EWG-SustSC2018: Sustainable supply chains and the circular economy

2ND CONFERENCE OF THE EURO WORKING GROUP ON SUSTAINABLE SUPPLY CHAINS

July 6-7, 2018
Amsterdam, Netherlands

EWG SUSTSC SUSTAINABLE SUPPLY CHAINS

EURO THE ASSOCIATION OF EUROPEAN OPERATIONAL RESEARCH SOCIETIES

WELCOME

Dear participants,

We welcome you to Amsterdam and to The Netherlands, where we have the pleasure to organize the 2nd biannual Conference of the EURO Working Group on Sustainable Supply Chains. During this conference, we will have the opportunity to attend and discuss interesting presentations and posters related to sustainable supply chains and the circular economy.

After a very successful first edition of this conference in Aachen in 2016, we hope to have put together a worthy successor. As was the case for the first edition, this edition is also preceded by a EURO PhD Summer School on Sustainable Supply Chains, hosted on campus at Wageningen University. Here, a variety of modelling approaches in relation to sustainable supply chains were addressed. Many of the PhD students attending the Summer School are also joining our conference, making for a good mix of young and experienced researchers.

We would like to thank the Amsterdam Institute of Advanced Metropolitan Solutions (AMS) for generously offering us to use their facilities and for sharing some sustainability challenges in metropolitan areas. We would also like to take this opportunity to thank the Dutch Science Foundation NWO, who (together with AMS) support the LogiCE research project on the role of logistics and supply chain management in the circular economy; this enables our group at Wageningen University to make the topic of this conference a key part of our work. We hope that, in turn, the conference provides inspiration for AMS and its activities, and that it leads to new food for thought within the LogiCE research project.

We hope you will enjoy the programme, and take the opportunity to discuss your research, to get inspired for new research, and to meet old and new friends in the community.

Your local organizers,

Renzo Akkerman & Rene Haijema

Wageningen University

AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS

LogiCE

WAGENINGEN UNIVERSITY & RESEARCH

EWG SUSTSC SUSTAINABLE SUPPLY CHAINS

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PRACTICAL INFORMATION

WiFi

Network: AMS
Password: amsterdam

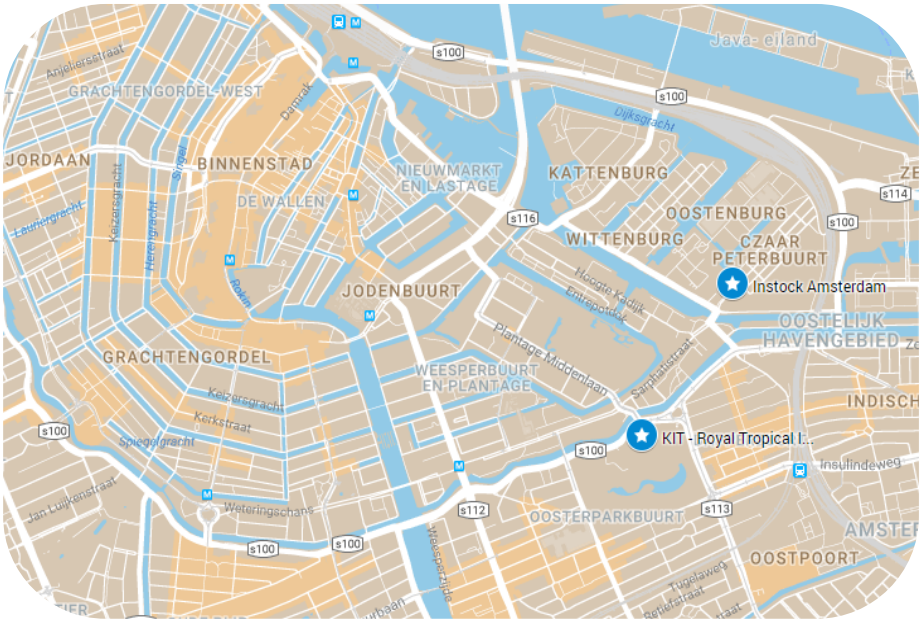
Locations:

Room: 'Leeszaal' @

Amsterdam Institute of Advanced Metropolitan Solutions:
(located in the Royal Tropical Institute)
Mauritskade 62
1092 AD Amsterdam
Tel +31 20 6651350

KIT Royal Tropical Institute:
Mauritskade 64
1092 AD Amsterdam
Tel: +31 20 568 8711
https://www.kit.nl/

Restaurant
Instock Amsterdam:
Czaar Peterstraat 21
1018 NW Amsterdam
Tel: +31 20 363 5765
Website:
https://www.instock.nl/en/



General travel information:

Payment:
In the Netherlands the OV-chipkaart is used for payments in bus, tram and metro. You can buy an OV-Chipkaart at a self-service ticket machine at stations or stops. You can upload your card with a balance in euros, which you can use everywhere.

