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Relevant Purchase Criteria or Basic Requirement: Customer Perspectives on Green Logistics

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Relevant Purchase Criteria or Basic Requirement: Customer Perspectives on Green Logistics

Matthias Klumpp, Julia Naskrent and Nikolaus A. D. Hohl

Abstract

Green and sustainable logistics is a major research topic and industry as well as the retail sector encounters an increasing pressure and obligation concerning this matter. But still, empirical tests and numbers about the appreciation of customers regarding sustainable logistics resulting in preferences for selection of products and services are missing.

This research contribution is conceptualizing an answer to this important question using a quantitative approach from market analysis and marketing research: A conjoint measurement analysis with end customer representatives (B2C, n=526) is used to quantify the specific customer utility of various components of sustainability and corporate social responsibility. An investigation of moderating variables shows that these components cause different utilities values among different groups of costumers.

Keywords: green logistics, conjoint analysis, sustainable logistics, sustainable production

1. Introduction

The future development of logistics is inadvertently connected to sustainability concepts and requirements, pushed by the political and end customer side and gaining momentum due to the overall struggle for competitive advantage and unique selling propositions (Min, Kim, 2013; Klumpp, Clausen, ten Hompel, 2013; Klumpp, Kersten, Brockhaus, 2011). Many research as well as business concepts have outlined the question of how to “green” transportation and supply chains (Lee, Lam, 2012; Bretzke, 2011; Kellner, Ogl, 2012). From this, it has been established that many factors like e.g. knowledge (Wu, Haasis, 2013) or for example the oil price (Gross, Hayden, Butz, 2012) are important drivers for sustainable logistics concepts; concluding evidence also highlights that specific and detailed concepts have to be established for different transport modes, i.e. shipping (Baindur, Viegas, 2012).

But the overarching question of how customers – in this case especially end customers as “final objective” of any supply chain – are actually evaluating and also honoring green logistics as purchase criteria are quite in the dark. Therefore, a B2C evaluation study was conceptualized and carried out by the authors in 2014, using the methodology of conjoint analysis within a quantitative empirical research setup.

After a detailed literature review on the topic green logistics as well as a conceptualization regarding green products and logistics (section 2), the basic characteristics of the conjoint analysis and the implemented empirical survey are outlined in section 3. The following section 4 provides the calculation result from the conjoint analysis, whereas section 5 describes the implications and discussion points for green logistics concepts from derived from these results. The final section 6 outlines questions for further research as well as business practice implications in an actionable approach.

2. Literature Review and Research Concept

From a customer research perspective, the topic of sustainability has focused on estimation of the appreciation of production methods and ingredients (aspects of naturalness: Gifford, Bernard, 2011; aspects of apple growing: Moser, Raffaelli, 2012; aspects of ingredient origin: Hustvedt, Bernard, 2008; aspects of green restaurants: Schubert et al., 2010; aspects of green hotels: Lee et al., 2010). None of these studies analyzed the appreciation of transportation and allocation. "The investigation on consumers' sensitivity to low carbon emission [...] is still in its infancy." (Moser, Raffaelli, 2012, p. 142).

First research contributions have already tried to measure consumers real purchasing behavior and possible willingness to pay for green products and product features, e.g. Michaud and Llerena (2011) – in this case for green re-manufactures products there is no increased willingness to pay discernible. Nevertheless, a significant effect of information regarding green features and impacts to purchasing criteria was recognized, implying that customers choose sustainable products preferably if informed about social and environmental criteria regarding the product.

From a customer's point of view, a general favoritism of green products or services (i.e. logistics) cannot be taken for granted. Some studies point out, that some respondents reported that they do not buy green products due to their skepticism about their functionality (e.g. Anderson, Hansen, 2004). Due to the increasing government attention to social and environmental problems, the customer might assume that the problem is being addressed, thus they might decrease their attention on such issues during a purchase decision.

Others believe that the environmental and social responsibility lies with the organizations and not with their purchase behavior (Anderson, Hansen, 2004, p. 43). They expect sustainability characteristics incorporated in all products and services and see it as the companies' duty to provide such products and services. They take it as basic requirement and would not assume a

responsibility and impact in their own purchasing behavior. Hence, they will not pay attention and will not value different purchase options in this sense.

