WHAT ARE THE MOST PROMISING INNOVATIONS IN LOGISTICS?

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ABSTRACT

Transformation in logistics is driven and shaped by a wide range of innovations. Innovations range from new products, services, processes and technologies to new organizational structures and can lead to significant economic, ecological and social impacts. While innovations certainly drive change within the logistics industry, it is difficult to accurately predict which particular innovations will actually have a substantial impact on value chains. Various indicators can be utilized to anticipate change. This work puts the focus on the frequency an innovation is debated among the logistics community. Therefore, presentations at Austrian events targeted at the logistics community are analyzed with a deductive content analysis. The systematic analysis is based on a framework, which considers business, technology, people and ecology as major dimensions and includes important key topics of innovation. Results confirm that the mega-trend digitalization is in the center of attention. While the dimensions technology and business dominate the agendas of logistics events, people- and ecology-oriented topics play a rather subordinate role. The presented approach offers indicators which can be used to focus on a selection of innovations. This can help managers and researchers to reduce complexity within the vibrant field of logistics-related innovations. Results also should be of particular interest to teachers in logistics to define future-oriented curricula based on the estimated potential innovations will have in the future.

Keywords: logistics innovations, supply chain innovations, Industry 4.0, trend research, content analysis

1. INTRODUCTION

Transformation in logistics is driven and shaped by a wide range of innovations (e.g., Speranza, 2016; Stank et al, 2015). Innovations comprise a new product or service, production process, organizational structure, type of marketing or overall behavior on the market (Sundbo, 1998). Sources of innovation can be for instance unexpected events, incongruities, process needs, changes in market structure, demographical changes or new knowledge (Drucker, 2014). Innovations enable companies to offer more competitive products and services and can improve the effectiveness and efficiency of production processes. Consequently, innovations can be considered as key determinants for a company's success and projecting the potential of an innovation can help to achieve competitive advantage.

The estimation of the potential an innovation will have in the future is not just relevant for managers and researchers, but for teachers too. This research is motivated by the initiative

"Research and Education on Transport Logistics"[1], which supports logistics education in secondary schools and creates awareness for working opportunities in logistics among students. Future-oriented logistics education needs to focus on relevant innovations. Thus, it is essential to estimate the potential an innovation will have in order to prepare students for their future jobs in logistics.

It is generally difficult to accurately predict which innovations will have substantial impacts in the long run. Various indicators can be applied to prognoses, like the number of publications in applied research, the amount of funds for research and development projects, as well as the level of innovation-related investments. Porter (2010) considers technology foresight as a multi-dimensional activity, which requires the application of a choice of qualitative and quantitative approaches from an extensive set of approaches. This paper aims to contribute to this set of approaches.

A possible approach for forecasting emerging technologies and innovations is bibliometrics, i.e., the use of statistics to analyze publications. This method can be based for instance on patent citation data (e.g., Kyebambe et al, 2017). The fundamental concept behind analyzing citation data is to form an indicator that reflects the intensity of paying attention to an innovation by a particular community. We adopt that basic idea and analyze the frequency an innovation is debated among the logistics community. In particular, this work systematically analyzes topics related to innovations in logistics, which have been presented at Austrian logistics events.

For the purpose of determining the relevance of different innovations and innovation-related topics in logistics, a framework to classify them is defined (see Figure 1). Innovations can have an impact in various thematic dimensions and/or can be determined by them. On an aggregated level essential dimensions are "business" and "technology". Considering sustainability as an aim of innovations, "people" and "ecology" constitute equally important dimensions.

