
Organisational Conditions Shaping Behaviour in the European Transport and Warehousing Sector: A Multidimensional Comparative Analysis

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Abstract:

Purpose: The purpose of this study is to assess and compare selected organisational conditions shaping organisational functioning and behavioural responses in the transport and warehousing sector across the EU Member States. The study focuses on differences in the country-level conditions under which logistics organisations operate, with particular attention to digital readiness, employee development, working-time conditions, occupational safety, labour-market pressure and the institutional environment.

Design/Methodology/Approach: The study adopts a multidimensional comparative approach based on a synthetic measure constructed using secondary country-level data for the EU-27 Member States. The selected diagnostic variables capture five main dimensions of organisational conditions: digitalisation capacity, investment in ICT competencies, working-time conditions, occupational safety and labour-market pressure. The institutional environment is incorporated as an additional contextual dimension reflecting the broader conditions in which logistics organisations operate. Data were obtained primarily from Eurostat and Transparency International. The synthetic measure is used to compare Member States and identify differences in the overall level of the selected organisational conditions.

Findings: The results reveal substantial differences between EU Member States in the selected organisational conditions. The findings indicate varying levels of digital readiness, employee development, working-time conditions, occupational safety, labour-market pressure and institutional quality across countries. The observed differences suggest that logistics organisations operate within significantly different national environments, which may affect organisational functioning and employee behavioural responses. The study also demonstrates the usefulness of a multidimensional approach for capturing the diverse conditions shaping the transport and warehousing sector.

Practical implications: The findings may support policymakers and logistics organisations in identifying areas requiring improvement, particularly in digital competence development, occupational safety, workforce management and the institutional environment. A country-level assessment of these conditions may assist in identifying structural areas that require targeted policy interventions and organisational initiatives aimed at improving the functioning of the transport and warehousing sector.

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Originality/Value: *The study contributes to the literature by providing a multidimensional country-level assessment of selected organisational conditions in the transport and warehousing sector across the EU Member States. By integrating economic, technological, labour-related, safety and institutional dimensions into a synthetic measure, the study complements approaches focused primarily on operational and economic performance. Importantly, the synthetic measure is not interpreted as a direct measure of organisational behaviour, but as a comparative assessment of country-level conditions that may influence organisational functioning and behavioural responses.*

Keywords: *Organisational functioning, behavioural responses, digital readiness, logistics, synthetic measure, European Union.*

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1. Introduction

The transport and warehousing sector plays a fundamental role in the functioning of contemporary economies by enabling the movement, storage and coordination of goods and information across increasingly complex supply chains. At the same time, logistics organisations operate under conditions of considerable time pressure, technological change, labour-market constraints and occupational safety requirements.

These factors influence not only operational performance but also the ways in which employees and organisations respond to changing circumstances, coordinate activities and adapt to disruptions. The COVID-19 pandemic further demonstrated the strategic importance of logistics for maintaining economic continuity and accelerated the adoption of digital and organisational solutions across the sector (Rokicki *et al.*, 2022).

In this context, organisational behaviour constitutes an important dimension of the functioning of transport and warehousing organisations. However, organisational behaviour is influenced by the organisational, technological, labour-market and institutional conditions in which employees and organisations operate. In logistics, these relationships are particularly important because individual actions are embedded in highly interdependent processes.

The activities of drivers, warehouse workers, freight forwarders, managers and information-system specialists are interconnected, meaning that decisions or errors in one part of the system may affect the performance, safety and reliability of other processes. Consequently, the analysis of organisational behaviour in logistics should consider not only individual attitudes and managerial practices, but also the broader organisational conditions that may facilitate or constrain particular behavioural responses.

Recent research increasingly emphasises the human and organisational dimensions of digital transformation in logistics. Although digital technologies and automation may improve productivity, communication and process coordination, they can also alter job content, intensify work, affect employee autonomy and create new psychosocial and organisational risks.

Studies of digitalised warehousing indicate that technological change may simultaneously improve selected working conditions and generate new challenges related to workload, surveillance, training, job quality and employee well-being (Ramstedt Stadin *et al.*, 2024; Zanoni *et al.*, 2025). Similar concerns are evident in research on algorithmic management, which demonstrates that digital technologies increasingly influence work organisation and management practices in logistics while raising questions about job quality and working conditions.

At the same time, the functioning of logistics organisations is shaped by factors that extend beyond digitalisation. Employee competencies, opportunities for professional development, working time, occupational safety, staff availability and the quality of the institutional environment may influence the capacity of organisations to maintain stable and effective operations and to respond to technological and organisational change.

This suggests that the conditions shaping organisational behaviour should be approached as a multidimensional phenomenon rather than reduced to a single measure of operational efficiency. Such an approach is particularly relevant in the transport and warehousing sector, where technological, human, organisational and institutional dimensions interact closely.

2. Literature Review

The literature provides substantial evidence concerning individual aspects of organisational functioning in logistics. Research has examined, among other issues, digitalisation and Industry 4.0 competencies (Raza *et al.*, 2023), employee development and vocational preparation (Hetmańczyk, 2024), occupational safety and innovative approaches to risk prevention (Lewczuk and Żuchowicz, 2024), as well as employee well-being and organisational stability during periods of disruption (Čižiūnienė *et al.*, 2025).

Increasing evidence suggests that the adoption of digital technologies is closely connected with changes in the organisation of work, required skills and working conditions (Rêgo *et al.*, 2022). Wang and Sarkis (2021) emphasise that emerging digitalisation technologies are transforming freight transport and logistics by changing the ways in which logistics actors connect, collaborate and create value. This transformation may consequently affect not only operational processes but also the roles and competencies of employees. Empirical evidence from Europe further indicates that the relationship between digital technologies and working conditions is multidimensional and may differ according to the type of technology and occupation.

Parteka *et al.* (2024), using data covering more than nine million workers in 22 European countries, show that computerisation, robotics and artificial intelligence may have differentiated effects on the non-income dimensions of job quality. Digital transformation should therefore be considered as part of a broader organisational process in which technological capabilities interact with human competencies and working conditions.

The interaction between technological change and working conditions is particularly relevant in transport and warehousing, where work is often characterised by time pressure, physical demands and the need to coordinate activities across highly interdependent processes (Certa and Schröder, 2021). Research on logistics work has shown that working conditions should be considered in relation to both technical and social aspects of work organisation.

Studies of warehousing and postal and delivery services indicate that employees may be exposed to demanding working conditions and that the relationship between technological work design, organisational resources and employees' work ability requires particular attention. Digitalisation may consequently have a dual character: while digital technologies can support the organisation and coordination of work, they can also transform job demands, intensify monitoring and alter forms of work organisation (Certa and Schröder, 2021; Nataraj *et al.*, 2025). This reinforces the need to consider working-time conditions, employee development and occupational safety jointly rather than as isolated characteristics of logistics organisations.

Labour-market conditions constitute another important component of the organisational environment in which transport and warehousing organisations operate. The availability of appropriately skilled workers is particularly important in a sector undergoing simultaneous technological, demographic and structural change.

Dorantes and Allen (2024) emphasise that the European transport labour market is being affected by automation, digitalisation, changing skill requirements and broader transformations in the sector. These developments may increase the importance of workforce availability and the ability of organisations to attract and retain employees

with appropriate competencies. Labour-market pressure can therefore affect organisational functioning through recruitment difficulties, the allocation of tasks among available employees and the need to invest in employee development (Mendoza-Chan and Pee, 2024).

From this perspective, indicators such as the job vacancy rate can provide an observable country-level approximation of labour-market pressure and complement indicators describing digital competencies and working conditions.

Organisations are also embedded in institutional environments that may influence the conditions under which organisational decisions and employment practices are implemented. Institutional transparency, regulatory quality and the perceived integrity of public institutions can affect the broader environment in which firms operate, particularly in sectors that depend on extensive interactions with public authorities, infrastructure systems and regulatory frameworks.

Research on transparency and digital public-sector processes highlights the importance of institutional conditions for the functioning of economic and administrative systems (Hochstetter *et al.*, 2023). At the same time, research on corruption risks demonstrates that institutional weaknesses may create conditions affecting organisational decision-making and the functioning of economic processes (Lisciandra *et al.*, 2022).