The definition of green products as well as green services and logistics is intertwined and based on a holistic understanding of a value chain, which combines all processes and services to an end customer product or service. This implies, that even in very mundane and simple products (e.g. an apple or a banana), many services like e.g. retail, packaging and logistics services are integrated and therefore consumed by the customer. This approach can be labeled an integrated or indirect definition of products and services as all process steps and companies within the value chain are analyzed. Therefore in the end, the concept makes no clear distinction between products and services but rather is a metaphor of the customer's purchase of a bundle of products and services stacked up throughout the supply chain.

This perspective is highly consistent with the basic assumptions of a conjoint analysis, which estimates partial utilities incorporated within a final product or service. Whereas most conjoint analysis in traditional marketing management focus on obvious and functional product and service elements clearly visible for the end customer, our approach represents an "additive supply chain view".

The question is, whether customers really take such product and service characteristics as granted, or if the consumers value them, which means that it increases their utility as well as subsequently their willingness to pay for such features. We want to know, if attributes even if they are not represented in the final product or service, such as green transport in the main haul towards Europe, foster the customer's purchase probability. This paper addresses this issue by conducting a conjoint analysis, using the division of product and services parts throughout the value chain for the example product of jeans pants with different product attributes or components.

3. Empirical Survey

Conjoint analysis is used when products should be designed market-oriented, i.e. according to customer benefits. The conjoint analysis centers on the assessment of the preferences of customers. It is based on the assumption that the total utility of a product (seen here as a bundle of attributes) consists of the sum of the partial utility of its attributes. The overall assessment (considered jointly) of several combinations of the attributes allows assessing their partial utilities (decompositional approach). For this, it is only necessary to make judgment on a fraction of all possible combinations of attributes (see e.g. Green, Srinivasan, 1978; Backhaus, Hillig, Wilken, 2007).

In a broad online survey all over Germany from 28.05.2014 until 09.06.2014 (12 days) altogether about 25.000 professionals as part-time students (FOM University of Applied Sciences) were invited to take part in a conjoint analysis as outlined below. Altogether 346 persons completed the whole questionnaire which took about 20-30 minutes of time to complete. The respondents are equally distributed all over Germany and also between gender and income as well as social stratification criteria. A general "working world" bias has to be acknowledged as all part-time students are in employment and therefore unemployed, older and younger people outside the age-framework for working people are underrepresented as well as older people in general (>40 years). As mostly this selected group is also in the center of marketing strategies and advertising campaigns, this may at least be seen as "indicative" for possible results regarding marketing management measures addressing green logistics. The implemented online survey was tested beforehand with more than 30 persons in order to exclude communication and technical mistakes and misunderstandings, comments received especially regarding understandability and placement of texts were included into the final used version of the questionnaire.

The conjoint analysis was designed as a choice-based conjoint (CBC), in which respondents repeatedly have to select one alternative from a limited number of

product (bundle of attributes) choices. Moreover, respondents could choose the "none-option", if they could not decide between presented two alternatives.

The questionnaire started with a brief introduction in form of a list of some advantaged and disadvantages of transportation means, in order to familiarize the respondents with the topic. It was assumed, that not all respondents knew about the potential problems of transportation means before participating at the survey. An integration of this list right in the beginning also rendered the advantage, that the decisions of the respondents later on in the survey was made without the evaluation at hand – like in real life.

The first part of the survey consisted of the choice-based conjoint for a pair of jeans. This piece of cloth was selected due to its general acceptance among people. It can be assumed, that most people can relate to a purchase situation of jeans. Since jeans pants are produced overseas it is a good item to assess the relevance of sustainable transportation. In addition, jeans comprises some further issues of sustainability: the growing of the cotton (standard or ecological) and the payment of the workers (standard (according to market prices) or fair trade (above market prices)). These two issues were integrated as the first attributes for describing the jeans. Afterwards two logistics aspects were presented: the overseas transportation to Europe (by plane or by ship) and the allocation and distribution within Germany, i.e. to retail stores in different cities (by truck or by train). Every presented combination of these attributes was randomly assigned one out of three possible prices.

