility (volume and number of product models) and quality. This study investigates the trade-offs between distance and product quality. The authors combined four independent data sets for the auto industry by the product level, empirically studied how the distance between manufacturer and supplier influenced the defect rate of auto components and investigated the factors that moderated the effect of distance.

Key Insights

The authors indicated that distance has negative effect on the defect rate. The authors also studied how other factors, such as generation of a model,

component complexity, investment size in research and development, whether a model is high end, and whether supplier and manufacturer are located in different countries, influence their findings. For example, they found that proximity is more important for a complex component of a first-generation, luxury model, which was assembled in a different country, than for a simple component for a seventh-generation standard model, which was assembled in the same country. So, proximity and these other factors should be considered in the facility location decisions and how to allocate product models to these facilities. Additionally, the authors found that quality systematically improved over time, but it improved more slowly when the supply chain was longer. Proximity was a substantial factor that influenced both the current and future performances.

Remaining Questions

From the perspective of the manufacturer, which is more important: proximity of supplier or proximity of market? To investigate the trend and take advantage of customs regulations, proximity to market may be more important. For a more efficient R&D operation, proximity to suppliers may be more important. How can we use data to prevent the product damage during shipment? Sensor data



MINI CASE

THE FACILITY LOCATIONS OF HELKAMA VELOX

Choosing a manufacturing location is related to many factors, such as initial capital investment, labor pool, supply chain, logistics, etc. Interdependence between operations within a company is one of the primary factors, including not just production but also research and development (R&D). According to recent studies, this interdependence is more important when a company develops and produces a technologically demanding product. Conversely, for a more standardized product, a production facility can be moved far away from other operations. Helkama Velox is Finnish bicycle manufacturing company. Helkama Velox moved

the manufacturing facility of Kaunotar model, a standardized product of the company, to follow a partner company in Indonesia. On the other hand, Helkama Velox decided to manufacture Jopo model in a domestic facility. Jopo model is a more customized model with a variety of possible colors and features. By doing this, the company gets the flexibility to react to the changing demand for these special models.

Image Source: Unsplash

Source: <https://www.engineering.com/AdvancedManufacturing/ArticleID/14525/Proximity-to-Manufacturing-Improves-RD-Efficiencies.aspx>

that measures environmental factors and handling factors could be used to monitor the products during shipment.

Want to Know More?

Robinson et al. (2005) defined supply chain quality management (SCQM) as "the formal coordination and integration of business processes involving all partner organizations in the supply channel to measure, analyze, and continually improve products, services, and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace". The proximity between the supplier and manufacturer could be one of the primary factors in SCQM. Xu (2011) studied information architecture for SCQM. The proximity between supplier and manufacturer

is important in the current environment, where there have been many innovative technologies and volatile customer requirements. Ketokivi et al. (2017) and Gray et al. (2017) studied the factors that influenced manufacturing facility locations in volatile environments and explained the changing trend of determining facility locations. They indicated that decision making for the facilities locations is complex, since it should consider many factors, such as markets, logistics, R&D, etc.

Foundational Classical Studies

The detailed concept, definition, and related research question of SCQM were introduced by Robinson et al. (2005). This article used B-spline functions and other econometric models as described in the textbook by Hansen (2017).

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. BRAY

**How did you come up with the idea for this paper?**

The supply chain discipline lacks data. So, when my coauthor Ahmet Colak discovered the Who Supplies Whom (WSW) dataset, which describes various auto supply chains, we saw potential for a new supply chain paper. We had previously used the NHTSA defect reports data. And the only thing we could really get from the WSW data was the physical distances between upstream supplier factories and downstream auto assembly plants. So, doing the obvious thing, we regressed the auto part failure rates, from NHTSA, on the supply chain distances, from WSW.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The WSW dataset listed the suppliers' names, but not their factory locations. To get these locations, we needed to merge the WSW dataset with the Orbis dataset. And this merge was difficult, because we had to join the tables by supplier name, a messy text-string variable with no standard format. To help merge these

tables we brought Juan Serpa onto the project, as he had done similar text-string matching.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Well, the final draft isn't exactly how I wanted it, as Juan Serpa, Ahmet Colak, and I had different visions for the paper. We had to make compromises with one another. So, if I could make some changes, I would cut Figure 8, which I've always hated, and I would downplay the interaction effects, which Juan insisted on. (I'm sure that Juan would cut some things that I insisted on, if he could.) Also, the conclusion got screwed up when the article was typeset for Management Science, so I would correct that.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

The WSW dataset is quite rich — I think it could probably support another paper or two.

INNOVATION, NEW PRODUCT DEVELOPMENT, AND PROJECT MANAGEMENT

Research and development projects can be very high-risk undertakings, due to their large investments and uncertain outcomes. Operations managers need innovative ways of improving their odds of success with such high-risk R&D projects. The articles in this section will enable managers to apply novel techniques and address often overlooked areas during their R&D decision making and planning process. Once an R&D project has been commercialized, managers can use these ideas to assess future alliances and manage their revenue streams.

Topics in This Section

Can the Performance of Biopharmaceutical Alliances be Predicted?

Based on Niyazi Taneri and Arnoud De Meyer (2017). Contract Theory: Impact on Biopharmaceutical Alliance Structure and Performance. *Manufacturing & Service Operations Management*, 19 (3), 453-471.

Empirical Research Bio-medical Sector

What is Holding Up Your Product Development Projects?

Based on Subramanian, A. M., & van de Vrande, V. (2019). The role of intellectual capital in new product development: Can it become a liability?. *Journal of Operations Management*, 65(6), 517-535.

Empirical Research Bio-medical Sector

When Is Royalty Optimal in Technology Supply Chains?

Based on Junghee Lee, Vish Krishnan, Hyoduk Shin (2020). Business Models for Technology-Intensive Supply Chains. *Management Science*, 66(5), 2120–2139.

Analytical Research Manufacturing Sector

CAN THE PERFORMANCE OF BIOPHARMACEUTICAL ALLIANCES BE PREDICTED?

Based on Niyazi Taneri and Arnoud De Meyer (2017). Contract Theory: Impact on Biopharmaceutical Alliance Structure and Performance. *Manufacturing & Service Operations Management*, 19 (3), 453-471.

Review by Rohan Korde

Background

In this study, an innovator refers to the party that holds the intellectual property prior to an alliance, and a partner refers to the party that gets involved once the alliance is formed. Alliances between an innovator and a partner create value by utilizing their complementary capabilities. The two commonly found archetypes of alliance structures in biopharmaceutical industry are: sequential and collaborative. In a sequential alliance, for the most part, the partner takes over going forward. In a collaborative alliance the partner and the innovator exert joint efforts. This paper seeks to understand what drives the alliance structure: the choice between collaborative alliances where the parties exert joint efforts and sequential alliances where the partner takes over going forward. Based on contract theory, this study focuses on private asymmetric information, holdup, and risk-aversion concerns.

Key Insights

Private information hinders the formation of strategic alliances but can be overcome by sending a credible signal. When innovators are risk averse and should higher risk be encountered, then the alliance will likely be of the sequential type. Risk aversion can be addressed by transferring risk from the risk-averse party to the risk-neutral (or less risk-averse) party.

For alliances that involve higher risk, the risk can be transferred to the partner through a sequential alliance. Based on empirical analysis, this study found that when the two parties choose a different type of alliance than what the model proposed, then there was a higher probability of ending the alliance.

Remaining Questions

Future research should test the implications of contract theory for NPD alliances in other industries such as consumer electronics, where alliances are common, but product lifecycles are much shorter. This would lead to further understanding of whether the findings from this study can be generalized across industries or are specific to biopharmaceutical industry.

Want to Know More?

In a sequential investment game where a provider invests in research effort and a client invests in development effort, Bhattacharya et al. (2015) show that milestones, along with a verifiable signal from the FDA, can address moral hazard, risk aversion, and the holdup problem. Crama et al. (2017) show that control rights, options, and alliance timing can be used to address moral hazard and private information. Schilling and Phelps (2007) find that firms embedded in alliance networks that exhibit dense local clustering and high reach have greater



MINI CASE

PHARMACEUTICAL SOLUTIONS PROVIDER SKILA LAUNCHES IALLIANCE

Alliances play a critical role in the pharmaceutical industry. An alliance partner represents the opportunity to quickly acquire resources - therapeutic expertise, market access, and marketing expertise - and share costs and risks. As a result, revenue from pharmaceutical alliances have almost tripled over the last decade and currently represent over 25% of total revenue. While pharmaceutical alliances can be lucrative, their formation is fraught with challenges that threaten their success. Skila's vast experience with alliances and partnerships led to the development of Ialliance, Skila's next generation Alliance Management Solution, which was developed so that pharmaceutical alliance partners can meet the key challenges

head on. "Product development and launches are very complicated endeavors for the pharmaceutical industry. Adding an alliance partner into this process raises this complexity exponentially", commented Simon Mason, Skila's Senior VP of Client Partnerships. "Our unique and proven approach with Ialliance enables pharmaceutical companies to optimize the promised potential of alliances".

Image Source: Pixabay

Case Source(s): Pharmaceutical solutions provider - Skila - launches Ialliance - the next generation of alliance management solutions designed to maximize pharmaceutical alliance opportunities. (2005, May 11). PR Newswire

innovative output. In the NPD domain, Sampson (2004) finds that deviations from predictions about the choice between equity joint ventures and pooling contracts leads to poorer performance in R&D collaborations.

Foundational Classical Studies

Akerlof (1970) shows that the presence of private information can lead to the collapse of markets, destroying value for all parties involved. A solution to the problem is proposed by Spence (1973). To address the problem, the holder of private information may be able to carry out an action that credibly conveys, or signals, the information it has to the other party. The party that incurs a lower cost to send the signal can do so and segment the market, thereby alleviating the problem. Another key problem addressed by contract theory is the

holdup problem. Hart and Moore (1990) take the view that ex post renegotiation of an incomplete contract occurs under conditions of symmetric information - both parties can see what has been left out of the contract - and when there are no wealth constraints, the bargaining proceeds efficiently. Inefficiencies arise solely because ex ante investments are distorted. In 2016, Oliver Hart and Bengt Holmstrom were awarded the Nobel Memorial Prize in Economic Science for building the foundations of contract theory. How are contracts constructed in the presence of information asymmetry? How do you address moral hazards in principal-agent relationships? What are the potential pitfalls in contract design? These are some of the questions that contract theory attempts to answer.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. TANERI:

**How did you come up with the idea for this paper?**

Much of the literature in OM about partnerships for R&D—including our prior work—views the problem with a game-theoretic/contract-theoretic lens, which is appropriate for studying strategic interactions. We realized that there was a gap in the literature with a need to empirically test or validate the theory developed by those papers. As we explored the question, we also wanted to go one step further to answer the “so what?” question. This is why we also study counterfactuals: Even if most firms align with theory, are there consequences for those firms that deviate from theory?

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

While finding data on publicly traded firms was just a matter of database subscription, it was a substantial effort to get information on private firms. For each private firm, we had to comb through many company profiles, industry reports, announcements, and company websites. Another, perhaps behavioral, challenge was letting go of some of the work that we had already done (like a game theoretic model aligned with the empirical results) as part of the revision process. Reflecting on the process, we can say that it works: The paper now elucidates its key ideas in a more focused manner, allowing us to have a more readable paper with well-defined contributions.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Ultimately, as business school professors, in addition to research impact, we aim for our work to have impact on practice. To that end,

after publishing the paper, we developed an online tool based on the data and models in the paper (available here: <https://niyazitaneri.com/online-tools>) that firms can freely use to check what form of alliance firms with similar characteristics are likely to form. Our interactions with companies and subsequent research also hint that immediate gains may be more persuasive toward inducing action than longer term performance. Therefore, if we were to do this again, we would make use of the subset of data on publicly traded firms to test the immediate stock market value impacts of aligning alliance structure with theory.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

We firmly believe that it is important to create a cycle of theoretical prediction, followed by empirical validation, and then theoretical model refinement across papers in our field. Prior work modeling the interaction between R&D partners has typically assumed risk-neutrality for all parties. Our work indicates that smaller biotech companies place more emphasis on project risks than their larger counterparts. Future work may thus consider these and other behavioral differences across firms in their models. We also note that papers naturally focus on firms' internal incentives on internal outcomes or cross-firm incentives on cross-firm outcomes. A further avenue of research could be to investigate the impact of intra-firm incentives on inter-firm outcomes. From a practical perspective, we notice that firms' incentive schemes place emphasis on *which* alliances are pursued. Our work can help to ensure that firms focus just as much on *how* to structure those alliances. As we show, doing so will have positive performance implications.

WHAT IS HOLDING UP YOUR PRODUCT DEVELOPMENT PROJECTS?

Based on Subramanian, A. M., & van de Vrande, V. (2019). The role of intellectual capital in new product development: Can it become a liability?. *Journal of Operations Management*, 65(6), 517-535.

