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THE NEEDS OF RESEARCHERS IMPLEMENTING SUPPLY CHAIN DIGITALISATION

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The digitalisation of the supply chain has presented substantial opportunities for companies to enhance resource allocation, pricing strategies, and overall operational efficiency. In this context, researchers play a crucial role in developing novel methodologies and algorithms that can confer a competitive edge to stakeholders. This study employed operational research methods to investigate the specific requirements of researchers in this domain. The results highlight the challenges, motivations, and practical needs experienced by researchers. Additionally, data-related issues and databases were examined to identify areas of improvement. The findings indicate that enhancing researchers' engagement in data-driven solutions for supply chain problems primarily hinges on addressing issues related to data quality, data accessibility, and regular dataset updates. By addressing all the aspects defined in this study, organisations can enhance the practical implementation of findings and drive advancements in supply chain management.

Keywords: Supply chain digitalization, researchers needs, operational research methods

1. Introduction

There are several research fields in the supply chain the scientific community has focused on, for the last decades. Notably, the emergence of climate change as a critical global concern has led to a significant focus on green and sustainable supply chain management tasks (Rahman *et al.*, 2023). Additionally, research has delved into fields such as risk management, optimising processes, circular economy encompassing reverse logistics, sinchromodality, and physical internet (Yang *et al.*, 2023; Jena and Singhal 2023; Mallick *et al.*, 2023; Šakalys *et al.*, 2019; Montreuil, 2011). Among these research areas, digitalisation stands out as one of the most pivotal and promising domains (Bigliardi *et al.*, 2022). Digitalisation has emerged as a transformative force, exerting a profound influence on the global business arena. By enabling companies to enhance their agility, competitiveness, and sustainability, it empowers them to deliver personalised products or services that cater to individual needs (Verhoef *et al.*, 2021). In today's dynamic market landscape, digital transformation has become indispensable for businesses seeking to thrive and effectively respond to evolving market demands (Kolagar *et al.*, 2022).

The transport sector is not immune to the impacts of digitalisation. Firstly, it brings opportunities for the emergence of new business models. Digitalisation practices that prove successful may involve the establishment of platform-based mobility services, offering innovative solutions such as mobility as a service, ride-hailing, car-sharing, on-demand buses, and other related services (Ušpalytė-Vitkūnienė *et al.*, 2022). Secondly, digitalisation has the potential to enhance process efficiency. However, digitalisation in the supply chain also presents challenges that must be addressed. One significant challenge revolves around data confidentiality and the reluctance to share data (Bazaras *et al.*, 2022). Trust becomes a critical hurdle as transport and logistics companies operate in fiercely competitive environments, where managing and exchanging information is perceived as a potential compromise to their competitive advantage. To tackle these challenges, the establishment of a dedicated framework for data governance, comprising agreements and rules, becomes imperative. The implementation of data governance plays a crucial role in ensuring the organization's continuity through effective risk management and optimization of data utilisation (Bazaras *et al.*, 2022). It establishes guidelines for data consumption within and outside the organisation and outlines the procedures for data sharing in collaborative environments with third parties.

In the field of supply chain management, the potential for digital innovations is substantial. One promising opportunity lies in the collaboration between supply chain stakeholders and research institutions. By working together, they can create and implement novel solutions. Zinn and Goldsby (2017) have examined the crucial role of researchers in enhancing supply chain practices. It was found that previous

investigations have focused on optimisation and risk management tasks. However, concerns have arisen that contemporary business research, including supply chain research, has become somewhat detached from real-world management practices (Hoffman, 2015; Zinn and Goldsby, 2017). Currently, companies may perform joint research with scientists in which the company is involved. This allows them to address relevant operational challenges or develop new technological or strategic solutions. Researchers could perform, real-time data analysis, develop a methodology for data exchange with supply chain actors, and tools for monitoring carbon footprint and the use of environmental resources. In collaboration with researchers, businesses pursue additional specific and practical goals, one of which is staff training. Additionally, providing relevant information to the study process will create favourable conditions for the purposeful training of students, that will become supply chain specialists in the future. Previous investigations found that companies working in the supply chain can generate datasets; however, the majority of them can only be generated on-demand, so there is no guarantee that the datasets will be systematised appropriately (Skrickij *et al.*, 2023). There are no clear leaders in the field of compilation of datasets, except for the transport companies under state influence (e.g. railways and some airlines).