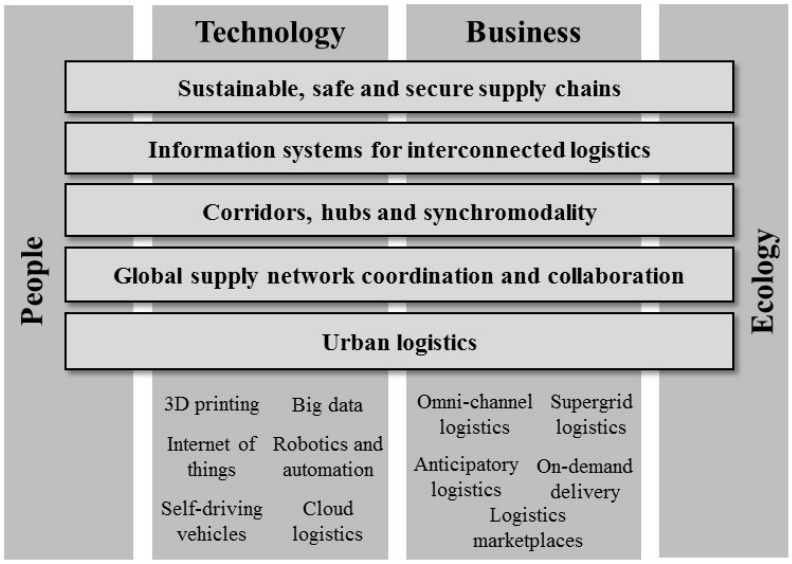

Figure 1. Framework of logistics innovations

[1] The initiative "Research and Education on Transport Logistics" (RETrans) is a cooperation between the University of Applied Sciences BFI Vienna and the University of Applied Sciences Upper Austria. RETrans is supported by the Austrian Ministry for Transport, Innovation and Technology and the SCHIG mbH.

The framework considers that innovations may be not just related to one or more of the four dimensions, but at the same time to specific topics. For defining a set of topics, which covers a wide range of potentially relevant innovations, the road map of the European Technology Platform ALICE is adopted. The following innovation topics are derived from the road map's framework (Alice, 2019): "sustainable, safe and secure supply chains", "information systems for interconnected logistics", "corridors, hubs and synchromodality", "global supply network coordination and collaboration", and "urban logistics".

Though the framework is open to virtually any kind of innovation in logistics, particular innovations with presumably high relevance are predefined to facilitate the classification procedure. Thus, business and technological innovations from DHL´s Logistics Trend Radar are integrated into the framework (DHL Trend Research, 2016). As a result, the framework includes five business and six technological trends (see Figure 1) having a high impact according to the Logistics Trend Radar. The described framework is utilized to answer the following question: Which kinds of logistics innovations were addressed by presentations at logistics events in Austria between the years 2013 to 2018? It can be hypothesized that topics more frequently presented to an audience are more likely to play an important role in the future.

2. METHOD

This work analyzes presentations at logistics events targeted at the logistics community. Specifically, events of four well-known Austrian business associations, reaching a relatively wide audience, have been chosen for analysis (see Table 1).

Table 1. Selection of Austrian logistics associations

Association	Acronym	Reference
Bundesverband Materialwirtschaft, Einkauf und Logistik in Österreich	BMÖ	www.bmoe.at
Bundesvereinigung Logistik Österreich	BVL	www.bvl.at
Österreichische Verkehrswissenschaftliche Gesellschaft	ÖVG	www.oevg.at
Verein Netzwerk Logistik	VNL	www.vnl.at

Associations have been asked to supply programs of their events and those publicly available on their websites have been collected. The sample comprises 1551 presentations at 171 events from 2013 to 2018 (see Table 2).

Table 2. Sample

Organizer	Events	Presentations
BMÖ	57	398
BVL	21	225
ÖVG	80	730
VNL	13	198

A content analysis of presentation titles is applied to estimate which innovations are in the center of attention in the logistics community. The deductive content analysis applies predefined categories (Krippendorf, 2013), which follow the terms used in the framework described above (see Figure 1). The content analysis has been carried out jointly by two senior researchers in logistics.

3. RESULTS

A general overview of four major dimensions for innovations according to the framework above reveals that technology (228 counts) and business (182 counts) were dominant dimensions, while people (48 counts) and ecology (28 counts) played a minor role between 2013 and 2018 (see Figure 2).

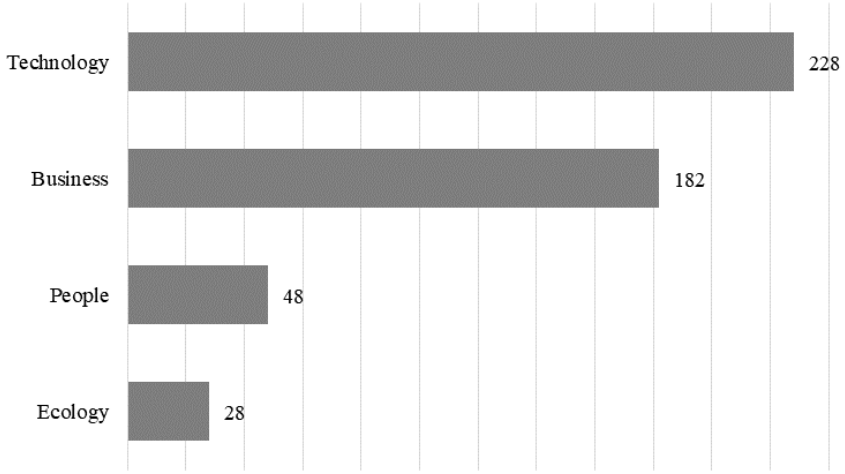

Figure 2. 6-year count of dimensions

Figure 3 illustrates the dynamic development of the dimensions' proportions, showing that innovations of the dimension "technology" have been increasingly popular compared to innovations related to the dimension "business" in recent years.