Review by Ben Stover

Background

There are inherent risks involved with new product development, which can make the process long and costly for the involved firm. However, many of these risks can be mitigated by leveraging the experience of their R&D managers and staff. Similarly, very structured processes can be implemented (i.e., stage gate process) to prevent projects from prematurely progressing if they do not pass certain standards. Previous advances in new product development research have shown that a firm's R&D knowledge base can significantly improve their ability to innovate and drive return on investment from development projects (Subramaniam and Youndt, 2005). The intellectual capital of a firm includes its human capital (people involved in development process), structural capital (recorded body of knowledge and experience), and social capital (importance of relationships in organization). In contrast, other research has found evidence to speculate that these innovation resources might hinder a firm's ability to terminate failing development projects. The authors of this article further argue that this intellectual capital does directly affect how long a firm will maintain a development project. Additionally, they investigate how previous experience with terminated projects and the firm's project portfolio size can potentially reduce the unfavorable effect of intellectual capital on a firm's commitment to these types of projects.

Key Insights

When large amounts of intellectual capital were associated with a failing project, it would take longer to eventually terminate it. More specifically, human, structural, and social capital were found to inhibit the firm's tendency to terminate these projects. The human aspect is related to biases about perceived losses, fear of failure, and larger resource availability for larger development groups. These effects can amplify when development groups become larger. The structural aspect corresponds to limitations of a development group to search outside their current body of knowledge. Limited knowledge in possible alternative areas can inhibit firms' investment resources to the failing project instead of terminating and investigating elsewhere. Finally, the social aspect affects project termination in a similar manner as the human aspect, but with an increased focus on the expectations of different collaborative groups. Larger amounts of interconnectedness can lead to increased groupthink and expected conformity that leads to the continuation of failing projects. Contrary to the conventional wisdom, more experience with failed projects can lead to longer duration of failing projects. This could be due to an increased expectation to produce successful projects and/or a lack of a project post-mortem learning system. Additionally, under high human or structural capital, the more simultaneous development



MINI CASE

EFFECT OF COVID-19 ON VACCINE DEVELOPMENT

Normally, vaccine development is a lengthy process which can take many years. However, with the COVID-19 pandemic and many people dying, there has been an increased pressure on the pharmaceutical industry to develop a vaccine as quickly as possible. Regardless of this pressure, there are still FDA-regulated steps that these drug companies must follow and pass to present a working vaccine safely and effectively to the public. In 2020, both Johnson & Johnson and AstraZeneca have paused their development process in Phase 3 due to unexpected complications with patients. Additionally, Eli Lilly has suspended testing of

two potential COVID-19 drugs (ACTIV-3 and Remdesivir) because of undisclosed safety issues. In these specific cases, there are both significant social and economic reasons to keep progressing their development projects, but they must still maintain the safety and ethical balance to produce an effective solution.

Image Source: Pixabay

Case Source(s): <https://www.npr.org/sections/coronavirus-live-updates/2020/10/13/923225994/johnson-johnson-vaccine-trial-paused-due-to-unexplained-illness-in-participant>

projects were present, the shorter failing projects would last before termination.

Remaining Questions

The authors of this article emphasize the effects of a firm's internal development resources and decisions on their ability to produce new products. However, many other effects can originate from the outside of a firm's ability to control, for example, government regulations. If government regulations became stricter, would this put more pressure on these firms to terminate these projects earlier? In addition, just as a firm's past experience matters, so a rival firm's past experience matters to the focal firm. The authors investigated the difference in project discontinuation across industries but found that competition level did not significantly drive any difference. However, one can expect that the discontinuation experience of competitors potentially would reduce a firm's development project length. Would it really matter? Finally, like the mini case subject, how would the level of societal need (i.e., disease severity) affect the rate of project discontinuation?

Want to Know More?

Shepherd et al. (2014) provide one of the few other data-driven analyses of managerial behavior

effects on delayed project termination timing. They study the immediate and lasting effects (both positive and negative) on project team employees after a delayed project is finally terminated. The authors of the current article also use this data set to investigate the effect of early-stage versus late-stage drug development on the time to project discontinuation (Subramanian et al., 2020). They also provide insight into optimum project exit points so the firm can effectively redeploy resources to more successful development projects.

Foundational Classical Studies

The role of intellectual capital on improving a firm's innovative capabilities was studied extensively by Subramaniam and Youndt (2005), which was a foundation used by the authors of the current article. This article also studied the interaction effects between the different types of intellectual capital (human, structural, social). Green et al. (2003) performed a survival analysis (hazard ratios) on predicting the effects of project termination on managerial decisions and industry context, like the current article. Schmidt & Calantone (1998) study different scenarios where managers will maintain and fund certain failing development projects, on which the current authors based their main dependent variable.

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BEHIND-THE-SCENES



INTERVIEW WITH PROF. SUBRAMANIAN AND VAN DE VRANDE:

How did you come up with the idea for this paper?

A comprehensive study of R&D productivity warrants careful attention to both successful and failed R&D initiatives. Studies related to technology and innovation management have given a lot of attention to successful R&D initiatives. While this body of work has underlined the significance of failed R&D activities, not many studies have delved deeper into investigating failed R&D projects, partly due to data unavailability. Therefore, we were actively looking for opportunities to study failed R&D projects. The moment we stumbled upon this prospect of studying discontinued new drug development initiatives, we immediately jumped at it. As we read more about dwindling R&D productivity of biopharma industry, we were awestruck to know that some of the traditional success factors of this industry could indeed trap firms in mishandling their failing R&D projects, thereby escalating commitments to failing course of action. This was the genesis of our research, which explores how intellectual capital can lead to escalation of commitment, thereby delaying the discontinuation of failing drug development projects.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Data featured in our research is both the strength and weakness of the study. In our eagerness to investigate failed R&D initiatives, we relied on secondary data source to gather information on a good number of discontinued drug development projects. However, a study on escalation of commitment warrants careful

understanding of the context in which the R&D project is executed and also requires information on key decision-makers. Gathering such context specific information from secondary data source is unlikely. This weakness hit us at every stage, including the revision process. However, with several constructive suggestions from the editor and reviewers, we were able to handle the shortcomings and turn it around into a strength.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

If we were to do the research again, we would have augmented the study with one of the following approaches: (a) in-depth case studies on a couple of new drug development initiatives, especially those that are going through uncertain trajectories like drugs developed to treat COVID-19 (b) build an analytical model that can potentially compensate for our inability to measure escalation of commitment.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

While the published paper proves escalation of commitment to be a challenge for new drug discovery projects, we have extended the research by looking at means through which firms can overcome escalation of commitment. We have taken two different approaches to address escalation of commitment. First, we investigate how firms can optimize time allocation to new drug development projects, which will naturally tackle the escalation of commitment concern. Second, we explore how firms can leverage their experiential learning in overcoming escalation of commitment. We adopt multi-method (analytical model and empirical analysis) for both approaches.

The projects are receiving good traction, with one of them being accepted for publication in Production and Operations Management Journal. The other project is under review in a leading journal. The above research portfolio has several implications for research and practice concerning R&D project failures, especially in diverting firm resources from underperforming projects to promising R&D initiatives.

Future research in the area could further tease out the factors that help firms mitigate their tendency

to escalate commitment. The role of firm-strategy is one area that deserves more attention. For instance, some firms may continue with risky, underperforming R&D projects to project themselves to be at the forefront of innovation or mislead the competitors. Additionally, given the benefits of extending R&D initiatives beyond firm boundaries, along with a trend towards more open innovation, interorganizational collaborations are expected to increase in the near future. These developments might alter a firm's decision to continue or discontinue R&D projects.

WHEN IS ROYALTY OPTIMAL IN TECHNOLOGY SUPPLY CHAINS?

Based on Junghee Lee, Vish Krishnan, Hyoduk Shin (2020). Business Models for Technology-Intensive Supply Chains *Management Science*, 66(5), 2120–2139.

Review by Ning Ma

Background

In multtier Technology-Intensive Supply Chains (TISCs), technology providers (TPs) provide technologies and intellectual property (IP). The technologies are embedded in manufactured subsystems like electromechanical components by subsystem suppliers, which are integrated into finished products by full system manufactures. TPs monetize their IP by obtaining royalty, which consists of royalty rate and royalty base. In multtier TISCs, a TP can choose the subsystem or the full system as the royalty base. This paper investigates whether the TP is better off with a subsystem or a full system royalty base.

Key Insights

There is a trade-off between the incentives for downstream firms' investment in product quality and the technology provider's investments in technology. The optimal royalty base depends on the consumers' willingness to pay for a unit of product's quality. When customers do not differ significantly, TP should implement the subsystem base royalty approach (SSB) to serve all customers. TP should change from SSB into a full-system base royalty approach (FSB) as the level of market inequality increases. By applying FSB and setting a lower royalty rate, a higher per-unit royalty payment from high-end manufacturer emerges, resulting in TP receiving increased profits. When the proportion of the high-segment customers becomes dominantly

large, TP should also implement SSB but only serve customers who are willing to pay a higher unit price for the product.

Remaining Questions

The overall product quality depends on the technical quality of the TP and the system quality of manufacturers. However, the impact of TP and manufacturers may not be the same, and it could also be impacted by subsystem suppliers. Therefore, considering a vertically integrated product line with a weighted sum of components could be a more realistic alternative. Moreover, there is no specific monopolist behavior that can determine the key aspects of downstream products, especially with the enhanced investment of R&D of substitute firms and downstream firms. When the downstream firms become less dependent on the technology providers, the strategic decisions of TPs have to be adjusted accordingly. What business models are effective under customers' perception of quality? Customers also pay attention to other aspects of the products, especially the product launch time of highly technological products in ITSCs. With the trade-off between quality and timeliness, customer behavior, and the market competition situation change, how might the royalty base decisions change?



MINI CASE

SHOULD QUALCOMM PERSIST IN ITS ROYALTY PLAN?

Qualcomm Inc. became one of the world's largest chip manufacturers because of their power over patents, and the majority of Qualcomm's profit is from patent royalties paid by handset manufacturers that use their chips. In countries that apply Qualcomm's technologies, China accounted for roughly half of their revenue in 2015. However, China's National Development and Reform Commission (NDRC), which has been investigating the company since November 2013, found that Qualcomm violated the country's anti-monopoly law. One of the allegations is that Qualcomm required royalties to be based on the selling price of mobile phone handsets. In February 2015, Qualcomm agreed to resolve the NDRC's investigation by paying a fine of \$975 million and proposed a "rectification plan" in which it committed to charging royalty fees separately based on the technologies the firm used. Qualcomm's use of the wholesale price as a base for royalties has been a major complaint

of handset manufacturers and one of the factors in antitrust complaints against the company in other markets, including the U.S. and Europe. Later, in 2017, Apple also sued Qualcomm for "charging royalties for technologies they have nothing to do with". Although policy makers and downstream manufacturers complained about technology providers' royalty plan, those technology providers argued that such a full-system base royalty business model is optimal. This gives rise to questions about the validity of such a policy, especially when considering marketing characteristics such as customer behavior and competition.

Image Source: Pixabay

Case Source(s): <https://www.lexology.com/library/detail.aspx?g=6cdde083-c980-4726-ac45-2405f740c2ed>
<https://legal-patent.com/patent-law/apple-versus-qualcomm-licensing-agreement/>

Want to Know More?

Hu et al. (2017) considered technologies owned by downstream manufacturers rather than by upstream TP. They studied the competing manufacturers' open-technology strategies and mentioned the conditions of sharing proprietary technology with competitors. This was aimed to spur investments by a common supplier. Wang et al. (2018) studied technology supplier's licensing decisions in multiparty networked supply chains. The TP can license to either a decentralized supply chain with a designer and a producer or a traditional vertical supply chain with an integrated device manufacturer. They showed that the network model could outperform the integrated configuration and suggested that a downstream firm can be better off decentralized with design and manufacturing functions taken by different firms.

Foundational Classical Studies

Technology licensing literature could be traced back to Arrow (1962), and early literature has proposed two types of licensing: fixed fee and royalty (Katz and Shapiro 1985, 1986, Savva and Taneri 2015). Royalty-based licensing has been more widely used in practice nowadays, and literature provides the reason for its popularity (Kulatilaka and Lin 2006, Savva and Taneri 2015). Moreover, the literature divides royalty licensing into per unit and ad valorem approach and compares them under different settings, for example, risk sharing (Bousquet et al. 1998), Cournot duopoly (San and Saracho 2010), and information asymmetry (Heywood et al. 2014). Another research stream related to this study is new product development with heterogeneous customers. This study is closest to Moorthy and Png (1992), which studied the introduction policy of two differentiated products targeting two customer segments with differing valuations of quality, and the decisions are analogous to this article's market coverage strategies.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. LEE:

How did you come up with the idea for this paper?

I have been always interested in new products and new technologies. In 2015, the news that Qualcomm to pay the highest fine in China immediately got my attention. The company was the one of the largest employers in San Diego, where I did my Ph.D. Moreover, several MBA students from Qualcomm talked about this matter in class that I TA'ed. I looked at the case from a supply chain perspective. The Qualcomm's supply chain seemed a very new to me, and I decided to work on it.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

On one hand, we were asked whether the model captures all the important characteristics of the issue. On the other hand, we were asked whether the model makes the matter extra-complicated. It was quite a dilemma.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

As technologies and intellectual properties are intangible products, there can be a variety of practices regarding how they are sold and adopted. Qualcomm is just one company with its own unique practice. I believe that there are more technology providers with interesting ways of distributing their technologies.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

There are two ongoing projects. One is about Qualcomm's another unique practice, cross-licensing between the supplier and the manufacturers. The other is about technology adoption in developing economy.