Together, each presented jeans variation consisted of five different attributes with different specification as listed in table 1.

The different specifications lead to list of 48 different bundles with characteristics concerning the attributes. From these 48 potential products, only 16 were taken for the conjoint analysis according to the procedure recommended by Aizaki and Nishimura (2008), which represent the state of the art of an analysis of partial utility scores in R (statistical computing program). We arranged an orthogonal design and had respondents compare two of the 16 products simultaneously, resulting in eight choice decisions.

	Growing of cotton	Payment of workers	Overseas transport to Europe	Allocation in Germany	Price
Specific. 1	Standard	Market prices	Plane	Truck	19 €
Specific. 2	Ecological	Fair trade	Ship	Train	39 €
Specific. 3					79 €

Tab. 1: List of attributes of jeans pants presented in the survey

Appendix 1 depicts one of these choice sets. The pictures of the pair of jeans were identical, but still were used in the survey for matters of design and activation of the respondents. Table 2 lists the two presented sets in each of the eight questions (the numbers 1-3 refer to table 1 with the particular specification).

After the conjoint analysis, people were asked to answer questions in regard to their environmental concern and demographic variables such as gender. The environmental concern was measured with the help of the scale by Kim and Choi (2005).

price	growing of the cotton	payment of the workers	Overseas transport to Europe	Allocation in Germany		price	growing of the cotton	payment of the workers	Overseas transport to Europe	Allocation in Germany
1	2	1	1	1	← Question 1 →	1	1	2	2	2
3	1	2	1	1	← Question 2 →	1	2	2	1	2
1	1	1	2	1	← Question 3 →	3	2	1	2	2
2	2	2	2	1	← Question 4 →	1	2	1	1	1
2	1	1	1	2	← Question 5 →	1	1	1	2	1
1	2	2	1	2	← Question 6 →	3	1	2	1	1
3	2	1	2	2	← Question 7 →	2	1	1	1	2
1	1	2	2	2	← Question 8 →	2	2	2	2	1

Tab. 2: Design of choice based analysis

4. Conjoint Measurement Results

The conjoint measurement was conducted based on the example of Aizaki and Nishimura (2008) which means that their outlined steps for estimating the model were strictly followed. For this, we created a data set which was used for the function "clogit" in R. According to the last step of the procedure recommended by Aizaki and Nishimura, the function renders the following results as described in table 3.

For an interpretation of these results, the second column – the exponential coefficient (exp (coef)) – is crucial. The general starting point for the number listed in the second column is the number 1, which could be understood as a neutral preference for an attribute. The difference between the numbers listed and the figure 1 now shows if a change in the specification of the attribute (e.g. fair trade payment of workers instead of market based compensation) leads to an utility increase (for numbers > 1), which can be equated with a preference for this attribute.

	coef	exp (coef)	se (coef)	z p
Price	-0.0222	0.978	0.00115	-19.4 0
Cotton grow	0.6530	1.921	0.04815	13.6 0
Payment	0.7736	2.168	0.06462	12.0 0
Overs. Transport	0.8933	2.443	0.05454	16.4 0
Last row	0.5628	1.756	0.04545	12.4 0

Tab. 3: Overall results of the conjoint analysis

For example if the specification changes from 1 to 2 (cf. table 1), then the probability of selection increases.

The intensity of this increase depends on the probability level, which enables to estimate the odds. Odds are defined as the probability for choosing an alternative divided by the probability for not doing so.

For an estimation of the real odds and probabilities it is necessary to assume a constant value, which is in our case by -0.771 (0.462). I.e. with this absolute term the fit of estimation to our data is best. E.g. the odds for buying a pair of jeans with the attributes price: 79 €, cotton grow: standard, payment: fair trade, overs. transport: plane, last row: truck are 0.1727 and the probability is 0.15 . If one would change the attribute "overs. Transport" to from plane to ship the odd would increase by the factor "number in column exp (coef)". In this case the factor is 2.443 and the odds are now 0.4219 which equals a probability of 0.30 . Over all respondents the overseas transport method therefore has a positive utility. Similar is the case for fair payment of the workers, a CO₂-friendly cotton cultivation and regional allocation. Only price renders a result of 0.978 which means, that a price increase leads of course – the so-called snob effect is disregarded – to a decreased overall utility and reduced selection probability. As Table 3 shows, the ecological overseas transportation and the fair wages of the worker present the strongest preference when it comes to selecting the product.