Train: If you travel up and down the same route on the same day, you have to purchase a return ticket. If you will not return the same day, you need to buy a one-way ticket product. If you visit several places on the same day, you should buy a ticket stating via which destination(s) you will be travelling. Note that there is a €1 supplement on the four most commonly used products. You can upload your card with a balance in euros, which you can use everywhere.

Bus: On busses it is still possible to also buy a single ticket at the bus driver's. However, this is commonly associated with higher costs.

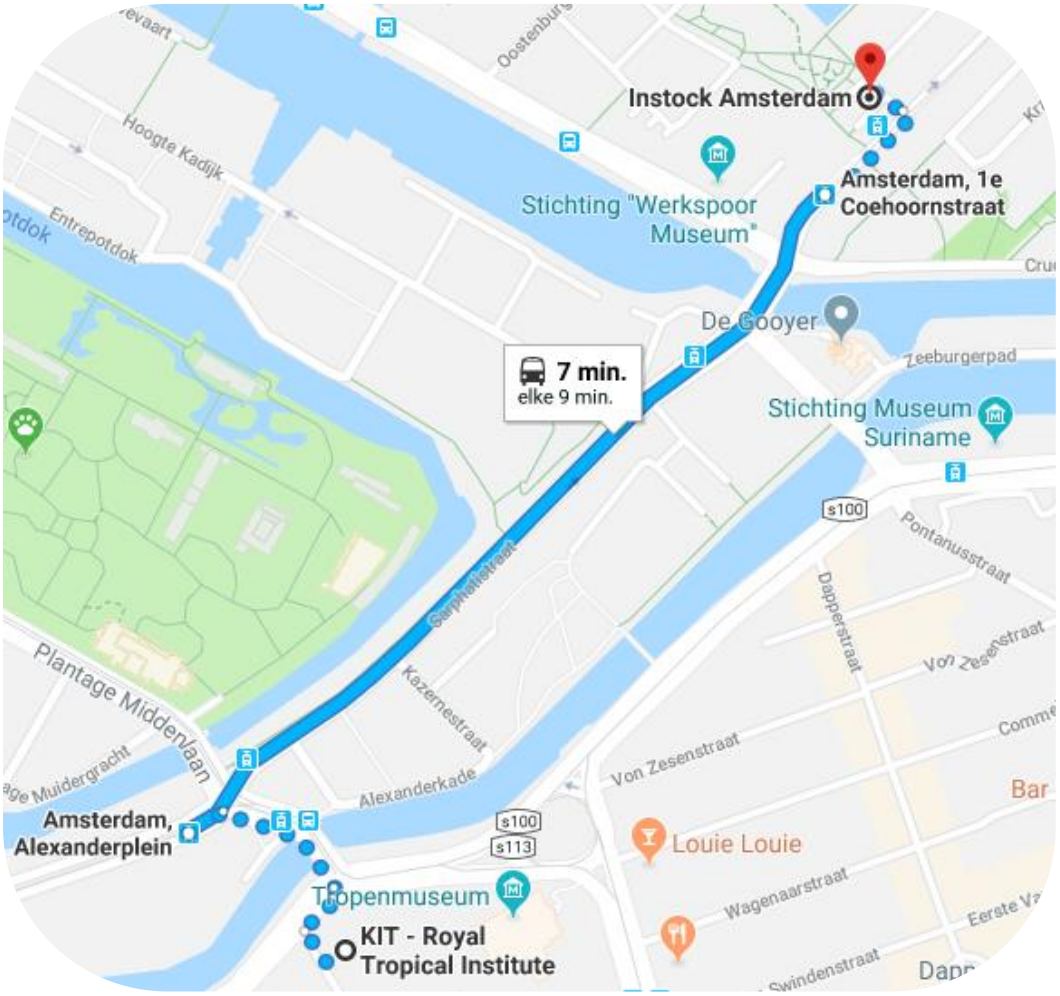
For more information about the OV-chipkaart and points of sale please visit 9292ov.nl.