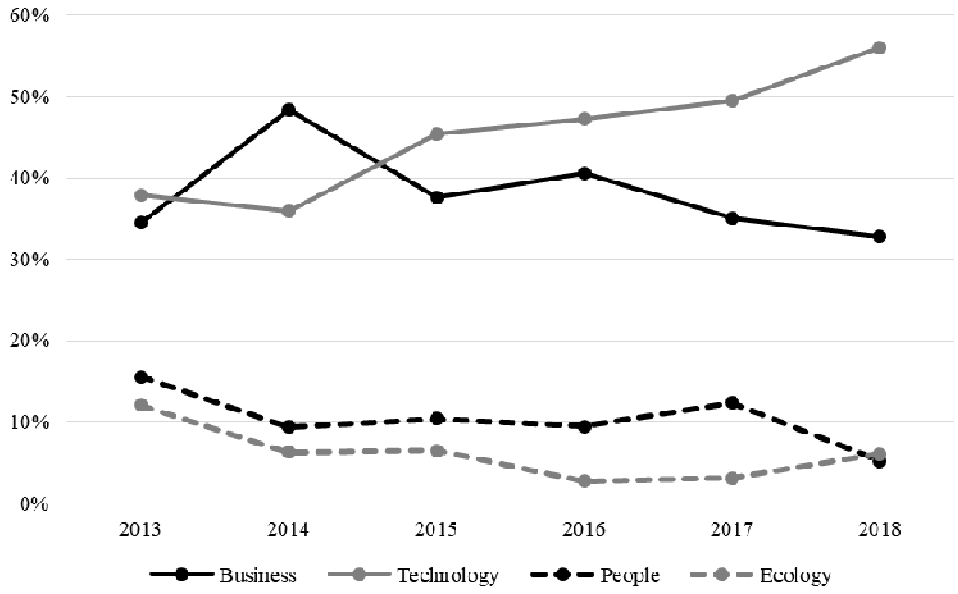

Figure 3. Trend of dimensions

For each of the five topics defined in the framework above total counts between 2013 and 2018 are calculated (see Figure 4). "Information systems for interconnected logistics" turns out to

be the top issue with 87 counts. It is followed by "corridors, hubs and synchromodality" (51 counts), "global supply network coordination and collaboration" (50 counts) and "urban logistics" (49 counts). "Sustainable, safe and secure supply chains" comes last with only 10 counts.

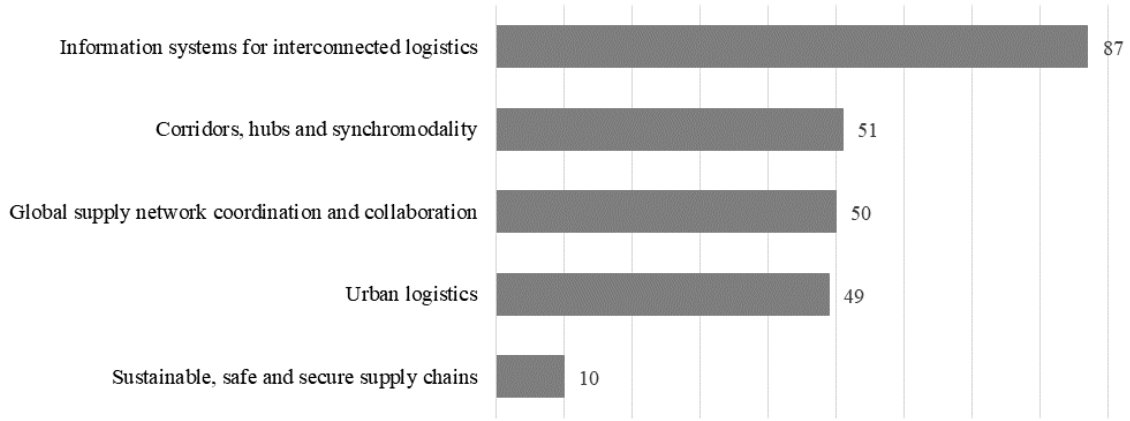

Figure 4. 6-year count of topics

The framework for innovations above includes four major dimensions. For the two predominant ones, i.e., "business" and "technology", specific innovations are defined. These innovations are ranked due to a 6-year count, i.e., the counts in presentation titles at logistics events between the years 2013 and 2018. Table 3 shows the top three innovations related to the dimension "business". The counts for "omni-channel logistics" are particularly high. Additionally, Table 3 also shows the 2-year trend for each of the three innovations. A rising, stable or falling trend results from a comparison of the combined count of 2017 and 2018 with the combined one of 2015 and 2016.

