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Meta-Analysis of Sustainable Transport Logistics Trends

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In general, Austrian manufacturing companies need to catch up in terms of sustainable transport logistics. Awareness-raising on sustainability and a broad debate are necessary that companies rethink in this context. This paper, therefore, develops and applies a meta-analysis in order to analyze the development of transport logistics trends. This research integrates qualitative and quantitative elements of the content analysis. Firstly, existing trend analyses are evaluated and compared in order to subsequently define trend categories. Secondly, the identified trend categories are analyzed by a qualitative content analysis. Finally, a frequency analysis is performed to describe temporal developments. This meta-analysis evaluates how sustainability in terms of transport logistics has developed in comparison with other subject areas based on a prestigious, well-known international journal regarding logistics and traffic issues. Five relevant trends have been identified, their temporal development has been analyzed and a forecast has been created. Current transport logistics trend analyses usually do not challenge the topic of sustainability qualitatively by means of a meta-analysis. The validity of the definition whether a trend is relevant is increased, since the search items are analyzed in the context of previously defined trend categories. The meta-analysis is practically applicable, as in the period from 2014 to 2017 short-term and medium-term effects were tested in 171 editions of a subject-specific, but nonscientific international journal around logistics and traffic issues. This journal is published since 1945 and, therefore, comprehensively reflects the practical discussion about transport logistics.

Keywords: Meta-Analysis; Sustainability; Logistics; Trends

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1 Introduction

Issues concerning sustainability are currently polarizing scientific, academic and practical debate. In 2018 the Institute of Industrial Management at FH JOANNEUM is conducting a study to identify the transport logistics status of Austrian manufacturing companies with sustainability as one core part of the survey. The closed survey involves logistics executives from manufacturing companies with more than nine employees and a turnover of more than two million euros. So far, 136 online questionnaires have been completed. This interim result corresponds to a return rate of 4% – the survey will be open until the end of June 2018.

The survey results reveal that sustainability has not yet found the spread that would be necessary regarding the climate targets of the European Union for instance. The following chart shows that companies are required to act.

Only one third of the questioned companies state, that they have set concrete, measurable sustainability goals and that they measure them regularly. Referring to the famous statement “what doesn’t get measured, doesn’t get done” this percentage shows, that there is a need to catch up for Austrian manufacturing companies. Furthermore, when asked whether the company is pursuing sustainable transport management, 80% respond with ”no”. For those who answer ”yes”, it is noticeable that the reasons are more in the self-motivation and image building than, for example, in legal requirements, as shown by Figure 2.

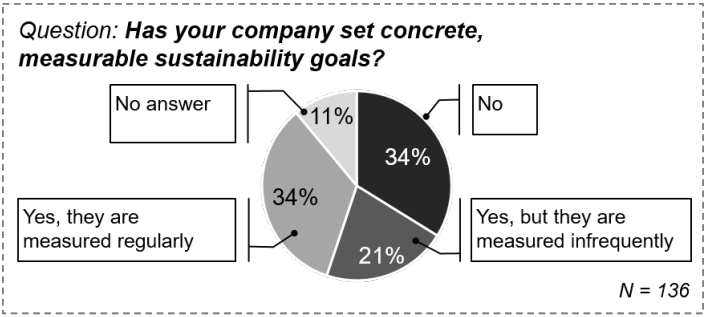

Figure 1: Survey interim result regarding sustainability goals

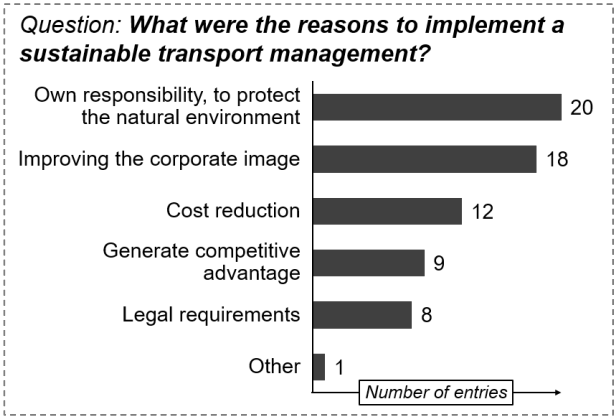

Figure 2: Survey interim result regarding sustainable transport management

The aspect that companies self-initiatively set sustainability measures is to be highlighted positively. However, 70% of the companies do not identify the carbon footprint caused by their transports (N=119) and another 65% are not willing to pay more for environmentally friendly logistics services (N=105). In general, the interim results of the survey show that there is a need for action.

