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Outsourcing in the supply chain as a driver of vulnerability – The case of the Republic of Serbia

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Purpose: Outsourcing is a widely used supply strategy for activities in which firms lack sufficient or appropriate competencies. While it enhances efficiency, extensive outsourcing may reduce transparency and control, thereby limiting firms' ability to detect disruptions and increasing supply chain vulnerability. This study examines to what extent outsourcing contributes to supply chain vulnerability in the context of the Republic of Serbia.

Design/methodology/approach: An empirical survey was conducted among 52 large enterprises from various sectors in Serbia, all of which were listed among the most successful based on their net profit. Hypotheses were tested using statistical methods, specifically the χ^2 test, cluster analysis, analysis of variance and linear regression in SPSS.

Findings/results: The survey results indicate that the proportion of outsourced activities did not significantly affect supply chain vulnerability ($p = 0.695$ and $p = 0.556$), while greater dispersion of outsourced activities ($p = 0.005$ and $p = 0.003$) and higher supply chain complexity ($p = 0.014$ and $p = 0.007$) were statistically significant. These findings suggest that although the share of outsourced activities alone does not increase vulnerability, both dispersion and complexity significantly elevate it.

Practical implications: These findings do not argue against outsourcing but emphasise the importance of enhanced risk management and contingency planning.

Originality/value: This pilot study provides initial empirical evidence on the impact of specific outsourcing activities on supply chain vulnerability. It also lays the foundation for future research, potentially extending to broader studies across the Western Balkans, given the similar business context and interconnections among enterprises in the region.

Keywords: outsourcing; vulnerability; supply chain; risk; disruption; complexity.

Introduction

In the last two decades, global supply chains have been influenced by business trends such as globalisation, outsourcing of internal activities and the adoption of just-in-time (JIT) and just-in-sequence (JIS) philosophies. These trends have enabled cost savings and enhanced competitiveness in global markets (Behdani et al., 2012; Mishra et al., 2025). However, while these strategies improve operational efficiency, they also increase exposure to risks, disruptions and vulnerabilities within supply chains (Faisal, 2009, p. 44; Kazancoglu et al., 2024; Mishra et al., 2025). Therefore, supply chain vulnerability arises not only from external shocks but also from strategic and managerial decisions made by firms (Shi & Ni, 2021; Vecchi & Vallisi, 2016).

Through intensified outsourcing, supply chains have increased their complexity both in terms of relationship management and process execution (Ekanayake et al., 2020; Karwasra et al., 2024; Shahbazi et al., 2013). The pressure to maintain organisational profitability in an increasingly uncertain business environment drives executives to seek competitive advantage by relying more heavily on outsourcing, accepting the associated risks (Sen et al., 2020). Recent production reshoring decisions have emphasised the need to reassess outsourcing strategies within supply chains (Bettiol et al., 2023; Choudhary et al., 2023; De Backer et al., 2016; Ellram, 2013; Götze & Brunner, 2019; Johansson et al., 2018).

Note: Additional supporting information may be found in the online version of this article as Online Appendix 1.

Disagreement in the scholarly literature leaves the question of supply chain vulnerability as a consequence of outsourcing strategies open. Some sources indicate that outsourcing can reduce the effectiveness of internal capacities. It may also increase dependency on external partners, thereby making supply chains more vulnerable (Cajal-Grossi et al., 2023; Ersahin et al., 2024; Karwasra et al., 2024; Kulembayeva et al., 2022; Laari et al., 2024; Zarghami & Dumrak, 2024). Conversely, other authors argue that there is no empirical evidence of a direct link between outsourcing and vulnerability (Abbasi et al. 2024), while some even consider outsourcing a risk mitigation tool (Shi & Ni, 2021; Wang et al., 2016).

While several studies highlight that outsourcing increases supply chain vulnerability because of reduced control and dependency on external partners (König & Spinler, 2016; Monyake et al., 2019), other studies report no direct link or even risk mitigation effects (Abbasi et al., 2024; Shi & Ni, 2021). These contrasting findings may arise from differences in context, industry characteristics or the dimensions of outsourcing considered (intensity vs. dispersion), underscoring the need for a comprehensive framework that integrates multiple outsourcing dimensions.