BEHAVIORAL AND DECISION- MAKING ISSUES IN OPERATIONS

Behavioral research in supply chain management has grown in importance over the last few years. Previously overlooked concepts in behavioral science have been assessed by recent research studies. These concepts address many shortcomings of previous decision-making models by correcting for some of their underlying biases. In addition to lab experiments, now researchers have additional sources for testing their theories, such as Amazon's MTurk, which can provide an online, worldwide community of human respondents. These articles present managers with choices and information about conducting behavioral studies in operations management.

Topics in This Section

Forecasting Models Using Less-than-Perfect Decision Makers

Based on Tong, J., & Feiler, D. (2017). A behavioral model of forecasting: Naive statistics on mental samples. *Management Science*, 63(11), 3609-3627.

Analytical Research Multi-Sector

Providing Context to Supplier Managerial Mimicry of Buyers

Based on Reusen, E., Stouthuysen, K., Roodhooft, F., Van den Abbeele, A., & Slabbinck, H. (2020). Imitation of Management Practices in Supply Networks: Relational and Environmental Effects. *Journal of Supply Chain Management*, 56(1), 54-72.

Empirical Research Manufacturing Sector

Is Amazon's Mechanical Turk the Right Fit for Your Behavioral Experiment?

Based on Yun Shin Lee, Yong Won SEO, Enno Siemsen (2018). Running Behavioral Operations Experiments Using Amazon's Mechanical Turk. *Production and Operations Management*, 27 (5), 973-989.

Empirical Research Multi-Sector

FORECASTING MODELS USING LESS-THAN-PERFECT DECISION MAKERS

Tong, J., & Feiler, D. (2017). A behavioral model of forecasting: Naive statistics on mental samples. *Management Science*, 63(11), 3609-3627.

Review by Ben Stover

Background

Humans are not always rational, as such, forecasting models that rely on statistical methods and assume that people will have perfect knowledge of the problem's current state and its natural variability around that state are flawed. The reality is that decision makers will usually make choices and predictions based on their current perception of the problem, not its actual state. Past research has focused on using behavioral economic concepts like utility to improve their forecasting models, but they still relied on the decision maker having perfect understanding of future state. In this article, the authors bridge this modeling gap by implementing naïve intuitive statistics from psychological perspectives and concepts to help understand how incomplete information and biases can affect forecasting models. The authors present two models in this article: a "perfectly rational" model and a naïve "behavioral" model. In the case of a perfectly rational model, the decision maker knows all possible outcomes and their variability. However, a naïve behavioral model assumes that the decision maker only has a small subset of possible solutions to a problem and their understanding of the variability is based on this subset. Utilizing a naïve behavioral model, the authors show how it better explains different behavioral phenomena.

Key Insights

People tend to assume that there is no bias associated with the mean and variance of decision

outcomes and will also underestimate the variance of these outcomes. Related to the effect of specific behaviors, insights from four phenomena from forecaster dispersion, overconfidence, the gambler's fallacy, and nonbelief in the law of large numbers will be discussed. First, forecaster dispersion refers to the occurrence where multiple decision makers will make different forecasting assessments. While larger amounts of dispersion in small number of forecasters can indicate lack of confidence, larger numbers of forecasters can help predict the actual variance in real demand. Second, overconfidence refers to the situation where decision makers assume that their forecasting accuracy is higher than reality. In a perfectly rational model, the assumption is that the decision maker knows all possible outcomes and variation for the problem and thus can be perfectly confident. However, a naïve behavioral model notes that the decision maker's forecast variability is an underestimate of reality. This effect can be portrayed in an ordering situation for a newsvendor model, where safety stocks may have to be increased considerably due to variability underestimation and incorrect understanding of actual demand need. Lastly, the concepts of the gambler's fallacy and nonbelief in the law of large numbers are inverse situations to each other. The first phenomenon relates to the idea that people will assume that a small number of low-valued outcomes can be used to fully understand the overall number of outcomes, which will result in underestimation. In a customer



MINI CASE

FORECASTING COVID-19 SPREAD BY DIFFERENT METHODS

With over 200,000 deaths due to COVID-19, it is critical for governments and health officials to have good predictive models of the future. However, this can be difficult due to the limitations of forecasting models and the variability of how officials are determining these models. Instead of focusing on predicting exact outcomes beyond four weeks in the future, officials are relying on these models to show more specific improvement areas in the two to three-week period. Beyond the four-week period, models can be utilized to predict trends to help local

governments and businesses generally plan for certain risks. They are also finding that even though there is a larger variability in individual forecasting models, aggregating these models can produce much more accurate predictions as compared to individual ones.

Image Source: Pixabay

Case Source(s): <https://www.washingtonpost.com/outlook/2020/09/15/scientists-want-predict-covid-19s-long-term-trajectory-heres-why-they-cant/>

queuing model, this situation would parallel customers that see a short line and underestimate its wait time. The second phenomenon is similar but with incorrect perceptions of high-valued outcomes, which will result in overestimation. In a similar queuing situation, customers that see a long line could considerably overestimate its wait time. This naïve behavioral model's purpose is to illustrate the effect where managers and consumers make decisions with imperfect information and the importance of separating certain selection decisions from the forecasting process.

Remaining Questions

The authors introduce behavioral models that describe how individual people make decisions and forecasts based on their current information and biases. However, if the decision maker was part of a company, then there could be an information bias from upper-level managers and top management teams. Future work could be done to see how management concepts like trickle-down effect could shift a lower-level manager's biases when it comes to forecasting. More generally, corporate culture might influence the forecast bias and training methods of future managers. Other studies could utilize event analysis to investigate potential shifts of manager forecasting biases after major supply chain disruptions. Would age become a moderating factor in this effect, where older managers who experienced

more disruptions during their tenure might adjust their biases differently than younger managers?

Want to Know More?

Su (2008) provides good background on how firms can optimize profits in newsvendor models under assumptions of non-ideal rationality and systematic biases. Croson et al. (2013) explains how the field of behavioral operations management has developed over the years and future directions. To learn more about overconfidence in demand forecasting, Croson et al. (2008) provide models where the expected forecast is accurate but with a different understanding of the problem variability.

Foundational Classical Studies

The statistical background for the naïve behavioral model come from three foundational articles. Fiedler & Juslin (2006) explain the purpose and methods of implementing certain psychological principles to improve the study of decision-making processes. Juslin et al. (2007) describe how naïve statistics can be applied to understand overconfidence behavior in the decision-making process. Tversky & Kahneman (1971) explore the effect that a person's limited knowledge about certain relevant events has on their ability to make decisions related to that specific event.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. TONG:

**How did you come up with the idea for this paper?**

This paper evolved even more than usual over the years that my coauthor (Dan Feiler) and I worked on it, so it is hard to pinpoint the exact genesis of the paper. In some broad sense, this project partially grew out of my desire to connect the analytical modeling world in OM and the JDM world that I had both been learning about during my PhD. I wanted to translate some of the things I had been learning from the behavioral decision-making and cognitive psychology literatures to the OM modeling community. Also, at the time, several papers in behavioral operations management had been exploring random error and risk-preferences in decision-making – making the natural but strong assumption that individuals have accurate beliefs about the underlying random variables. Having previously worked on a project with Dan that focused more on the judgment and forecasting side, I was curious to see if he and I could similarly capture JDM findings on random errors and biases in beliefs in a portable way to OM models.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

This paper was one of my hardest to write and publish for a few reasons – most I think due to inexperience on my own part. The first version got some fairly negative feedback, which was pretty discouraging for two assistant professors. It contained both models and experiments and I think we tried to be too many things to too many people – we didn't have a clear enough audience and contribution in mind. Part of the challenge was that the type of contribution we were making, in my opinion, is not as common as some of the other papers I've written so we didn't have a clear "template" to follow. Another challenge we faced was that the paper is interdisciplinary. I love interdisciplinary work, but it has its challenges – do

you pick only one audience? Where can you publish that is good for both coauthors?

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

This paper was a huge learning experience for me, so in that sense I would not want to do it differently. (Of course, it also helps that it was eventually accepted!) The way we approached the paper was certainly not the most efficient, though. I think at one point I literally opened a new blank document and started over. (A move Dan now calls "Pulling a Jordan," as in "Please let's not pull a Jordan.") For PhD students and assistant professors though, efficiency can be extremely important. So, I would probably advise my past self to mostly pursue projects for which you can more clearly define the contribution up front. For example, name 3-5 people in the field who you think would easily understand, appreciate, and cite that contribution. And more consciously specify early on who exactly will use your finding and how they'll use it. If it is other researchers, exactly which ones and how will they use it? If it is practitioners, exactly which ones and what should they do?

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Because of the nature of this work, I think the primary audience is other researchers. From a research perspective, one opportunity is to embed this behavioral forecasting model into larger models of OM systems to generate system-level predictions that one can test in the lab or field. I think the model is rich enough to generate both descriptive and prescriptive insights that are testable – and have worked on some of them myself.

PROVIDING CONTEXT TO SUPPLIER MANAGERIAL MIMICRY OF BUYERS

Based on Reusen, E., Stouthuysen, K., Roodhooft, F., Van den Abbeele, A., & Slabbinck, H. (2020). Imitation of Management Practices in Supply Networks: Relational and Environmental Effects. *Journal of Supply Chain Management*, 56(1), 54-72.

Review by Ben Stover

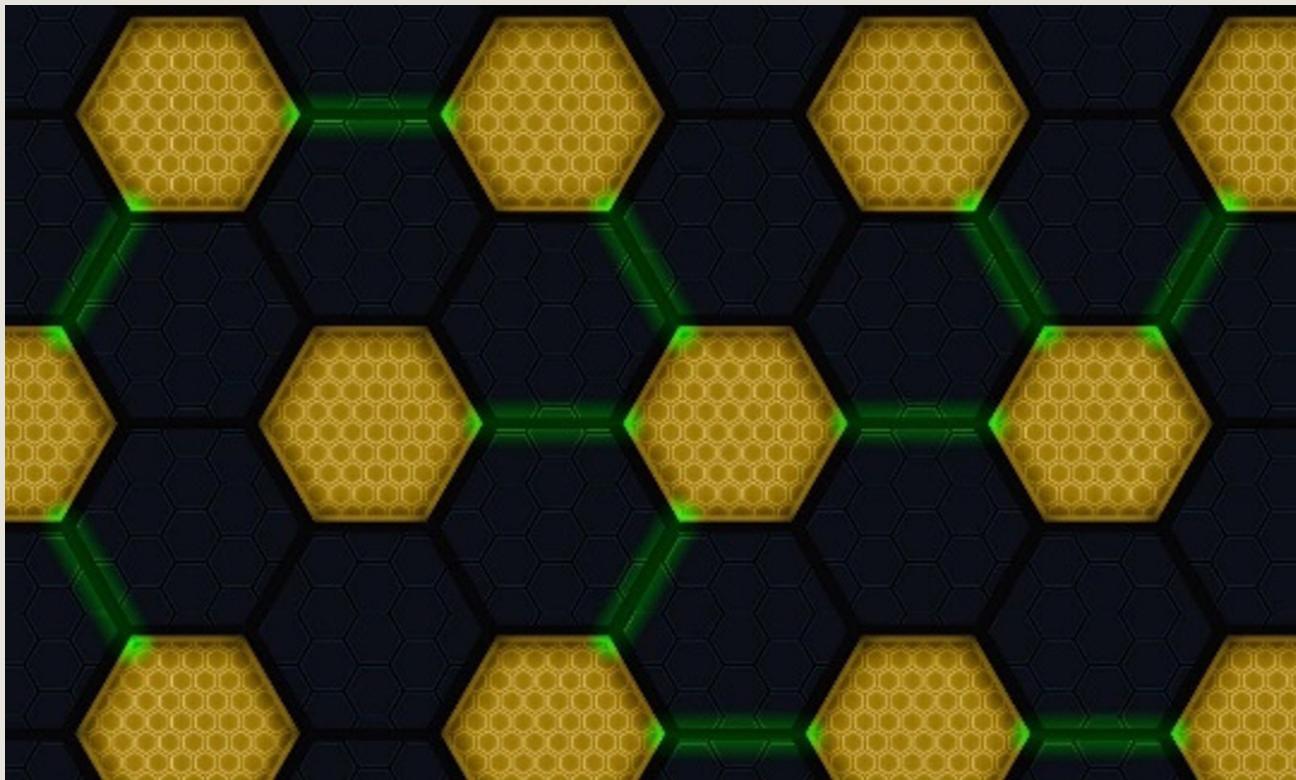
Background

“Imitation is the sincerest form of flattery” is a popular idiom when it comes to the adoption of one individual’s practices by another individual. However, when this concept is applied to supply chain participant interactions, do firms readily embrace similar management practices as other firms they do business with? Within this question lies not only an issue of if there will be an adoption of managerial practices but also when and in what context do they tend to happen. Previous research in interorganizational imitation has highlighted the benefits of mimicry in supply chain dyads and how certain situational contexts can promote this behavior. This article contextualizes the likelihood to imitate their buying firm’s managerial practices based on their affective commitment and environmental uncertainty. Affective commitment refers to the supplier’s level of respect and connection to their buyer and environmental uncertainty refers to the degree of unpredictability in this supplier’s market. Additionally, the authors’ focus is on a triad, where a focal buyer firm sources from a first-tier supplier, who then outsources work to a second-tier supplier. In this context, they study factors that affect the first-tier supplier to imitate the buyer firm and, in turn, the likelihood that the second-tier supplier will imitate the first-tier supplier.