In academic circles, big data analytics and artificial intelligence (AI) have emerged as hot topics, showcasing the potential of new algorithms to drive advancements in supply chain practices (Barzizza *et al.*, 2023). However, the current reality in supply chain-related tasks paints a different picture. Scientists need access to relevant datasets to increase their research output, they often focus on developing new methods rather than solving practical, applied tasks. Remarkably, valuable datasets exist in other fields such as medicine, automated driving, and even car-sharing, but the same abundance is not seen in the supply chain domain (Ma *et al.*, 2020; Song *et al.*, 2022; Šabanovič *et al.*, 2020). Commonly, researchers are looking for suitable datasets to work with, rather than focusing on the area that the dataset belongs to.

This investigation targets identifying the needs of researchers to solve data-related problems in the field of supply chain. We deeply believe that this area changes very quickly and researchers can help businesses maintain a competitive edge.

The organisation of this paper is as follows: The introduction section provides an analysis of supply chain-related tasks with a focus on the digitalisation of the transport sector, examining the tasks that can be addressed from the perspectives of both business and research representatives. In Section 2, the research methods employed are outlined, and a comprehensive system of criteria and subcriteria is established for evaluating the specific requirements of researchers engaged in supply chain digitalisation. Section 3 involves the calculation of key criteria and subcriteria weights, accompanied by a detailed analysis. The concluding section presents the key findings and conclusions derived from the study, summarising the overall research outcomes.

2. Theoretical background

This section describes the methods used for research. The investigation presented in this article is part of a wider research, during which we are looking for ways to increase the effectiveness of cooperation between representatives of business, science and government organisations in the field of the supply chain. Our previous study identified business needs and possible collaboration areas between researchers and business representatives (Skrickij *et al.*, 2023). In this study, the focus is on researchers. Specific steps of the investigation are presented in Figure 1.

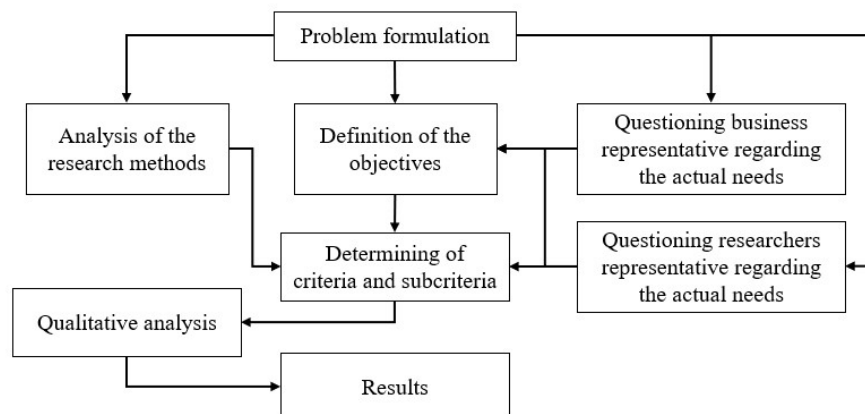


Figure 1. Research flowchart

A systematic review and surveys of business representatives and scientists have been performed to define the obstacles researchers face working with data-related tasks in the field of the supply chain. After that questionnaire was prepared, and experts were asked to answer the questions. The final questionnaire included four groups of key criteria with subcriteria. A list of subcriteria was selected during several iterations (see Figure 2). Below short descriptions of criteria and subcriteria are presented.