In the present study, the corruption perception indicator is therefore not interpreted as a direct measure of organisational behaviour. Instead, it is treated as a contextual indicator capturing differences in the institutional environment within which transport and warehousing organisations operate.

Despite these contributions, an important gap remains in the literature. Existing research has generated substantial knowledge about particular aspects of logistics organisations, including digital transformation, employee competencies, working conditions, occupational safety and labour-market change. However, these dimensions are most often investigated separately, through studies focusing on particular technologies, occupational groups, organisations or specific labour-market challenges. As a result, there is still limited evidence on how different organisational and human-related conditions coexist and differ across national contexts within the European Union.

This gap is particularly relevant because the individual dimensions considered in the literature are not independent. Digitalisation changes skill requirements and work organisation (Rêgo *et al.*, 2024); workforce shortages may increase pressure on existing employees and strengthen the need for training (Mejía Dorantes and Allen, 2024; Mendoza-Chan and Pee, 2024); working-time arrangements may interact with occupational safety; and institutional conditions may shape the broader environment in which organisations implement technological and employment-related changes.

Analysing these dimensions separately may therefore provide only a partial representation of the conditions under which logistics organisations operate.

A multidimensional comparative approach can address this limitation by bringing together several observable indicators within a common analytical framework. Rather than attempting to measure organisational behaviour directly, such an approach makes it possible to assess the country-level conditions that may facilitate or constrain organisational functioning and behavioural responses. This perspective is particularly suitable for cross-country research because comparable secondary data allow differences between EU Member States to be examined systematically.

A multidimensional approach is also justified by the established use of comparative and synthetic-measure methods in European transport research. Previous studies have demonstrated the usefulness of multidimensional methods for comparing transport development and sustainability across European countries.

For example, Czech *et al.* (2016) applied a synthetic measure to assess differences in transport development among EU Member States, while more recent research has used multidimensional approaches to evaluate different pillars of transport sustainability across European countries. Such studies demonstrate that complex and heterogeneous transport phenomena can be meaningfully analysed by combining multiple diagnostic variables within a common comparative framework.

However, established assessments of logistics performance have traditionally focused on operational and supply-chain performance dimensions, including infrastructure, logistics services, trade facilitation and related performance indicators (Wudhikarn *et al.*, 2018; World Bank, 2023; Io Storto and Evangelista, 2023).

At the same time, research has highlighted the importance of human resources and workforce-related factors for logistics performance, including skilled labour, training and working conditions (Jhavar *et al.*, 2014). More recent research on Supply Chain 4.0 further emphasises the need for multidimensional performance measurement frameworks that account for the interaction between technological developments and different dimensions of logistics performance (Govindan *et al.*, 2022).

Against this background, a synthetic measure designed specifically to capture selected organisational and human-related conditions of the transport and warehousing sector provides a complementary perspective.

Rather than replicating conventional logistics performance measures, such an approach focuses on the organisational and human-related conditions that may enable or constrain organisational functioning and employee responses. It therefore makes it possible to examine the organisational context underlying logistics performance, rather than assessing performance outcomes alone.

These dimensions are represented by indicators describing the employment of ICT/IT specialists, the provision of ICT/IT training, the average number of hours actually worked per week, the frequency rate of non-fatal accidents at work, the job vacancy rate and the corruption perception indicator. The selected variables do not constitute a direct measure of employee attitudes, motivation, satisfaction, leadership style or organisational culture. Rather, they represent observable organisational and contextual conditions that may influence organisational functioning and behavioural responses and that can be consistently compared across EU Member States using secondary statistical data.

3. Research Methodology

The unit of analysis in this study is the EU Member State rather than the individual enterprise or employee. Accordingly, the synthetic measure should be interpreted as a country-level comparative indicator of selected organisational conditions in the transport and warehousing sector. It does not provide a direct assessment of organisational behaviour at the individual or enterprise level. This distinction is essential for interpreting the results and for avoiding conclusions that extend beyond the level of aggregation represented by the underlying data.

To operationalise the multidimensional concept adopted in this study, the synthetic measure is constructed using Hellwig's taxonomic measure of development. The choice of this method is justified by the multidimensional structure of the research problem, which combines heterogeneous indicators representing digital competencies, working conditions, occupational safety, labour-market conditions and the institutional environment.

These dimensions cannot be adequately represented by a single observable variable. Hellwig's method enables their integration into a single synthetic measure while preserving the information provided by the individual diagnostic variables and allowing the relative positions of EU Member States to be compared.

The application of Hellwig's method also provides a systematic procedure for dealing with indicators expressed in different units of measurement and characterised by different directions of influence. The selected variables are first classified according to whether higher values represent more or less favourable conditions.

Following the appropriate transformation and normalisation of the diagnostic variables, a reference pattern representing the most favourable configuration of the analysed characteristics is established. The distance of each EU Member State from this pattern is then determined, providing the basis for calculating the synthetic measure. Consequently, the resulting measure reflects the relative position of each country with respect to the favourable reference pattern rather than the absolute level of any individual organisational characteristic.

The use of Hellwig's approach is therefore consistent with the main objective of the study: to identify and compare the overall configuration of selected organisational and human-related conditions in the transport and warehousing sector across EU Member States. The measure is not intended to establish causal relationships between the individual indicators or to assess organisational performance directly. Rather, it provides a comparative analytical tool that makes it possible to examine whether countries differ in the extent to which their national transport and warehousing sectors are characterised by a more or less favourable combination of the selected conditions.

The inclusion of digital competencies reflects the growing importance of technological adaptation and organisational learning as conditions shaping organisational functioning and behavioural responses. The employment of ICT specialists may indicate an organisation's internal capacity to implement, maintain and develop digital solutions, whereas the provision of ICT training reflects investment in the development of competencies required to adapt to technological change.

Previous research indicates that digitalisation and robotisation require not only technical skills but also cognitive, informational and social competencies (Ramstedt Stadin *et al.*, 2024). Accordingly, both the availability of specialised digital competencies and organisational investment in their development are relevant dimensions of organisational behaviour.

Working time and occupational safety represent important working conditions within which organisational behaviour develops. The average number of hours actually worked per week is treated as a proxy for workload and work intensity rather than as a direct measure of working-condition quality. Excessive working time may contribute to fatigue, psychological strain and a higher probability of errors, while accident rates may provide information about occupational risks, work organisation and the implementation of safety practices.

Labour-market conditions constitute another relevant dimension. In this study, the job vacancy rate is interpreted primarily as an indicator of labour-market pressure and recruitment constraints. Although a higher vacancy rate may partly reflect economic growth and increasing labour demand, persistent high vacancy levels may also indicate difficulties in recruiting and retaining employees.

From the perspective adopted in this study, the latter interpretation is particularly relevant because sustained staffing shortages may increase workloads, constrain organisational flexibility and hinder the implementation of technological and organisational changes. Therefore, a higher vacancy rate is treated as an unfavourable condition within the synthetic measure.

Finally, the institutional environment provides a broader context in which logistics organisations operate. The corruption perception indicator does not directly measure corruption, organisational behaviour or management practices within transport and warehousing enterprises. It is therefore treated as a country-level contextual indicator reflecting broader institutional conditions, including perceived transparency, accountability and integrity of public institutions.

Its inclusion is intended to capture an aspect of the external environment in which organisations make decisions, cooperate with public institutions and participate in activities such as public procurement. Consequently, the indicator should not be interpreted as a sector-specific measure, but as a contextual characteristic of the national environment in which transport and warehousing organisations operate.

The construction of the synthetic measure requires a clear specification of the expected direction of each indicator. The employment of ICT specialists and the provision of ICT training are treated as stimulants because higher values indicate greater organisational capacity for technological adaptation and learning. The frequency of non-fatal occupational accidents is treated as a destimulant because higher values indicate greater occupational risk.

The average number of hours actually worked per week is interpreted as a proxy for workload and is treated as a destimulant within the adopted framework. The job vacancy rate is also treated as a destimulant because, in the context of this study, persistently high vacancy levels are interpreted primarily as an indicator of recruitment pressure and labour shortages. The corruption perception indicator is not interpreted as a direct organisational measure; it is included as a contextual indicator, with higher values representing a more favourable institutional environment.

