Rebalancing operations and and supply chain management

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Rebalancing operations and supply chain management:

Models, data, and humans

Inaugural speech by

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Tilburg University

Understanding Society

Jan C. Fransoo (1965) was appointed as Full Professor of Operations and Logistics Management in the School of Economics and Management at Tilburg University per 1 November 2020. He has conducted research across a wide variety of domains and methodologies, all related to supply chain and operations management, and published extensively in academic journals in operations management, operations research, industrial engineering, and transportation science. He currently serves as Associate Editor of Operations Research, and of Production and Operations Management. In recent years, his research has mainly focused on retail operations in developing countries and other emerging markets. Further, he is specifically interested in supply chain decision making by human supply chain planners operating in an increasingly automated context. Apart from these lines of research, he also has active research lines on omnichannel retail, intermodal and ocean container transportation, and urban logistics.

In his research, Fransoo regularly collaborates with industrial, governmental and inter-governmental partners. His research and his analyses of the societal impact of operations and supply chain management have featured in national and international media. Fransoo teaches at Tilburg University in the Supply Chain Management Master Program, the CentER PhD Program in Business Administration, and the International Business Administration Undergraduate Program, along with executive teaching at TIAS and the Massachusetts Institute of Technology (MIT).

Prior to his appointment at Tilburg University, Fransoo held faculty and leadership positions at Eindhoven University of Technology and Kuehne Logistics University, and visiting positions at Clemson University, Stanford University, the University of California at Los Angeles, the University of Ljubljana, and MIT. He currently holds honorary affiliations with Eindhoven University of Technology and MIT.

Rebalancing operations and supply chain management: Models, data, and humans

Prof dr ir Jan C. Fransoo

Lecture,
delivered at the occasion of the public acceptance of the position of Full Professor of Operations and Logistics Management at Tilburg University on 23 September 2022

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Welcome

Dear Rector Magnificus,

Dear Deans,

Dear colleagues,

Dear attendees in today's event, whether present here in person or online,

The 2020 Covid-19 pandemic and the 2022 Ukraine war have been revelations to anyone around the globe on the importance and complexity of global supply chains. We have learnt the hard way that semiconductor shortages due to an increase in demand for home electronics in 2020 can lead to severe disruptions in the automotive supply chain that we still feel more than two years later. We have observed how market lockdowns in Europe and factory lockdowns in China, augmented by a single stranded ship in the Suez canal, have been able to massively disrupt a fine-tuned, seemingly simple and seamlessly operating ocean container transportation system. We have experienced how a successful vaccination campaign is highly dependent on a proper design of the supply chain and its operations. And we have noted the fragility of the newly developed Eurasian rail corridor that has been disrupted by the Ukraine war and subsequent Western sanctions against Russia.

Introduction

The growth in global trade in the last three decades has been largely enabled by what some have denoted as the most influential technological invention of the past century: the ocean shipping container.[1] The ocean shipping container is not just the standardized "box" that we see everywhere nowadays, but the entire system of standardized loading carriers such as ocean vessels, inland barges, trucks, and rail cars, along with the handling equipment that can move a container from one load carrier to another for a very small marginal cost. Bernhofen, El-Sahli and Kneller[2] published an analysis in the *Journal of International Economics* demonstrating that the impact of the ocean shipping container on global trade has been almost 3 times as large as the adoption of the GATT agreement, later transitioning to the WTO. Reversely, this also implies that impediments in the ocean container supply system are likely to have much larger effects than the imposition of new tariffs undermining free trade. US imports from China continued to increase following the imposition of tariffs by the Trump administration. However, disruptions in the global container system in 2021 severely affected Chinese exports. Hence, a thorough understanding of global supply chains is essential, and this explains why supply chain management is a key discipline in a school of economics and management like ours here in Tilburg.