Key Insights

The authors utilize the concept of buyer controls, which correspond to methods of managing supplier

risk and improving supplier cooperation, as a central type of practices that could be readily imitated throughout a supply chain. Within these control practices, they emphasize three subdivisions: outcome (measurement and monitoring of desired results), behavior (appropriateness level of process), and social (shared benefits and communication) controls. Their study investigated three models portraying the potentially positive effect of affective commitment on the propensity of the three control types to be imitated. Based on a survey of the first tier and second tier suppliers of a large, multi-national buyer firm, they found that affective commitment promoted both outcome and social controls, but not behavior control. Under more uncertain environments, outcome controls are more likely to be imitated while behavior controls are much less likely. Additionally, with more commitment and higher uncertainty, the tendency to adopt a social control weakens. In general, results-based practices (outcome) are imitated in situations where there is high commitment between the two parties and environmental uncertainty is low. Next, imitation of activities that emphasize the definition and monitoring of behavior of the partners (behavior) tended to improve under more uncertain environments. Finally, adoption of frequent and intentional interactions between partners (social) improved under higher partner commitment, but its improvement effect weakened when environmental uncertainty increased.



MINI CASE

UTILIZING BLOCKCHAIN TO IMPROVE PRACTICE VISIBILITY

A lack of visibility and communication can be a significant problem for a supply chain, especially during a disruption or other problematic period. Over time, buyer firms have tried to mitigate these risks by attempting to create open communication lines with their suppliers, while others have just increased the number of potential suppliers to reduce risk. However, with the increased speed of market growth and more catastrophic events that can significantly disrupt supply chain business, firms need more stable methods to communicate. This is where blockchain can assist in risk mitigation. With blockchain, firm transactions

and inventory allocations are encrypted, known only to the buyer and supplier. It also provides a path where other manufacturing practices can be shared and improved, such as better food safety or decreased expiration of products in a supply chain. Blockchain can also help build trust throughout a supply chain since you can guarantee that only certain firms have access to transactional data.

Image Source: Pixabay

Case Source(s): <https://hbr.org/2020/05/building-a-transparent-supply-chain>

Remaining Questions

Within the survey questions related to outcome control and behavior control, the authors utilize questions that correspond to the existence and use of information technology to monitor and communicate with suppliers. In this research direction, one could study the level of IT spending within a buyer firm and how this might increase the tendency for supplier to imitate these procedures, due to better communication. Another perspective that could be studied is how CEO and top management team characteristics (i.e., ethics, cohesion, etc.) might improve the overall perception of a buyer firm and thus, increase the possibility of process imitation.

Want to Know More?

Organizational contingency theory is utilized by the authors to explain how environmental conditions can drive imitation. Lawrence and Lorsch (1967) and Sousa and Voss (2008) provided similar studies on how managerial practices can vary in effectiveness across different situations and firm requirements.

This was used to support the idea that higher process effectiveness can improve the willingness of interfirm adoption of such processes. The authors of this article referenced much of their survey validation process, especially related to how they reduce biases from many different sources (Podsakoff et al., 2003). Podsakoff et al. provided a comprehensive approach and explanations for researchers that are interested in survey-based research methods.

Foundational Classical Studies

To create their main dependent variable of difference of control practices, the authors reference Westphal et al. (2001) and McFarland et al. (2008), which investigate the effects of differing types of policies have on interfirm imitation of certain policies. Das et al. (2001) study the relationships between trust and control and their effect on mitigating risk in strategic alliances. The authors utilize many of their findings to strengthen their claims on how environmental uncertainty can affect supply chain relationship behavior.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. REUSEN:

**How did you come up with the idea for this paper?**

We started our study from being intrigued by the general observation of *imitation* as a common phenomenon. Given the prevalence of inter-organizational imitation and its diverse possible consequences, we thought it would be interesting to understand whether this would also affect the usage of supply chain management practices. Particularly in a supply chain setting, interfirm linkages have been shown to provide a channel for the diffusion of management practices. Specifically, recognizing the broader network setting, we figured that suppliers firms may get inspiration about how to manage and control their own supplier relationships by looking at how their buyer firm controlled them, giving rise to imitation. Yet, while spill-over effects and imitation in supply chains have been documented in prior research, we know very little about the determinants thereof. Not only is the empirical literature on the occurrence of imitation across multiple tiers quite limited in general, the questions of *whom* suppliers imitate, *when* they are more or less prone to do so and, particularly, whether suppliers are selective in *what* they imitate under specific conditions have been left unanswered, providing the motivation of this study.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

While using triadic data is promising in providing a more complete picture of firm behavior in supply networks, such data collection requires multilevel efforts, and we ended up with a total of 91 matching triads. Although this sample size is quite comparable to other studies that have relied on matched samples and is generally

regarded as adequate for the used statistical techniques, we must recognize its limitations. Our study is effectively a single quantitative case study of imitation in the supply chain of one buyer. While we believe the first-tier suppliers are representative of the buyer firm's supply base, the response rate and sample size are small and there may be other biases we are unaware of, also in relation to the second-tier suppliers. The focused setting of our data collection also suggests caution in generalizing to other contexts.

Furthermore, the most important challenge to our study, in uncovering imitation effects, is to ensure that reported effects are indeed the result of firm responses to the actions of other firms, and not the result of identical responses to a common external stimulus. To the extent possible, we have examined potential rival explanations of positive evidence for control practices similarities, for example, exploring the impact of tied firms experiencing similar conditions. Moreover, to mitigate the possibility that results from our similarity measure captures some factor other than imitation and that this factor also drives our results, we repeated the test with an alternative dependent variable. That is, we also included an alternative, more direct, measure of imitation at the end of the survey questionnaire. As our main results are highly comparable with those for the direct measure, this provides substantial corroborating evidence for the envisaged concepts of imitation.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Yes, the general set-up I believe would be the same. We collected survey data from partner

firms working together in close buyer-supplier relationships. We gained the cooperation of a buyer firm—a large, Fortune 500, consumer goods manufacturer that outsources various production and service functions. I want to emphasize that we are very grateful for the buyer's commitment and support in our data collection process. We have chosen this buying company because it provides an excellent setting in which to study control imitation in the supply chain. Due to the buyer's long experience with outsourcing, it has developed a tacit proficiency in managing and governing suppliers effectively. Moreover, in this setting, it is common for first-tier suppliers, in turn, to outsource to one or more second-tier suppliers, which provides a good context for investigating imitative behavior. Especially because the buyer is regarded as an organization of high prestige, it likely serves as a role model for other companies upstream in the supply chain. For these reasons, our research setting provides both the necessary network conditions and motivational context for imitation to take place.

Yet, as with all research, the findings should be interpreted in light of the study's strengths and weaknesses. While we consider the first-tier supplier as focal actor, and accordingly focus on first-tier relationship characteristics in order to explain the first-tier suppliers' imitative tendencies, the possibility to control for second-tier relationship characteristics would have been superior for our study. We must acknowledge that specific features of the transaction context, if similar across tiers, may affect control practices similarity. Hence, if we could re-do the study, we would make sure to capture more detailed, specific features of the transaction context at both the tiers as to more directly control for transaction context similarity, as a potential alternative contributor to the observed similarities in practices usage. Overall, we view our examination of imitation as an important step in the development of this construct, and

in providing new evidence on the imitation phenomenon in supply chain networks, but sure there are possibilities for future theoretical and empirical refinement. This is accordingly recognized in the limitations section of the article, at the same time providing opportunities for further research.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

In general, this study lays the foundation for a contingency perspective on imitation, offering many possible directions for further investigation. For example, while the evidence of this study is limited to the spread of control practices, the insights that emerge from it are relevant to developing further understanding of the diffusion or imitation of other supply chain management practices as well. Our findings also open up interesting avenues for more nuanced explorations of factors that are commonly believed to influence imitation. Considering different types of supply chain uncertainty, for instance, could help to provide further clarity on the notions of choice and deliberateness in imitation.

Also, while we adopt a triadic study design, investigating how the buyer-supplier relationship influences the supplier-supplier relationship, a logical extension would be to consider whether the presence of direct connections between the buyer and the supplier's supplier would influence the dynamics. Additional insight could also be gained by further expanding the unit of analysis in relationship research. For example, pointing to the wider network of relationships, how far imitation carriers in the supply chain remains an interesting issue for further investigation. This is especially relevant considering that firms may want to influence specific parts of their network and gain control across multiple tiers. Moreover, if suppliers manage to copy controls in an appropriate way, a multi-tiered control system may result in improved efficiency and enhanced

supply chain orchestration. While performance implications are beyond the present study's scope, a fruitful avenue for future research would be to examine the link between control imitation and supply chain performance, as to find out whether firms, if done well, benefit from imitation.

The findings of this study not only provide new insights and directions for operations and control research, but also generate practical implications to assist managers in leveraging practices across multiple tiers.

Since organizational performance increasingly depends on collaborations with supply chain partners, expanding manager's view across the supply chain is of paramount importance. However, given the level of complexity that supply networks might reach, it would not be possible or desirable for any one firm to manage and control the whole of it. As supply chain managers struggle with what and what not to manage and control, this study hints at the potential indirect control benefits resulting from suppliers' imitative tendencies. In particular, this study points out that control decisions do not only affect the focal dyadic relationship, but also adjacent relationships, and thus stretches beyond the dyad to multiple tiers. Our overall contention is that understanding such imitation

effects can offer firms interesting indirect means of keeping their supply chain under control. In fact, being part of a network, firms may have good reasons for their control practices to be imitated and passed on along the chain. By understanding the occurrence of imitation and the determinants thereof, firms could maximize chances for imitation when it is indeed desired that practices spread in this manner. Our results suggest, for instance, that suppliers often do not internalize or diffuse ideas and practices from a buyer with whom they do not feel somehow associated. As such, building strong and committed exchange relationships would be particularly instructive for the purpose of encouraging and assisting supplier firms to adopt relevant practices.

Again, note that, while we consider applications with respect to control practices in particular, such strategies may also extend to the diffusion of other supply chain management practices, and reasonably apply to any practice that could be diffused across the supply network. Hence, we believe the insights of our research are broadly applicable or, at least, can be broadly inspirational, and highly relevant for the networked relationships and partnerships of today and tomorrow.

IS AMAZON'S MECHANICAL TURK THE RIGHT FIT FOR YOUR BEHAVIORAL EXPERIMENT?

Based on Yun Shin Lee, Yong Won SEO, Enno Siemsen (2018). Running Behavioral Operations Experiments Using Amazon's Mechanical Turk. *Production and Operations Management*, 27 (5), 973-989.