Most studies have assessed outsourcing decisions in a binary manner – whether activities are outsourced or not (Akbari, 2024b; Karpagavalli, 2022; Mahmoudi et al., 2020; Sharma et al., 2023) – without examining the intensity of outsourcing or the geographical dispersion of partners. Only a few studies (e.g. Barbieri et al., 2020; López & Ishizaka, 2019) explore the effects of location and dispersion, but they do not combine these dimensions. Moreover, research has predominantly focused on developed economies, while transitional and developing economies remain underexplored because of their unique structural and institutional challenges.

This study addresses these gaps by simultaneously investigating the impact of the share of outsourced activities and the dispersion of outsourcing partners on supply chain vulnerability. By integrating both the intensity and dispersion dimensions of outsourcing, the study develops a more comprehensive framework for assessing supply chain vulnerability. This dual focus not only enriches the theoretical understanding of outsourcing and vulnerability and fills the empirical gap in transitional economies where evidence has been limited. By focusing on large enterprises in a transitional economy, the study provides novel insights into whether outsourcing strategies increase exposure to risks under resource-constrained conditions.

Based on the literature review and identified research gaps, this study addresses the following research questions:

RQ1: Can outsourcing be considered a factor of supply chain vulnerability?

RQ2: Does a higher share of outsourced activities increase exposure to risks?

RQ3: Does greater dispersion of outsourcing partners exacerbate supply chain vulnerability?

Theoretical background

Supply chain vulnerability

In the literature, there is broad consensus that merely identifying risk events is not sufficient in supply chain management. Supply chain design decisions are not conditioned solely by risk itself but by the degree of its vulnerability (König & Spinler, 2016; Wagner & Bode, 2006). Christopher and Lee (2004) emphasise that risk is often considered exclusively in terms of negative outcomes, whereas understanding supply chain behaviour requires a focus on its exposure to major internal and external disruptions.

Definitions of vulnerability vary, but they share common elements. Briano et al. (2010, p. 138) describe it as 'exposure to severe disruptions arising from internal and external risks', while Fazli and Masoumi (2012, p. 2765) stress that it is a function of supply chain characteristics and the losses resulting from its susceptibility to interruptions. Asbjørnslett (2009) goes a step further and highlights the dynamic dimension: a system is vulnerable if it is unable to survive a disruption, absorb its consequences and re-establish stability.

Synthesising these perspectives, vulnerability can be understood as encompassing two key components: exposure to risky events (the extent to which a system is subject to potential disruptions) and limited adaptive capacity (the extent to which it can absorb and overcome consequences). This dual nature makes vulnerability a central concept in analysing the effects of outsourcing: the strategy can simultaneously reduce exposure by delegating risks to partners but also weaken adaptive capacity because of the loss of control and resources. Thus, this study contributes to supply chain management theory by integrating the three key dimensions of outsourcing (intensity, dispersion and network complexity) with the two-dimensional concept of supply chain vulnerability (exposure and limited adaptive capacity).

In the outsourcing context, these dimensions can be operationalised through the number of disruptions in the supply chain and the duration of their recovery. While disruption costs are often used as an indicator (Ellram et al., 2013), they are strongly conditioned by industry and cost structures, which complicates comparability. In contrast, the frequency and duration of disruptions provide a relatively universal measure of vulnerability, applicable across different sectors. This approach measures vulnerability through the dynamics of disruptions and recovery, thereby avoiding inconsistencies caused by industry-specific financial indicators.

Outsourcing in the supply chain

The development of outsourcing as a supply strategy dates back to the 1970s and 1980s, when companies sought to increase agility by focusing on core competencies while transferring secondary activities to specialised partners

(Kabus et al., 2022). Three main groups of outsourcing benefits are highlighted in the literature:

- Economic benefits – cost reduction, efficiency gains and economies of scale (Akbari, 2024b; Charles & Ochieng, 2023; König & Spinler, 2016; Lee et al., 2012; Malhotra, 2014; Maloni & Carter, 2006; Monyake et al., 2019, p. 80; Olson & Wu, 2011).
- Strategic benefits – the ability to focus on core competencies, access to new technologies and innovations and enhanced competitiveness in the global market (Blair et al., 2023; Kabus et al., 2022; Karakolias, 2024; Karpagavalli, 2022; Khalatur et al., 2021; Mukherjee et al., 2023; Oleiwi & Kazem, 2023; Rajini & Kaluarachchi, 2024; Tian & Guo, 2019, p. 217).
- Organisational benefits – greater flexibility and agility, improved responsiveness to market demands and enhanced quality of products and services (Mahmoudi et al., 2020; Munjal et al., 2019).