Traveling directions to restaurant INSTOCK

By foot: 13 minutes

By tram (7 minutes):

1. Walk to Tramhalte Alexanderplein, Amsterdam (2 minutes)
2. Take **tram line 10** in the direction of **Azartplein** (departs every 9 minutes)
3. Get off the tram at the stop **Tramhalte Eerste Coehoornstraat,** Amsterdam
4. Walk to Instock Amsterdam @ Czaar Peterstraat 21 (1 minute)



RESCUED FOOD NEVER TASTED SO GOOD!

At restaurant Instock, we turn food surplus into delicious meals. Crooked fish, carrots with two legs or ripe mangoes play the main role in our dishes. These are ingredients that normally remain unsold. Why? Due to beauty flaws, strict quality requirements or simply surpluses. Buuuuut, we got some good news. By eating breakfast, lunch, or dinner at Instock, you rescue food! Enjoy your meal!

SCHEDULE FRIDAY (JULY 6)

9:00-9:25	**Registration**	
9:25-9:35	Welcome and Introduction	Renzo Akkerman/Rene Haijema *Wageningen University*
9:35-10:00	Challenges in de Metropolitan of Amsterdam	Arjen Spijkerman *AMS: Amsterdam Institute for Advanced Metropolitan Solutions*
10:00-10:45	How Sustainable is Big Data in supply chains?	Charles Corbett *UCLA Anderson School of Management*
10:45-11:15	**Coffee Break & Posters**	
11:15-12:30	**Session I**	***Session Chair: Grit Walther***
		Alistair Beames, R. Akkerman, R. Haijema, J. Bloemhof *Logistics in the circular economy: Challenges and opportunities*
		Bruna Mota, A. Carvalho, M.I. Gomes, and A.P. Barbosa-Póvoa, *Impact of life cycle inventory and life cycle impact assessment steps in sustainable supply chain design and planning*
		Maximilian Schiffer, S. Stütz, and G. Walther, *Are ECVs breaking even? Competitiveness of electric commercial vehicles in mid-haul logistics*
12:30-13:30	**Lunch**	
13:30-14:00	**Poster pitches**	
14:00-15:15	**Session II**	***Session Chair: Ana Paula Barbosa Póvoa***
		Weichun Chen, B. Mantin, and B. Li, *Government's optimal inter-temporal subsidy and firm's dynamic pricing in the presence of uncertain cost reduction*
		Mostafa Pazoki, and G. Zaccour, *A mechanism to promote product recovery and environmental performance*
		Yael Perlman, *A two-dimensional vertical differentiation consumer choice model in a sustainable supply chain*
15:15-15:45	**Coffee Break & Posters**	
15:45-17:00	**Session III**	***Session Chair: Rene Haijema***
		Christian Fikar, and M. Leithner, *Consolidation and distribution strategies to mitigate food losses within regional organic food deliveries*
		Valentas Gružauskas, and E. Gimžauskienė, *Food wastage reduction with collaborative forecasting: Emergence of sustainability*
		Vanessa S.M. Magalhães, L.M.D.F. Ferreira, and C. Silva, *Modelling the causes of food loss and waste: an integrated TISM-fuzzy MICMAC analysis*
19:00	**Conference dinner @ Instock**	

SCHEDULE SATURDAY (JULY 7)

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		Cátia da Silva, A.P. Barbosa-Póvoa, and A. Carvalho, *Design and planning of supply chains using environmental impacts monetization*
		Vibhanshu Abhishek, J. Guajardo, and Z. Zhang, *Business models in the sharing economy: Manufacturing durable goods in the presence of peer-to-peer rental markets*
10:15-10:45	**Coffee Break & Posters**	
10:45-12:00	**Session IV**	***Session Chair: Renzo Akkerman***
		Arsham A. Khoei, H. Süral, and M.K. Tural, *Multi-facility green Weber problem*
		Karsten Kieckhäfer, C. Müller, K. Schmidt, and T.S. Spengler, *Configuration of automated disassembly lines enabled by Industry 4.0 technologies*
		Shailly Chaurasia, S.S. Padhi, and R.K. Pati, *Nutraceutical industry: A new path to attain sustainable development goals of 2030*
12:00-13:00	**Closing & Lunch & Farewell**	

POSTER SESSION

INTRODUCTION

In the week leading up to our conference (July 2-5) , the EURO Summer School on Sustainable Supply Chains was organized on campus at Wageningen University. Several of the presentations scheduled at this conference are also held by PhD students that attended the Summer school.

In addition, some of the participants prepared poster presentations, which will be briefly pitched as part of the conference programme. Below, an overview of the poster details can be found.