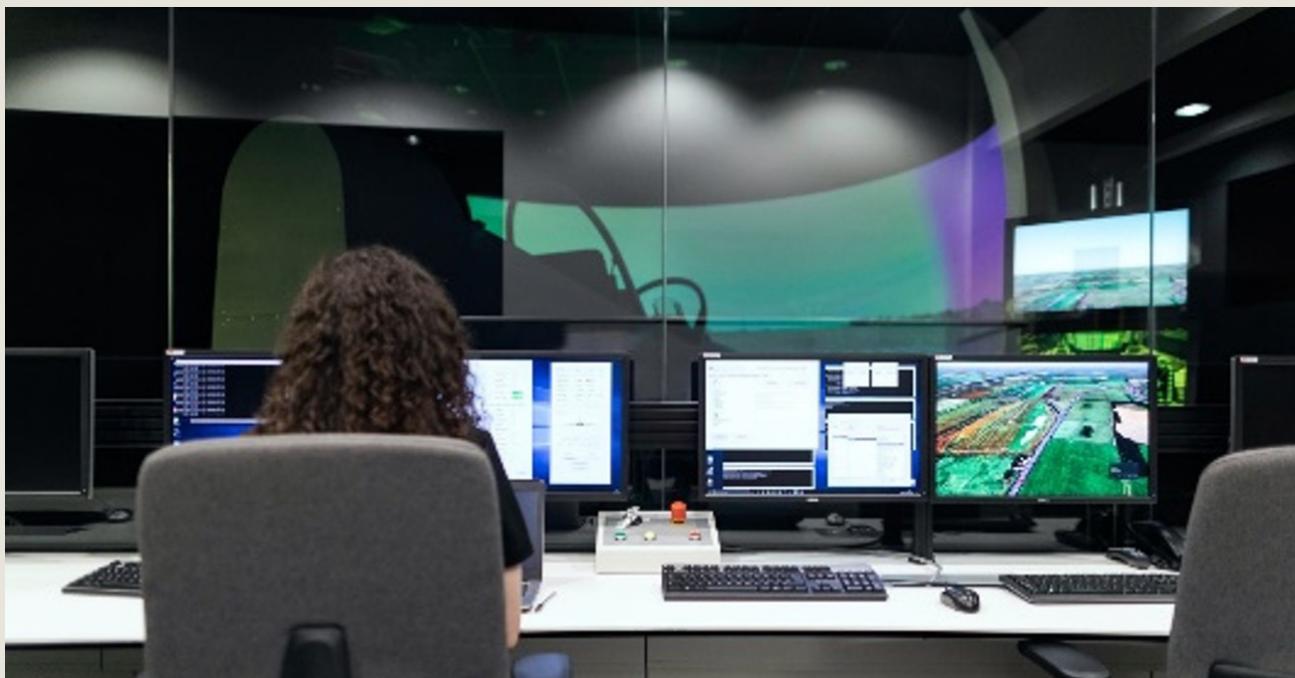
Review by Rohan Korde

Background

Traditionally behavioral scholars conduct experiments in a laboratory setting. Mechanical Turk (MTurk), an online labor market, was introduced by Amazon in 2005. It provides a web platform for conducting behavioral experiments and offers immediate access to a large subject pool at a fraction of the cost of laboratory experiments. The authors of this study replicated on MTurk three popular laboratory experiments and compared the results with the original findings. The first experiment was the Bolton and Katok (2008) experiment on inventory management, the second one was the Engelbrecht-Wiggans and Katok (2008) experiment on procurement auction, and lastly the Loch and Wu (2008) experiment on supply chain contracting. In the first experiment, MTurk subjects show pull-to-center bias similar to the original experiment. In the auction experiment, MTurk subjects tend to overbid much like the students in the original experiment albeit with slower learning on MTurk. In the Loch and Wu (2008) replication, the findings diverged from the original study i.e., the social preference manipulations were found to be ineffective in changing the behavior of MTurk subjects.

Key Insights

Behavioral scholars looking to conduct laboratory experiments should consider running their experiments on MTurk with the two caveats listed below. MTurk is a strong alternative, especially when budgets are tight, subject pool needs to be of the adequate size and more representative of the population (for external validity), and there is limited time available to run the experiment. Most experiments on MTurk can often be completed within hours. Behavioral scholars should understand that when there are differences in findings, these differences are less related to the online environment and more related to the diversity and characteristics of subject pools on MTurk. Scholars should also know about these two caveats: first, MTurk subjects on average learn slower than their counterparts in a lab setting, and second, the effectiveness of social preference manipulations can be highly dependent on the characteristics of subject pool and scholars must be wary about making a general conclusion about social preference effects using MTurk only.



MINI CASE

RUNNING EXPERIMENTS WITH AMAZON MECHANICAL TURK

In 2011, psychological researchers Michael Buhrmester, Tracy Kwang, and APS Fellow Sam Gosling published a paper in *Perspectives on Psychological Science* titled "Amazon's Mechanical Turk: A new source of cheap, yet high-quality, data?". This paper has been cited more than 2,300 times according to Google Scholar. APS Fellow Jeffrey Karpicke believes that MTurk is a valuable research tool. "We are very enthusiastic about MTurk. We have done several experiments both in the lab and on MTurk, and the results look the same", Karpicke said. In a recent blog post Professor Gilad Feldman said that "I think Amazon Mechanical Turk (MTurk) and online markets offer no less than a revolution in experimental psychology. By now, I've already conducted over a hundred experiments on MTurk and have come to consider it as one of the most important tools available to me". Furthermore, he adds that there are lots of high-profile articles popping up in various journals across all domains that have come to the same conclusion. Here

are some examples: Paolacci and Chandler (2014, *Current directions in Psychological Science*) Insider the Turk: Understanding Mechanical Turk as a participant pool, Shapiro, Chandler, & Mueller (2013, *Clinical Psychological Science*) Using Mechanical Turk to study clinical populations, Horton, Rand, & Zeckhauser (2010, *Experimental Economics*) The online laboratory: Conducting experiments in a real labor market, Paolacci, Chandler, & Ipeirotis (2010, *Judgement and Decision Making*) Running experiments on Amazon Mechanical Turk, Rand (2011, *Journal of theoretical biology*) The promise of Mechanical Turk: How online labor markets can help theorists run behavioral experiments.

Image Source: Pexels

Case Source(s): <https://mgto.org/running-experiments-with-amazon-mechanical-turk/>
<https://www.psychologicalscience.org/observer/under-the-hood-of-mechanical-turk>

Remaining Questions

Herrmann et al. (2008) observed a significant cross-societal variation in cooperation levels in public goods experiments. Could such cultural differences between subject pool drive the differences in findings between MTurk and lab experiments? Since MTurk is available in 43 countries, experiments can be run on MTurk with subjects from culturally diverse countries such as Japan, USA, South Africa, Norway etc. to investigate how cross-cultural differences impact experiments.

Want to Know More?

To see how scholars in behavioral operations have successfully used MTurk, see Dixon et al. (2017), Hutchison-Krupat and Chao (2014), and Lau et al. (2014). To see why MTurk provides a more demographically diverse sample than the pool in a typical American college, see Buhrmester et al. (2011). To see how MTurk can cost a lot less than laboratory experiments, see Horton et al. (2011) who

successfully replicated many experiments on MTurk at a fraction of the cost of a physical laboratory. To see why MTurk is the most commonly used online labor market for behavioral experiments, see Mason and Suri (2012).

Foundational Classical Studies

Students are readily available at universities, and they can be sufficiently motivated to take their assigned tasks in the laboratory seriously. Bolton et al. (2012) and Kremer et al. (2016) found that students often behave similar to executives and managers in behavioral operations experiments, which implies that students act as good proxies for managers in experiments. A number of studies used MTurk to replicate classic findings in behavioral economics and decision-making research and found no significant differences between online participants and traditional samples (see Goodman et al. 2013, Horton et al. 2011, Paolacci et al. 2010, Suri and Watts 2011).

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. YONG WON SEO:

**How did you come up with the idea for this paper?**

I was working on doing behavioral experiments with human players about behavioral decisions under various supply chain contracts. To do the experiment I developed my own computer program to do the experiments with Java language. The laboratory experiment is costly, yet number of data gathered is limited. I thought that, since I have a computer program which can be easily ported to online environment, it would be greatly helpful to do this area experiments if I can post the program on online workplace like MTurk and achieve the data. Further, this kind of online decision is consistent with modern working environment where decision makers are mainly working on top of network connected online systems. Hence I ported the program onto web based environment and testing experiments via online.

I talked with my colleague Yun Shin about this idea, and she proposed an idea that since such online workplace based experiments are promising, if we can write an article about verifying the validity of online workplace experiments compared with existing well known offline experiments, that can significantly contribute to the following researches. That's how this research project began.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

There were certainly technical difficulties. Doing single player experiment was quite straightforward. However, as in the third experiment of our paper, multi-player game type experiments raised quite challenging technical issues about paring anonymous participants coming into our system in asynchronous way. And also dealing with unexpectable network problems on

the players' side should be dealt with, raising issues about how to ensure the game session under random disconnected and reconnected network environment.

Another difficulty is about covering the various decision types. An initial version of our paper was covering only the classic single player newsvendor experiment. While revising our paper, the experiment coverage expanded to three types of seminar decision experiments including multi player contract game. Since we had positioned the paper as covering a variety of decision types which can be representative in this area, we needed to investigate all the well-known OM experiments to set up the experiment scenarios representative yet simple as possible. Yun and Enno contributed a lot of ideas about this.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Basically, similar implementation I would do. However, since it means that I had multiple chances to do the similar experiments again, I would have to invest more time to make the experiment framework more robust and general purposed.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Since it is verified that OM decisions of online workers are comparative to offline workers, the usage of online operations management workers could be promoted. Utilization of online workers could then contribute to operational excellence under online cooperative working situations which is especially important in the situations like current one of COVID19.

OPERATIONAL ISSUES IN GLOBAL SUPPLY CHAINS

In general, supply chains have become more global and complex in nature because factors affecting labor and sourcing costs. This has opened a whole host of new ethical issues for operations managers to consider. Furthermore, natural phenomena, such as severe weather, not only can create havoc to local operations, but also cause problems elsewhere in the world. This requires operations managers to consider these risk factors when planning their production. The articles in this section will inform operations managers on how to mitigate such risks.

Topics in This Section

What was the Immediate Impact of the Great East Japan Earthquake (GEJE) of 2011 on Global Supply Chains?

Based on Kevin B. Hendricks, Brian W. Jacobs, Vinod R. Singhal (2020). Stock Market Reaction to Supply Chain Disruptions from the 2011 Great East Japan Earthquake. *Manufacturing & Service Operations Management*, 22 (4), 683-699.

Empirical Research

Multi-Sector

Developing Outsourcing Relationships that Minimize IP Issues

Based on Skowronski, K., & Benton Jr, W. C. (2018). The influence of intellectual property rights on poaching in manufacturing outsourcing. *Production and Operations Management*, 27(3), 531-552.

Empirical Research

Manufacturing Sector

Do Differences in Demographics and Race Affect B2B Transactions?

Based on Ruomeng Cui, Jingyun Li, Meng Li, Lili Yu (2020). Wholesale Price Discrimination in Global Sourcing. *Management Science, Articles in Advance*, 1–22.

Empirical Research

Multi-Sector

WHAT WAS THE IMMEDIATE IMPACT OF THE GREAT EAST JAPAN EARTHQUAKE (GEJE) OF 2011 ON GLOBAL SUPPLY CHAINS?

Based on Kevin B. Hendricks, Brian W. Jacobs, Vinod R. Singhal (2020). Stock Market Reaction to Supply Chain Disruptions from the 2011 Great East Japan Earthquake. *Manufacturing & Service Operations Management*, 22 (4), 683-699.

Review by Rohan Korde

Background

On March 11, 2011, the Great East Japan Earthquake (GEJE) that struck the northeast coast of Japan is one of the most severe natural disasters ever recorded. The earthquake, tsunami, after-shocks, and the subsequent meltdown at the Fukushima nuclear plant brought devastating human, social, and economic damages. Six Japanese prefectures, home to more than 6,000 factories, saw heavy damages and destruction. Domestic and global supply chains, especially in the automotive and semiconductor industries, were disrupted. This article investigates the effect of the GEJE on the financial performance of firms from both manufacturing and service industries from around the world. The authors develop insights and implications of GEJE into direct effects, upstream and downstream effects of supply chain disruptions, and the contagion and competitive effects in varied industries.

Key Insights

The losses suffered by both Japanese firms and non-Japanese firms experiencing supply chain disruptions as a result of the GEJE are economically

significant. Although the loss is more severe for firms whose operations were directly impacted by the GEJE, it is also significant for firms that experienced indirect effects from their upstream and downstream supply chain partners, further confirming the importance of supply chain risk mitigation strategies. The contagion effect of the GEJE on automotive industry and nuclear energy industry is significantly negative but not for the electronics manufacturing industry. Insurance companies with exposure to the GEJE lost some shareholder value. Thus, contagion effects seem to depend on specific industry characteristics. For firms in the rebuilding industries or competitors to firms affected by the GEJE, the competitive effect of the GEJE is positive.

Remaining Questions

In general, there are trade-offs between resilience and costs, i.e., high resilience comes at a high cost. When buyers use suppliers in low-cost locations that are vulnerable to natural disasters, they should account for the cost of disruption in total landed cost calculations. What are the factors that justify buyers' decision to use suppliers in vulnerable regions versus suppliers in non-vulnerable regions?



MINI CASE

STRESS TEST FOR GLOBAL SUPPLY CHAIN

Tony Prophet, a senior vice president for operations at Hewlett-Packard, was awakened at 3:30 a.m. in California and was told that an earthquake and tsunami had struck Japan. Soon after, Mr. Prophet had set up a virtual "situation room", so managers in Japan, Taiwan, and America could instantly share information. Mr. Prophet oversees all hardware purchasing for H.P.'s \$65-billion-a-year global supply chain, which feeds its huge manufacturing engine. He and his team scrambled to define the impact on the company's suppliers in Japan and, if necessary, to draft backup plans. "It's too early to tell, and we're not going to pretend to predict the outcome," Mr. Prophet said in an interview. "It's like being in an emergency room, doing triage." Modern global supply chains, experts say, mirror complex biological systems like the human body in many ways. They can be remarkable resilient and self-healing, yet at times quite vulnerable to some specific, seemingly small weakness. Japan is the world's third-largest economy, and a vital supplier of parts and equipment for major industries like computers, electronics, and

automobiles. The worst of the damage was northeast of Tokyo, near the quake's epicenter, though Japan's manufacturing heartland is farther south. Already, there are some ripple effects worldwide: for example, a General Motors truck plant in Louisiana announced that it was shutting down temporarily for lack of Japanese-made parts. "In the past, when you had a disruption, the response was regional," says Timothy Carroll, vice president for global operations at I.B.M. "Now, it's globalized." The quake will prompt companies to re-evaluate risk in their supply chains. For global operations managers like Mr. Prophet, the disaster will be a severe test of their supply networks. Once the triage stage is passes, it will be a learning experience. "We'll do a retrospective on what worked best and what didn't, and how to change things to make our supply chain more resilient," he says.