Table 3. Business-related innovations

Rank	Innovation	6-year count	2-year trend
1	Omni-channel logistics	13	→
2	Logistics marketplaces	9	↘
3	Anticipatory logistics	5	↗

Likewise, results for technology-related innovations can be seen from Table 4. The first rank takes "big data", which also has a positive 2-year trend. This is followed by "internet of things" and "self-driving vehicles", both having a relatively high 6-year count.

Table 4. Technology-related innovations

Rank	Innovation	6-year count	2-year trend
1	Big data	33	↗
2	Internet of things	14	↗
3	Self-driving vehicles	19	↗

Finally, the view is on a frequently used innovation-related term in the sample under study. "Industrie 4.0" (German for "Industry 4.0"), which originates from the high-tech strategy of the German government (Bundesministerium für Bildung und Forschung, 2015), can be found 37

times as identical expression in presentation titles from 2013 to 2018. Results are compared to the development of an indicator retrieved from Google Trends (2019), which expresses how often "Industrie 4.0" is entered in Google's search relative to Google's total search-volume in the region Austria. For each year the average value of the monthly values is calculated. Both indicators are presented as percentage relative to the year with the highest value, which accounts for 100%. See Figure 5 for the development of the indicators over time.

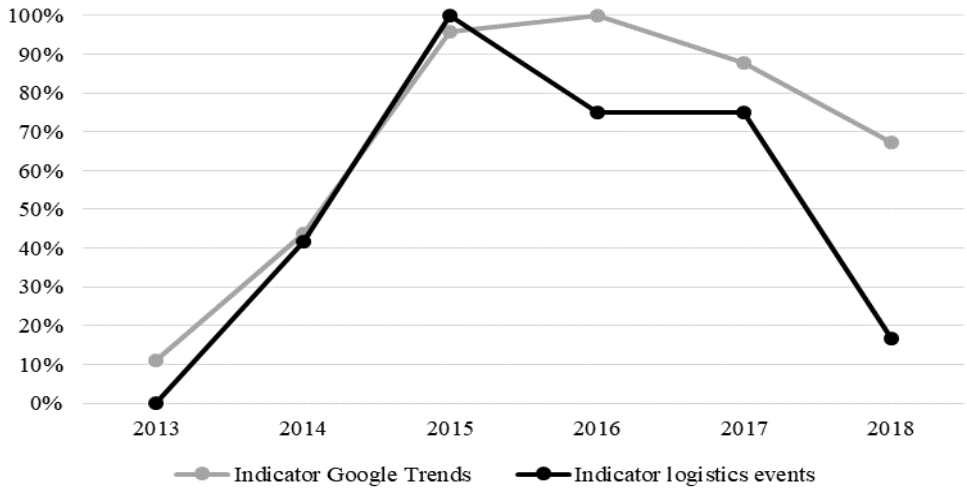

Figure 5. Trend of Industry 4.0

From both indicators can be seen, that after an initial steep increase the popularity of the term "Industrie 4.0" shows a downward trend. However, it should be noted that a lot of presentation titles contain derivatives from the term "Industrie 4.0", such as "Einkauf 4.0" (German for "Procurement 4.0").

4. CONCLUSION

The analysis of topics related to innovations in logistics presented at Austrian logistics events allows the following conclusions: (1) The dimensions technology and business dominate the agendas of logistics events, while people- and ecology-oriented topics play a rather subordinate role. This contrasts with the popular topic "Industry 4.0", which ideally should be closely related to qualification of staff and eco-friendly solutions. (2) In accordance with the mega-trend digitalization, information systems for interconnected logistics play an outstanding role. Also, the application of big data is a very dominant topic with a rising trend. (3) E-commerce is a great opportunity as well as a challenge for today's trade and logistics. Consequently, omni-channel logistics, which can help to exploit the full potential of traditional retail and e-commerce, is a prevailing topic showing a stable trend.

The present work gives insights into the Austrian logistics community but has its limitations, too. Innovations can be discussed heavily but turn out to have no significant impact later on, and vice versa. For that reason, the popularity of innovation topics should be combined with other indicators and assumptions to predict the relevance of innovations. Moreover, the choice of popular logistics associations allows to analyze events relevant to a wide audience in logistics, but does not necessarily include more specialized fields of logistics. Overall, the presented approach is a possible starting point for managers, researcher and teachers to explore trends in the complex and vibrant field of logistics innovations.

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