Gender is expected to have clear significance on these results because literature suggest, that women are more concerned in general (Gifford, Bernard, 2011; Baker, Burnham 2001). Therefore, the next step was so compare the results in terms of gender differences. Table 4 lists the relevant exponential coefficients for each attribute.

In terms of price there barely exists a difference between men and woman. For both groups a price increase leads to nearly the same reduction of the selection probability. But when it comes to the logistic attributes one can see, that men are more influenced by overseas transport while the utility of women depends more on the last row.

Since for both groups the value is the highest, one can assume that it has the most impact on consumer behavior. For the given product (39 €, standard, fair

trade, plain, truck) the men (women) show a selection probabilities of 0.10 (0.11). By changing the transport mean to ship the probability would be 0.24 (0.24). Seen the other way around, this means, that by changing the transport mean from plane to ship, one could raise the price to 122 € (114 €) to keep the selection probability constant at 0.10 (0.11).

	exp (coef) - MEN	exp (coef) - WOMEN
Price	0.975	0.973
Cotton grow	1.903	1.986
Payment	1.706	2.342
Overs. Transport	2.887	2.604
Last row	1.789	2.076

Tab. 4: Gender-specific results of the conjoint analysis

In our study, we also controlled for the impact of environmental concern on the preference structure. When it comes to selection food, 50 percent of the consumers are influenced by environmental considerations (Anderson, Hansen, 2004). Therefore, our study investigated its impact in the case of clothes. Table 5 compares the group of respondents with high environmental concern (n = 95) with those with low environmental concern (n = 91).

As one could guess, the preference for an eco-friendly cotton cultivation is a lot stronger in the group of the people with a high environmental concern; for a similar result for organic and natural meat see Gifford and Bernard (2011).

The second interesting result is, that the probability for selecting a product, which is regionally allocated in an eco-friendly train instead of a truck is higher in the group of people with the least environmental concern. These results are contradictory to our assumptions and can only be explained by an information deficit among the respondents concerning the advantages of transportation by train.

	exp (coef) - High environmental concern (first quartile)	exp (coef) - Low environmental concern (last quartile)
Price	0.971	0.974
Cotton grow	2.556	1.529
Payment	2.244	2.124
Overs. Transport	2.789	2.668
Last row	1.760	2.485

Tab. 5: Results of the conjoint analysis in regard to environmental concern

5. Discussion: Implications for Green Logistics?

In contrast to the ingredients of a product the fact of allocation almost goes unrecognized by the customer. There are concepts and ideas to overcome this: "Ecolabels" are a key source of information about a product's environmental attributes (Anderson, Hansen, 2004). Companies that engage in such certification schemes not only receive assistance in becoming more sustainable, but can also improve customer awareness due to such an accreditation. This can be leveraged as a source of competitive advantage over those companies that do not engage in eco-certification schemes (Schubert, et al., 2010). Green companies should focus their efforts on communicating the positive results of their green practices. Customers need to have these issues, and their impact on prices explained to them.

The described results of the conjoint analysis show that this is definitely also true for service components of supply chains, especially in the case of regional allocation. Here, our studied showed the contradictory effect, that people with a high ecological concern only showed a small utility increase for transport per train.

This contributes to the already existing discussion regarding possible willingness to pay for green and sustainable logistics measures – as well as production and trade conditions (fairness, ecological criteria in production). It can be derived, that "willingness to pay" is not a "one-way-street" at all, but retail and supply corporations as well as logistics service providers first and foremost have to inform customers in and at the end of the supply chain about the production and transport conditions, i.e. their sustainability impact. If clearly informed, customers are at least significantly willing to consider more sustainable products, even if there is a price premium on this.