The use of a synthetic measure makes it possible to integrate these heterogeneous indicators into a single multidimensional assessment and to identify differences between EU-27 countries. Synthetic measures have previously been applied to multidimensional comparisons of European transport and logistics systems, demonstrating their usefulness in reducing a complex set of diagnostic variables to an interpretable comparative measure.

3.1 Research Questions

In the present study, the synthetic measure is used to move beyond analyses focused on individual indicators and to provide an integrated assessment of organisational behaviour as reflected in selected organisational, labour, technological, safety and institutional conditions.

The aim of this study is therefore to identify and assess differences in selected organisational conditions shaping behaviour in the transport and warehousing sector

across European Union Member States using a multidimensional comparative approach based on a synthetic measure.

The study seeks to determine the extent to which EU countries differ in terms of digitalisation capacity, digital competence development, working-time conditions, occupational safety and labour-market pressure, while also considering the institutional environment as a contextual dimension. The analysis also aims to identify the relative position of individual countries within the resulting comparative framework.

Based on the research objective, the following research questions are formulated:

RQ1: *To what extent do EU Member States differ in the selected organisational conditions shaping behaviour in the transport and warehousing sector?*

RQ2: *Which countries occupy the most and least favourable positions according to the proposed multidimensional synthetic measure?*

RQ3: *To what extent does the proposed framework provide a differentiated assessment of digital competence development, working conditions, occupational safety and labour-market pressure across EU Member States?*

The contribution of the study is twofold. First, it proposes a multidimensional framework for comparing selected organisational conditions that may shape organisational and employee responses in the transport and warehousing sector. Second, it applies a synthetic measure to country-level data to identify differences between EU Member States and thereby complements studies focused primarily on logistics performance, individual technologies or specific aspects of working conditions.

The study therefore contributes to the discussion by linking technological, labour, safety and institutional dimensions within a common comparative framework, while explicitly recognising that these indicators represent contextual and organisational conditions rather than direct measures of employee behaviour.

3.2 Organisational Conditions Shaping Behaviour in Logistics: A Multidimensional Approach

In logistics enterprises, organisational behaviour develops within a set of organisational, technological, labour and institutional conditions. Delivery fulfilment requires cooperation between multiple links, timeliness, compliance with procedures and a rapid response to unforeseen events. For this reason, work organisation cannot be analysed solely through the formal structure of an enterprise.

Adaptive capacity, communication quality, organisational learning and employee resilience are also influenced by the conditions in which employees perform their tasks. Research concerning the logistics sector indicates that crises encourage

enterprises to modify human resource management practices, as employee well-being and organisational stability influence each other (Čižiūnienė et al., 2025).

Adopting a multidimensional perspective justifies the use of a synthetic measure. It combines variables relating to different aspects of activity: digitalisation, competency development, workload, safety, the staffing situation and the quality of the institutional environment.

This approach avoids an oversimplification in which a positive assessment of an organisation would result solely from the implementation of new technologies or a low number of accident events.

In theoretical terms, organisational behaviour should be treated as the result of relationships between individual characteristics, management practices and institutional conditions. In logistics, these relationships are particularly visible because employee actions directly affect the timeliness, safety and reliability of processes.

A warehouse employee, freight forwarder, driver or specialist responsible for information systems operates within a shared operational system. An error in one area may have a cascading effect on other links in the supply chain. For this reason, an analysis of organisational behaviour should take into account not only individual attitudes, but also the organisational conditions in which decisions are made.

3.3 Digitalisation and ICT Competencies as Conditions of Organisational Adaptation

The digital transformation of logistics includes the use of information systems, automation, analytical tools and solutions enabling the tracking of goods flows. The implementation of technology changes the division of responsibilities, methods of communication and expectations towards employees.

An analysis of maritime logistics shows that digitalisation creates new opportunities to improve efficiency, but its implementation also encounters organisational and competency-related barriers (Raza *et al.*, 2023). The employment of ICT/IT specialists can therefore be interpreted as an indicator of an enterprise's internal capacity to implement, maintain and develop digital solutions.

The presence of ICT specialists does not, however, determine organisational maturity. In the digitalisation process, it is important to update employees' knowledge systematically. Brzozowska *et al.* (2022) emphasise that technological development and robotisation require the development of Industry 4.0 competencies, including not only technical skills, but also cognitive, information and social competencies. Similar conclusions are presented by Ramstedt Stadin *et al.* (2024), who indicate the importance of digital competencies and the need to balance the

benefits and burdens arising from the digital work environment in transport and logistics.

From the perspective of organisational behaviour, ICT training is an expression of investment in organisational learning. It helps to reduce the risk of competency mismatch, facilitates the acceptance of technological change and increases employees' ability to solve problems independently.

Hetmańczyk (2024) indicates that the rapid development of digitalisation requires multidimensional vocational preparation of employees, as the level of competencies affects the competitiveness of the economy. It is therefore appropriate for the analysis to include both the percentage of enterprises employing ICT specialists and the percentage of companies providing training for them.

3.4 Occupational Safety and Working Time

Transport and warehousing are activities in which working conditions and occupational safety constitute important organisational conditions. Risks are associated, among other things, with vehicle traffic, the operation of handling equipment, shift work and pressure to meet deadlines. Non-fatal accidents at work are a useful indicator of compliance with procedures, the quality of workstation organisation and the functioning of safety culture. Their interpretation requires caution because national reporting practices may also affect the level of reported incidents.

A contemporary approach to safety should not be limited to reacting to accidents that have already occurred. Preventive measures, training and the design of processes taking human behaviour into account are important. Lewczuk and Żuchowicz (2024) demonstrate the possibility of using virtual reality to improve the safety of intralogistics systems. Solutions of this kind can support hazard identification, develop employee awareness and improve procedures before an actual incident occurs.

The average number of hours actually worked per week complements the safety analysis. Long working hours may be associated with fatigue, psychological strain and an increased risk of errors. In logistics, this relationship is particularly important because of the need to maintain concentration and process continuity. The working-time indicator is not a direct measure of organisational behaviour, but it makes it possible to assess the conditions in which such behaviour is shaped.

4. Materials and Hellwig's Development Pattern Method

The study covers the 27 Member States of the European Union. The unit of analysis is the country, and the analysis is based on secondary statistical data describing

selected organisational conditions in the transport and warehousing sector. The primary data sources are Eurostat and Transparency International.

The selection of indicators was determined by their conceptual relevance to organisational adaptation, competence development, working conditions, occupational safety, labour-market pressure and the institutional environment, as well as by the availability of comparable data for EU Member States. The selected dimensions and indicators, together with their measurement units, expected directions and data sources, are presented in Table 1.

Table 1. *Dimensions, indicators and data sources used in the analysis*

Dimension	Indicator		Unit	Expected direction	Data source
Digitalisation capacity	Enterprises employing ICT/IT specialists	X ₁	%	Stimulant	Eurostat
Digital competence development	Enterprises providing ICT/IT training	X ₂	%	Stimulant	Eurostat
Working-time conditions	Average hours actually worked per week	X ₃	hours	Destimulant	Eurostat
Occupational safety	Frequency rate of non-fatal accidents	X ₄	rate	Destimulant	Eurostat
Labour-market pressure	Job vacancy rate	X ₅	%	Destimulant	Eurostat
Institutional environment	Corruption Perception Index	X ₆	score	Stimulant	Transparency International

Source: *Own work.*

To assess differences in the organisational conditions shaping behaviour in the transport and warehousing sector across EU-27 Member States, the Hellwig development pattern method was applied. The method enables several diagnostic variables describing different dimensions of a multidimensional phenomenon to be aggregated into a single synthetic measure and facilitates comparative assessment of the analysed countries.

Before constructing the synthetic measure, the diagnostic variables were classified according to the direction of their influence. The employment of ICT/IT specialists and the provision of ICT/IT training were treated as stimulants, as higher values indicate greater digital and organisational capacity. The average number of hours actually worked per week and the frequency rate of non-fatal accidents at work were treated as destimulants, as higher values may indicate less favourable working conditions and greater organisational risks.

The job vacancy rate was treated as a destimulant, reflecting potential recruitment difficulties and labour shortages. The corruption perception indicator was treated as

a stimulant, since higher values indicate a more favourable institutional environment.

The diagnostic variables were standardised to eliminate differences in measurement units and scales. Subsequently, a development pattern was established based on the most favourable values of the standardised variables. The Euclidean distance of each EU-27 Member State from this pattern was then calculated. The final Hellwig synthetic measure was determined on the basis of the distance from the development pattern, with higher values indicating a more favourable multidimensional position.