Awareness-raising on sustainability and a broad debate are necessary that companies rethink in this context. Therefore, this paper analyzes a prestigious, well-known international journal regarding logistics and traffi issues and shows how sustainability aspects in logistics develop according the research question: "Which logistics trends are currently relevant and how have these developed in the medium term?" For this purpose, a meta-analysis was carried out on the international weekly journal "Verkehr". We examined how trends evolved depending on how often they were covered within a text passage over the period from 2014 to 2017. In addition, forecasts have been created for the next three years (2018 to 2020). This is not a meta-analysis in the classical sense. It focuses on the integration of qualitative and quantitative content analysis elements to evaluate logistics trends. However, the journal includes a large number of differ-

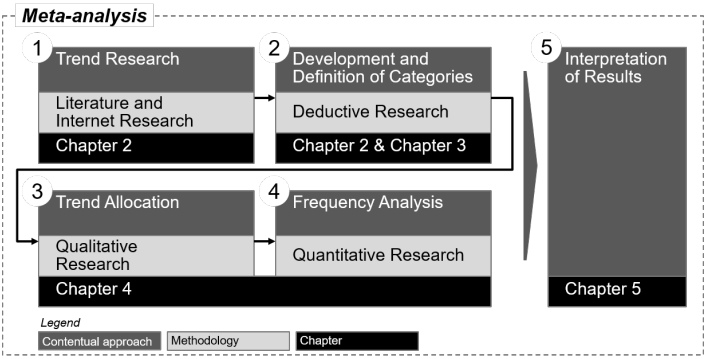

Figure 3: Methodology of this paper

ent interviews, contributions, studies, evaluations etcetera that are evaluated. This equals the “analysis of analyses” as Glass (1976, pp.3-8) has described the meta-analysis. Therefore, this paper summarizes the approach under the term ”meta-analysis”. The following chart shows this paper’s methodology.

Firstly, published transport logistics trends are identified and evaluated by a literature and internet research (chapter 2). Secondly, chapter 2 and chapter 3 develop categories regarding trends and define their content in order to carry out a deductive research. Based on the previously defined categories, the text material – 171 editions of the international weekly journal “Verkehr” – is analyzed with the aid of “QCAMap” and all search items are allocated to the trend categories due to their context. Then, a frequency analysis is performed in order to analyze the time series the search items have been mentioned. Furthermore, a forecast about future developments is created. Finally, the results are interpreted.

2 Development of the Analysis Categories

Due to the fact that relevant and irrelevant pieces of information are mixed up in texts, qualitative evaluation methods have to analyze fuzzy data. For this purpose, standardized approaches are missing (Saunders, Lewis and Thornhill,

2012, p.556). The methods range from the free interpretation of texts to qualitative content analysis, which follows strict rules (Gläser and Laudel, 2006, pp.41-42). Mayring (2010, p.602; 2015, pp.20-22) for instance distinguishes between three variants: data summary, explication and structuring, whereby hybrid forms are commonly applied. Data summary is the process of reducing the text material to one text corpus. Explication stands for scrutinizing problematic passages in the text by examining the surrounding text passage. However, structuring the qualitative data is the key technique in qualitative analysis: characteristics of a text are identified by using a category system (Diekmann, 2004, pp.512-513).

Several approaches exist of how to structure data. Basically, text passages, words, a combination of words, paragraphs or even an entire newspaper page can be used as an analysis criterion (Diekmann, 2004, p.488 and 513). The relevant information is marked with a code, usually a keyword. The target of coding relevant information is to create a well-structured framework that supports analysis. Numerous possibilities exist of how to assign a code. As this papers follows the purpose of analyzing transport logistics trends, the codes are created by using terms of theoretical concepts (Saunders, Lewis and Thornhill, 2012, p. 558).

Furthermore, the codes can either be created prior to conducting the data analysis – deductively – or – inductively – during the data analysis (Gläser and Laudel, 2006, p.43). Due to the fact, that this meta-analysis aims at identifying trends within text passages based on a previously carried out literature and internet research, the deductive approach is applied.

2.1 Deductive Category Application

The goal of the deductive category application is to evaluate the text material based on predefined categories. For this purpose, the structuring dimensions – categories – are derived from the research question. These dimensions are then often differentiated or split into characteristics. The defined dimensions and differentiated characteristics are then combined into a category system. Whether and when a text part is assigned to a category is specified through coding rules. The text passages that address a category are marked. Mayring (2015, pp.97-106) refers to these passages as "references". Subsequently, the marked text material is processed and extracted. This processing is based on the goal of structuring. In the context of this paper the objective of the structuring process is to summarize the material on specific topics or contents, meaning logistics trends in this case.