While we have started to realize how the enormously efficient and low-cost logistics, and their associated global supply chains have enabled global trade to flourish, we also simultaneously – and maybe surprisingly - have little understanding why the consequences of the disruptions that we have seen over the past couple of years have been so massive. Many in the business press have argued that the so-called "just-in-time" inventory philosophy has been the root cause. The just-in-time philosophy is an important element in the set of operations management principles as developed by Japanese car maker Toyota in the 1970s. In that philosophy, it is argued that having inventory is a signal of problems in the supply chain. Only by reducing inventory, the true problems in the supply chain become visible. It is important to realize that the focus of the Just-in-Time philosophy is not to reduce the cost of carrying inventory or the capital tied up in inventory, but instead very much to improve product quality. Since production defects of parts typically become visible at the next stage in a supply chain where the parts are being used in subassemblies, or the subassemblies being used in final products, first storing them in inventory delays the point in time where production defects are being discovered. Hence, the just-in-time system is generally not driven by a drive to reduce inventory. Instead ,studies that have been conducted in the past few decades show generally that inventory in global supply chains has increased globally. While I am unaware of more recent studies, a simple look at the US census data of the decade prior to the pandemic suggests that inventories have been increasing globally. Using an excessive deployment of just-in-time.

[1] For an excellent introduction to the history and importance of the ocean shipping container, see Levinson, M. (2016). *The Box.* Princeton University Press.

[2] Bernhofen, D. M., El-Sahli, Z., & Kneller, R. (2016). Estimating the effects of the container revolution on world trade. *Journal of International Economics, 98,* 36-50.

As a sidenote, we oftentimes do not realize that these additional inventories are not just paper data. Inventories are physical goods that require physical space. This physical space is provided by warehouses, container yards, and distribution centers. The current discussion in densely populated areas such as here in the Netherlands and also in the greater New York City area that too much of the scarce public space is used for such buildings to hold inventory is closely linked to this growth in inventory. While I believe that the predominant societal pressure to reduce this usage of our limited public space is warranted, some basic understanding of tradeoffs in the operations management discipline will tell us that limiting this space will unavoidably lead to consumers experiencing lower availability of goods, higher costs for their online purchases, and more freight vehicles on the road. It is simply not possible to expect very short lead times when ordering products online at no cost, while not being willing to make public space available to deliver such services. A common English proverb says that "you can't have the cake and eat it". Operations management is always about making choices as a trade-off. In our group at Tilburg, we have just started a study to better understand the impact of this growing need of inventories on the requirements of public space. It is our role as supply chain management researchers to make these trade-offs visible to policy makers such that eventual decisions will be fact-based, and with oversights of the consequences.

Model-based Operations Management theories

Leaving this interlude on the use of public space aside, the reasoning that I just outlined implies that it is likely not to be the scarcity of inventories that has driven the enormous operations disruption of the global supply system, but there are other drivers that can collectively explain the status that we are in. Without the intention of being complete, or even having conducted a formal analysis on the matter, I will briefly outline these drivers as they are a good way to list the basic model-based theories of my discipline that is operations management. These are:

1. The role of margins in the supply chain to decide on inventory levels based on the newsvendor model;
2. The exponential effect of utilization on lead times based on queuing models; and
3. The bullwhip effect driven by the existence of positive lead times.

After briefly introducing these basics, I will then shift to the main areas of research that I am currently working on and that will scope my research in the coming years.

Supply chain managers are expected to smartly decide on buffers to counter risk and other uncertainties. Uncertainties may include sudden increases or decreases in consumer demand, such as dealing with an unexpectedly high demand in beer or ice-cream due to the heat wave that we have experienced in the past Summer. Uncertainties may also include disruptions in supply due to labor shortages or transport disruptions. While these uncertainties are omnipresent, customers expect products to be available for the most part of the time. To guarantee a certain level of availability, supply chain managers need to introduce buffers into the supply chain. Such a buffer could exist of additional capacity or could be created by making the lead time a bit longer than actually might be needed. The most common buffer to be introduced is inventory. Inventory serves to buffer customers from uncertainties in the supply chain. However, inventory carries a cost: it ties up capital that could have been allocated to other investments, and it leads to operational expenses for storage and handling. The willingness of a firm to invest in inventory largely depends on the margin that the company can realize: if a firm's margin is larger, a firm should create more buffers to counter uncertainty. In supply chain management, this is captured in the newsvendor model, that essentially computes the buffer size, given the gross margin of the product. A fashion sneaker firm like Nike with a very strong brand and a large gross margin will likely be willing to invest more in such buffers than a hard-discount retailer operating at tight margins like Aldi. If Nike however outsources its production to a contract manufacturer in South Asia with a low margin, that contract manufacturer might be much less willing to do so. Consequently, under uncertainty, the buffers of low margin supplier will be smaller than the required buffers for the firm with the high margin, effectively harming the service level the consumer is experiencing.