This is also clearly different for several socio-economic clusters according to gender, income and especially social and ecological awareness – a standard marketing approach to segment customers according to this is therefore a "strategic fit" and should also be developed for logistics services.

6. Conclusion and Outlook

In this contribution we have outlined that there is still a considerable research gap existing regarding specific purchasing criteria dedicated to sustainability criteria in production and transport, notably throughout the whole supply chain, i.e. for consumer products in this case (B2C).

Therefore, a conjoint analysis with 526 customers with the buying stimulus of different variations of a jeans pant was conducted in Germany in order to identify different purchasing criteria from the customer point of view, including the long-haul transport leg (plane or ship) and the local distribution towards retail shops (truck or train).

A key finding is that the probability of selecting a jeans pant made of ecological fiber under social production conditions (fair wages) is highest among those, who have an environmental concern. This attitude, however, has barely no impact on the selection probability in terms of regional allocation and partly in terms of sustainable overseas – main haul – transportation.

Further research may establish if, for example, similar purchasing criteria are also valid for B2B products and services as well as for customers in different countries as many items (fair trade, transport) may be highly country- and culture-specific.

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Appendix

3.3 Welche Jeans würden Sie kaufen?
Bitte wählen Sie eine der folgenden Alternativen:

Ich würde diese Jeans kaufen.

Ich würde diese Jeans kaufen.

Ich würde keine dieser beiden Jeans kaufen.