2.2 Development of Trend Catagories

It has been outlined that categories have to be defined before starting the text analysis. These categories represent the trends that are analyzed qualitatively and quantitatively. An initiating trend research is carried out to examine published developments in transport logistics. Four sources, which publish logistics trend assessments have been identified: Transalex (Transalex Internationale Spedition GmbH, 2018), Chamber of Commerce Austria (Wirtschaftskammer Österreich, 2017), Journal "Verkehr" (Stiftne , 2014, p.9; 2015, p.5; Breinbauer, 2014, p.10; 2015, p.6; 2016, p.7; Klacska, 2015, p.4; Senger-Weiss, 2016, p.6; Müller, 2017, p.8) and Logistik News 24 (Beilhammer, 2017). Table 1 shows the results of the trend research. They are clustered in "Logistics" for all general logistics trends, "Transport Logistics" and "Intralogistics", since only trends in the context of transport logistics are further analyzed. The journal, which was finally analyzed, is in German, therefore also German trend publications were evaluated in advance. In the following, the German search items are described in English in Table 3 and chapter 3.

Table 1: Overview about logistics trends

Source	Trend	Category
Transalex	Green Logistics	Logistics
	RFID Nutzung	
	Intelligente Logistik	
	Grüne Logistik	
	Automation	
	Technologietrends	
	Bündelung von Transporten	Transport
	Flexible Logistikketten	
	Innovative Fahrzeugkonzepte	
	Nutzung von Frachtbörsen	
	Selbstfahrende Fahrzeuge	
Transalex	Schienengüterverkehr	Transport

	Osteuropa Transporte	
	Intralogistik	Intralogistics
	Trends in der Lagerhaltung	
	Smart Devices und Datenbrillen	
Chamber of Commerce Austria	Vernetzung von Regionen	Logistics
	Internationale Kooperation	
	Ausbau Logistikzentren	
	Universelle Logistik-Service-Anbieter	
	Digitalisierung	
	End-Consumer-Logistik	
	Supply-Chain-Management	
	Autonome, elektrische, vernetzte Nutzfahrzeuge	Transport
	Entkoppelung Gepäcktransport von Personenverkehr	
	Flexible Transporte	
	Umweltfreundliche Transportmittel	
	Gütertransport im urbanen Raum: Elektromobilität, Last-Mile-Problem	
Journal ”Verkehr”	Digitalisierung und Automatisierung	Logistics
	Reindustrialisierung	
	Politik im Supply Chain Riskmanagement	
	Regionalisierung der Supply Chain	
Journal ”Verkehr”	Industrie 4.0, Logistik 4.0	Logistics
	Green Logistics	
	Österreich als Logistikstandort	
	Wandelnde Kommunikation (Internet of Things)	

	Industrie 4.0, Big Data, Internet of Things	
	Arbeitsbedingungen im Wandel	
	Start-Up-Boom	
	Stärkung Wettbewerbsfähigkeit	
	Logistik 4.0 für kleine und mittlere Unternehmen	
	Autonomisierung	
	Drohnen	
	Elektromobilität	Transport
	Möglichkeiten von Flüssigerdgas	
	Smart Urban Logistics	
	Fahrerloser Lkw	
	Autonome Fahrzeuge	
	Innovative Zustellkonzepte	
	Frachtbörsen	
Logistic News 24	Umweltschutz	Logistics
	Digitalisierung	
	Big Data	
	Emissionsärmere Zukunft	Transport
	Logistik ohne Emissionen	
Logistic News 24	Elektromobilität, Hybridantrieb	Transport
	Lieferungen über Nacht (Elektromobilität)	

The identified trends are reviewed. Trends that do not belong to the external transport of goods, as developments in internal logistics or passenger transport, are not taken into account. Trends which are marked with “Logistics” and, therefore,

Table 2: Defined categories for the trend analysis

#	Category	German Wording
1	Green Logistics	Green Logistics
2	Smart Logistics	Intelligente Logistik
3	Alternative Drive Systems	Alternative Antriebe
4	Innovative Vehicle Concepts	Innovative Fahrzeugkonzepte
5	Freight Exchange	Frachtbörsen
6	Rail Freight	Schienengüterverkehr
7	Transport Bundling	Transportbündelung
8	Flexible Supply Chains	Flexible Logistikketten
9	Smart Urban Logistics	Smart Urban Logistics

apply to transport logistics as well, are evaluated whether they are meaningful for the underlying research question or not. Therefore, “Policies in Supply Chain Risk Management” (“Politik im Supply Chain Riskmanagement”), for example, is not taken into account in category formation.