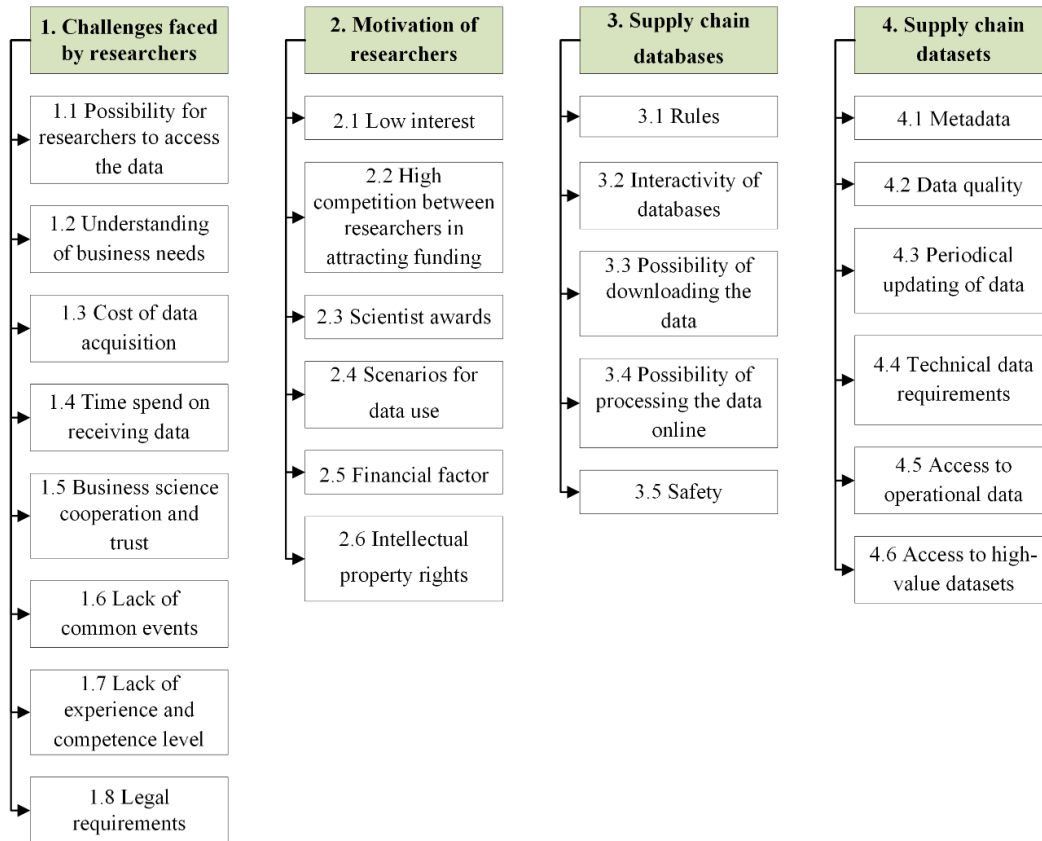


Figure 2. List of criteria and subcriteria

1. Challenges faced by researchers. The challenges that researchers face when solving supply chain-related tasks which require data.

- 1.1. Possibility for researchers to access the data. Availability of datasets that researchers can work with; or the possibility of receiving the data under a specific request.
- 1.2. Understanding of business needs. Availability of information regarding actual business problems.
- 1.3. Cost of data acquisition. The price that researchers need to pay to receive the data.
- 1.4. Time spent on receiving data. Duration of time that researchers need to spend to acquire the data they need.
- 1.5. Business science cooperation and trust. Continuous cooperation between research and business representatives/institutions.
- 1.6. Lack of common events. Availability of forums, conferences, hackathons, and roundtables where researchers can contribute to task solving and perform discussions with business representatives.
- 1.7. Lack of experience and competence level. Lack of researchers' experience and /or competence as an essential obstacle to participating in the preparation of competitive applications for financing.
- 1.8. Legal requirements. Knowledge of legal requirements governing the exchange of data and information between the private and public sectors (if research institutions belong to the public sector) and the legal framework governing sensitive, personal data protection.

2. The Motivation of researchers. These criteria are primarily oriented toward researchers working with data not related to the supply chain. Many available datasets can be used to develop and test original

algorithms. Attracting researchers to supply chain-related tasks would have many practical benefits. At the same time, it is important to understand the motivation of current researchers working in the field.