Ocean container liners like Maersk have been operating for decades under very thin margins, and hence have built in smaller buffers to deal with uncertainty. Hence, the ocean container supply chain has been unable to deal with unexpected fluctuations in demand. The newsvendor model hence provides us with a structural explanation for the lack of capacity buffers in this supply chain. Similar, in last year's vaccination campaign here in the Netherlands, I argued to prepare with excess capacity in the mass vaccination facilities, to ensure that any available vaccine could be administered as soon as possible. My reasoning was that the societal cost of having a vaccine sit unused in a freezer was much higher than having excess capacity available at the mass vaccination sites. A simple societal application of newsvendor thinking.

The second basic theory to understand in global supply chains is the exponential effect of system utilization on the waiting times in a system. This is grounded in queuing theory. In a queuing system with stochastic arrivals and stochastic processing times, the waiting time at the server will increase exponentially with utilization. The implication is that for instance in a manufacturing line where the utilization of a server increases from 70 to 90%, it may easily happen that the average waiting time for customers increases 4-fold. In the ocean container supply chain, we saw this happen late last year on the US West Coast, where the utilization of the container yard increased from about 60% to well over 80%, resulting in more than 100 container ships anchored at the roadstead. Also in our vaccination campaign, the excess capacity was required to ensure that vaccines, which experienced a highly uncertain supply situation, would not be in line to wait for scarce vaccinators to reach upper arms in need.

The third important theory that I would like to bring up here is the dynamics in a supply chain caused by the fact that lead times in a supply chain are positive, that is, they are greater than zero. Since we deal with physical products, it takes time to manufacture these products, and it takes time to transport intermediate products to other facilities for final assembly, and it takes time to move consumer products to the store or to consumers' homes. Even more so, within firms it takes time between the moment that a decision is made, for instance about placing an order with a supplier, until that decision is implemented, in this case by starting production of that order on a machine. In supply chains, lead times are almost always positive, and if lead times are positive, any control theorist will know that it is very hard for supply chains to be in equilibrium. The mere existence of positive lead times leads to imbalances in supply and demand. Moreover, human decision makers respond to such imbalances in supply and demand by more excessive overordering or underordering, a phenomenon discovered by Jay Forrester in the 1950s, and later systematically analyzed by Hau Lee and coined as the "bullwhip effect". In work that we conducted in our team in 2009[3], we could demonstrate that a substantial effect of the dynamics following the 2008 global financial crisis was the consequence of

[3] Udenio, M., Fransoo, J. C., & Peels, R. (2015). Destocking, the bullwhip effect, and the credit crisis: Empirical modeling of supply chain dynamics. *International Journal of Production Economics, 160,* 34-46.

such bullwhip decision making in firms. Again in the covid-19 pandemic, the persistent dynamics in supply and demand have been amplified by bullwhip behavior[4].

In my inaugural lecture as Professor at Eindhoven University of Technology, now almost 20 years ago, I have dubbed the discipline of operations and supply chain management as "lead time technology", positioning this within the field of control theory. Now that I have some more grey hair, and now that I have been appointed in a School of Economics and Management, I am tempted to use the term lead time economics, to clearly delineate the importance of including lead time – and uncertainty – in the decision making of firms in a supply chain. It is unfortunate that in most research in the economics and business disciplines lead times are abstracted from, as lead times under uncertainty are a critical phenomenon to not only explain the behavior of firms at micro and meso level – and potentially even at macro level - , but also to develop prescriptive theories of management. It is my intention that with the growth of supply chain management research here at TiSEM, we can find ways to contribute to such insights that transcend my own discipline.

[4] Fransoo, J. C., & Udenio, M. (2020). Exiting a COVID-19 Lockdown: The Bumpy Road Ahead for Many Supply Chains. *Available at SSRN 3590153*.

The role of humans

While the principles of the newsvendor, from queuing theory, and decision making in the presence of positive lead times under uncertainty have long dominated and maybe still dominate the thinking in model-based Operations and Supply Chain Management research, a key element has received remarkably little attention in our field, and this is that eventually virtually all operations decisions (and maybe any managerial decision) are made by humans. These humans operate within individual firms within the supply chain, and some of my supply chain management colleagues here in Tilburg study this *firm perspective* from the angle of organization theory. This is a highly relevant field, and I am glad to have these colleagues in our team here in Tilburg.