Equally excluded are trends that cannot be measured, for example due to their regional roots, as this meta-analysis focuses on international transport. These include, inter alia, the ”Networking of Regions” (“Vernetzung von Regionen”) and ”Austria as a logistics location” (“Österreich als Logistikstandort”). Furthermore, ambiguous trend labels are broken down and assigned to the respective trend category. As an example, the “Autonomous, Electric, Networked Commercial Vehicles” (“Autonome, Elektrische, Vernetzte Nutzfahrzeuge”) are suitable. Firstly, they are separated into “Autonomous Vehicles”, “Electric Vehicles” and “Digitalization”. Then redundancies are equalized with other trends. Finally, trends are logically clustered in superordinate categories. For example, the trends “Environmental Protection” (“Umwelt-schutz”), “Low-emission Future” (“Emissionsärmere Zukunft” and “Logistics without Emissions” (“Logistik ohne Emissionen”) are assigned to the category ”Green Logistics”. “Autonomous Vehicles” and “Self-Driving Vehicles” (“Selbstfahrende Fahrzeuge”) are assigned to the category “Innovative Vehicle Concepts” (“Innovative Fahrzeugkonzepte”). Table 2 shows the defined trend categories. The wording that is used in German is included, since the meta-analysis has been applied to a journal that is published in German.

2.3 Identification of Search Items

In order to examine the categories by meta-analysis, search items are assigned to the defined categories. The reason for this is that in the source material, but also in the trend publications, often several names for the same trend can be found. This can also be observed in the previous category formation. In addition, sub terms for trends are assigned to the categories, which represent a collective term.

Table 3 provides an overview of the search items of all categories and a description why the search item is selected.

Table 3: Search items per category

Category	Search Items	Description
Green Logistics	Grüne Logistik	The category name Green Logistics is translated into German. The term Green Logistics is also used in the trend publication of Transalex.
	Umweltfreundlich*	It is confirmed that environmental friendliness is related to Green Logistics (Niess, 2017). The synonym ”environmentally friendly*” (”umweltfreundlich*”) is interrupted with a star and should be used as a placeholder for terms such as environmental friendliness or environmentally friendly, to take every conceivable expression of the term into account in the following text analysis.
	Sustainability	Sustainability represents the English translation of the German term ”Nachhaltigkeit”. The term ”Nachhaltigkeit” itself is not cited in this context as a search item, since it is not considered in the analysis material in the ecological, but rather in the political context.
Smart Logistics	Intelligente Logistik	”Intelligente Logistik” represents the German name of the category.
	Industrie 4.0, Big Data, Internet of Things, Cloud Computing	These terms are taken directly from the trend research, before summarizing in this category. In addition, these are digitization trends (Gensrich, 2017).
	Logistik 4.0	This synonym is taken directly from the trend research.
	Physical Internet	The vision of the ”Physical Internet” is a smart concept per se (Montreuil and Louchez, 2015).

Alternative Drive Systems	Alternative Antriebe	”Alternative Antriebe” represents the German name of the category.
	Elektromobilität, E-Mobilität, E-Mobility, elektrisch*, Hybrid, Brennstoffzelle, Erdgas, CNG, Flüssigerdgas, LNG	The terms of the left column are given as Alternative Drive Systems to the conventional internal combustion engine. CNG is a synonym for natural gas and LNG for liquefied natural gas. In electric mobility, due to their versatile spelling, different variants are given. Electric* (”elektrisch*”) serves, as well as environmentally friendly* before, as a collective term for further modifications. The same principle applies to the term hybrid (Hilgers, 2016, p.7, 19 and 58).
Innovative Vehicle Concepts	Innovative Fahrzeugkonzepte	”Innovative Fahrzeugkonzepte” represents the German name of the category.
	Fahrerlos, selbstfahrend, autonom	The term autonomous (autonom) is taken from the results of the trend research and supplemented by the synonyms driverless (fahrerlos) and self-propelled (selbstfahrend”).
	Drohnen	An internet research on the subject of Innovative Vehicle Concepts shows that drones are part of the autonomous delivery logistics. Therefore, they are included in this category (Horizont, 2017).
	Cargo-Bike, Cargo Bike, Lastenrad, Lastenfahrrad	According to the research project EMILIA, Cargo Bikes are among the Innovative Vehicle Concepts of the future (Kotrba, 2017). English and German terms were used for the analysis.
Freight Exchange	Frachtbörsen	”Frachtbörsen” represents the German name of the category.

	Laderaumbörse, Transportbörse, Frachtportal	There are different logistics exchanges, which are considered in this category (Schneider, 2018).
Rail Freight	Schienengüter-verkehr	”Schienengüterverkehr” represents the German name of the category.
	Schiene, Zug	The name of the Rail Freight category is abbreviated to find as many terms as possible in the source material. The term ”train” (”Zug”) is added as a synonym.
	Güterbahn*	In literature, the freight yard is considered as part of Rail Freight Transport, which is why it is included as a search item in this category. The asterisk (*) at the end of the word serves as a placeholder. So ”Güterbahn*” covers the terms ”freight yard” and ”freight stations” for example.
Transport Bundling	Transportbündelung	”Transportbündelung” represents the German name of the category.
	Sammelverkehr, Sammeltransport, Sammelguttransport	In the trend research, Transport Bundling is identified as a trend. In the trend description the groupage/collective freight/transport (”Sammelverkehr”, ”Sammeltransport” and ”Sammelguttransport”) is a form of transportation bundling.
	Bündelung von Transport	In this case, the category name has been reworded.
Flexible Supply Chains	Flexible Logistikketten	”Flexible Logistikketten” represents the German name of the category.
	Flexible Lieferkette, flexible Versorgungskette	For this category two synonyms were defined as search items.

