

# Putting the customer first:

How researchers are hoping to optimise a new flexible retail model

*The 'omnichannel' retail model is the brick-and-mortar store's answer to online retailers. By making their products available across stores and online, they allow customers new levels of flexibility: 'click and collect' or 'buy online return in-store'. However, with these new options comes an operational nightmare. In 2016, University of Michigan Assistant Professors Joline Uichanco and Stefanus Jasin were awarded a National Science Foundation grant to look into streamlining omnichannel retail logistics. So how do they do it?*

Once upon a time, if you needed a new hat you would wait until you had time off work at the weekend and go into town with your pay packet. You would perhaps visit one or two hat shops and choose your favourite within your budget, maybe taking the advice of a shop assistant. You would take your new hat home with you the same day. Today if you need a new hat, you might first check online. You might find several that fit your needs and your budget at various different retailers. You might save some pictures and text them to your friends, and your mum, and then order two dissimilar ones, because the retailers offer free returns. They will be delivered directly to your front door.

Shoppers want flexibility, and while this suits the increasingly busy lives of the modern-day spender, it has introduced intense complexities to the logistics of selling. Huge retailers like Amazon have cornered the online market, making themselves an increasingly attractive option for shoppers with their massive range of products, quick and free shipping and easy returns. In the United States, over 40% of shoppers said they now couldn't live without online shopping. This year in the United Kingdom, footfall in shopping centres and on high streets fell to levels lower than even those immediately after the financial crash of 2008. In order to

compete with the online giants, brick-and-mortar stores have had to come up with a new model.

Imagine, for example, you have just ordered your hats online when your friend texts you back recommending another retailer which has similar hats at a better price. They happen to have a store near your workplace, so you visit on your lunch break and try them on. They don't have the colour you want but that doesn't matter, you use their smartphone app to order one to be delivered in-store, for free. Two days later you pick it up and take a trip to the post office to return the two you ordered initially. This solution has been called the 'omnichannel' retail system.

## A MODERN SYSTEM

A single-channel retailer only sells its products through a single medium, i.e. in-store or online. A multi-channel retailer sells its products via more than one medium, but these outlets, say in-store and online, operate completely separately from one another, managing their pricing, promotion and inventory independently. In the omnichannel model, there are no barriers across the channels; customers can order online and pick up in-store, or vice-versa.



The omnichannel retailer uses its legacy of a network of brick-and-mortar stores to its advantage.

The omnichannel shop can keep prices low by making the whole of its inventory (both in-store and online warehouse stock) available to a larger pool of customers. It maintains product variety by making it possible to ship products from other stores and warehouses to alternative locations. It is possible to ensure a competitive speed of delivery by making use of stock in stores and warehouses local to customers rather than relying on one or two national centres. Finally, returns can be made even easier for customers by offering them 'buy online return in-store' and 'buy in-store return online' options.

Ideal as this shopper's paradise seems, the logistics of managing such a system efficiently and cost-effectively are in practice challenging. The omnichannel retailers are not without expert guidance though. At the Ross School of Business, University of Michigan, Assistant Professors of Technology and Operations Joline Uichanco and Stefanus Jasin have been looking to optimise the model, and find solutions to the many-faceted complications of running a business that can compete in a modern shopping economy.

## A MODERN PROBLEM

Despite the increasing practical importance of this area of research, there is a paucity of literature on the issues facing omnichannel retail businesses. There are a number of potential operational obstacles that Uichanco and Jasin and associated colleagues have looked to address in recent years, and in 2016, the critical nature of such

investigation was recognised by a National Science Foundation grant. The pair aim to develop algorithms and identify policies that lead to optimal decision-making within the omnichannel retail sector.

One problem that faces both online-only and omnichannel retailers is that of fulfilment and split delivery. Shipping products to customers from the nearest warehouse is not always the best solution; future demand forecast must also be taken into account. In addition, if the customer orders more than one product should they be delivered from different warehouses or the same one? In the immediate present, it may be cheaper to group and deliver products from the same place but depending on predictions

of upcoming orders, that may prevent cheaper shipping options in the future.

Another consideration for omnichannel retailers is the necessity to combine both logistics and marketing decisions. For example, whilst you may have considered the cost, time and distance factors affecting a pricing and fulfilment decision, you may also need to try and avoid store markdowns. With products that are of limited stock or shelf-life, it may be more advantageous to ship them from a store with more of that product remaining (even if this might incur higher shipping costs), therefore avoiding large amounts of salvage stock in one place later. In addition, whilst in brick-and-mortar stores, you know your local customer well, as an online retailer your customer

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may order from anywhere, to anywhere. Inventory decisions (where the stock should be best placed to suit customer demands) becomes an infinitely more complex problem.

Further to these dynamics, inventory replenishment and product assortment also become a much more complicated issue in an omnichannel business. A customer might buy an item online, for example, and then return it in-store. The store that the customer returns it to may already have a full shelf of the same item, but without shipping the item back to a warehouse at added cost, the item can now only be sold in-store. It is sometimes also the case that (1) firm strategically places different items at different store locations (i.e., product variety customisation based on local market demand) and (2) some items are only sold online, not in store. This makes return management more challenging since some of the items that are returned to stores are not supposed to be there in the first place.