Image Source: iStockPhoto

Case Source(s): <https://www.nytimes.com/2011/03/20/business/20supply.html>

What are the effects of firm-level characteristics such as firm size, geographic and business diversification, and operational slack on abnormal returns after an exogenous shock event such as earthquake? How did supply chain operations, structures, and strategies around the world change, in the short and long term, in response to the GEJE?

Want to Know More?

This study compares with Hendricks and Singhal (2003, 2005, 2014) who measure the financial performance impacts from endogenous, firm-specific supply chain disruptions from parts shortages, order changes, production problems, and ramp-up issues. Shelor et al. (1992) discuss two competing hypotheses regarding the impact of natural disasters on insurers: loss claims can deplete insurer resources, leading to loss in shareholder

value ("loss-as-loss"), or disasters might lead to increased demand for policies as well as premium increases, leading to gain in shareholder value ("loss-as-gain"). Cohen and Frazzini (2008) and Menzly and Ozbas (2010) used firm-level and industry-level supplier-customer relationships and found that economically significant relationships can help predict each of the related firms' stock returns.

Foundational Classical Studies

Bowen et al. (1983) and Kalra et al. (1993) studied the contagion effects of the Three Mile Island incident of 1979 and the Chernobyl incident of 1986, respectively. Shelor et al. (1990) studied the effects of the 1989 San Francisco earthquake on real estate firms, and Lamb (1995) studied the impact of Hurricane Andrew on insurance firms.

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**BEHIND-THE-SCENES****INTERVIEW WITH PROF. SINGHAL:****How did you come up with the idea for this paper?**

We came up with the idea from articles by reporters and experts in business publications that talked about how the 2011 Great East Japanese Earthquake disrupted supply chains at a global level and how it could negatively affect the financial performance of firms. However, these articles gave very little objective evidence on the financial impact. This motivated us to examine what was the magnitude of the financial impact of the earthquake. We were also interested in studying how deep is the propagation of major supply chain disruptions on upstream and downstream supply chain partners.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

We did have some challenges and difficulties in collecting data, but this is normal in any empirical study. Collecting data turned out to be very tedious and time consuming but this was necessary to make the paper rigorous

and enhance its contribution. As with all top journals, the review process was thorough and demanding. We learnt a lot from the comments of the reviewers, and it took substantial effort and time to make the revisions. The reviewers were very thoughtful, constructive, and reasonable, and their efforts made the paper more rigorous and better.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

We would have done the same thing.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

This work basically documents the financial impact of a major supply disruption caused by one of the worst natural disasters. As such it provides a lower bound on the negative consequences of natural disasters on supply chains. Managers can use the results of the financial impact to guide them on how much they should invest in strategies that builds resilience against natural disasters.

DEVELOPING OUTSOURCING RELATIONSHIPS THAT MINIMIZE IP ISSUES

Based on Skowronski, K., & Benton Jr, W. C. (2018). The influence of intellectual property rights on poaching in manufacturing outsourcing. *Production and Operations Management*, 27(3), 531-552.

Review by Ben Stover

Background

A firm's intellectual property (IP) can be a significant asset that can promote both market growth and profitability. However, to reduce manufacturing-related costs, many firms will outsource strategic production to suppliers in other countries. The main concern with this type of outsourcing is that many of these countries have weak IP protection laws. Because many of these supplier contracts require the firm to disclose proprietary information related to their products, they are exposed to potential risks of these suppliers utilizing their IP to imitate their products (supplier poaching). Previous research has focused on different factors that promote opportunism in buyer-supplier relationships, which include poaching, shirking, and forced renegotiation. In this article, the authors investigate the effect of IP protection rights on the extent that a supplier might engage in poaching and how a firm's specialized asset requirements and communication intensity with the supplier help mitigate this poaching risk.

Key Insights

In line with previous theories, the authors found that buyers with facilities in countries with higher levels of IP rights resulted in a lower risk of suppliers poaching the buyer's IP. The specific

investments (idiosyncratic investments) that suppliers purchase, which are necessary to produce products for a particular buyer, can expose the buyer's IP to supplier poaching. While the authors did not find a direct relationship between these two variables, they found that increasing IP rights will reduce the effect of this relationship. Under very strong IP rights, higher levels of these idiosyncratic investments will decrease supplier poaching. High levels of intense (media-rich) communication have been shown to promote better buyer-supplier relationships. However, the authors found that this type of communication did not directly reduce the chance of supplier poaching. Instead, they found that, under lower levels of IP rights, media-rich communication reduced the chance of poaching. Similarly, when IP rights are very high, communication has no effect on poaching, due to the IP protection pressure on suppliers. Additionally, since poaching is not normally viewed as socially desirable, the authors controlled their assessment by measuring the supplier's desire to poach. Following theory, they found that as the supplier's desirability to poach increases so does its chance to poach.

**MINI CASE**

KEEPING INTELLECTUAL PROPERTY SAFE DURING THE SOFTWARE DEVELOPMENT OUTSOURCING PROCESS

For many reasons such as lack of expertise, insufficient resources, and a burden of funding full time employees, some software developments are outsourced. However, because this software can potentially interact with many of a firm's intellectual property, much care is needed to ensure that their assets are not put at risk. The most important factor is to make sure that the exact interaction points of software and IP assets are readily known and documented. From this point, the firm can decide what structural parts of the software can be outsourced and other parts that need to be integrated internally. Like one of the findings in the authors' article, active communication with the outsourced software developer firm is critical. Within these communications, the

focal firm must maintain intense monitoring of the supplier's development and project management processes so potential risks and losses can be mitigated. In initial contractual discussions, strong legal accords must be included to protect the firm's IP, such as non-disclosure agreements. Additionally, firms will need to investigate the IP protection laws in the country where the developer resides as that can significantly affect how this outsourcing can safely and effectively be implemented.

Image Source: Pixabay

Case Source(s): <https://technologyrivers.com/blog/protect-intellectual-property-outsource/>
<https://technologyrivers.com/blog/signs-to-outsource/>

Remaining Questions

The authors investigate the effect of distance between the supplier and buyer manufacturing plants as a potential variable that can affect the extent of supplier poaching, but they found that this did not significantly explain this effect. However, any extended organizational boundary may reduce the poaching effect. For example, if the buyer firm had an operational center in the same country of the supplier, would this help reduce poaching? In recent years, there have been a significant amount of trade wars and significant tariffs implemented between different countries. Since this could negatively change the perception between the buyer and the supplier, would this lead to higher levels of supplier poaching? At the same time, these situations may lead buyer firms to increase their level of communication, which could reduce the magnitude of this trade war-poaching effect.

Want to Know More?

Handley and Angst (2015) provided an interesting study on the effects of culture on how buyers interact with outsourced suppliers. It also discussed how these buyers utilize contracts and relationship

governance to help mitigate poaching under scenarios of large cultural differences. The authors' article has also led to other interesting extensions of controlling supplier opportunism in outsourcing settings. Dong et al. (2020) investigated the effect of supplier innovation and how that can lead to improved buyer performance. This emphasized the importance of intense and purposeful communication with suppliers. Skowronski et al (2020) extended their previous articles, where they studied the factors that affect shirking and poaching in situations where the outsourced supplier resides in a country with an emerging economy.

Foundational Classical Studies

Teece (1986) emphasized the effect of collaboration and communication between buyers and suppliers and how it helps reduce poaching when imitation is easy. Aron et al. (2005) discussed the importance of redesigning workflows and diversifying supplier work for reducing the propensity of IP risks in outsourcing. Dyer and Singh (1998) studied the effects of increased communication between buyers and suppliers and complimentary capabilities can result in significant competitive advantages when outsourcing.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. SKOWRONSKI:

How did you come up with the idea for this paper?

Most of my research focuses on problems that I am personally familiar with. I worked in industry prior to pursuing my PhD and encountered the difficulties related to intellectual property protection that arise when managing offshore-outsourcing relationships. Those experiences formed the motivation for pursuing this project.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

The data collection for this paper was extremely challenging. This research project required not only dyadic buyer-supplier survey data, but the suppliers also had to be globally dispersed to evaluate how managing these relationships changes based on intellectual property rights. Manufacturers are very protective of their supplier list, so getting managers to respond about a specific supplier and then to share their key contact at that supplier was arduous. We ended up contacting every potential buyer respondent by telephone. This resulted in over 3,000 phone calls, of which I made about half, and, as a result, the data collection took several months.

In terms of the revision process, we received some of the most helpful reviews that I have encountered. While the review team definitely challenged us on all aspects of the paper, we were very fortunate because their guidance resulted in improvements to the paper. For example, some of the literature that a reviewer recommended resulted in more refined arguments for the hypotheses. I am extremely thankful that the review team helped us improve the paper. That experience has made me be much more developmental when serving as a reviewer.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Overall, I would have implemented it similarly. As with any research endeavor, we definitely learned things along the way that could have streamlined the process, but things are always clearer in hindsight.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

The findings from this research illustrate those mechanisms that can safeguard a relationship with U.S. suppliers can have a deleterious effect in relationships with suppliers in low intellectual property rights locations. In essence, buyer-supplier relationship management practices need to be tailored to fit the locations in which the firms are operating. There are many additional aspects that can be explored to better understand how globally-dispersed buyer-supplier relationships should be tailored based on location. I have several subsequent research projects that examine the nuances created by location differences and how they relate to innovation within the supply chain. For example, in one project, we examine how a supplier's location and strategy interact to affect the buyer's view of the supplier's propensity to engage in poaching or shirking. We find that innovation-focused suppliers from emerging economies are viewed as much more likely to steal a buyer's intellectual property than their counterparts in advanced economies. In another project, we examine how differences between a firm's first-tier suppliers (i.e., the supply base) affect its ability to generate financial returns from supply base R&D efforts, and we find that having suppliers from more countries impedes those efforts.



DO DIFFERENCES IN DEMOGRAPHICS AND RACE AFFECT B2B TRANSACTIONS?

Based on Ruomeng Cui, Jingyun Li, Meng Li, Lili Yu (2020). Wholesale Price Discrimination in Global Sourcing *Management Science, Articles in Advance*, 1–22.

Review by Ning Ma

Background

In global sourcing, suppliers use price discrimination based on demographic regions and races as a common tool to obtain higher profit in various business-to-customer (B2C) markets. However, literature has not studied such types of price discrimination in the business-to-business (B2B) market, which is another important part of the global market. B2B markets differ from B2C markets in many aspects such as larger order quantity, longer customer relationships, and most importantly, the characteristics of buyers in B2B markets may not represent the end customers. Therefore, it is not clear whether the same phenomena and mechanisms of price discrimination in B2C markets still hold in B2B transaction platforms. Meanwhile, to deal with the price discrimination, buyers could provide market information of the lowest market price and social information of peer recommendation to the suppliers. This article also studied the impact of information disclosure on wholesale pricing and potential discrimination in the B2B market.

Key Insights

When inquiring about wholesale prices for products whose retail prices are similar across regions, there is no need for buyers to manipulate their regional information, for example, changing IP addresses via VPN, since suppliers do not discriminate under this situation. However, buyers could take advantage of hiding their racial information by changing names

and profile pictures, especially for white buyers, because suppliers believe buyers in the white group have a higher willingness to pay and thus charge higher prices compared to black and Asian groups. Buyers should gather information from the market and peers. By providing the lowest market price and saying that they have recommendations of the suppliers by their peers, buyers could see lower wholesale prices. On the other hand, suppliers could obtain larger profit by discriminating buyers by their regions and races. However, if suppliers care about developing longer term and mutually beneficial relationships with buyers, then this might not be a good strategy. Platforms owners and market regulators should reduce price discrimination by improving information transparency, so that buyers and suppliers can easily compare market prices and make social connections.

Remaining Questions

This article conducted a field experiment with computer accessories and electronic devices whose sale prices are similar between the United States and South Africa and found no significant price discrimination between regions. How would the wholesalers price discriminate for products that have different sale prices, for example, luxury goods and high-tech products? Because the U.S. has a higher average income than South Africa, U.S. consumers tend to have a higher willingness to pay for high-cost products, thus may receive a higher



MINI CASE

A SPECIAL PRICE JUST FOR YOU

Retailers such as Amazon.com, Home Depot, and Staples modify prices displayed on their websites depending on the customers' information like location. The Wall Street Journal has discovered that Staples is specifically adjusting item pricing for different people according to their distance from a rival's store. The closer to a rival's store, the more likely customers would see discounted prices. Prices fluctuated between different New York City boroughs. Customers located in the Bronx, Manhattan, and Staten Island may see higher pricing, while customers in Brooklyn and Queens see discounted prices. This reveals a link between the discounts and the weighted average of household incomes:

a higher average income \$59,900 in higher prices areas, while a lower average income of \$48,700 in lower prices areas . B2C firms price discriminate based on customers' IP addresses, browser history, and even the operating system used. This might reveal the customers' spending characteristics and willingness to pay. However, in the B2B market, the buyers usually are larger firms. Their spending characteristics are different from those of the B2C consumers.