Smart Urban Logistics	City-Log*, City Log*, Ballungsraumlog*	The Climate and Energy Fund commissions a new program in its annual programs (2012 and 2014) Smart Urban Logistics. In these annual programs logistics in conurbations and city logistics are emphasized (Vogel, 2018). City-Log*, City Log* and "Ballungsraumlog*" are placeholders for German and English terms in this context.

Nine categories were determined in the trend research. Based on the further defined search items, the text material will subsequently be searched. In order to assign text passages correctly to the categories, the concepts behind the categories are defined in the following.

3 Content Definition of the Analysis Categories

In the following all categories are defined in order to assign text passages accordingly.

Green Logistics

Green Logistics aims to capture and ultimately reduce emissions and resource consumption resulting from transportation processes. Green Logistics belongs to the field of environmental management, which integrates environmental aspects into business decisions (Wittenbrink, 2015, p.1). As the trend towards Green Logistics is considered a veritable revolution in the logistics industry, there are accordingly many research projects that promote the implementation of Green Logistics. One example is the research project "Green Logistics", which, among other things, has targets such as the reduction of the environmental impact of logistics and the development of new green products for the logistics market (Fraunhofer-Institut für Materialfluss und Logistik IML, 2018). From the objective of Green Logistics to capture and reduce emissions and resource consumption

resulting from transport processes, it can be deduced that this trend is the starting point for other trends as Alternative Drive Systems for instance.

Smart Logistics

Since the search items of Smart Logistics are quite extensive, each of them is addressed in order to create an overall picture.

Industry 4.0: The term for the so-called fourth industrial revolution is a conception of the German government in order to maintain the competitive ability of high-wage countries as Germany through measures in the fields of science, economy and society (Wollert, 2017). The Internet of Things (IoT) enables the networking and communication of objects. Technical devices of various types automatically transmit data to one another and assume monitoring, control and regulating functions. The automatic exchange of data between devices is referred to as machine-to-machine (M2M) communication. In transport logistics, this technology can be used, for example, in fleet management or in shipment tracking (Pfohl, 2016, p.16 and 318).

Internet of Things: There exist many definitions for the IoT. Therefore, this paper follows the definition of the ISO, because several aspects are covered: *"An infrastructure of interconnected objects, people, systems and information resources together with intelligent services to allow them to process information of the physical and the virtual world and react."* (ISO/IEC JTC1, 2015, p.3).

Physical Internet: A global supply chain system is outlined by the vision of the Physical Internet (PI). Due to the fact that the manufacturers, transportation providers and retailers operate in a shared logistics network which has an internet-like structure, the name Physical Internet has been assigned. The PI is open and intermodal. Standardized, modular and reusable containers are used, which have real-time identification capabilities. They are routed through commonly operated logistics facilities. The basis technology for the realization of the PI is the IoT. The PI relies on the IoT in terms of communication and also has many features in common (Montreuil and Louchez, 2015).

Cloud Computing: Cloud computing is characterized by the provision of IT infrastructure as well as platforms and applications as an electronically available service on the Internet (Baun et al., 2011, pp.1-2).

Big Data: Large, fast-moving, complex data volumes, caused by the increasing use of information technology, characterize Big Data. Those characteristics of Big Data can be highlighted by the "Three Vs". Volume – increasing amounts of

data are available. Velocity describes the speed of new data creation. Variety provides information about the heterogeneity of the data content (Dorschel, 2015, pp.6-8)

Logistics 4.0: Logistics 4.0 represents a link between the IoT and high-performance sensors and innovative robotics in logistics. According to this, Logistics 4.0 can be described as networking the entire supply chain through IT. This means that there exists a digital twin of all objects affected in the supply chain. The properties of these objects, such as the identification number or the current physical location, can be communicated to the environment – the objects are networked with the environment (Bousonville, 2017, p.5).