- 2.1. Low interest. Lack of interest in solving supply chain and transportation-related problems from researchers who previously did not specialise in supply chain-related tasks (for example, data scientists and mathematicians).
- 2.2. High competition between researchers in attracting funding. The number of project calls is insufficient in the field of the supply chain, with high competition and little chance of winning.
- 2.3. Scientist awards. Recognition of scientific achievements for the specified task as the motivation of researchers to focus on supply chain-related tasks
- 2.4. Scenarios for data use. Possibility of reusing existing data from private business and/or public sector for the research and possibility of sharing findings via publications and teaching.
- 2.5. Financial factor. Opportunity for the researcher to receive satisfactory/motivating payment for task solutions in projects or directly from companies.
- 2.6. Intellectual property rights. Clear definition of intellectual property rights; researchers' engagement in the commercialisation of findings with long-term profits implied.
3. *Supply chain datasets*. The quality of datasets, their availability, compliance with the requirements, and other data-related questions were distributed into separate criteria.
 - 3.1. Rules. Clearly explained data usage rules taking into account the legal, ownership and other aspects.
 - 3.2. Interactivity of databases. Possibility to contact data owners to solve data-related issues.
 - 3.3. Possibility of downloading the data. Possibility to download, save and process data externally.
 - 3.4. Possibility of processing the data online. Possibility to process the data using database online tools only, without downloading the dataset.
 - 3.5. Safety. Fulfilment of data safety requirements, depersonalisation and normalisation-related issues by its owners.
4. *Supply chain databases*. The supply chain combines stakeholders working in different areas, and database-related issues are important topics.
 - 4.1. Metadata. Variety of details in the provided dataset.
 - 4.2. Data quality. Completeness, stability and normality of the data in the dataset.
 - 4.3. Periodical updating of data. Periodical updates of data.
 - 4.4. Technical data requirements. Data format, dataset size, structure, and sampling rate.
 - 4.5. Access to operational data. Access to the operational level data (vehicle/vessel and cargo telemetry data, warehouse and terminal internal system data and others).
 - 4.6. Access to high-value datasets. Access to data that provide considerable benefits for society, the environment and the economy (geospatial data, earth observation and environment, meteorological data, others).

2.7. Data processing procedure

Two groups of experts were interviewed. The first group are scientists working in the field of supply chain with significant experience in joint projects with industry. The second group are data scientists who are experienced in data analytics, algorithms, and optimisation and could bring much value if would start solving supply chain-related tasks.

Firstly, the criteria and subcriteria were ranked by each expert using the scale of ranks from 1 to m . Rank 1 is assigned to the most important criteria, the 2nd to the second most important, etc. as described in Saaty (1980.) Secondly, the conformity of opinions among the experts was estimated using the concordance coefficient. In the third stage, the pairwise comparison method was used to estimate exact weights compared to ones established by the ranking scale (Saaty, 1980, 2000).

The concordance coefficient developed by Kendall (1970) uses W , which is calculated from the matrix of ranks of criteria $E = \|e_{ij}\|$; $i = 1, \dots, m$; $j = 1, \dots, r$, e_{ij} are estimation ranks of the i -th criteria by the j -th expert; m is the number of criteria; r is the total number of experts.

Sums of elicited ranks of each criterion are calculated (Kendall, 1970; Podvezko, 2007):

$$e_i = \sum_{j=1}^r e_{ij}, i = 1, \dots, m. \quad (1)$$

Average of the sums from formula (1) are:

$$\bar{e} = \frac{\sum_{i=1}^m e_i}{m} = \frac{\sum_{i=1}^m \sum_{j=1}^r e_{ij}}{m}. \quad (2)$$

Sum of squares of deviations:

$$S = \sum_{i=1}^m (e_i - \bar{e})^2. \quad (3)$$

The concordance coefficient:

$$W = \frac{12S}{r^2 m(m^2 - 1)}. \quad (4)$$

The numerical values of the concordance coefficient vary in the interval from 0 to 1. The value $W=0$ means that experts' opinions are contradictory. When $W=1$, the opinions are fully in line with each other. Kendall (1970) proved that the test statistics are distributed following the χ^2 distribution:

$$\chi^2 = Wr(m-1) = \frac{12S}{rm(m+1)}. \quad (5)$$

If the value of the test statistics appears to be beyond a critical value χ_{kr}^2 , the alternative hypothesis H_1 stating that experts' opinions are concordant may be accepted for the selected significance level.

In the case under investigation, the number of criteria is 4, and for subcriteria, 8, 6, 5, 6. From the theory, it is known that in the case the number of the compared criteria m ranges from 3 to 7, the distribution χ_{kr}^2 cannot be used in all cases because sometimes the critical value may be larger than the calculated one. The probability table of the critical values was used (Podvezko 2005, Bešelev *et al.*, 1974).