POSTER 1

Reverse logistics network for fiber reinforced plastic waste
Valentin Sommer and Grit Walther

POSTER 2

Title: *Efficient meat analogue production chains*
Nynke Draijer and Atze Jan van der Goot

POSTER 3

Quantitative models for resource efficient supply chains: a systematic review
Ursula Davis, Alok Choudhary, Grammatoula Papaioannou, Ravi Shankar

POSTER 4

Collaboration mechanism design for green supply chains with asymmetric information
Kailan Wu, Jafar Rezaei, Lori Tavasszy, Bart de Schutter

COLLECTION OF ABSTRACTS

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Schiffer, M., Stütz, S., & Walther G. (2018). Are ECVs breaking even? Competitiveness of electric commercial vehicles in mid-haul logistics

BUSINESS MODELS IN THE SHARING ECONOMY: MANUFACTURING DURABLE GOODS IN THE PRESENCE OF PEER-TO-PEER RENTAL MARKETS

Vibhanshu Abhishek[1], Jose Guajardo[2], Zhe Zhang[1]

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ABSTRACT:

Business models that focus on providing access to assets rather than on transferring ownership of goods have become an important industry trend. We analyze the interaction of a peer-to-peer (P2P) rental market and an original equipment manufacturer (OEM). Our analysis highlights the role of consumer heterogeneity in usage rates. Introduction of P2P creates an equalizing effect (willingness-to-pay of high/low-usage consumers becomes more similar), which leads to purchases from low-usage consumers. It also allows the firm to implicitly segment the market, while providing just one good. As a consequence, the firm can be better off in the presence of P2P when the level and heterogeneity in usage rates are above a threshold. Surprisingly, consumers might be worse off due with P2P rentals, because the firm's ability to implicit segment consumers and extract a larger fraction of their surplus. In addition, P2P rentals benefit low-usage consumers proportionally more than high-usage consumers. We investigate alternative market structures for the OEM, and show that the firm is never better off with P2P when usage rates in the market are too low. If usage rates are sufficiently large, the firm is better off with P2P rentals when the equalizing effect dominates, which requires a sufficient level of heterogeneity in usage rates. If a P2P market is unavoidable, the OEM would not necessarily be better-off by introducing its own rentals to compete against P2P. Thus, contrary to what could be expected, the OEM has an incentive to facilitate P2P rentals in a large variety of cases.

KEYWORDS: sharing economy, business models, peer-to-peer marketplaces, rentals

MULTI-FACILITY GREEN WEBER PROBLEM

Arsham Atashi Khoei[1], Haldun Süral[2], Mustafa Kemal Tural[2]

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[2] Department of Industrial Engineering, Middle East Technical University, Ankara, Turkey.

ABSTRACT:

The multi-facility Weber problem corresponds to locating a number of facilities on the plane so as to minimize the sum of the weighted Euclidean distances between the customers and the allocated facilities. Its applications can be exemplified by locating warehouses or facilities for a distribution system in which the demands will be delivered directly to the customers. Such distribution systems consume a large amount of fuel and increase the emissions of greenhouse gases.

In this scope, the multi-facility green Weber problem (MF-GWP) is a planar location problem that aims to minimize the amount of CO2 emission in a distribution system. The MF-GWP, determines the locations of p facilities on the plane and the speeds of the vehicles while minimizing the total CO2 emission. We formulate the MF-GWP as a mixed integer second order cone programming (MISOCP) problem. Since the MISOCP formulation of the MF-GWP is weak, only small size instances can be solved to optimality in 4 hours. For solving large problem instances, well-known heuristics developed for the multi facility Weber problem such as alternate location-allocation heuristic, transfer follow-up heuristic, and decomposition heuristic are utilized as well as a newly developed local search approach.

The computational results represent the difficulties of finding the exact solution of the MF-GWP with the MISOCP formulation even for the small size instances. For larger problem instances, quality of solutions obtained by different settings of computational experiments, depict the performance and benefits of the improvement heuristics proposed in our study.

KEYWORDS: multi-facility Weber problem, carbon dioxide emission, green facility location, second order cone programming

LOGISTICS IN THE CIRCULAR ECONOMY: CHALLENGES AND OPPORTUNITIES

Alistair Beames[1], Renzo Akkerman[1], Rene Haijema[1], Jacqueline Bloemhof[1]

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ABSTRACT:

Circular Economy (CE) is a concept that has gained considerable attention in recent years, particularly in scientific literature in the Industrial Ecology domain. CE is both a critique of what its advocates refer to as the 'Linear Economy' and an exhortation to preserve the natural environment by minimizing resource extraction and waste generation. CE requires products to be easily repaired, refurbished, remanufactured, and eventually recycled. Clearly, this development creates many distinct material flows that have to be managed in an efficient and sustainable manner.