Alternative Drive Systems

Alternative Drive Systems are defined as systems, which do not work on the principle of the internal combustion engine. The first truck with a diesel engine dates back to the 1920s and is expected to dominate the commercial vehicle market for the next decade. However, some important arguments, such as the dependency on energy suppliers, characterize the need for alternatives or additions to conventional drives. Concern about global warming remains the most significant criterion for finding alternative energy. The most well-known form of the complementary technology to the diesel fuel is the electrical powered drivetrain in hybrid vehicles. In hybrid drive systems, the primary energy is derived from fossil fuels. However, hybrid drives take a second energy source into account, normally electricity. Although this increases the efficien y of diesel fuel, it does not solve the problem of fossil fuels. In contrast the electric motor completely replaces the conventional combustion engine. A distinction is made between electric drive with fuel cell and electric drive with batteries. Natural gas, also a fossil energy source, decreases CO2 emissions by about 25 percent in direct comparison with diesel. The name for natural gas in vehicles is “Compressed Natural Gas” (CNG). Natural gas liquefies at -163 degrees Celsius. This creates another alternative fuel – Liquefied Natural Gas (LNG) (Hilgers, 2016, pp.3-4).

Innovative Vehicle Concepts

Autonomous or driverless driving means the targeted movement of a vehicle without any intervention of a person. The vehicle recognizes by visual information sources, which are also available to the driver, which input data to obtain. Autonomous driving serves primarily to relieve the driver by supporting or replacing human perception. The vehicle recognizes potential sources of danger independently and reacts accordingly (Daimler AG, 2018). The drone, an unmanned aerial

vehicle, is either man-controlled with a joystick or autonomous (Ziegler, 2016). Cargo bikes are mainly used in parcel delivery, such as the Postal Operators and are suitable for transporting goods. Since 2012, cargo bikes with electric drive have been tested in Germany's urban areas. The potential savings are around 85 percent of car rides (Bombach, 2016, p.1 and Schradi, 2018).

Freight Exchange

At Freight Exchanges the freight providers meet cargo space providers. It has to be considered by contract that loading date and region as well as and unloading date and region are recorded. Furthermore, the times for loading and unloading are defined. An advantage for the providers of freight services is that agreement and information costs can be reduced, since the provider has to submit his offer only once (Sänger, 2004, pp.73-74).

Rail Freight

Rail Freight Transport describes the transport of goods by train. In 2012 in Austria around 30 percent of the total land freight traffi were handled on the railway. According the overall traffi plan's goal this value has to be increased by ten percentage points by 2025 (Wirtschaftskammer Österreich, 2017).

Transport Bundling

Transport Bundling is a collective transport that collects goods from several consignors and delivers them to a receiving point. It is generally more cost-effective than the shipment of individual goods. The decisive factor in Transport Bundling is that the cargoes are picked up and delivered in one tour (Sihn, Meizer and Leitner, 2009, p.10).

Flexible Supply Chains

The aim of a flexible supply chain is to anticipate changes and react agile (Dr. Thomas + Partner GmbH & Co. KG, 2015).

Smart Urban Logistics

In Europe, around 80 percent of people live in urban cities – a challenge for logistics and the environment. Reaching people in metropolitan areas, while taking into account the environment, characterizes Smart Urban Logistics and city logistics (Allen, Browne and Holguin-Veras, 2015, p.293 and Erd, 2015, pp.2-3).

The categories and the search items have been identified and defined. Chapter 4 describes how the text material is analyzed within the soft are "QCAmap".

4 Implementation of the Meta-Analysis – Trend Allocation and Frequency Analysis

The text material is available digitally in PDF format. Therefore, it is possible to evaluate the text material using soft are. The development of soft are solutions for the qualitative analysis of content has progressed since the 1980s. Developed by Philipp Mayring and Thomas Fenzl together with the company coUnity Software Development, QCAMap represents one of these soft are applications. The soft are offers a specific focus on qualitative content analysis (Mayring, 2014).

First of all, the result expectations have to be defined. In this study, a frequency analysis should provide information on the number of mentions and on the temporal distribution of trends. Based on this evaluation, the frequencies are examined to assess the relevance of the trends. The trend analysis is based on the "inductive category generation", which is available in the soft are. The reason for this is that it is possible to find previously defined search items, mark them and assign them to the predefined categories. In the "category statistics", it is then possible to evaluate the categories in their relative and absolute frequency. In addition, it reveals in how many documents the category occurs. The "document statistics" assigns the entries per category to the documents in which they were selected. Based on this method different analyzes can be carried out. Subsequently, it is necessary to define the analysis units.

Coding unit: The coding unit is the smallest component of the material that can be coded. For trend analysis, the "klare Bedeutungskomponente" is selected from the drop-down box.

Context unit: The context unit defines the background of the coding decision. All text material is entered in this field.

Recording unit: The recording unit is the whole text material.