The resulting synthetic measure was used to rank the EU-27 Member States according to the organisational conditions shaping behaviour in the transport and warehousing sector. For interpretative purposes, the countries were additionally divided into four groups representing high, moderate, low and very low levels of the analysed conditions.

The Hellwig measure should be interpreted as a comparative measure of organisational conditions shaping behaviour, rather than as a direct measure of organisational behaviour itself. It integrates heterogeneous indicators related to digital competencies, employee development, working conditions, occupational safety, labour-market conditions and the institutional environment. Therefore, the resulting ranking reflects the relative position of countries within the multidimensional framework adopted in the study and does not imply causal relationships between the individual variables and organisational behaviour.

5. Labour-Market Pressure and the Institutional Environment

The job vacancy rate illustrates enterprises' recruitment difficulties. A high level of vacancies may lead to an increased workload for current employees, overtime work and greater operational pressure. It may also limit the possibility of implementing changes if an organisation concentrates its resources on maintaining day-to-day operations. Employment stability and flexible personnel-management practices are especially important in crisis situations, when logistics enterprises must quickly adapt how they operate (Čižiūnienė *et al.*, 2025).

The final dimension of the analysis is corruption risk. In this case, a precise distinction between measurement levels is necessary. The corruption perception indicator does not directly describe the behaviour of transport and warehousing enterprises, but rather the quality of a country's institutional environment. It can therefore serve as a contextual variable.

This is relevant, among other areas, to public procurement involving infrastructure and transport services. Lisciandra *et al.* (2022) show that corruption risk in public procurement can be estimated using replicable indicators referring to specific contracts. Fazekas *et al.* (2024) indicate that cross-country comparisons can be

developed through the standardisation of tender data and the use of composite risk indices.

Including the corruption indicator in the synthetic measure is justified as an attempt to capture the institutional conditions in which the sector operates. It should, however, be clearly emphasised that this is not a measure of corruption in the logistics sector itself. The results should be interpreted as an assessment of conditions conducive to transparency, trust and organisational accountability.

From the perspective of constructing the measure, the direction of the variables' impact is also important. The employment of ICT specialists and the organisation of training can be regarded as stimulants, as higher values indicate the development of organisational potential. Accident rates and excessive working time are destimulants because their increase may indicate a deterioration in working conditions. The interpretation of the vacancy rate is more complex: it may indicate sectoral development and growing demand for labour, but a persistently high level of vacancies also points to staff shortages. The results of the quantitative analysis should therefore be supplemented by qualitative commentary.

The selection of diagnostic variables makes it possible to analyse organisational behaviour in logistics as a complex phenomenon. ICT competencies and training reflect organisations' readiness for learning and technological adaptation. Working time and accidents indicate working conditions and safety culture. The job vacancy rate illustrates staffing pressures, while the corruption indicator characterises the broader institutional environment.

Combining these dimensions in a synthetic measure enables a comparison of EU-27 countries, provided that the results are interpreted with caution and the limitations of individual data are taken into account. The descriptive statistics for the first diagnostic variable, representing the share of enterprises employing ICT/IT specialists, are presented in Table 2.

Table 2. X_1 - Percentage of enterprises employing at least 10 persons in the transport and warehousing sector that employ ICT/IT specialists [%]

	2018	2019	2020	2022	2024	Mean	Median	Kurtosis	Std. Dev.	Change between 2018 and 2024 [% (pp)]
EU-27	12.54	12.55	13.63	15.97	14.96	13.93	13.63	-1.83	1.50	2.42
Belgium	26.42	26.01	24.48	30.36	30.67	27.59	26.42	-2.68	3.11	4.25
Bulgaria	17.16	11.79	9.29	7.87	15.48	12.32	11.79	-2.27	3.34	-1.68
Czechia	11.10	9.23	7.93	11.04	14.29	10.72	11.04	0.63	2.76	3.19
Denmark	16.35	19.59	18.03	29.97	26.81	22.15	19.59	-2.21	5.72	10.46
Germany	9.39	10.56	12.38	17.23	16.52	13.22	12.38	-2.73	3.22	7.13
Estonia	13.16	10.47	11.33	11.75	13.64	12.07	11.75	-1.91	1.34	0.48
Ireland	31.49	25.43	22.52	23.63	19.14	24.44	23.63	1.48	2.65	-12.35

Greece	29.87	33.11	N/A	27.38	40.10	32.62	31.49	0.73	6.37	10.23
Spain	13.75	11.16	16.57	11.18	10.39	12.61	11.18	0.26	2.85	-3.36
France	10.93	10.24	13.80	8.99	6.74	10.14	10.24	0.70	2.95	-4.19
Croatia	15.81	13.71	11.86	11.12	10.03	12.51	11.86	-0.50	1.55	-5.78
Italy	11.41	9.40	N/A	10.91	9.89	10.40	10.40	-3.39	0.77	-1.52
Cyprus	29.41	40.15	40.18	32.67	37.73	36.03	37.73	-1.79	3.53	8.32
Latvia	10.76	13.31	16.26	16.58	13.81	14.14	13.81	-0.73	1.67	3.05
Lithuania	9.53	9.59	8.80	11.35	7.98	9.45	9.53	1.25	1.44	-1.55
Luxembourg	18.68	17.06	16.25	19.40	17.66	17.81	17.66	-1.35	1.34	-1.02
Hungary	20.56	21.36	25.12	27.71	26.91	24.33	25.12	-2.77	2.83	6.35
Malta	24.35	22.85	23.58	31.57	33.95	27.26	24.35	-2.57	5.60	9.6
Netherlands	19.94	20.19	19.93	24.93	24.06	21.81	20.19	-2.92	2.59	4.12
Austria	15.40	11.27	12.28	16.96	12.04	13.59	12.28	-1.91	2.58	-3.36
Poland	8.97	17.67	16.08	25.32	18.01	17.21	17.67	1.69	4.12	9.04
Portugal	N/A	10.46	17.89	14.75	15.64	14.69	15.20	1.62	3.11	-
Romania	8.72	6.94	13.58	8.32	11.07	9.73	8.72	-0.31	2.95	2.35
Slovenia	11.03	5.76	4.87	5.56	5.07	6.46	5.56	4.62	0.41	-5.96
Slovakia	11.36	13.15	7.29	14.47	14.95	12.24	13.15	1.24	3.53	3.59
Finland	15.23	21.35	16.46	15.80	16.43	17.05	16.43	4.21	2.58	1.2
Sweden	8.85	4.28	9.63	14.18	12.86	9.96	9.63	-0.01	4.41	4.01

Note: N/A – Not Available.

Source: Own elaboration based on Eurostat data.

The mean value of the indicator for the EU-27 was 13.93%, while the median was 13.63%. The highest mean value was recorded in Cyprus, at 36.03%, while the lowest was observed in Slovenia, at 6.46%. In Poland, the mean value of the indicator was 17.21%, the median was 17.67%, and the standard deviation was 4.12. In 2024, the highest percentages of enterprises employing ICT or IT specialists were recorded in Greece (40.10%), Cyprus (37.73%), and Malta (33.95%). The largest positive changes between 2018 and 2024 were observed in Denmark, at 10.46 percentage points (pp), Greece, at 10.23 pp, and Poland, at 9.04 pp. The largest decreases in the indicator were recorded in Ireland, at 12.35 pp, Slovenia, at 5.96 pp, and Croatia, at 5.78 pp.