My personal research interest in the role of humans, is in the human individuals that actually make day-to-day decisions in the supply chain. I have had a small, but continuous - and I believe impactful - line of research studying these humans in supply chain decision making. For instance, in joint work with Larco and Wiers[5], we documented that supply chain planners only spend a very small fraction of their time in solving decision-making puzzles, while they spend massive amounts of time on obtaining and cleaning the required data, and on building personal relationships with other humans in the supply chain to be able to get their plan implemented. In another study, with Van Donselaar, Broekmeulen, Gaur, and Van Woensel[6], we show that humans outperform a decision-support system at the best-performing grocery retailer here in the Netherlands, since the decision support system in place typically cannot model the entire complex reality. In fact, I would argue that in principle the reality of making complex decisions in supply chain, operations, and logistics management will require additional human involvement over and above what a system is able to do. This is because real-life decisions have characteristics such as ambiguous goals, incomplete information, and oftentimes also involve emotions and time pressure. These characteristics are a likely explanation why, next to the many advanced tools that are available on the market, many supportive tools such as Excel, phone, and WhatsApp remain critical in making supply chains work.

While it is good to see that humans and their decision making role in the supply chain has been receiving much more attention recently in world-class research, I believe that further rebalancing the role of humans versus the role of formal models and microeconomic theories is required to substantially advance our field.

This is much akin to early developments in our field in the manufacturing industry more than 100 years ago. Frederick Winslow Taylor, in his paper "The Principles of Scientific Management", studied the work of human labor in steel plants in Pennsylvania. Using

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[5] Larco, J. A., Fransoo, J. C., & Wiers, V. C. (2018). Scheduling the scheduling task: a time-management perspective on scheduling. *Cognition, Technology & Work, 20*(1), 1-10.

[6] Van Donselaar, K. H., Gaur, V., Van Woensel, T., Broekmeulen, R. A., & Fransoo, J. C. (2010). Ordering behavior in retail stores and implications for automated replenishment. *Management Science, 56*(5), 766-784.

time-and-motion studies, he minutely defined the micro-movements that workers should make, converting meaningful work into a purely transactional activity. To quote Taylor: "One of the very first requirements for a man who is fit to handle pig iron as a regular occupation is that he shall be so stupid and so phlegmatic that he more nearly resembles in his mental make-up the ox than any other type. The man who is mentally alert and intelligent is for this very reason entirely unsuited to what would, for him, be the grinding monotony of work of this character."[7] Essentially, this reduced the worker to a purely transactional machine. Later, in studies conducted at the Hawthorne Western Electric Plant[8], researchers concluded that human motivation and attention to their well-being has an impact on their performance. Humans are not machines, but instead do set their own priorities and decide on their own goals, impacting their operational performance.

A similar development has been unfolding over the past two decades with the deployment of highly advanced supply chain planning systems, initially enabled by the deployment of techniques from the field of Operations Research, and recently augmented by machine learning techniques from the field of computer science. Only five years ago, a much-quoted article in *Harvard Business Review* argued that the field of Supply Chain Management is dead, as effectively all decision making in supply chains would become transactional and fully automated. The premise was that new techniques, under a collective banner of "Artificial Intelligence" could simply collect all data, subsequently solve all problems, and feed this into execution systems where (human or machine) operators would execute these decisions.

Only five years later, the perspective on this has changed massively, as both philosophical groundings and actual industrial experience have now demonstrated that the role of the humans in supply chain decision making is as much alive as ever, with humans making use of the system rather than reverse.

Current availability of massive data and novel methods that have been developed in econometrics will enable us to further develop this understanding of human decision making in the supply chain, especially in relation to the large-scale implementation of very advanced algorithms in many current supply chains. I intend to increase my involvement in this line of research. There, I specifically value the collaboration with researchers in psychology and organizational behavior, as I believe especially the role of emotions in supply chain decision making is much undervalued. Over the past few years, in this respect I have learnt a lot from my former colleague and current collaborator Professor Brosi. In one study that is currently underway, we show that by manipulating compassionate feelings in managers, they make decisions that are significantly more socially responsible.