After the input parameters are defined, the user is directed to the coding mode. In order to analyze a category, the search items are identified by a search function. For example, if the category Green Logistics is to be researched, the terms Green Logistics, "Grüne Logistik", "umweltfreundlich*" and "Sustainability" will be searched one after the other. The category Green Logistics achieves more than 500 hits, which have to be analyzed step by step by the user. The user decides now, based on the categories defined in Chapter 3, whether the hit is related to Green Logistics, or whether it is mentioned in a different context. If a hit meets the

criteria, the user marks the affected text (word, phrase, sentence, paragraph) and creates a new category (in this case ”Green Logistics”). If a new trend is analyzed, a new category has to be created. Once all the categories have been created and all search items listed in Table 3 have been explored and assigned, the evaluations can be downloaded. The findings and results of this paper are presented and explained in chapter 5.

5 Findings and Results

Figure 4 shows an overview about the relevance of the trends according the analyzed editions of the journal “Verkehr”. The time course of the trend development is subsequently presented for all trends with more than 100 hits.

In the chart above the context-related mentions of the categories analyzed by the meta-analysis in this paper are shown. Based on a mere counting of the search items in the text material, the search items of the category Alternative Drive Systems have more than 800 hits and the search items of the category Rail Freight even more than 5,000. This makes the benefit of the conducted meta-analysis

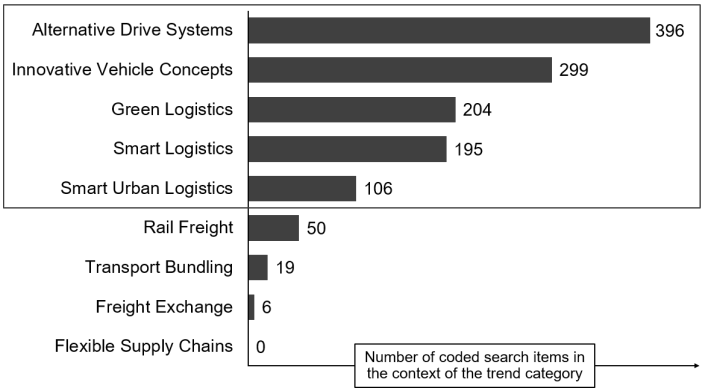

Figure 4: Absolute frequencies of trend categories

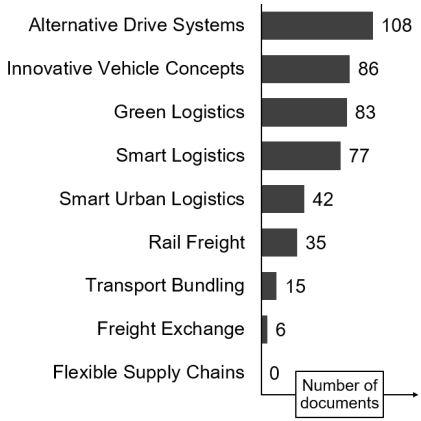

Figure 5: Number of documents the trends were covered

clear: The validity of the definition whether a trend is relevant has been increased, since only text passages that cover the defined trend have been assigned. Figure 5 shows the number of documents in which the trends occurred.

The chart shows that the more journal editions cover a trend, the more often it occurs. Consequently, occasional thematic priorities do not distort the overall ranking in this analysis. The first five trends which have been covered more than 100 times during the period from 2014 to 2017 are presented on a quarterly basis in the following (Figure 6 to Figure 10) and interpreted subsequently. For this purpose, the data available on a weekly basis have been aggregated. The x-axis shows the time course on a quarterly basis. The y-axis shows the frequency in which the search items of the category occur in the context of the category. Based on the maximum value, the y-axis was set for all charts from 0 to 60. The black line shows the development of the trends according the analyzed editions of the journal (historic data). The dashed line shows the forecast until the end of the year 2020. The forecast has been created via the Excel function “PROGNOSE.ETS”. This function calculates a future value based on existing historic values using the AAA version of the ETS (Exponential Smoothing) algorithm. The forecasted value is a continuation of historic values at the specified target date (Microsoft Offi e

Support, 2018). This function has been chosen, because Exponential Smoothing is a widely applied standard method for forecasting historic values (Raessler and Mertens, 2017). However, it has to be noted, that the presented forecast is a rough empirical estimation based on the identified historic values. Especially, in connection with the long underlying forecasting horizon, this value has to be understood as an indication.