2.8. Weight estimation for criteria and subcriteria

Criteria weights were estimated using the operational research method proposed by Saaty (1980, 2000). The pairwise comparisons of the importance of criteria and subcriteria were used. The final matrix of pairwise comparisons $P = \|p_{ij}\|$, $(i, j = 1, 2, \dots, m)$ contains ratios of comparison of significance in each pair of criteria and subcriteria R_i and R_j ($i, j=1, 2, \dots, m$). The estimation scores p_{ij} are outlined in the scale 1-3-5-7-9 or inverse values, $p_{ij} = 1$ means that criteria (subcriteria) R_i and R_j are equally important while $p_{ij} = 9$ means that the i -th criteria are incomparably more important than the j -th. In some cases, 2-4-6-8 values can also be used if the standard scale is insufficient (Liachovičius *et al.*, 2020).

The matrix elements contain ratios of criteria weights:

$$p_{ij} = \frac{\omega_i}{\omega_j}. \quad (6)$$

The matrix P is the inverse symmetrical matrix:

$$p_{ij} = \frac{1}{p_{ji}}, (i, j = 1, 2, \dots, m). \quad (7)$$

For correctly filled matrixes, the vector of weights $\omega = (\omega_1, \omega_2, \dots, \omega_m)^T$ could be derived as the normalised eigenvector of the matrix P that corresponds to the maximal eigenvalue λ_{max} :

$$P\omega = \lambda_{max}\omega. \quad (8)$$

To estimate the matrix consistency, the Consistency Index ($C.I.$) is used (Saaty 1980, 2000):

$$C.I. = \frac{\lambda_{max} - m}{m-1}. \quad (9)$$

For the ideal case, $C.I. = 0$, when columns of the matrix are strictly proportional, and the matrix is strictly reciprocal. In practice, the matrix indicates an acceptable/tolerable consistency level if the following Concordance Ratio ($C.R.$) is less or equal to 0.1 (i.e., 10%) Saaty (1980):

$$CR = \frac{C.I.}{R.I.}, \quad (10)$$

where $R.I.$ is the consistency index, random values corresponding to the observed number of items/alternatives are presented in Table 1.

Table 1. The values of a consistency index

Matrix order	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>R.I.</i>	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

3. Results and their analysis

In this Section, results are presented. Experts ranked all the criteria and subcriteria pointing out their importance. This step is needed to compare the importance of criteria required by the operations research method used in this study and assign direct weights. The results are presented in Table 2.

Table 2. Ranking of criteria and subcriteria

Criteria	1		2		3		4	
RANK	4		2		3		1	
Subcriteria of Criteria 1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
RANK	1	2	4	3	5	6	7	8
Subcriteria of Criteria 2	2.1		2.2		2.3		2.4	
RANK	6		1		5		2	
Subcriteria of Criteria 3	3.1		3.2		3.3		3.4	
RANK	5		1		2		3	
Subcriteria of Criteria 4	4.1		4.2		4.3		4.4	
RANK	6		1		3		5	

For four criteria, the distribution χ^2_{kr} cannot be used, and critical values S were used for this case. $Scr = 114.75$ (with a significance level of 5%) and calculated value $S = 201$, we may reject the hypothesis that experts' opinions regarding criteria ranks are non-concordant. For subcriteria 1, $n=8$, the distribution χ^2_{kr} can be used. The standard significance level of 5% was used for all the cases in this research. The degree of freedom is 7 ($8 - 1 = 7$), as there are eight sets of criteria. $\chi^2_{kr} = 18.475$ and achieved $\chi^2 = 47.222$, the hypothesis that experts' opinions regarding criteria ranks are non-concordant may be rejected. As a result weights from the group of experts can be used. For subcriteria 2, $n = 6$, the critical values S were used for this case. $Scr = 337.85$ and calculated value $S = 509.5$, the hypothesis that experts' opinions in terms of criteria ranks are non-concordant can be rejected. For subcriteria 3, $n = 5$, critical values S were used for this case. $Scr = 207.45$ and calculated value $S = 210$, the hypothesis that experts' opinions in terms of criteria ranks are non-concordant can be rejected. For subcriteria 4, $n = 6$, the distribution χ^2_{kr} cannot be used, and with critical values $Scr = 337.85$ and calculated value $S=1061.5$, the hypothesis that experts' opinions regarding subcriteria ranks are non-concordant may be rejected. After the ranking structure of both sets of criteria had been set, they were compared in pairs using the Analytic Hierarchy Process method scale. The results of such a comparison are presented in Tables 3, 4, 5, 6, and 7.