Table 3. X_2 - Percentage of enterprises employing at least 10 persons in the transport and warehousing sector that provided ICT/IT specialists with training to develop their digital competencies [%]

	2018	2019	2020	2022	2024	Mean	Median	Kurtosis	Stand. dev.	Change between 2018 and 2024 [pp]
EU-27	6.12	5.9	6.53	7.37	7.93	6.77	6.53	-1.78	0.90	1.81
Belgium	16.59	20.09	14.47	17.98	19.68	17.76	17.98	-0.89	2.56	3.09
Bulgaria	3.7	2.62	2.32	2.0	2.44	2.62	2.44	2.96	0.26	-1.26
Czechia	5.52	4.09	4.94	5.48	5.19	5.04	5.19	1.92	0.60	-0.33
Denmark	12.01	13.24	12.73	18.46	17.35	14.76	13.24	-2.72	2.88	5.34
Germany	5.74	7.23	7.26	9.92	8.72	7.77	7.26	-0.44	1.29	2.98
Estonia	7.26	6.82	7.71	7.68	8.22	7.54	7.68	-0.02	0.58	0.96
Ireland	9.56	7.58	5.73	3.33	8.1	6.86	7.58	-0.02	2.16	-1.46

Greece	11.58	18.38	N/A	15.01	17.53	15.63	16.27	-0.50	1.75	5.95
Spain	7.37	5.34	8.57	4.16	5.52	6.19	5.52	-1.22	1.88	-1.85
France	5.51	4.38	7.80	3.59	3.64	4.98	4.38	1.24	2.00	-1.87
Croatia	8.19	6.3	6.59	6.26	4.82	6.43	6.30	1.83	0.80	-3.37
Italy	4.36	5.11	5	7.04	4.72	5.29	5.11	3.09	1.03	0.36
Cyprus	19.21	25.45	21.19	17.53	20.56	20.79	20.56	1.62	3.26	1.35
Latvia	2.82	4.14	3.3	N/A	5.92	4.05	3.72	0.87	1.34	3.10
Lithuania	3.27	2.67	2.33	3.6	4.12	3.20	3.27	-1.36	0.83	0.85
Luxembourg	12.5	9.71	6.72	7.75	12.15	9.77	9.71	-2.57	2.39	-0.35
Hungary	5.46	5.54	5.1	5.31	6.59	5.60	5.46	3.52	0.66	1.13
Malta	12.81	10.61	12.84	15.96	15.57	13.56	12.84	-1.44	2.51	2.76
Netherlands	10.49	N/A	10.59	13.96	13.06	12.03	11.83	-4.71	1.74	2.57
Austria	7.95	4.99	5.37	11.02	7.96	7.46	7.95	-0.22	2.79	0.01
Poland	3.72	3.05	3.65	5.65	13.24	5.86	3.72	3.89	4.70	9.52
Portugal	N/A	7.98	10.2	5.97	9.14	8.32	8.56	-0.03	1.81	-
Romania	1.76	1.85	0.88	3.66	5.72	2.77	1.85	0.13	2.13	3.96
Slovenia	7.19	4.03	2.42	4.05	3.19	4.18	4.03	2.71	0.78	-4.00
Slovakia	4.27	4.0	4.22	4.27	8.09	4.97	4.27	4.92	1.97	3.82
Finland	9.23	10.58	9.91	6.87	8.6	9.04	9.23	0.72	1.64	-0.63
Sweden	5.73	1.96	3.24	5.54	6.8	4.65	5.54	-1.61	2.19	1.07

Note: N/A – Not Available.

Source: Own elaboration based on Eurostat data.

According to the data presented in Table 3, the mean value of the indicator for the EU-27 was 6.77%, while the median was 6.53%. The highest mean value was recorded in Cyprus, at 20.79%, followed by Belgium and Greece, at 17.76% and 15.63%, respectively. The lowest mean values were observed in Bulgaria, at 2.62%, Romania, at 2.77%, and Lithuania, at 3.20%.

In Poland, the mean value of the indicator was 5.86%, the median was 3.72%, and the standard deviation was 4.70. In 2024, the percentage of enterprises providing training for ICT or IT specialists in Poland reached 13.24%, compared with 3.72% in 2018.

The largest positive changes between 2018 and 2024 were recorded in Poland, at 9.52 percentage points (pp), Greece, at 5.95 pp, and Denmark, at 5.34 pp. The largest decreases in the indicator were observed in Slovenia, at 4.00 pp, Croatia, at 3.37 pp, and France, at 1.87 pp.

Table 4. X_3 - Average number of hours actually worked per week in the main job by employed persons aged 15–64 in the transport and warehousing sector [hours]

	2018	2019	2020	2022	2024	Mean	Median	Kurtosis	Stan. dev.	Change between 2018 and 2024 [%]
EU-27	39.3	39.2	38.4	38.5	38.1	38.70	38.50	-2.52	0.47	-3.05
Belgium	38.1	38.3	37.6	36.3	36.2	37.30	37.60	-3.00	1.02	-4.99

Bulgaria	40.8	40.5	40.1	39.8	39.2	40.08	40.10	-0.44	0.55	-3.92
Czechia	41.30	41.1	39.8	39.6	39.2	40.20	39.80	-2.77	0.82	-5.08
Denmark	38.7	37.5	37.3	37.6	37.0	37.62	37.50	2.92	0.26	-4.39
Germany	38.0	38.0	37.0	37.2	36.4	37.32	37.20	-1.52	0.66	-4.21
Estonia	39.7	40.6	38.8	37.9	37.4	38.88	38.80	-1.52	1.41	-5.79
Ireland	39.4	39.1	38.1	38.4	37.5	38.50	38.40	-1.38	0.67	-4.82
Greece	47.2	46.6	45.0	43.7	42.6	44.92	44.50	-2.17	1.69	-9.75
Spain	40.1	39.7	38.2	39.2	39.4	39.32	39.40	1.55	0.65	-1.75
France	37.8	37.4	36.9	37.1	36.9	37.22	37.10	-0.17	0.24	-2.38
Croatia	40.5	40.9	39.9	39.0	39.7	40.00	39.90	-0.60	0.78	-1.98
Italy	38.9	39.0	38.0	38.4	38.1	38.38	38.40	-0.73	0.62	-2.06
Cyprus	39.2	38.9	37.7	38.1	38.8	38.54	38.80	-1.64	0.57	-1.02
Latvia	40.1	39.2	39.4	39.6	39.4	39.54	39.40	2.10	0.16	-1.75
Lithuania	39.7	39.6	39.3	38.9	39.1	39.32	39.30	-1.98	0.30	-1.51
Luxembourg	40.6	40.4	39.4	36.5	37.1	38.80	39.40	-2.79	1.85	-8.62
Hungary	39.9	39.9	39.5	39.5	38.2	39.40	39.50	3.45	0.74	-4.26
Malta	39.0	40.6	37.6	39.0	40.0	39.24	39.00	0.03	1.31	2.56
Netherlands	36.6	36.6	35.7	35.2	34.7	35.76	35.70	-2.21	0.81	-5.19
Austria	38.00	38.4	36.4	36.8	37.0	37.32	37.00	-2.15	0.87	-2.63
Poland	41.3	40.9	40.7	40.7	40.7	40.86	40.70	2.66	0.10	-1.45
Portugal	41.0	41.6	40.3	40.6	39.9	40.76	40.60	-2.25	0.73	-3.62
Romania	40.9	41.1	40.6	40.4	39.8	40.56	40.60	0.45	0.54	-2.69
Slovenia	39.3	39.3	39.7	39.7	38.8	39.36	39.30	0.21	0.43	-1.27
Slovakia	40.0	40.5	39.9	39.3	39.1	39.76	39.90	-1.35	0.63	-2.25
Finland	38.4	38.3	37.4	38.1	36.8	37.80	38.10	-0.91	0.69	-4.17
Sweden	37.5	37.7	36.4	37.8	36.9	37.26	37.50	-1.08	0.67	-1.60

Source: Own elaboration based on Eurostat data.

Table 4 presents the average number of hours actually worked per week in the main job by employed persons aged 15–64 in the transport and warehousing sector. The mean value for the EU-27 was 38.70 hours, while the median was 38.50 hours.

The highest mean value was recorded in Greece, at 44.92 hours, followed by Poland and Portugal, at 40.86 and 40.76 hours, respectively. The lowest mean values were observed in the Netherlands, at 35.76 hours, France, at 37.22 hours, Belgium, at 37.30 hours, and Austria, at 37.32 hours.

In Poland, the average number of hours actually worked decreased from 41.3 hours in 2018 to 40.7 hours in 2024. The largest decreases between 2018 and 2024 were recorded in Greece, at 9.75%, Luxembourg, at 8.62%, and Estonia, at 5.79%. Malta was the only country to record a positive change, with the value of the indicator increasing by 2.56%.

The descriptive statistics for the frequency rate of non-fatal accidents at work in the transport and warehousing sector are presented in Table 5.