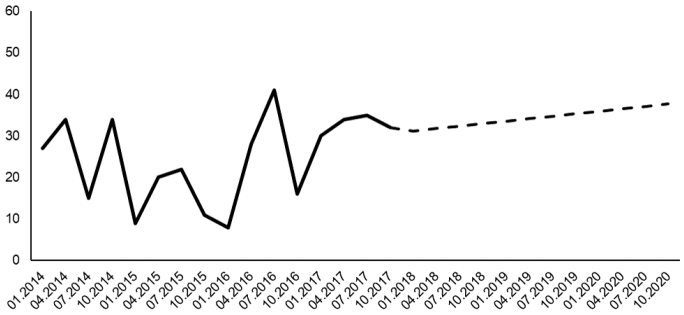

Figure 6: Trend development ”Alternative Drive Systems”

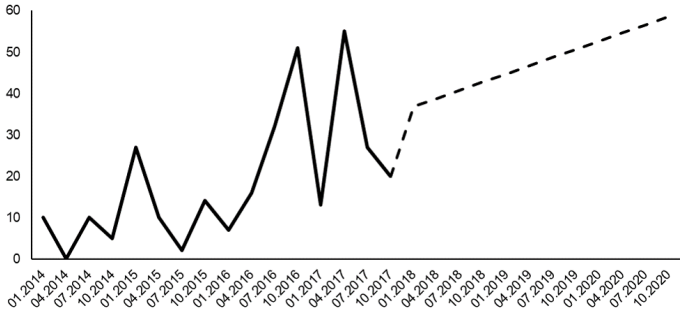

Figure 7: Trend development ”Innovative Vehicle Concepts”

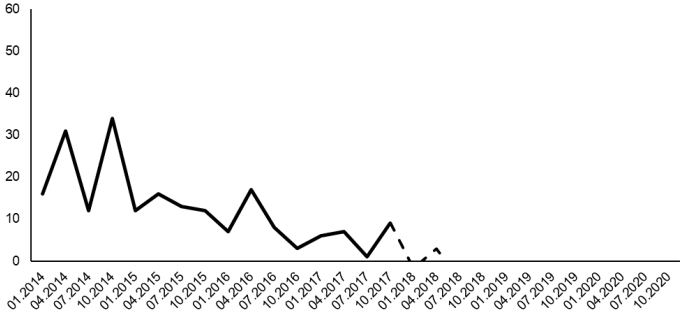

Figure 8: Trend development ”Green Logistics”

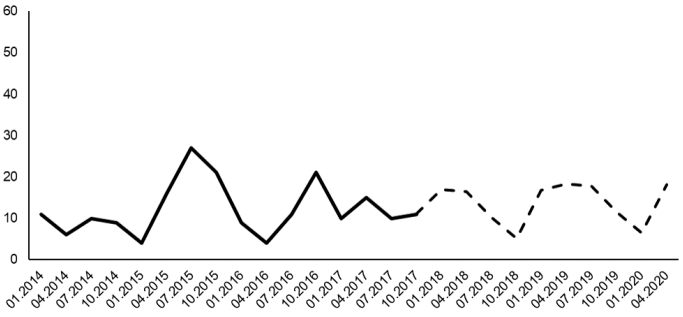

Figure 9: Trend development ”Smart Logistics”

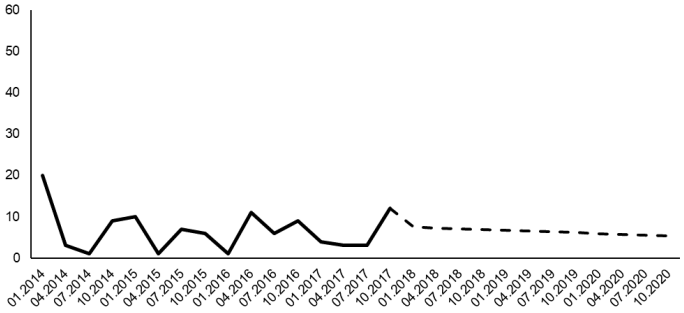

Figure 10: Trend development "Smart Urban Logistics"

Alternative Drive Systems: The trend Alternative Drive Systems shows strong fluctuations. Recently, there has been an increase in this trend and, according to the forecast, this topic will increase slightly in the future.

Innovative Vehicle Concepts: While little attention has been paid to this trend in the past, there has recently been an increase that is likely to continue in the future.

Green Logistics: Green Logistics was a strong trend at the beginning of the analysis period but has recently dropped. It is interesting, if the forecast proves true and whether this topic will be ignored in the future.

Smart Logistics: It turns out that this subject fluctuates and obviously has a certain consistent seasonality.

Smart Urban Logistics: In general, this trend is less relevant than the other trends. A slight decrease in the future is forecasted.

The meta-analysis reveals that the top trends Alternative Drive Systems and Innovative Vehicle Concepts will continue to be important topics in the logistics debate. Especially, the trend Alternative Drive Systems has a strong relationship to Green Logistics. However, even if the meta-analysis shows that sustainability aspects play an important role in the debate on logistics trends and their development, it is noticeable that Green Logistics itself has become less relevant during the last years. It has also been confirmed in the interim results of the study of the Institute Industrial Management presented at the beginning of this paper that the topic

of sustainable transport logistics in general is not that important to companies. Therefore, sustainability aspects should not only be given more importance in the future in terms of Alternative Drive Systems, but rather generally.

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