[7] Taylor, F.W. (1911). *The Principles of Scientific Management,* 59.

[8] The Hawthorne studies have been repeatedly criticized in terms of the actual underlying mechanism. Current consensus is that the manipulation imputed a so-called demand effect, and the methods may not have been very rigorous.

I believe studies like this will provide us with additional means to improve the oftentimes poor working conditions under which factory workers or delivery drivers operate in global supply chains. With the current PhD students Emily Dickey, Joan Stip, and Iman Moosavi we are working to further enhance our understanding of the role and value of humans in supply chain decision making.

My research on nanoretailing

Next to the work on the role of human behavior in supply chain decision making, my most extensive current line of research is on nanoretailing. I have been developing this from scratch over the past decade. Similar to much of my other work, I have benefited in this work from working with co-authors in Europe, China, the United States, Latin America, and the Middle East. My former PhD student Jiwen Ge, and current PhD students Rafael Escamilla and Simone Balvers have been and are making significant contributions to this field of research. I am also very thankful to the Dutch Research Council NWO for recently awarding me a substantial grant to further develop this line of work.

While we as European consumers are used to buy virtually all of our groceries in supermarkets and – especially during the pandemic – also online, consumers in the developing world buy most of their groceries in a traditional retail channel consisting of millions of mom-and-pop stores. Interestingly, and as a side note, these stores go by very specific names in each country, such as *bodega* in Peru, *changarro* in Mexico, *mercadinho* in Brasil, *hanout* in Morocco, *duka* in Kenya, *kirana* in India, and *warung* in Indonesia. In our work, we use the generic name *nanostore*, and we estimate the globally around 50 million nanostores serves about 4 billion consumers. Collectively, they are the largest retail channel in the world[9]. Since the nanostore retail channel is very fragmented, it faces significant operational challenges. For instance, a supplier may be visiting more than 50 nanostores in a single day to deliver the goods, implying high fragmentation of the channel and high logistics costs. Further, many nanostores are cash-constrained and they hence might not be able to buy enough goods to avoid consumers facing a stockout on the shelf. Interestingly, in the past few years manufacturers have started to recognize the strategic importance of this channel and they have been investing in improving its performance, for instance by granting trade credits, or by digitizing transactions.

In our work, we develop and study interventions that make the channel more competitive. Apart from this being of interest to the Consumer-Packaged-Goods firms that supply them, our insights also help reducing the underlying operational costs, and hence benefit both shopkeepers and consumers at the bottom of the pyramid.

To illustrate our work, I will briefly discuss two examples. One of the interesting observations when being out in the field, is that many manufacturers and brand owners physically visit the stores to collect orders and to deliver the products, rather than making use of wholesalers or distributors. Given the very high logistics costs, this does not seem to be fully rational. Together with Ge, Honhon, and Zhao[10], we modeled the decision of a manufacturer serving a network of nanostores. When entering the market, the manufacturer needs to make the decision whether to serve the stores herself, or whether to make use of

[9] Fransoo, J. C., Blanco, E. E., & Argueta, C. M. (2017). *Reaching 50 million nanostores: retail distribution in emerging megacities*. CreateSpace Independent Publishing Platform.

[10] Ge, J., Honhon, D., Fransoo, J. C., & Zhao, L. (2021). Supplying to mom and pop: Traditional retail channel selection in megacities. *Manufacturing & Service Operations Management, 23*(1), 19-35.

a wholesaler. The manufacturer may also choose to pick one of the two channel strategies, and switch strategy whenever needed. We developed a stylized analytical model. In such stylized models, in the tradition of much of what happens in micro-economics, we try to capture the key tradeoffs that the decision maker, in this case the manufacturer, faces. When going direct, the manufacturer can grow the market faster as it has direct market access, and also serve the market better, due to double marginalization happening in the case of indirect distribution. However, serving the market direct incurs a higher cost of distribution. This cost of distribution is dependent on the density of stores. These characteristics are the basis of our stylized model, and in this way the stylized model captures the main tradeoff.