Existing studies on CE tend to focus on product design, material use, and the market potential of CE products with little attention paid to the logistics challenges associated with such developments. In order to be able to design and operate sustainable and circular supply chains, as well as inform policy on the transition to a CE, these challenges should be addressed.

From a logistics perspective, CE can be seen as the integrated management of forward and reverse flows of products in a supply chain. In the quantitative operations and supply chain management literature, a large body of knowledge on how to operationalise closed-loop supply chains (CLSC), already exists and is a starting point for understanding logistics in the CE context. This presentation presents an overview of possible modelling concepts to simulate, optimize, and measure the performance of CE products in their supply chain context. The central question addressed is how operationalising a CE supply chain differs from the 'Linear Economy' and traditional CLSCs.

KEYWORDS: circular economy, logistics, closed-loop supply chains, operations management

NUTRACEUTICAL INDUSTRY: A NEW PATH TO ATTAIN SUSTAINABLE DEVELOPMENT GOALS OF 2030

Shailly Chaurasia[1], Sidhartha S. Padhi[1], Rupesh K.Pati[1]

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ABSTRACT:

Sustainable development agenda of 2030 has mentioned first three major goals such as eradication of Poverty, hunger, maintenance of good health and well-being. With ever-changing lifestyle, population growth, ageing population, escalating costs of healthcare, most of the habitats leads to malnutrition (nutritional deficiency), overweight persons all over the world resulting in high out-of-pocket expenditure of medicines, congestion in hospitals, doctors' availability, biomedical wastes etc. This is particularly observed in developing/underdeveloped economies compared to structured developed economies.

Reactive customers concerned about proper nutritional intake are less susceptible to acute and chronic diseases whereas, unreactive customers have higher tendency to increase expenditure on medicines. Hence, as a preventive health care measure proper Nutraceuticals consumption can play a vital role to improve all the customers' overall health. In this paper, we use system dynamics approach to understand the market dynamics of nutraceuticals to capture the causal and non-linear relationships between factors. Efficient pricing policies, capacity decision and consumer behaviour have been analyzed.

It was observed that the personalized nutraceutical products with premium quality with higher price demonstrate higher price elasticity than the standardized products with allowable quality and comparatively low price. Reactive customers prefer both personalized and standardized products leading to high demand but unreactive customers prefer only personalized products. Hence, subsidy by government agencies can help to bridge the elasticity gap along with proper market penetration strategies by government, self-help groups, companies. This would improve the health of community with reduced pharmaceutical (production and disposal causing environmental pollution) and competitive advantage for the manufacturers.

KEYWORDS: nutraceutical supply chain, sustainable development goals, reactive/ unreactive customers, system dynamics modelling

GOVERNMENT'S OPTIMAL INTER-TEMPORAL SUBSIDY AND FIRM'S DYNAMIC PRICING IN THE PRESENCE OF UNCERTAIN COST REDUCTION

Weichun Chen[1,2], Benny Mantin[2], Bo Li[1]

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[2] Luxembourg Centre for Logistics and Supply Chain Management, University of Luxembourg, Luxembourg,
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ABSTRACT:

We study a two-period monopolistic setting where a manufacturer sells environmental-friendly products to consumers under government's consumption subsidy provided directly for consumers. We model the interaction among government, manufacturer and consumers incorporating with uncertain production cost reduction which is induced by technology improvement, cost learning and uncertain factors.

The goal of this paper is to investigate the government's two subsidy adjustment policies: (1) committing the subsidy adjustment beforehand (commitment policy); (2) dynamically announcing the subsidy policy before each period (dynamic policy). Then the manufacturer dynamically decides the corresponding optimal price in each period, and consumers strategically choose whether to purchase in the first period or to wait until the second period when the product will be offered at a lower price.

Our results show that the expected effective sales price (original price minus subsidy) is the same under both policies. Thus, both the two policies lead to the same expected demand and finally the same environmental benefit. However, the consumer's surplus is higher under the dynamic policy, which contributes to the dynamic policy's domination in social welfare. The manufacturer can be better-off or worse-off under the dynamic policy. If the variance of cost reduction is sufficiently small and the fixed cost reduction is higher than a certain level, then the commitment policy is better for the manufacturer. In addition, we further analyze the model extensions such as assumption relaxation, impacts of consumer's network effect and the government's sales target.