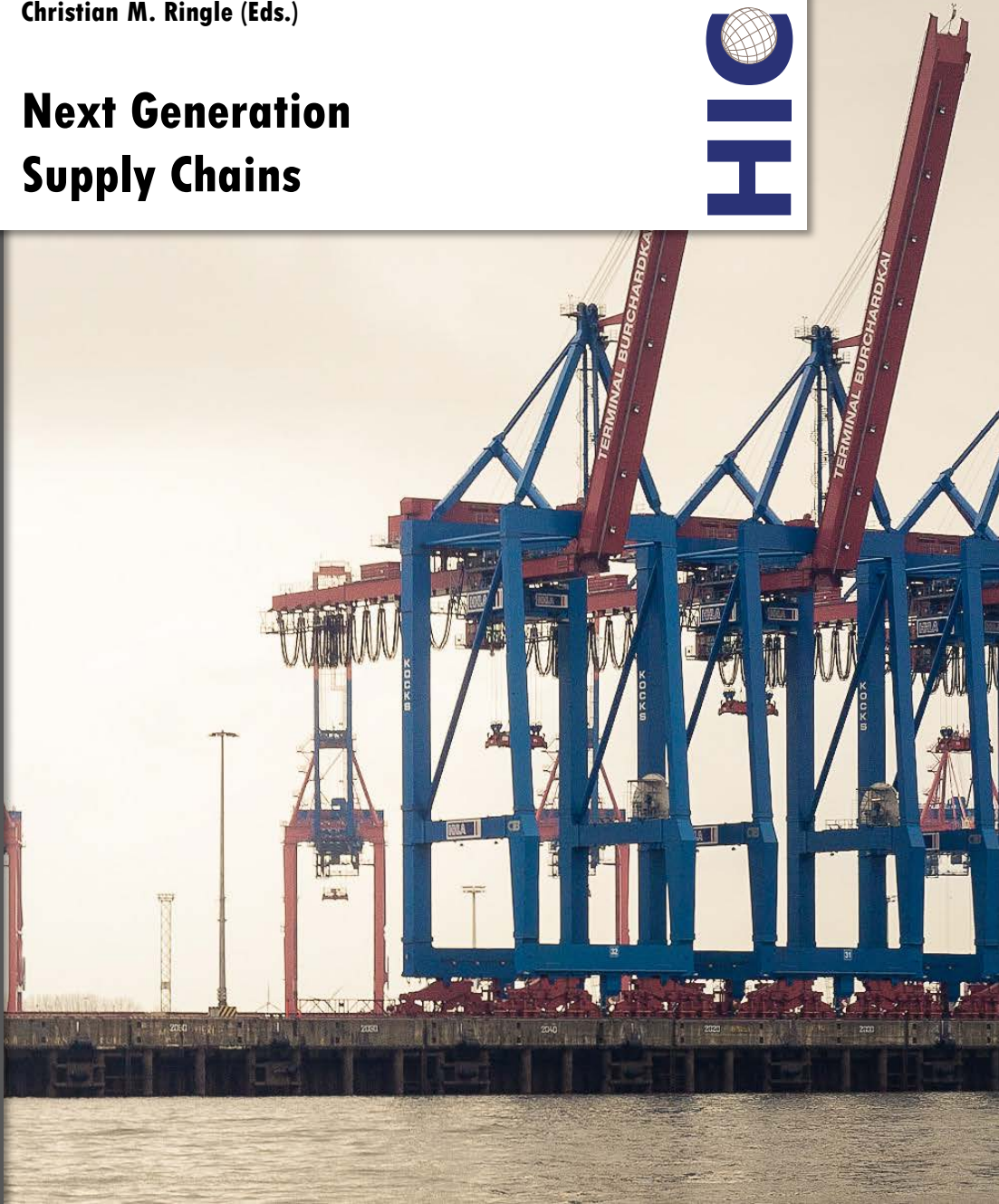


Option	Attributes	Price
Left	<ul style="list-style-type: none">Anbaumethode der Baumwolle standardVergütung der Baumwoll-Bauern nach MarktpreisenTransport nach Europa mit SeeschiffVerteilung in Deutschland mit LKW	€ 19,00
Right	<ul style="list-style-type: none">Anbaumethode der Baumwolle BiologischVergütung der Baumwoll-Bauern nach MarktpreisenTransport nach Europa mit SeeschiffVerteilung in Deutschland mit Bahn	€ 79,00

Fig. 1: One conjoint analysis choice set (example)

**Wolfgang Kersten, Thorsten Blecker and
Christian M. Ringle (Eds.)**

Next Generation Supply Chains



Prof. Dr. Dr. h. c. Wolfgang Kersten
Prof. Dr. Thorsten Blecker
Prof. Dr. Christian M. Ringle
(Editors)

Next Generation Supply Chains

Trends and Opportunities

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Preface

Today's business environment is undergoing significant changes. Demand patterns constantly claim for greener products from more sustainable supply chains. Handling these customer needs, embedded in a sophisticated and complex supply chain environment, are putting the players under a constant pressure: Ecological and social issues arise additionally to challenges like technology management and efficiency enhancement. Concurrently each of these holds incredible opportunities to separate from competitors, yet also increases chain complexity and risks.

This book addresses the hot spots of discussion for future supply chain solutions. It contains manuscripts by international authors providing comprehensive insights into topics like sustainability, supply chain risk management and provides future outlooks to the field of supply chain management. All manuscripts contribute to theory development and verification in their respective area of research.

We would like to thank the authors for their excellent contributions, which advance the logistics research progress. Without their support and hard work, the creation of this volume would not have been possible. We would also like to thank Sara Kheiravar, Tabea Tressin, Matthias Ehni and Niels Hackius for their efforts to prepare, structure and finalize this book.

Hamburg, August 2014

Prof. Dr. Dr. h. c. Wolfgang Kersten
Prof. Dr. Thorsten Blecker
Prof. Dr. Christian Ringle

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About HICL

Since 2006 the annual conference Hamburg International Conference of Logistics (HICL) at Hamburg University of Technology (TUHH) is dedicated to facilitate the exchange of ideas and contribute to the improved understanding and practice of Logistics and SCM. HICL creates a creative environment which attracts researchers, practitioners, and industry thinkers from all around the world.



Innovation is increasingly considered as an enabler of business competitive advantage. More and more organizations focus on satisfying their consumer's demand of innovative and qualitative products and services by applying both technology-supported and non technology-supported innovative methods in their supply chain practices. Due to its very characteristic i.e. novelty, innovation is double-edged sword; capturing value from innovative methods in supply chain practices has been one of the important topics among practitioners as well as researchers of the field.

This volume, edited by Thorsten Blecker, Wolfgang Kersten and Christian Ringle, provides valuable insights into:

- Innovative and technology-based solutions
- Supply chain security management
- Cooperation and performance practices in supply chain management

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