Image Source: Pixabay

Case Source(s): <https://www.wsj.com/articles/SB10001424127887323777204578189391813881534>

price quote. If one buyer were to recommend a supplier to another buyer and if this buyer mentioned to the supplier that they were referred, would this result in a different quoted price? More specifically, would the supplier have a lower level of trust in Chinese buyers? Based on the race of buyers, would this social information reduce the wholesale prices for non-Chinese buyers compared to Chinese buyers? When buyers refer other buyers to a supplier, the supplier might know some of their racial characteristics and historical price charged to that group. Can this social information reduce price discrimination for all groups under this setting?

Want to Know More?

Suppliers might charge different wholesale prices for buyers not only based on the buyers' demographic and racial characteristics, but also based on other factors. Zhang et al. (2017) studied the effects of order quantity of electronic goods on the quoted prices. They showed that larger purchases do not always result in bigger discounts. Tunca and Zhu (2018) studied the role of buyer intermediation.

Using data from a large Chinese online retailer and through structural regression estimation, they showed that the buyer intermediation can lower wholesale prices and simultaneously benefit both supply chain participants.

Foundational Classical Studies

This article is related to the stream of the literature on price discrimination in a B2C setting. Studies have found that certain group of customers of different origins, genders, and races are able to obtain lower prices than others across different markets like car purchasing (Ayres and Siegelman 1995), taxi riding (Castillo et al., 2013), and automotive repair (Busse et al., 2017). Another related field is information sharing. Both market and social information in this article generated a reference price point effect. Mezias et al., (2002) studied how suppliers quoted B2C prices based on this effect. Bruno et al. (2012), Elmaghraby et al. (2015), and Pilehvar et al. (2017) studied how suppliers quoted B2B prices based on this effect.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. CUI:



How did you come up with the idea for this paper?

I have a series of works on discrimination related topics such as "Reducing Discrimination with Reviews in the Sharing Economy: Evidence from Field Experiments on Airbnb". This paper is a natural extension to studying discrimination in pricing.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Come up with a consistent theory that unifies various hypotheses.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Still figuring it out.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Still figuring it out.

SUSTAINABILITY AND SOCIAL RESPONSIBILITY

Due to recent tragic global events that have taken human toll, humanitarian operations have been critical to help those in need and effectively manage donations toward these efforts. Furthermore, environmental, social, and governance (ESG) topics have been in the news lately, causing corporate boards to take actions toward meeting sustainability goals. Brand image and firm reputation are tied to such initiatives and any missteps can lead to customer base erosion. The articles in this section will help operations managers navigate sustainability and social responsibility as it relates to their triple bottom line.

Topics in This Section

Does Negative News on Firm's Operations Affect Perceived Product Quality?

Based on Bridget Nichols, Hannah Stolze, Jon Kirchoff (2019). Spillover effects of supply chain news on consumers' perceptions of product quality: An examination within the triple bottom line. *Journal of Operations Management*, 65 (6), 536-559.

Empirical Research

Multi-Sector

How to Regulate Suppliers Use of Child Labor

Based on Soo-Haeng Cho, Xin Fang, Sridhar Tayur, Ying Xu (2019). Combating Child Labor: Incentives and Information Disclosure in Global Supply Chains. *Manufacturing & Service Operations Management*, 21(3):692-711.

Analytical Research

Non-Profit Organization

Operational and External Effects on Humanitarian Aid Success

Based on Turrini, L., Besiou, M., Papies, D., & Meissner, J. (2020). The role of operational expenditures and misalignments in fundraising for international humanitarian aid. *Journal of Operations Management*, 66(4), 379-417.

Empirical Research

Non-Profit Organization

DOES NEGATIVE NEWS ON FIRMS' OPERATIONS AFFECT PERCEIVED PRODUCT QUALITY?

Based on Bridget Nichols, Hannah Stolze, Jon Kirchoff (2019). Spillover effects of supply chain news on consumers' perceptions of product quality: An examination within the triple bottom line. *Journal of Operations Management*, 65 (6), 536-559.

Review by Rohan Korde

Background

John Elkington, a global authority on corporate responsibility and sustainable development, first coined the term "triple bottom line" (TBL). This concept examines a company's social, environmental, and economic impact. When information about a company or product - which may be unrelated to the actual quality of the product - influences whether or not a consumer purchases the item, this is referred as the quality spillover effect. This study examines how news about supply chain operations related to the TBL influence consumers' quality perceptions and purchase intentions. This study specifically examines spillover effect, intensity effect, and recovery effect.

Key Insights

This research has implications for both supply chain and marketing managers. Consumers' interests and involvement extend beyond the product itself to include firms' operations, stakeholder management, employee relations, and community involvement, among others. Consumer involvement creates expectations, which, in turn, can influence how confident consumers are in a brand's quality promise. Managers who downplay or ignore this expanded role of consumers may not be in a position to arrest potential damage once consumer

perceptions of poor quality begin to impact brand performance. Thus, the results from this study can help managers better understand the potential impacts of negative news and encourage them to work to mitigate them as quickly as possible. This study helps managers better understand the unexpected and unintentional spillover effects of negative news and strategically design their supply chains to avoid risks related to poor operations oversight. When negative news emerges, firms must be prepared to reinforce positive consumer perceptions of brands and product attributes even if the news is not directly related to an environmental, social, or economic failure.

Remaining Questions

How negative information about one brand may influence other brands for similar products with a focus on perceived attribute quality? For example, if there are food recalls at fast-food company A, does this influence consumers' perception of food quality at fast-food company B? Can negative spillover effects from company A lead to a positive spillover effect towards company B, if company B can separate itself from company A and attract company A's customers? Is the magnitude and direction of spillover effects product specific? In other words, if a product is closely tied to consumers' self-image



MINI CASE

SUSTAINABILITY'S SPILLOVER EFFECT

The word sustainability is not new to the fresh produce industry, but recently it has taken on greater significance. Triple bottom line (TBL) sustainability is gaining traction with consumers and influencing purchases at the retail level. TBL which includes the economic, environmental, and social actions of a company, impacts consumers' perceptions of product quality and their willingness to buy. Part of this equation revolves around transparency. Business research in recent years has demonstrated that consumers have demanded greater transparency from companies and are now more aware of the authenticity of corporate claims. According to a recent study by Accenture, 63% of consumers globally prefer to buy goods and services from companies with a purpose that reinforces their personal values and beliefs. Further, consumers

are ditching companies that do not pursue quality, social awareness, and improvements for the environment. Demand for transparency is a double-edged sword for companies. On one hand, transparency is beneficial for companies actively pursuing the components of TBL. On the other hand, it exposes companies to various consequences when things do not go as planned. Adding to this challenge are extended supply chains. Noncompliance from supply chains has the potential to create vulnerabilities for companies, based on the actions of their suppliers.

Image Source: Pexels

Case Source(s): <https://www.producebluebook.com/2019/07/26/sustainabilitys-spillover-effect/>

such as apparel and automobiles, then could such products be immune from spillover effects from negative news, or could they have a much greater spillover effect from negative news?

Want to Know More?

Consumers reacted negatively to news that Mattel's supply chain was responsible for loose magnets in toys, a potential health hazard. The ensuing fallout was further compounded and complicated by Mattel's internal design flaws (Carvalho et al. 2015). H&M operations were called into question following a series of allegations that contract manufacturers mistreated workers and followed poor environmental practices (Bergeson 2018). This resulted in a 33% revenue loss for two years. Consumers boycotted grocery company Trade Joe's for not disclosing genetically engineered ingredients in their food products (Parmigiani et al. 2011). Yet triple bottom line (TBL) related information can also produce positive spillover effects, which are beneficial to firms, including brand recognition and positive word of mouth (Du et al. 2010).

Foundational Classical Studies

Sustainable supply chain management (SSCM) is broadly defined as the cooperative management of material, information, and capital flows among companies along the supply chain with a strategic focus on all three dimensions of the TBL, derived from an understanding of customer and stakeholder

requirements and perceptions (Seuring & Muller, 2008). Social SCM is defined as "product- or process-related aspects of operations that affect human safety, welfare, and community development" (Klassen & Vereecke 2012, p. 103). Environmental SCM is "integrating environment thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumer, and end-of-life management of the product after its useful life" (Srivastava, 2007, p. 54). Economic sustainability in SCM is defined as the "effort to enhance total (firm) value while reducing supply chain cost associated with the manner in which the firm conducts its business" (Closs, Speier, & Meacham, 2011, p. 107). The spillover effect is evident in brand extensions and brand alliances. Votola and Unnava (2006) determined that failures by one brand in an alliance can spillover to harm the partner brand and that moral failures on the part of a spokesperson connected to a brand can harm the host brand. Consumers pay more attention to negative information compared to equally valenced positive information (Ito et al. 1998; Maheswaran et al. 1990). Negative information is more condemning to a brand than positive information is enhancing (Klein & Dawar 2004; Muller & Gaus 2015). The spillover effect on evaluations of product quality is especially important to measure because quality inferences directly impact purchase intentions (Tsotsou, 2006).

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. KIRCHOFF:

How did you come up with the idea for this paper?

We (the authors) have been publishing marketing-SCM integration research for several years and wanted to continue to explore how consumers perceive firms' SCM operations. From that springboard, we started to look at how the concept of the spillover effect (from the marketing literature) could be used in SCM research. Consumers are a critical part of any supply chain, yet much of the SCM and marketing research has largely ignored their participation and importance. We landed on the idea to combine our interest in marketing-SCM integration with the triple-bottom line (TBL) to better understand how consumers react to both positive and negative TBL news about a fictitious firm's supply chain and what, if any, impact this had on their perceptions of the brand.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

We encountered two primary issues with this research: one during our initial data collection for the first submission and then a second one with the revise and resubmit process. The first challenge centered around developing the scenarios for the experiment. The process of developing believable vignettes that are simultaneously non-biased and valid for data collection in experiment methodology is always a challenge. In the case of this research, we were combining different aspects of supply chain operations, a fictitious brand, TBL, and message valence in each scenario. The stories also had to be written in a way that would pick up the spillover effect of supply chain news on consumers' perceptions of quality. This was quite a challenge!

The second difficulty we encountered was with the necessary changes for our first revise and re-submit. The EIC, AE, and reviewers liked the research and

were supportive of recommending an R and R. However, the AE stated bluntly that in order to move forward, we would need to make significant changes to the survey. This, of course, demanded that we recollect all of the data. We didn't hesitate to comply -but- the ensuing work was challenging and time consuming.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Well, we would have made the changes to the survey recommended by the AE *before* our first submission. But of course, that is the benefit of hindsight. In general, I think we were on the right path with the way we developed the methodology, our logic, and our arguments. We may have simplified some of the ideas that were added to the data collection. Another idea we discussed was to add a second DV to the model such as consumer behavior.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

Future research has already started! We continue to expand our research on the marketing-SCM integration topic by looking deeper into consumers' perceptions of supply chain operations and how these perceptions impact behavior.

This research has strong implications for managers. While recent events have significantly boosted the interest in SCM by many different stakeholders, including consumers, most firms still see consumers as passive members of the supply chain. Our research challenges this notion and can help firms realize that consumers are interested in the inner-workings of supply chain operations -and- that consumer perceptions of brands may go beyond the product or service itself to include the processes and operations that bring them to market.

HOW TO REGULATE SUPPLIERS USE OF CHILD LABOR

Based on Soo-Haeng Cho, Xin Fang, Sridhar Tayur, Ying Xu (2019) Combating Child Labor: Incentives and Information Disclosure in Global Supply Chains. *Manufacturing & Service Operations Management*, 21(3):692-711.

Review by Zhen Chen

Background

Child labor remains as a concerning issue in many developing countries. The prevalence of global outsourcing and firms' quest for lower labor costs have made it difficult to eliminate child labor because of firms' lack of motivation. Even when firms intend to control their suppliers' use of child labor, these attempts are often hampered by ineffective control and inspection methods, as well as the potentially high costs they must pay to keep their suppliers away from using child labor. Firms should improve their internal inspections and adjust wholesale prices to control the use of child labor. Additional external inspection and policy disclosure may also reduce child labor. This article examined how these initiatives and information disclosure could impact suppliers' use of child labor.

Key Insights

First, the firm should conduct internal inspection when inspection cost is low. Otherwise, when the inspection cost is high, the firm should offer the supplier a higher wholesale price to increase his expected loss (due to usage of child labor). Also, firms can combat child labor by conducting internal inspections and offering a medium price with information disclosure. In this scenario, supplier knows the level of inspection before deciding whether to use child labor and accept a medium wholesale price. Second, increasing the goodwill cost can reduce child labor. By enhancing public awareness, firms will suffer greater goodwill

losses when they are caught using child labor. Reducing inspection costs, however, does not necessarily reduce the use of child labor. This is because inspections might not always accurately detect the use of child labor. Finally, the disclosure of inspection policies may not necessarily reduce the use of child labor. On the one hand, information disclosure allows firms to use both internal inspections and medium wholesale prices to reduce the use of child labor. On the other hand, by disclosing a lower inspection level, firms can also benefit from attracting suppliers to accept lower wholesale prices. In this context, the supplier is not motivated to reduce the use of child labor.