When analyzing this model, we show mathematically that it is never optimal to switch strategy more than once, limiting the number of existing strategies to four: (1) serve the market directly over the entire decision horizon; (2) serve the market via a wholesaler over the entire decision horizon; (3) first serve the market directly, and subsequently switch to wholesale; or (4) the reverse. It turns out that the longer the decision-making horizon is, the more attractive it is to make more use of the direct channel. This requires extensive investments in developing the market but provides a positive payoff later on. Only if the decision-making horizon is short, or if the store density is very low (such as in rural areas), it might be beneficial to make use of wholesalers. Our model can explain the most successful strategies of companies that serve the market directly, and can inform managers at these companies why it makes sense to follow such a strategy.

The second example that I would like to discuss here is an empirical study where we investigate the effect of trade credit on the performance of the nanostore channel. In this recently completed work I collaborate with my PhD student Rafael Escamilla and my colleague Santiago Gallino at The Wharton School. We study the question whether it makes sense for a manufacturer to extend trade credit to the nanostores that she serves. Granting credit will likely increase sales, since shopkeepers are often cash constrained. However, granting credit may also lead to shopkeepers defaulting on their outstandings, leading to a financial loss and potentially also a damaged relationship with a shopkeeper. We leverage data from a Peruvian distributor of hygiene paper products to 20,000 nanostores in Lima. During the three years of observational data, about 6,000 of these stores at some point in time has received a short-term credit. We named the credit an order-based trade credit (OBTC), since the trade credit is limited by at most one order outstanding, and payment is required before the next order is due, one week later. Hence, the credit is actually very limited: one order, for one week. Using a conventional difference-in-difference estimation (and conducting more advanced estimations for robustness), we show that granting a one-week credit increases sales by 160%. That is: sales more than doubles. We can take the mechanism apart and demonstrate that this is driven by a higher sales visit conversion ratio, by larger orders, by a larger assortment, and by fewer rejections of orders upon delivery. While manufacturers are typically very cautious to grant trade credits, our analysis demonstrates that managers can be substantially more generous by granting the credit.

Even at default rates that are much higher than what is currently observed, it is beneficial to extend such trade credit to most clients.

Our upcoming research will address other important questions. Several are centered around the topic of digitization. As the interaction between shopkeepers and manufacturers is increasingly digitized, making use of smartphones, we want to understand the effect of digitization on ordering behavior. My current thinking is that if this is not properly managed and designed, digitization could lead to an increase in logistics costs, eventually hampering the competitiveness of the channel. In a further series of projects, we are studying the effect of making the distribution more responsive and dynamic to take advantage of modern technologies in routing. Also here, we want to understand potential backlashes, for instance to the learning effects of drivers and shopkeepers. We are very fortunate to collaborate closely with many global and local CPG manufacturers and distributors, including several technology startups that have been growing rapidly, in particular in Africa. I therefore very much look forward to expanding our geographical reach beyond Latin America, where most of our work has been conducted until now, to Africa where undoubtedly new and challenging research questions will await us. Such questions will also relate to the role that a fine-grained network of nanostores can play in helping to eradicate malnutrition, an objective within the scope of Tilburg's Zero Hunger Lab. I therefore also look forward to further connecting my work to the important work conducted at the ZHL.

Supply Chain Management at TiSEM

I have been here at TiSEM now for almost two years. Arriving in the middle of a pandemic in a new institution that is so different from my prior affiliations has not been easy. Over the past two years, I have experienced fabulous support by our co-heads of Department and the leadership of the School and the University to help develop the supply chain management area.

First, we have been able to substantially modify the curriculum of our Supply Chain Management master program. This program is one of the largest programs on campus, and one of the largest in Europe, but unfortunately the funding allocation mechanism at TiSEM is such that large programs receive a disproportionately small amount of funding compared to smaller programs in the school. In the new curriculum we have chosen a clear strategic positioning with a focus on supply chain strategy and supply chain sustainability, delivering professionals to the job market that understand the theories underlying supply chain strategic decision making, while also being trained in handling data such that decision-making is evidence-based. The focus now allows us to deliver an efficient high-quality program to the large number of students that choose the Tilburg Supply Chain Management master. To further develop the program, especially in strengthening the link to our rapidly growing research output, will require the School to reconsider the extensive reallocation of income from large programs to small programs. I am convinced this can be achieved by a much closer collaboration between the various TiSEM departments, and having much more cross-departmental collaboration in teaching, valuing the disciplinary and pedagogical strength of the various faculty in our school. I am hopeful that our new Associate Dean for Education will initiate changes such that in the end we are able to deliver high quality, research-based education that is efficient and in line with the way-too-limited funding we receive from the Minister.