Table 5. X_4 - Frequency rate of non-fatal accidents at work in the transport and warehousing sector [rate]

	2018	2019	2020	2022	2023	Mean	Median	Kurtosis	Stand. dev.	Change between 2018 and 2023 [%]
EU-27	2,789.38	2,662.36	2,217.86	2,444.69	2,365.98	2,496.05	2,444.69	-1.49	185.38	-15.18
Belgium	3,604.94	3,311.04	2,694.83	2,964.98	2,850.86	3,085.33	2,964.98	-1.08	261.66	-20.92
Bulgaria	181.24	176.43	155.34	177.74	173.5	172.85	176.43	3.63	10.43	-4.27
Czechia	1,428.83	1,367.91	1,235.17	1,216.56	1,094.91	1,268.68	1,235.17	-1.07	111.76	-23.37
Denmark	3,211.77	3,090.58	3,213.91	3,295.82	2,739.31	3,110.28	3,211.77	2.87	245.35	-14.71
Germany	3,327.82	3,182.29	2,842.15	2,882.91	2,768.52	3,000.74	2,882.91	-2.00	181.82	-16.81
Estonia	1,319.01	1,645.94	975.84	861.89	787.57	1,118.05	975.84	-0.74	393.12	-40.29
Ireland	1,293.27	807.91	554.28	1,342.49	1,277.43	1,055.08	1,277.43	-1.69	378.48	-1.22
Greece	360.25	247.61	197.0	211.79	168.68	237.00	211.79	2.34	32.89	-53.18
Spain	4,268.94	3,711.11	2,903.19	3,391.04	3,337.22	3,522.30	3,391.04	0.72	332.20	-21.83
France	5,092.41	5,038.43	4,077.35	4,104.92	3,920.67	4,446.76	4,104.92	-3.18	508.57	-23.01
Croatia	1,002.79	720.49	615.19	722.28	657.32	743.61	720.49	3.41	52.08	-34.45
Italy	2,533.73	2,370.27	1,717.0	2,687.49	2,490.07	2,359.71	2,490.07	3.37	420.33	-1.72
Cyprus	923.26	970.17	643.09	552.68	571.95	732.23	643.09	-3.02	194.39	-38.05
Latvia	396.87	418.57	288.89	436.6	467.95	401.78	418.57	2.54	78.76	17.91
Lithuania	418.96	505.25	409.60	347.98	349.5	406.26	409.60	0.57	73.91	-16.58
Luxembourg	2,475.37	2,445.27	1,920.87	1,858.51	1,726.03	2,085.21	1,920.87	-2.99	315.70	-30.27
Hungary	1,168.53	1,111.08	1,391.29	1,316.96	1,280.39	1,253.65	1,280.39	-1.59	118.58	9.57
Malta	1,980.31	2,063.7	1,342.38	1,493.44	1,241.34	1,624.23	1,493.44	-2.86	367.24	-37.32
Netherlands	2,355.07	2,671.27	1,741.39	2,395.53	2,797.43	2,392.14	2,395.53	1.55	470.93	18.78
Austria	3,289.52	2,091.2	2,693.01	2,066.02	2,088.81	2,445.71	2,091.20	0.23	305.71	-36.50
Poland	774.25	786.49	541.73	654.74	688.25	689.09	688.25	-0.16	100.95	-11.11
Portugal	3,924.0	3,771.27	2,847.44	3,176.41	3,307.99	3,405.33	3,307.99	-1.69	382.93	-15.69

Romania	154.09	143.32	115.67	83.82	85.92	116.56	115.67	-2.71	28.14	-44.24
Slovenia	1,918.81	1,786.61	1,630.18	1,518.92	1,868.94	1,744.69	1,786.61	-1.69	156.74	-2.60
Slovakia	572.39	581.65	509.01	533.12	518.88	543.01	533.12	-2.70	32.21	-9.35
Finland	2,789.56	2,515.21	2,235.63	2,280.79	2,140.36	2,392.31	2,280.79	0.01	159.29	-23.27
Sweden	1,438.97	1,673.92	1,607.11	1,837.79	1,941.48	1,699.85	1,673.92	-0.92	152.39	34.92

Source: Own elaboration based on Eurostat data.

According to the data presented in Table 5, the mean value of the indicator for the EU-27 was 2,496.05, while the median reached 2,444.69. The highest mean value was recorded in France, where it amounted to 4,446.76, followed by Spain and Portugal, with mean values of 3,522.30 and 3,405.33, respectively. The lowest mean values were recorded in Romania, at 116.56, Bulgaria, at 172.85, and Greece, at 237.00.

In Poland, the mean value of the indicator was 689.09, the median was 688.25, and the standard deviation amounted to 100.95. The value of the indicator in Poland decreased from 774.25 in 2018 to 688.25 in 2023, representing a decrease of 11.11%. The largest positive changes were recorded in Sweden, at 34.92%, the Netherlands, at 18.78%, and Latvia, at 17.91%. The largest decreases occurred in Greece, at 53.18%, Romania, at 44.24%, and Estonia, at 40.29%. The descriptive statistics for the corruption perception indicator for EU-27 countries are presented in Table 6.

Table 6. X_5 - Corruption perception indicator [%]

	2018	2019	2020	2022	2024	Mean	Median	Kurtosis	Stand. dev.	Change between 2018 and 2024 [pp]
EU-27*	64	64	64	64	62	63.52	63.67	3.67	0.70	-2.00
Austria	76	77	76	71	67	73.40	76.00	-0.65	4.65	-9.00
Belgium	75	75	76	73	69	73.60	75.00	2.04	3.10	-6.00
Bulgaria	42	43	44	43	43	43.00	43.00	2.00	0.50	1.00
Croatia	48	47	47	50	47	47.80	47.00	2.66	1.50	-1.00
Cyprus	59	58	57	52	56	56.40	57.00	2.02	2.63	-3.00
Czechia	59	56	54	56	56	56.20	56.00	2.36	1.00	-3.00
Denmark	88	87	88	90	90	88.60	88.00	-2.41	1.50	2.00
Estonia	73	74	75	74	76	74.40	74.00	-0.18	0.96	3.00
Finland	85	86	85	87	88	86.20	86.00	-1.49	1.29	3.00
France	72	69	69	72	67	69.80	69.00	-1.82	2.06	-5.00
Germany	80	80	80	79	75	78.80	80.00	4.15	2.38	-5.00

Greece	45	48	50	52	49	48.80	49.00	0.80	1.71	4.00
Hungary	46	44	44	42	41	43.40	44.00	-0.82	1.50	-5.00
Ireland	73	74	72	77	77	74.60	74.00	-2.72	2.45	4.00
Italy	52	53	53	56	54	53.60	53.00	1.46	1.41	2.00
Latvia	58	56	57	59	59	57.80	58.00	-1.49	1.50	1.00
Lithuania	59	60	60	62	63	60.80	60.00	-1.69	1.50	4.00
Luxembourg	81	80	80	77	81	79.80	80.00	3.25	1.73	0.00
Malta	54	54	53	51	46	51.60	53.00	2.32	3.56	-8.00
Netherlands	82	82	82	80	78	80.80	82.00	0.31	1.91	-4.00
Poland	60	58	56	55	53	56.40	56.00	-0.68	2.08	-7.00
Portugal	64	62	61	62	57	61.20	62.00	2.40	2.38	-7.00
Romania	47	44	44	46	46	45.40	46.00	-2.41	1.15	-1.00
Slovakia	50	50	49	53	49	50.20	50.00	3.25	1.89	-1.00
Slovenia	60	60	60	56	60	59.20	60.00	5.00	2.00	0.00
Spain	58	62	62	60	56	59.60	60.00	-1.49	2.83	-2.00
Sweden	85	85	85	83	80	83.60	85.00	1.74	2.36	-5.00

Note: *average based on available data.

Source: Own elaboration based on Transparency International data.

Table 6 presents the values of the corruption perception indicator for EU-27 countries in 2018, 2019, 2020, 2022 and 2024. The mean value of the indicator for the EU-27 was 63.52, while the median reached 63.67. The highest mean value was recorded in Denmark, where it amounted to 88.60, followed by Finland and Sweden, with mean values of 86.20 and 83.60, respectively.