Table 3. Comparison matrix for criteria

	1	2	3	4
1	1.00	0.20	0.33	0.14
2	5.00	1.00	3.00	0.20
3	3.00	0.33	1.00	0.20
4	7.00	5.00	5.00	1.00

Table 4. Comparison matrix for subcriteria 1

	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
1.1	1.00	3.00	5.00	4.00	6.00	7.00	8.00	9.00
1.2	0.33	1.00	4.00	3.00	5.00	6.00	7.00	8.00
1.3	0.20	0.25	1.00	0.50	3.00	5.00	6.00	7.00
1.4	0.25	0.33	2.00	1.00	4.00	6.00	7.00	8.00
1.5	0.17	0.20	0.33	0.25	1.00	3.00	4.00	5.00
1.6	0.14	0.17	0.20	0.17	0.33	1.00	3.00	4.00
1.7	0.13	0.14	0.17	0.14	0.25	0.33	1.00	3.00
1.8	0.11	0.13	0.14	0.13	0.20	0.25	0.33	1.00

Table 5. Comparison matrix for subcriteria 2

	2.1	2.2	2.3	2.4	2.5	2.6
2.1	1.00	0.11	0.33	0.14	0.25	0.20
2.2	9.00	1.00	7.00	2.00	5.00	3.00
2.3	3.00	0.14	1.00	0.14	0.33	0.20
2.4	7.00	0.50	7.00	1.00	5.00	3.00
2.5	4.00	0.20	3.00	0.20	1.00	0.33
2.6	5.00	0.33	5.00	0.33	3.00	1.00

Table 6. Comparison matrix for subcriteria 3

	3.1	3.2	3.3	3.4	3.5
3.1	1.00	0.14	0.17	0.20	0.33
3.2	7.00	1.00	3.00	5.00	7.00
3.3	6.00	0.33	1.00	3.00	5.00
3.4	5.00	0.20	0.33	1.00	3.00
3.5	3.00	0.14	0.20	0.33	1.00

Table 7. Comparison matrix for subcriteria 4

	4.1	4.2	4.3	4.4	4.5	4.6
4.1	1.00	0.11	0.14	0.33	0.13	0.20
4.2	9.00	1.00	5.00	9.00	2.00	7.00
4.3	7.00	0.20	1.00	7.00	0.33	5.00
4.4	3.00	0.11	0.14	1.00	0.20	0.33
4.5	8.00	0.50	3.00	5.00	1.00	5.00
4.6	5.00	0.14	0.20	3.00	0.20	1.00

For all the cases, achieved values of Concordance Ratios were less than 0.1. It means that all comparison matrixes indicate an acceptable/tolerable consistency level.

During the last procedure, the weight of criteria and subcriteria were calculated. From Table 8, it can be seen that the most important criterion is Supply chain datasets (weight 0.613). The data remains the main obstacle. There is a lack of supply chain datasets; at the same time, there is a huge amount of datasets from other areas and researchers interested in creating new methods are using them and providing a competitive advantage to other areas. In this regard, business representatives need to concentrate on dataset preparation if they expect to receive solutions.

Table 8. Overall scoring of criteria

	Criteria	Weight	Rank
1	Challenges faced by researchers	0.0526	4
2	Motivation of researchers	0.222	2
3	Supply chain databases	0.113	3
4	Supply chain datasets	0.613	1

The next comment regarding existing datasets is that they are not updating periodically. Even when scientists have access to the data, the result may not be used by stakeholders as it is outdated data. Regarding the most important Criteria Supply chain datasets, the top 3 subcriteria are (Table 9): Data quality (weight 0.436); Access to operational data (0.267); Periodical updating of data (0.164).

The second criterion researchers pointed out as important is Motivation (weight 0.222). For this criteria, the most important subcriteria are: High competition between researchers in attracting funding (0.391). Scenarios for data use (0.297) and Intellectual property rights (0.158).

The third place is supply chain databases (0.113). The subcriteria that experts pointed out as most important are: Interactivity of databases (0.545), Scenarios for data use (0.254) and Possibility of processing the data online (0.114). Challenges faced by researchers ranged in fourth place with a weight of only 0.0526. It means there are not many problems here. The subcriteria that experts pointed out as most important for this criterion are: Possibility for researchers to access the data (0.356), Understanding of business needs (0.236) and Time spend on receiving data (0.154).