KEYWORDS: government subsidy adjustment, cost reduction uncertainty, cost learning, strategic consumers

DESIGN AND PLANNING OF SUPPLY CHAINS USING ENVIRONMENTAL IMPACTS MONETIZATION

Cátia da Silva[1], Ana Paula Barbosa-Póvoa[1], Ana Carvalho[1]

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ABSTRACT:
Managing supply chain complex systems towards efficient and sustainable goals is a challenge due to the increase of business competitiveness and legislation compliance faced by industry's supply chain. In order to manage these concerns efficiently, industries need to be able to design, plan and operate their chain towards sustainability. When addressing such problems, the academic community has been mainly focused on economic indicators, but environmental concerns are today a reality that has to be deal with. Taking into account the supply chain complexity due to its geographical dispersion and higher number of products and entities involved, it is imperative the usage of decision support tools that can inform decision maker's decisions. Most sustainable supply chain design and planning published approaches have employed multi-objective optimization methods to optimize its economic and environmental performances individually leaving to the decision maker the weighting of these objectives. But this may create difficulties when taking decisions, as the adequate weighting of such objectives is not an easy task and academically is still a problem to be solved. Monetization appears as a possible method to address such problem where environmental impacts are monetized. This work contributes to the development of this theme and proposes a mathematical optimization model that accounts for the economic and environmental pillars in the same unit by monetizing environmental impacts. In this way, objectives weighting can be explored, and conclusions can be drawn on how monetization can improve decision maker's decision. The model is applied to a European supply chain case study and its applicability is demonstrated.

KEYWORDS: supply chain, sustainability, monetization

CONSOLIDATION AND DISTRIBUTION STRATEGIES TO MITIGATE FOOD LOSSES WITHIN REGIONAL ORGANIC FOOD DELIVERIES

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[2] Institute of Production and Logistics, University of Natural Resources and Life Sciences, Vienna, Austria,

ABSTRACT:
Increased demand in regional organic food products result in high amounts of such perishable food products being shipped daily to reach customers on-time and with the desired quality. To support sustainable food logistics operations and mitigate food losses, this work investigates the option to facilitate existing agricultural infrastructure to consolidate multiple food shipments of independent organic farmers prior to shipment to end customers. A decision support system is developed that integrates food quality models within simulation and heuristic optimization procedures to dynamically estimate food spoilage and model delivery operations. Various consolidation and distribution strategies are investigated to derive implications and provide guidelines on how to reduce food losses and lower travel distances. The focus is set on highly perishable fresh fruits and on regional organic food supply chains where products originate at multiple small independent locations and are commonly transported in small batches. Computational experiments originating from the distribution of organic strawberries in Austria highlight the benefits of such consolidation strategies to achieve sustainable operations by both reducing food losses and total travel distances.

KEYWORDS: simulation-optimization, food logistics, organic food, decision support

FOOD WASTAGE REDUCTION WITH COLLABORATIVE FORECASTING: EMERGENCE OF SUSTAINABILITY

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ABSTRACT:

Consumer demand for high variety, just in time delivery with minimal costs has drastically changed the business environment. These problems are an even bigger concern for the food industry, which is required to move towards organic products with short expiration time. The growing world population, increasing urbanization level is contributing to these challenges even more. Current supply chain management approaches are generating a lot of food waste due to ineffective inventory control and supply chain length. This paper will focus on advanced forecasting approaches to limit the negative effect of these issues. The authors of this paper propose to implement a logistic cluster to provide information sharing abilities for forecasting accuracy improvement. The literature analysis identified the importance of the involvement of the whole supply chain members in the information sharing processes, including end-consumer.

The novelty of this research consist of information sharing influence determination to forecasting accuracy in different contingencies such as market size, type and consideration of consumer integration. The interdisciplinary approach is grounded through complexity theory, which is a developing field in operation research context. The methodology used in the paper consist of an agent based food supply chain model, which is based on fitted distributions functions on real empirical data. The results confirms that information sharing increases forecasting accuracy. Moreover, consumer integration is beneficial in perfect competition market, however has a less positive effect in an oligopoly market. The proposed methodology creates adaptation abilities, which causes in the long run sustainability to emerge. In future research, the findings of this simulation will be used to develop a sustainable supply chain framework.