Second, I am very happy with the great and talented group of young colleagues, not only in supply chain management but also in the information management group of our section. Leveraging, and maybe also inheriting, the excellent overall TiSEM research culture, Information and Supply Chain Management should be able to be among the top of European research groups in our field. I personally also very much appreciate the extremely friendly and collegial attitude among researchers. In my short tenure here, I have benefited from such interactions with colleagues in Operations Research, Econometrics, Economics, and Marketing, and also across school boundaries with researchers in the School of Behavioral Sciences, the Law School, and the Jheronimus Academy of Data Science. I am very fortunate to also be able to continue my interactions with the engineering scientists at Eindhoven and MIT.

All of this has resulted in excellent publication output of our group over the past few years. Despite the "Recognition and Rewards" program's intentions, we should not abandon the importance of publication output. Academic publications in management undergo a critical peer-review process that serves as a first indicator of quality. To reach true global impact with our work, it is critical that other academics, especially those at other leading

business schools, read and listen to our work. They amplify our findings to help create impact with our work. It is unfortunate that some researchers *only* publish and do not appreciate other types of research output; it is even worse that some of those researchers that only publish are sometimes derogatory of other types of research output. However, such poor attitudes should not be used as an argument that publications have no value and should not be aimed for. It is my intention for our group to ensure we can maintain a healthy culture of publishing our work in the best journals in our field for maximum global impact. I also realize this can never be seen in isolation of other more local impacts, such as in bringing our research into the classroom here at Tilburg, in setting up collaborations with companies and governmental authorities here in Brabant and in the Netherlands at large, in informing the general public of our research findings, and in helping the general public understand developments in logistics and supply chain management affecting their daily wellbeing. I believe that in our supply chain management group we have clearly demonstrated that excellent academic publications, and a much wider impact on society with our research are not mutually exclusive, but mutually reinforcing – excellent research and responsible societal impact can go hand in hand.

Some of these interactions with our corporate partners deserve to be made more explicit and might also need to be institutionalized. For logistics in particular, we have a fair share of the most innovative logistics companies, many of them family-owned, in our backyard in Tilburg and the greater Brabant region, and one of my ambitions, with the strong support of the University, is to make Tilburg University also a home for the logistics companies in the region.

Closing remarks

Since this is not my first professorial appointment, and this inaugural lecture is almost 20 years after my first one, it somehow feels odd to extensively thank those that have brought me to an initial professorship in 2003. However, I would like to mention again and specifically my promotor Will Bertrand. While we could not be more different in character, and I have shaped my career in a completely different way than Will had shaped his, I would like to believe that at least in one dimension we are very similar, and that is in a common thinking that there is no distinction between theoretical research and applied research. There is only a distinction between good and bad research. I have been fortunate that Will has demonstrated throughout his career that close collaboration with companies, and making an impact in society can be very much aligned with publishing the best papers. I am hopeful that more and more colleagues at TiSEM will also recognize that the distinction between theoretical and applied research is just an artefact of policy makers that should not be adopted by academics.

I would like to thank my co-authors for the many collaborations that I have been able to enjoy and still experience today. Given that my curiosity is much larger than my ability, I needed each and every one of you to be able to get the research done that we envisioned. Moreover, in virtually all cases, the collaborations have also been extremely fun and pleasant. Maybe one of the main benefits of academic life that has kept me up and running is that I could work in collaborations that brought such fun and excitement. More specifically, I would like to thank all my former and current PhD students and postdocs, and many of my former Master students, for bearing with me and helping me to elaborate on new ideas. The most fantastic part of being a professor is to have an infinite flow of young people that are interested in collaboration. Despite having reached the mid-50s, I continue to feel young and energized because of you.

Me spending so much of my time on research and teaching (and yes, also administration) has only been possible since at home Nicolette has never complained about my absence or late working hours. Thank you for that! The unfortunate news is that there is hopefully still at least another decade like that ahead of us.

Ik heb gezegd.

Colophon

Website
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