Table 9. Overall scoring of subcriteria

Criteria	Subcriteria	Weight	Rank
1. Challenges faced by researchers	Possibility for researchers to access the data	0.356	1
	Understanding of business needs	0.236	2
	Cost of data acquisition	0.111	4
	Time spend on receiving data	0.154	3
	Business science cooperation and trust	0.0627	5
	Lack of common events	0.0382	6
	1.7. Lack of experience and competence level	0.0251	7
	1.8. Legal requirements	0.0167	8
2. Motivation of researchers	2.1. Low interest	0.0281	6
	2.2. High competition between researchers in attracting funding	0.391	1
	2.3. Scientist awards	0.0444	5
	2.4. Scenarios for data use	0.297	2
	2.5. Financial factor	0.0818	4
	2.6. Intellectual property rights	0.158	3
3. Supply chain databases	3.1. Rules	0.0339	5
	3.2. Interactivity of databases	0.545	1
	3.3. Possibility of downloading the data	0.254	2
	3.4 Possibility of processing the data online	0.114	3
	3.5. Safety	0.0532	4
4. Supply chain datasets	4.1. Metadata	0.0233	6
	4.2. Data quality	0.436	1
	4.3. Periodical updating of data	0.165	3
	4.4. Technical data requirements	0.0396	5
	4.5. Access to operational data	0.267	2
	4.6. Access to high-value datasets	0.0686	4

4. Conclusions

Over the past decade, numerous innovative data-driven solutions have emerged across various domains. Presently, digitalisation is reshaping the operational frameworks of transportation companies and entire supply chains. In partnership with researchers, businesses are actively striving to achieve tangible and pragmatic objectives. These initiatives range from crafting technological and strategic innovations, poised to confer competitive advantages, to nurturing the next generation of industry professionals through student training programs, who will contribute to the future workforce of the sector.

Two distinct groups of researchers have the potential to make valuable contributions. Firstly, professionals deeply entrenched in the transportation sector problems, who possess an intimate understanding of the associated challenges, albeit with varying degrees of familiarity with data-driven

research. The second group consists of researchers specialising in digitalisation, particularly in the realm of big data. Collaborating toward shared objectives can yield substantial outcomes for both these groups.

In conclusion, this research underscores the critical importance of addressing the needs of researchers engaged in implementing supply chain digitalisation. The findings from our analysis reveal key insights into the priorities and challenges faced by these researchers.

The paramount criterion identified is the availability of Supply chain datasets, which carries a substantial weight of 0.613. This highlights a glaring issue in the field - a deficiency of supply chain-specific datasets. While researchers across various domains benefit from an abundance of data, those in supply chain-related fields struggle due to this scarcity. The dearth of such datasets not only hampers progress but also leaves supply chain researchers at a competitive disadvantage. Consequently, business stakeholders must direct their efforts towards dataset preparation if they expect to yield viable solutions.

Furthermore, research identified that even when datasets are accessible, they often suffer from a lack of periodic updates, rendering them less valuable. The importance of data quality, access to operational data, and periodic data updates within the Supply chain datasets criterion (weight 0.436, 0.267, and 0.164, respectively) cannot be overstated.

The second significant criterion, Motivation of researchers (weight 0.222), emphasises the competitive landscape in funding acquisition, the creation of scenarios for data utilisation, and the safeguarding of intellectual property rights. These aspects collectively drive the motivation of researchers in the supply chain digitalisation domain.

Supply chain databases, while slightly less significant, remain a critical factor (weight 0.113). Within this criterion, the interactivity of databases, scenarios for data utilisation, and the ability to process data online take precedence.

Lastly, the relatively lower weight assigned to challenges faced by researchers (0.0526) suggests that this aspect is relatively well-addressed. However, ensuring researchers' continued access to data, understanding business needs, and streamlining the time spent on acquiring data remain pivotal for their success.

In light of these findings, it is evident that enhancing the availability and quality of supply chain datasets should be a primary focus for businesses and stakeholders looking to support and collaborate with researchers in the supply chain digitalisation field. Additionally, fostering a competitive and innovative research environment, while addressing the identified challenges, can further accelerate progress in this critical domain.

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