KEYWORDS: supply chain management, information sharing, agent-based modelling, food industry

CONFIGURATION OF AUTOMATED DISASSEMBLY LINES ENABLED BY INDUSTRY 4.0 TECHNOLOGIES

Karsten Kieckhäfer[1], Christoph Müller[1], Kerstin Schmidt[1], Thomas S. Spengler[1]

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ABSTRACT:
In this contribution, a profit-oriented optimization model for the disassembly line balancing problem with collaborative robots is provided. The model decides simultaneously on the work elements and resources (collaborative robots) to be assigned to disassembly stations and the optimal level of disassembly. The work is motivated by the potential of Industry 4.0 and digitization technologies to increase the level of automation in disassembly facilities. While the (partial) disassembly of products is considered to be an essential step in order to extend the life cycle of products through reuse, repair, remanufacturing, and refurbishment and to recover raw materials as secondary feedstock through recycling at the end the end of a product's life, it often lacks profitability due to a high degree of manual work and resulting high labor costs. With Industry 4.0 and digitization technologies on the rise, product data can be analyzed in detail to provide better information on the condition and structure of the end-of-life products, and collaborative robots can be applied to support the manual disassembly activities. As a consequence, disassembly lines can be configured with a higher degree of automation, which would additionally allow for relieving workers from dangerous tasks. The developed model should thus serve to analyze the potential of Industry 4.0 technologies for disassembly lines from an economic, ecological, and social perspective.

KEYWORDS: disassembly line balancing, circular economy, Industry 4.0, robotics

MONETISING THE IMPACTS OF WATER USE IN FOOD SUPPLY CHAINS

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ABSTRACT:

There is an ongoing debate between the water footprint and LCA communities regarding whether the best approach to managing water resources that are exploited by globally dislocated supply chains is to focus on local impacts of varying water scarcity, or global allocation, and whether it is characterised by aggregated impact indices or a principal focus on volumetric measures.

This paper contributes to the debate by advocating a new approach to assessing the sustainability of water use in global supply chains, that involves supplementing water volumes with monetary values that reflect the economic and social benefit associated with the green, blue and grey water consumed and degraded. The merit of such approach, it is argued, is that it would allow the distribution of the impacts associated with water appropriation to be revealed, as well as the trade-offs necessary to restructure supply chains to improve sustainable water usage. However, in keeping with the original water footprint, it would do so in a metric which is easily understood by businesses and consumers alike, and which, in the case of the former, would facilitate a comparison between the financial and non-financial costs and benefits of water use and thus help to build the business case for conservation.

The paper outlines an approach to monetising water in the supply chain, reviews existing welfare economics derived environmental valuation data on the values associated with water resources, and based on this, advocates a new methodology to monetise the water within a realistic agri-food supply chain case study.

KEYWORDS: water footprint, value of water, Total Economic Value, ecosystem services.

MODELLING THE CAUSES OF FOOD LOSS AND WASTE: AN INTEGRATED TISM-FUZZY MICMAC ANALYSIS

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ABSTRACT:

In our previous work, we identified the main causes of food loss and waste per stage of the food supply chain. This is the first step for researchers and practitioners to know where the efforts should be applied towards food loss and waste prevention. However, this is not enough to make assumptions about which of these causes have more urgency to be tackled. To do so, an interrelationship analysis should be performed to prioritize the causes.

In this paper, a total interpretive structural modelling technique (TISM) will be applied to the causes of food loss and waste already identified, to study their interrelationships, by developing a hierarchical model that will feed the fuzzy MICMAC (*Matrice d'Impacts Croisés Multiplication Appliqué á un Classement*) analysis to determine the driving and dependence powers of these causes. Although some authors have already used this approach to model the causal factors of food loss and waste, no one has yet attempted, to the best of our knowledge, to do so for each stage of the food supply chain. The TISM technique was chosen since it interprets all links and nodes of the problem under study, making it more transparent, self-explanatory and fully interpretive than the conventional ISM. The developed TISM model intends to help the supply chain actors making decisions at different stages of the supply chain in order to reach sustainability in the social, economic and environmental dimensions and increasing their efficiency by eliminating or mitigating the root causes of food loss and waste.

KEYWORDS: food loss and waste, food supply chain, Total Interpretive Structural Modelling

IMPACT OF LIFE CYCLE INVENTORY AND LIFE CYCLE IMPACT ASSESSMENT STEPS IN SUSTAINABLE SUPPLY CHAIN DESIGN AND PLANNING

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ABSTRACT:

Supply chain design and planning models play an important part in the circular economy context by providing strategical and tactical decision support in a variety of industrial contexts, allowing for resource optimization. Life Cycle Assessment (LCA) is increasingly being applied embedded in such models in search for an environmentally-optimized supply chain. However, the validity and usefulness of the results obtained, within these studies, can be questioned as these can be significantly influenced by decisions taken in the application of the LCA methodology.