The lowest mean values were recorded in Bulgaria, at 43.00, Hungary, at 43.40, and Romania, at 45.40. In Poland, the mean value of the indicator was 56.40, the median was 56.00, and the standard deviation amounted to 2.08. The value of the indicator in Poland decreased from 60 points in 2018 to 53 points in 2024, representing a decrease of 7 percentage points.

The largest positive changes were recorded in Greece, Lithuania and Ireland, with an increase of 4 pp in each country. The largest decreases occurred in Austria, at 9 pp, Malta, at 8 pp, and Poland and Portugal, at 7 pp each. The descriptive statistics for the job vacancy rate in the transport and warehousing sector, including the values and changes observed between 2018 and 2024, are presented in Table 7.

Table 7. X_6 - Job vacancy rate in the transport and warehousing sector [score]

	2018	2019	2020	2022	2024	Mean	Median	Kurtosis	Stand. dev.	Change between 2018 and 2024 [%]
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EU-27	2.2	2.1	1.5	2.7	2.3	2.16	2.20	1.73	0.50	4.55
Belgium	3.1	2.8	2.4	3.7	3.1	3.02	3.10	0.83	0.55	0.00
Bulgaria	1.2	0.9	0.7	1.1	1.4	1.06	1.10	-0.68	0.30	16.67
Czechia	5.70	4.7	4.9	5.2	4.5	5.00	4.90	0.07	0.30	-21.05
Denmark	1.6	2.0	1.7	3.1	2.3	2.14	2.00	1.23	0.60	43.75
Germany	4.3	4.1	2.6	5.1	3.5	3.92	4.10	0.27	1.05	-18.60
Estonia	1.5	1.8	1.3	0.9	1.8	1.46	1.50	-0.31	0.44	20.00
Ireland	0.5	0.5	0.4	0.6	0.3	0.46	0.50	-0.18	0.13	-40.00
Greece	0.8	1.7	0.0	0.7	2.8	1.26	0.80	0.27	1.12	250.00
Spain	0.3	0.4	0.1	0.4	0.6	0.36	0.40	1.07	0.21	100.00
France	1.1	1.2	0.8	1.8	2.0	1.38	1.20	-2.11	0.55	81.82
Croatia	0.8	0.6	0.5	0.8	0.8	0.70	0.80	-1.75	0.15	0.00
Italy	0.7	0.8	1.0	1.1	1.5	0.92	0.80	0.00	0.43	114.29
Cyprus	0.5	1.2	0.4	2.0	1.9	1.20	1.20	-2.91	0.74	280.00
Latvia	2.8	3.3	2.5	3.2	2.7	2.90	2.80	-2.23	0.39	-3.57
Lithuania	1.4	1.4	1.5	2.7	3.3	2.06	1.50	-1.86	0.93	135.71
Luxembourg	0.8	0.5	0.4	1.3	1.2	0.84	0.80	-2.71	0.47	50.00
Hungary	2.2	2.7	1.6	2.5	1.6	2.12	2.20	-2.70	0.58	-27.27
Malta	2.6	1.6	0.6	1.5	4.1	2.08	1.60	0.58	1.50	57.69
Netherlands	3.3	3.0	2.0	4.5	3.8	3.32	3.30	0.38	1.08	15.15
Austria	3.20	2.5	2.4	6.2	3.5	3.56	3.20	3.28	1.77	9.38
Poland	1.4	1.3	0.9	1.3	1.1	1.20	1.30	-0.19	0.19	-21.43
Portugal	1.0	1.0	0.6	0.9	0.8	0.86	0.90	0.54	0.17	-20.00
Romania	1.9	1.3	1.1	1.4	1.0	1.34	1.30	1.51	0.18	-47.37
Slovenia	2.9	1.8	1.7	2.9	2.7	2.40	2.70	-3.15	0.61	-6.90
Slovakia	2.1	1.7	1.1	1.7	1.8	1.68	1.70	2.37	0.32	-14.29
Finland	1.8	2.2	1.1	1.7	2.6	1.88	1.80	0.09	0.65	44.44
Sweden	1.7	1.5	0.8	1.8	1.6	1.48	1.60	3.50	0.43	-5.88

Source: Own elaboration based on Eurostat data.

The mean value of the indicator for the EU-27 was 2.16, while the median was 2.20. The highest mean value was recorded in Czechia, where it amounted to 5.00, followed by Germany and Austria, where it reached 3.92 and 3.56, respectively.

The lowest mean values were recorded in Spain, where the indicator was 0.36, Ireland, where it reached 0.46, and Croatia, where it stood at 0.70.

In Poland, the mean value of the indicator was 1.20, the median was 1.30, and the standard deviation was 0.19. The value of the indicator for Poland decreased from 1.4 in 2018 to 1.1 in 2024, representing a negative change of 21.43%. The largest positive changes were recorded in Cyprus, at 280.00%, Greece, at 250.00%, and Lithuania, at 135.71%.

The largest decreases occurred in Romania, at 47.37%, Ireland, at 40.00%, and Hungary, at 27.27%. The values of the diagnostic variables, their standardised values, and the resulting synthetic measure are presented in Table 8.

Table 8. Statistical characteristics of diagnostic variables and synthetic measures of organisational behaviour in the transport and warehousing sector in the EU-27

Country	Values of diagnostic variables						Standardisation						d ₁	Synthetic measure M
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	t ₁	t ₂	t ₃	t ₄	t ₅	t ₆		
Austria	13.59	7.46	37.32	2,445.71	73.40	3.56	-0.41	-0.12	-1.00	0.60	0.03	1.51	8.06	0.1731
Belgium	27.588	17.76	37.30	3,085.33	73.60	3.02	1.45	2.09	-1.01	1.14	0.03	1.02	7.05	0.2770
Bulgaria	12	2.62	40.08	172.85	43.00	1.06	-0.58	-1.15	0.62	-1.32	-0.61	-0.74	9.43	0.0325
Croatia	13	6.43	40.00	743.61	47.80	0.70	-0.55	-0.33	0.57	-0.84	-0.51	-1.07	9.02	0.0744
Cyprus	36.028	20.79	38.54	732.23	56.40	1.20	2.57	2.74	-0.28	-0.85	-0.33	-0.62	7.92	0.1874
Czechia	11	5.04	40.20	1,268.68	56.20	5.00	-0.79	-0.63	0.69	-0.39	-0.34	2.80	8.05	0.1745
Denmark	22	14.76	37.62	3,110.28	88.60	2.14	0.73	1.45	-0.82	1.16	0.35	0.23	7.20	0.2614
Estonia	12.07	7.54	38.88	1,118.05	74.40	1.46	-0.61	-0.10	-0.09	-0.52	0.05	-0.38	8.49	0.1287
Finland	17.054	9.04	37.80	2,392.31	86.20	1.88	0.05	0.22	-0.72	0.56	0.30	0.00	7.87	0.1921
France	10.14	4.98	37.22	4,446.76	69.80	1.38	-0.86	-0.65	-1.06	2.29	-0.05	-0.45	8.86	0.0908
Greece	32.615	15.63	44.92	237.00	48.80	1.26	2.11	1.63	3.45	-1.27	-0.49	-0.56	7.37	0.2439
Spain	12.61	6.19	39.32	3,522.30	59.60	0.36	-0.54	-0.39	0.17	1.51	-0.26	-1.37	8.64	0.1131
Ireland	24.442	6.86	38.50	1,055.08	74.60	0.46	1.03	-0.24	-0.31	-0.57	0.05	-1.28	8.58	0.1194
Lithuania	9.45	3.20	39.32	406.26	60.80	2.06	-0.96	-1.03	0.17	-1.12	-0.24	0.16	9.07	0.0694
Luxembourg	17.81	9.77	38.80	2,085.21	79.80	0.84	0.15	0.38	-0.13	0.30	0.16	-0.94	8.03	0.1756
Latvia	14	4.05	39.54	401.78	57.80	2.90	-0.33	-0.85	0.30	-1.13	-0.30	0.91	8.57	0.1212
Malta	27.26	13.56	39.24	1,624.23	51.60	2.08	1.40	1.19	0.13	-0.09	-0.43	0.18	7.46	0.2343
Netherlands	21.81	12.03	35.76	2,392.14	80.80	3.32	0.68	0.86	-1.91	0.56	0.18	1.29	7.96	0.1838
Germany	13.216	7.77	37.32	3,000.74	78.80	3.92	-0.46	-0.05	-1.00	1.07	0.14	1.83	7.85	0.1942
Poland	17	5.86	40.86	689.09	56.40	1.20	0.07	-0.46	1.08	-0.88	-0.33	-0.62	8.43	0.1350
Portugal	14.685	8.32	40.76	3,405.33	61.20	0.86	-0.26	0.07	1.02	1.41	-0.23	-0.92	7.87	0.1929
Romania	9.726	2.77	40.56	116.56	45.40	1.34	-0.92	-1.12	0.90	-1.37	-0.56	-0.49	9.35	0.0404
Slovakia	12.244	4.97	39.76	543.01	50.20	1.68	-0.59	-0.65	0.43	-1.01	-0.46	-0.18	8.89	0.0883
Slovenia	6.458	4.18	39.36	1,744.69	59.20	2.40	-1.35	-0.82	0.20	0.01	-0.27	0.46	8.71	0.1061
Sweden	9.96	4.65	37.26	1,699.85	83.60	1.48	-0.89	-0.72	-1.03	-0.03	0.24	-0.36	9.00	0.0766
EU-27	13.93	6.77	38.70	2,496.05	303.71	2.16	-0.36	-0.26	-0.19	0.64	4.88	0.25	6.33	0.3500
Hungary	24.332	5.60	39.40	1,253.65	43.40	2.12	1.02	-0.51	0.22	-0.41	-0.61	0.21	8.22	0.1565
Italy	10.40	5.29	38.38	2,360.0	53.6	1.0	-0.83	-0.58	-0.38	0.53	-0.39	-0.87	9.04	0.0729
Arithmetic mean	16.66	8.00	39.03	1,733.87	72.10	1.88	0.0	0.0	0.0	0.0	0.0	0.0	8.26	0.1523
Standard deviation	7.55	4.67	1.71	1,182.77	47.42	1.11	1.0	1.0	1.0	1.0	1.0	1.0	0.74	0.0762
Coefficient of variation	45%	58%	4%	68%	66%	59%							9%	50%
Max	36.03	20.79	44.92	4,446.76	303.71	5.00	2.57	2.74	3.45	2.29	4.88	2.80	9.43	0.3500
Min	6.46	2.62	35.76	116.56	43.00	0.36	-1.35	-1.15	-1.91	-1.37	-0.61	-1.37	6.33	0.0325