Remaining Questions

The authors also examine how suppliers should compensate children to encourage them to return to school. However, if this compensation is too low, it is possible that this work will persist out of necessity. Compensation may not be an effective strategy to prevent children from continuing to work as child laborers. In developing countries, child labor is not only a result of poverty, but can also cause additional poverty. Children are forced to work because their families are poor. As a result, this interferes with their ability to get an adequate education, which further contributes to regional poverty. In this case, compensation may instead be an incentive to promote more children to work. Working as a child laborer could also become an



MINI CASE

HAZARDS OF CHILD LABOR

In order to reduce labor costs, some firms choose to use child workers, especially when the cost of labor is high.. Although child labor is illegal in most countries, many developing countries do not have effective means to prevent firms from using child labor. Some companies in developing countries are attracted to hiring child workers as it lowers labor costs. With the globalization of supply chains, many firms in developed countries outsourced basic manufacturing to developing countries with lower labor costs, which also happen to be the regions where child labor is prevalent. As a result, child labor has become a common global problem. For example, according to a new report sponsored by the U.S. Department of Labor, the world's largest confectionaries firms, such as Nestle,

Hershey, and Mars, depend on more than one million western African child laborers. These firms have been under the pressure of the U.S. Congress since 2001, but the incidence of child labor in western African cocoa production rose in recent years. The use of child labor is a violation of the most basic individual rights of citizens and can encourage firms to use unfair means to increase their competitiveness, which is detrimental to the healthy development of the economy. As a result, child labor is a problem that must be addressed by all countries.

Image Source: Pixabay

Case Source(s): <https://www.washingtonpost.com/business/2020/10/19/million-child-laborers-chocolate-supply/>

attractive option for families with lower incomes because the compensation is relatively high compared to their income level. Will the children go back to school after receiving the compensation? Due to family pressures, they could be more likely to work as child laborers again. To sum up, compensation is necessary to protect the rights of child workers, but compensation alone may in turn attract children from poor areas to become child laborers, further contributing to poverty in the area. To potentially address the problem of child labor, could pressure by multinational firms cause local governments to put more effort into educating and protecting children's rights, rather than just asking suppliers to compensate?

Want to Know More?

For more details of the settings in this article's model, Babich and Tang (2012) and Plambeck and Taylor (2016) provide further explanation. Since the supplier and the manufacturer (i.e., the multinational firm) do not know each other's decision before making their own decision, the authors assume they make decisions simultaneously (i.e., a game of imperfect information) based on

the two articles. Nisen (2013) showed that Nike disclosed inspection policies and provided price premiums to suppliers and has been an industry leader in social responsibility.

Foundational Classical Studies

The model in this article is based on previous economics research on inspection and compliance in law enforcement. For example, Becker (1968) is a foundational article, which considered an enforcement authority. Through combining random audits with penalties, this authority must maximize the probability of seizing violators. Tsebelis (1990) considered a one-shot simultaneous game ("inspection game") to model the interactions between the enforcement authority and violators. In terms of suppliers' reaction to information disclosure, Baiman et al. (2000) studied the impact of the supplier's knowledge of the buyer's inspection effort on product quality. They found that, after knowing the buyer's inspection effort, the product quality would always be improved. In this article, however, knowing the firm's inspection level may in turn cause more child labor to be used.

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BEHIND-THE-SCENES

INTERVIEW WITH PROF. CHO:

How did you come up with the idea for this paper?

I often receive this question from other colleagues because the topic of this paper, 'child labor,' is unique in the operations literature. My interest in child labor started from the HBS case on IKEA's global sourcing challenges in Indian rugs and child labor (Bartlett et al. 2006). I came across this case while I was developing a new MBA elective course, Operations Strategy, back in 2010. I was looking for a case that addresses social responsibility issues involved with global outsourcing. This was the perfect case, and students enthusiastically participated in class discussions. Then I spoke to my colleague, Sridhar Tayur, about the case. Coincidentally, he was supporting the Polaris Project, which is a non-profit organization that fights human trafficking and slavery (including child labor). Then we learned about the California Transparency in Supply Chains Act which requires large manufacturers and retailers in California to publicly disclose to which degree the firms are engaged in combating forced labor (including child labor) in their supply chains. Motivated by this Act, our paper examines how firms' disclosure of their policies on child labor affects the incentives of a multinational firm to combat child labor that may be used by its offshore supplier.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

Like many other modeling papers, we had to demonstrate the robustness of results through various extensions. Some of these extensions required long, painstaking processes. While we were adding some of those extensions to the paper, other well-known researchers wrote a paper that studies a related topic. Although our paper was written first, we had to write detailed comparison

between the two papers in order to convince the review team of our novel contribution.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

I am pleased with the published version of this paper. But it took about 7 years from start to its eventual acceptance. In hindsight, we spent too much time in perfecting the paper by checking the robustness of results. When a topic is very novel, I learned that it might be better to go through a faster track in publication, even if a paper is not in the best shape – a paper can never be perfect anyway!

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

This paper was one of early papers that led to a stream of research in socially responsible operations. Following this paper, I wrote a few papers that study related social issues. For example, in Fang and Cho (2020), we study firms' collaborative approaches to managing suppliers in the wake of recent incidents of safety and labor violations (e.g., fires in Bangladesh garment factories that produced items destined for major retailers such as Walmart). In Cho et al. (2020), we study auto manufacturers' incentives to cover up a potential defect in their vehicles under different information disclosure policies in the United States and in the United Kingdom. These papers are theory papers that generate useful insights for firms, governments, and non-profit organizations. Empirical or field research will nicely complement these papers – for example, one may empirically test the impact of the California Transparency in Supply Chains Act on child labor.

OPERATIONAL AND EXTERNAL EFFECTS ON HUMANITARIAN AID SUCCESS

Based on Turrini, L., Besiou, M., Papies, D., & Meissner, J. (2020). The role of operational expenditures and misalignments in fundraising for international humanitarian aid. *Journal of Operations Management*, 66(4), 379-417.

Review by Ben Stover

Background

Natural disasters, like floods and earthquakes lead to lasting and damaging effects. To help mitigate these lasting effects, international humanitarian organizations (IHOs) provide immediate help in the form of supplies, healthcare, and other logistical aid in response. However, many of these IHOs are heavily dependent on donations from a range of other organizations, which may have different levels of understanding of the IHOs' methods and the severity of the disaster in question. One of the main concerns is that these donations be less than the actual demand needed to provide adequate aid. Previous research has shown that this information asymmetry has led to varied managerial decisions by the IHO to increase donations, like fundraising tactics and adjustment of operational spending. To further the understanding of these decision factors, the authors investigate how controllable aspects (i.e., internal operation spending strategies) and uncontrollable aspects (i.e., media attention of disaster) can affect the amount of donations.

Key Insights

In disaster relief situations, IFRC (International Federation of Red Cross and Red Crescent Societies) will create an appropriate budget to cover the necessary aid effort and then present it publicly to their potential donors. Previous research has highlighted concerns on how donors respond to specific outlined aspects of the

budget. When tested, the authors found that increased amounts of operational spending (procurement, logistics, and assets) resulted in higher donations. However, no single spending item exclusively provided significantly larger amounts of donations. The other main concern with the donating organizations is whether these donors understand the extent of the disaster or not. When a disaster receives considerable media attention, it can provide increased visibility of the efforts of an IHO. Under this situation, increased spending in operational expenses will lead to larger donations. Similarly, increasing fundraising, another method for increasing effort visibility, can create a complimentary effect, where higher operational expense spending will also lead to larger donations. Interestingly, media attention and fundraising can be substituted for one another, where high amounts of fundraising counteract low media attention and vice versa.

Remaining Questions

The authors also investigate the effects of different types of disasters (i.e., flood, storm, earthquake) and the intensity of the disaster. However, some humanitarian organizations might have better success providing certain operational tasks as compared to others (i.e., better logistics versus procurement) during certain types of disasters. For these organizations, would donors recognize this combined effect and thus, increase their donations



MINI CASE

CURRENT TRENDS IN CRISIS FINANCING

In recent years, due to changes in global climate, larger and more severe natural disasters have been prevalent across the globe. This has led to a significant negative impact on many of the world population, especially those in third-world countries. One of the main problems is the lack of risk-mitigation efforts in humanitarian aid, which amounts to \$0.40 spent from \$100 donated. However, utilizing tools such as forecast-based financing, shock-responsive social protection, and climate-risk insurance programs has been shown to significantly decrease the impact of these impacts and,

in many cases, is significantly cheaper than reactionary efforts. More pressure must be placed on governments and humanitarian aid organizations to add risk-mitigation efforts into their budgets so that these endeavors become a norm. These efforts will also help protect the aid investment that many of these donors are providing.

Image Source: Pixabay

Case Source(s): <https://news.trust.org/item/20201021165653-29gck>

to these “specialty” organizations? Studies could also include networks of IHOs that coordinate based on the specific disasters in an area. Similarly, do certain types of disasters produce more media attention and therefore, promote more donations? Like the media attention variable for disaster intensity, sentiment analysis could be utilized to create a general social desirability variable of the IHO and be used as another visibility effect on the willingness of a donor to donate. Another study could be related to different IHO operational strategies that could help increase media attention to disaster-related and other problematic events in third-world countries.

Want to Know More?

Burkart et al. (2016) provided a comprehensive account of different topics research gaps and promising areas for future research in humanitarian supply chain funding and the importance of evaluating related managerial decisions. Othman (2020), who referenced the authors’ article, investigated the role of humanitarian intervention as a political power tool and how it can sometimes

affect the stability of a nation. They provided an interesting counterpoint to some of the political situations, where humanitarian organization supply chain managers can get unintentionally involved.

Foundational Classical Studies

Parsons (2007) investigated the effect of non-profit’s accounting information line items affect their managerial visibility to their donors using a field-based experiment. The authors utilized this study to build their argument on how this visibility can improve donations. Eftekhar et al. (2017) examined the many of the negative effects of media attention and communication between different humanitarian organizations and their respective donors. Van Wassenhove (2006) discussed the importance of management of humanitarian supply chains that are agile, adaptable, and aligned with their corresponding aid sources and providers. They also investigated the possible overlap between humanitarian organizations and private sector organizations and how they could learn from each other.

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BEHIND - THE - SCENES

INTERVIEW WITH PROF. TURRINI:

How did you come up with the idea for this paper?

We realized that in the literature many people were talking about the idea that donors do not like logistics and prefer instead to give money for food, medicines or general consumption items that would make them feel more 'useful' since they would be used by the beneficiaries/people in need. This resonated with us also individually as it felt like a natural preference. However, we couldn't find any empirical study linking the type of operational expenditures to donations. We decided to fill this gap.

What were some of the difficulties that you encountered for this paper (e.g., data, methodology, revise/resubmit process etc.)?

This paper has a long history. In its first versions we did not have the media variable in the model, and this caused endogeneity concerns as the public attention arising after a disaster would remain unobserved. Mainly because of those concerns, the paper did not make it to the JOM special issue we submitted it to. After that we went through a lot of data collection effort: at the very beginning we had 62 disaster observations, while we have 174 in the published version; in addition to that, we collected the media mentions for each disaster by searching 6 major media outlets with global reach for disaster-related keywords and then manually screening through each result. Finally,

we reworked the model entirely before we resubmitted it successfully to JOM last year.

In your opinion, if you had the chance to do this research again, would you have implemented it the same or differently?

Going through the review process we already had the chance to implement this research almost from scratch. I am happy with the latest shape it took.

Based on what you know now, what do you think are the future research directions and applications of this work in industry?

I know for a fact that IFRC is working on refining its fundraising policies. Their aim is to make sure that the fundraising expenses are directed in the best way possible, to make sure they can raise enough funds from the donors without wasting more money than needed in fundraising, which is not an operational expenditure. Other organizations have the same budget constraints and the same need to optimize their fundraising spent, so our work has definitely many potential applications. Future research could look into benchmarking our results for other organizations and help create a decision optimization tool for more effective fundraising. Also, looking at how preferences change for private donors or for preparedness and development programs would definitely be a very valuable future contribution.

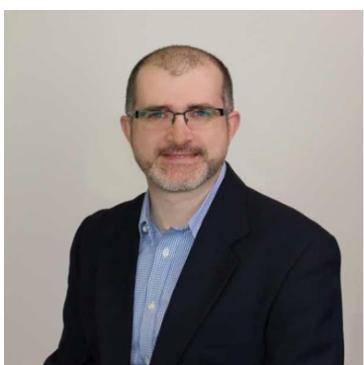
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Ben Stover

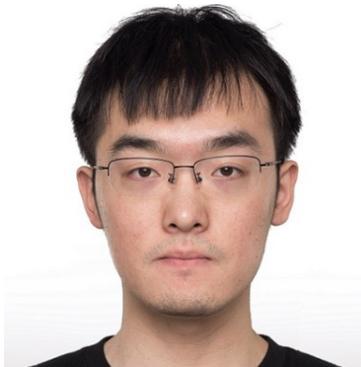
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