In this work the impact of different approaches taken in the Life Cycle Inventory (LCI) and Life Cycle Impact Assessment (LCIA) steps of LCA on supply chain design and planning decisions is assessed. A multi-objective supply chain design and planning model is applied to a case-study in the pulp and paper industry, where the different approaches are tested.

Results evidence significant differences when applying different LCIA methods as well as? different normalization data sets. On the other hand, considering different system models at the LCI step, different cultural perspectives or considering variations in the characterization factors tend to result in the same strategic decisions.

Important managerial insights can be gathered from this work regarding the impact of LCA application in supply chain design and planning models. Special importance is to be attributed to optimization models as a way to overcome fragilities in the LCA methodology.

KEYWORDS: circular economy, life cycle assessment, supply chain design and planning, multi-objective

A MECHANISM TO PROMOTE PRODUCT RECOVERY AND ENVIRONMENTAL PERFORMANCE

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ABSTRACT:

To address the problem of the effectiveness and efficiency of environmental protection regulations, we propose a general functional form for the regulation to provide a decision support system that serves the social planner with improving an existing regulation or with designing a new one. Thanks to the proposed functional form, we are to be able to compare a variety of different regulations within a single framework.

It is shown that how the values of subsidies and penalties in remanufacturing subsidy, buy-back and carbon emission tax regulations should be set to minimize environmental impact of production or to maximize product recovery. Further, this paper presents a set of guidelines on how to modify target rates and incentives to improve certain environmental goals. Finally, it is proved that the amount of past production (available product for remanufacturing) modifies the impact of target rates and incentives on environmental performance.

KEYWORDS: remanufacturing, collection, environmental protection regulations, regulation design.

A TWO-DIMENSIONAL VERTICAL DIFFERENTIATION CONSUMER CHOICE MODEL IN A SUSTAINABLE SUPPLY CHAIN

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ABSTRACT:

The trend towards the proliferation of direct channels is applicable to many sectors and industries. Specifically, in recent years, it has become more common for agricultural suppliers to market their products directly to consumers, rather than to rely on indirect sales through retailers. Reliance on direct marketing channels is particularly salient in the organic food market. In this paper, we consider a supplier of an organic product. Organic products offer some benefit over conventional products and less damaging to the environment compared with their conventional counterparts. The supplier distributes his product directly to consumers. On the same time, a retailer offers a conventional version of the product. Consumers' purchase decisions are influenced by two attributes: The first relates to the product, namely, whether or not it is organic. The second attribute relates to the supply channel namely, the service experience provided by the retailer.

We study a duopolistic market where the direct supplier and the retailer decide on their pricing. The consumer demands at most one unit of the product, either an organic or a conventional version. We address several questions. First, how do the value of the attributes affect the parties pricing? Specifically under what conditions the common practice that the direct price is lower than the retail price hold. Second, because the market may not be fully covered in relatively young industries, how does the equilibrium pricing differ for covered and non-covered markets? We further analyze the effect on the parties expected profit and the consumer expected utility under the covered or none-covered scenarios.

KEYWORDS: direct channel, sustainable supply chain, game theory

ARE ECVS BREAKING EVEN? COMPETITIVENESS OF ELECTRIC COMMERCIAL VEHICLES IN MID-HAUL LOGISTICS

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ABSTRACT:

Focusing on sustainable means of transportation, freight transportation remains as the only sector in which the consumed energy and the generated emissions are still rising. In this course, researchers and practitioners discuss the use of electric commercial vehicles (ECVs) in logistics fleets in order to realize ambitious governmental targets on greenhouse gas and other noxious emissions. Although big logistics companies realized first pilot projects on electric logistics fleets successfully within short-haul transportation, the acceptance of operating ECVs in mid-haul transportation channels is still missing. Against this background, we investigate the competitiveness of medium-duty ECVs in mid-haul transportation for a logistics network of a large German retail company. We present an aggregated total cost of ownership analysis based on a two-stage decision support system (DSS) with a location-routing component to locate charging stations and a vehicle-routing component for daily vehicle operations. We present a hybrid of adaptive large neighborhood search, local search and dynamic programming that helps to solve large sized instances of the proposed planning task. Using this DSS, we evaluate the competitiveness of ECVs against conventional vehicles based on real world data of the considered logistics network. We show that ECVs are on the verge of breaking even for this specific logistics network and derive managerial insights for further application cases

LIST OF PARTICIPANTS

We are welcoming 31 participants from 13 different countries.

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