Whilst the timings and patterns of walk-in customers may also be fairly predictable, sudden and unpredictable online orders can mean that keeping track of and replenishing stock is difficult. Added

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to this, with 'click and collect' online options comes the potential for no-shows; where customers order items, they are taken off the shelf and packaged by store assistants, but then are never picked up. The customer then has to be refunded (if they have paid already) and the item unwrapped and put back on the shelf, or in the storeroom, which in brick-and-mortar stores can be under-sized and over-filled already. As well as the item having been out of sight and unsellable to anyone else for a number of days during the pick-up period, labour has been wasted in the packing and unpacking of the item.

### A MODERN SOLUTION?

These multitudinous problems require innovative solutions that can stand



up to the infinite variables that the situations present. By approaching the puzzles with algorithmic and analytical model methodologies, Uichanco and Jasin have been able to face-down some of the most tangled of these. In 2015 Jasin co-authored a paper hoping to find a method to optimise the fulfilment of multi-item orders in the presence of inventory constraints (location, size of item/warehouse/store). The researchers developed a heuristic best suited to smaller numbers of grouped items, noting

that there was substantial potential for extension of the algorithm. In 2018, Jasin and others published more research on the topic, this time looking to solve the conundrum of jointly deciding prices of items and where best to ship items from for an online retailer selling many products in many regions. In this case, the group theoretically and numerically proved that their heuristic control was very close to a benchmark that jointly re-optimises both price and fulfilment at the beginning of each selling period. In an upcoming study, Jasin and two other researchers have demonstrated two heuristic policies that will help optimise shipping consolidation (the grouping of items) options and delivery deadlines, avoiding expensive shipping costs that might be incurred if

shorter delivery time items are grouped with longer ones.

This year, Uichanco and colleagues have applied a similar theory to a fictitious omnichannel retail network in the United States, proving that a combined heuristic could outperform a short-sighted, decentralised planning strategy when making a joint inventory and fulfilment decisions. Uichanco has also been looking into price optimisation when there is cross-channel (i.e., online and in-store) supply and demand as well as price transparency across mediums (i.e., customers can see if prices are different online and in-store). By modelling the pricing problem in a particular programme, the group managed to write two pricing policies that resulted in an estimated 13.7% increase in clearance period revenue in a pilot trial at a large United States retailer.

With their application of modern research methods, and combined experience in operations management and computational and mathematical engineering, it is clear that Joline Uichanco and Stefanus Jasin are making an impressive contribution towards the optimisation of the new omnichannel retail model. Whilst this flexible type of selling has obvious advantages for customers, it is critical that sellers find a way to make it work for them as well. If brick-and-mortar stores are to survive at all in a world led by online giants, retailers certainly need to take on board the solutions offered by researchers such as these.

# Behind the Research



Assistant Professor  
Joline Uichanco



Assistant Professor  
Stefanus Jasin

**E:** [sjasin@umich.edu](mailto:sjasin@umich.edu) **T:** +1 734 764 2305 **W:** <https://sites.google.com/a/umich.edu/jasin/> **W:** <https://sites.google.com/a/umich.edu/juichanco/home> **W:** [www.nsf.gov/awardsearch/showAward?AWD\\_ID=1561791](http://www.nsf.gov/awardsearch/showAward?AWD_ID=1561791)

## Research Objectives

The objective of this research is to develop algorithms and identify policies that are optimal or near-optimal for decisions arising in retail operations with multiple channels. These decisions include (1) assortment and inventory policies that prescribe which products, and how many units per product, should be stocked in each store and distribution centre; (2) fulfillment policies that prescribe from which store, or distribution centre, online orders should be fulfilled; and (3) pricing policies that dynamically adjust the price of products sold in certain channels to maintain a balanced system-wide inventory distribution.

## Detail

Prof Stefanus Jasin  
University of Michigan's Ross School of Business  
701 Tappan Street  
Ann Arbor, MI 48109-1234  
USA

### Bio

Joline Uichanco is an Assistant Professor in Technology and Operations at the Ross School of Business, University of Michigan, where she conducts research in analytic models for e-commerce and omnichannel retail operations. She received her PhD in Operations Research from the Massachusetts Institute of Technology in 2013.

Stefanus Jasin is an Assistant Professor in Technology and Operations at the Ross School of Business, University of Michigan. His research interest is in algorithmic and prescriptive business analytics, with applications in revenue management, pricing, and e-commerce/omnichannel logistics. He received his PhD in Computational and Mathematical Engineering from Stanford University in 2011.

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### Collaborators

- Amitabh Sinha ([amitabsi@amazon.com](mailto:amitabsi@amazon.com))
- Roman Kapuscinski ([kapuscin@umich.edu](mailto:kapuscin@umich.edu))
- Yanzhe (Murray) Lei ([leiyz@umich.edu](mailto:leiyz@umich.edu))
- Lai Wei ([laiwi@umich.edu](mailto:laiwi@umich.edu))
- Aravind Govindarajan ([arav@umich.edu](mailto:arav@umich.edu))
- Shivaram Subramanian ([subshiva@us.ibm.com](mailto:subshiva@us.ibm.com))
- Pavithra Harsha ([pharsha@us.ibm.com](mailto:pharsha@us.ibm.com))



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## Personal Response

**From the customer's point of view, what problems do you think remain with the omnichannel retail model? How do you think retailers and researchers like yourself will be able to resolve them?**

One big challenge is due to the high likelihood of customer return, especially for experiential products such as fashion, which makes operations more challenging. Retailers can partially resolve this issue by thinking about smart ways to encourage customers to keep their products. In terms of research, there is a need for a model (for inventory and fulfillment decisions) that explicitly takes customer return behaviour into account. This can be done by first developing more accurate predictive models of customer behaviour, which can later be used for building better decision tools.