Source: Own elaboration.

Based on the synthetic measure calculated for each EU-27 country, the countries were ranked and classified according to the level of organisational behaviour captured by the proposed multidimensional framework. The resulting classification is presented in Table 9.

The synthetic measure revealed substantial differences in the selected organisational conditions across EU Member States. The highest value was recorded in Belgium (0.2770), followed by Denmark (0.2614) and Greece (0.2439). Malta also recorded a relatively high value (0.2343). Poland obtained a value of 0.1350, placing it fourteenth among the EU-27 Member States.

Table 9. Classification of EU-27 countries by the level of organisational behaviour in the transport and warehousing sector

NUTS region	2	Synthetic measure M1	Synthetic measure M1	Level of organisational conditions
Belgium		0.276995387	0.276995387	HIGH
Denmark		0.261358406	0.261358406	
Greece		0.243851744	0.243851744	
Malta		0.234344018	0.234344018	
Germany		0.194229902	0.194229902	MODERATE
Portugal		0.192931611	0.192931611	
Finland		0.192101812	0.192101812	
Cyprus		0.187368315	0.187368315	
Netherlands		0.183776041	0.183776041	
Luxembourg		0.175623086	0.175623086	
Czechia		0.174526538	0.174526538	
Austria		0.173082456	0.173082456	
Hungary		0.156533708	0.156533708	
Poland		0.134977618	0.134977618	LOW
Estonia		0.128726235	0.128726235	
Latvia		0.121190695	0.121190695	
Ireland		0.119390551	0.119390551	
Spain		0.11313789	0.11313789	
Slovenia		0.106093181	0.106093181	
France		0.090780397	0.090780397	
Slovakia		0.088348355	0.088348355	VERY LOW
Sweden		0.076613434	0.076613434	
Croatia		0.074435177	0.074435177	
Italy		0.072922216	0.072922216	
Lithuania		0.069359315	0.069359315	
Romania		0.040356975	0.040356975	
Bulgaria		0.03252708	0.03252708	

Source: Own elaboration.

Similar values were observed in Estonia (0.1287), Latvia (0.1212) and Ireland (0.1194). The lowest values were recorded in Bulgaria (0.0325), Romania (0.0404) and Lithuania (0.0694). These results indicate substantial cross-country differences in the organisational conditions captured by the proposed multidimensional framework.

Based on the values of the synthetic measure, the EU Member States were classified into four groups representing different levels of the selected organisational conditions: high, moderate, low and very low. These categories refer to the comparative position of countries within the synthetic measure and should not be interpreted as direct levels of organisational behaviour.

6. Discussion

The analysis demonstrated substantial differentiation in selected organisational conditions shaping behaviour in the transport and warehousing sector across EU-27 countries. The highest values of the synthetic measure were recorded in Belgium, Denmark and Greece, whereas the lowest values were observed in Bulgaria, Romania and Lithuania. Poland occupied fourteenth position with a value of 0.1350, indicating an intermediate position in the comparative assessment of the selected organisational conditions.

The results correspond with research indicating that the digitalisation of logistics requires the simultaneous development of employee competencies, the implementation of technologies and the improvement of organisational processes (Tubis *et al.*, 2024). Wang and Sarkis (2021) emphasise the importance of enabling technologies, cooperation and the use of data, while Dorantes and Allen (2024) draw attention to staff shortages, working conditions and competency transformation in transport.

Including accidents at work remains appropriate because contemporary transport systems require a joint analysis of operational safety and technological threats (Fan and Yang, 2022). The corruption perception indicator should be treated as a characteristic of the institutional environment, as the transparency of public procedures reduces the risk of abuse (Hochstetter *et al.*, 2023).

At the same time, the comparison includes both variables directly related to logistics enterprises and an indicator of the national institutional environment. The results should therefore be interpreted as a multidimensional comparison rather than an assessment of a single aspect of sectoral functioning. This approach corresponds to the complex nature of the sector across European Union Member States as a whole.

7. Conclusions

1. The analysis demonstrated substantial cross-country differentiation in the selected organisational conditions shaping behaviour in the transport and warehousing sector across EU-27 Member States.
2. Belgium, Denmark and Greece occupied the highest positions according to the synthetic measure, whereas Bulgaria, Romania and Lithuania recorded the lowest values. Poland ranked fourteenth, indicating an intermediate position within the comparative framework.
3. Indicators related to ICT specialists and ICT training highlight the importance of digital competence development as a component of organisational adaptation to technological change.

4. Working time, occupational safety and labour-market pressure provide complementary information on the conditions under which logistics organisations operate and adapt to operational requirements.

5. The synthetic measure enables several heterogeneous dimensions to be considered simultaneously; however, its results should be interpreted as a country-level comparative assessment of selected organisational conditions rather than as a direct measure of organisational behaviour.

8. Limitations and Directions for Future Research

The study has several limitations that should be considered when interpreting the results.

First, the analysis is based on country-level secondary data and therefore does not capture the subjective and interpersonal dimensions of organisational behaviour, including employee motivation, job satisfaction, organisational commitment, leadership and organisational culture.

Second, differences in statistical definitions and reporting practices may affect the comparability of selected indicators between EU Member States.

Third, the institutional indicator represents the broader national environment and is not specific to the transport and warehousing sector. Fourth, the results of a synthetic measure depend on the selection of diagnostic variables, their normalisation and the aggregation procedure.

Finally, the interpretation of the job vacancy rate as an indicator of labour-market pressure represents a specific analytical assumption and may not capture all dimensions of labour-market development.

Future research should therefore combine country-level statistical indicators with firm-level and employee-level data. Survey-based measures of job satisfaction, employee engagement, organisational commitment, leadership and organisational culture could be integrated with the objective indicators used in the present study.

Further research could also test alternative specifications of the synthetic measure and examine whether country rankings remain stable when individual indicators or the institutional context variable are excluded. Such an approach would provide a more comprehensive understanding of the mechanisms through which organisational conditions influence behaviour in the transport and warehousing sector.

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