This classification demonstrates that outsourcing is not a one-dimensional strategy aimed solely at cost reduction but also a tool for developing dynamic capabilities and creating long-term value. Hence, the literature presents a dual perspective: on one hand, outsourcing strengthens resilience and competitiveness; on the other, it may increase vulnerability because of loss of control and greater reliance on partners.

While economic benefits of outsourcing reduce operational costs and improve efficiency, strategic and organisational benefits enhance adaptive capacity and flexibility (Maloni & Carter, 2006; Munjal et al., 2019; Sarvari et al., 2023; Tian & Guo, 2019). However, excessive reliance on outsourcing can simultaneously increase supply chain vulnerability by reducing internal control and dependence on external partners (König & Spinler, 2016; Monyake et al., 2019). This ambivalent nature makes outsourcing a crucial factor for understanding the mechanisms of supply chain vulnerability.

Outsourcing as a risk mitigation strategy

Several studies show that outsourcing allows companies to avoid or reduce risk. By delegating activities to external partners, firms can manage multiple parallel supply chains and cover markets more quickly (Karwasra et al., 2024; Kurniawan et al., 2017; Wang et al., 2016). Chen and Xiao (2015) demonstrate that manufacturers in high-risk conditions often outsource entire orders to avoid delays and reduce costs arising from disruptions, while Sugimoto and Tanimizu (2018) emphasise that this strategy enables faster recovery of productivity after disturbances. Similarly, Shi and Ni (2021) recognise the importance of outsourcing in post-crisis recovery, while Bakhtiari (2023) recommends intensifying outsourcing under conditions of increased competition and uncertainty.

Outsourcing as a source of vulnerability

However, a significant body of research warns that outsourcing increases supply chain vulnerability. König and Spinler (2016), Monyake et al. (2019), Mahmoudi et al. (2020), Karpagavalli (2022) and Akbari (2024b) note that this strategy can generate new risks: the bullwhip effect, quality issues (Karakolias, 2024; Kaya & Özer, 2009), supply risks (Zsidisin et al., 2004) and coordination difficulties. Kam (2012), Munjal et al. (2019), Kulembayeva et al. (2022) and Karakolias (2024) warn of the loss of cross-functional competencies, excessive dependency on partners and a reduction in capacity to develop new knowledge. Sharma et al. (2023) also highlight outsourcing as a source of vulnerability, while Sarkandi et al. (2013) identify three 'traps':

- Loss of market dominance when suppliers transfer proprietary technology to competitors.
- Over-reliance on a single supplier, weakening negotiation power.
- Outsourcing to reduce costs but facing higher costs or reduced functionality in the final product.

Ambivalence and the dimensions of outsourcing vulnerability

In seeking greater agility under turbulent conditions, companies increasingly rely on outsourcing. At the same time, this reduces their own resources and risk management capacity, making them more vulnerable. Just-in-time practices further amplify this effect by eliminating stockpiles that could mitigate disruptions. Empirical studies show that higher outsourcing leads to more frequent supply chain disruptions (Anđelković et al., 2017) and that risk rises with the number of outsourced functions (Tsai et al., 2012). Excessive reliance also reduces internal capabilities (Bakhtiari, 2023; Monyake et al., 2019).

Risk stems not only from the level of outsourcing but also from partner dispersion and network complexity. Global partnerships introduce risks such as currency fluctuations, social instability and natural disasters (Chauhan et al., 2015; Kersten et al., 2007). The coronavirus disease 2019 (COVID-19) crisis demonstrated how global dependency can trigger massive supply chain disruptions (Barbieri et al., 2020). Managing multiple partners increases costs and reduces control, while lack of transparency limits detection of potential disturbances (Anđelković, 2017; Behdani, 2013; Ekanayake et al., 2020).

Unlike previous studies that treat outsourcing as a one-dimensional phenomenon, as shown in Table 1, this study distinguishes its three interrelated dimensions – intensity, dispersion and network complexity – which together shape supply chain vulnerability.

Research model and hypotheses development

Thus, outsourcing acts as a 'double-edged sword': it not only provides agility but also increases exposure to vulnerability. Its effect depends on three key dimensions, which form the basis of the research model. Figure 1 visualises the proposed research model, highlighting the pathways through which outsourcing affects supply chain vulnerability. This model

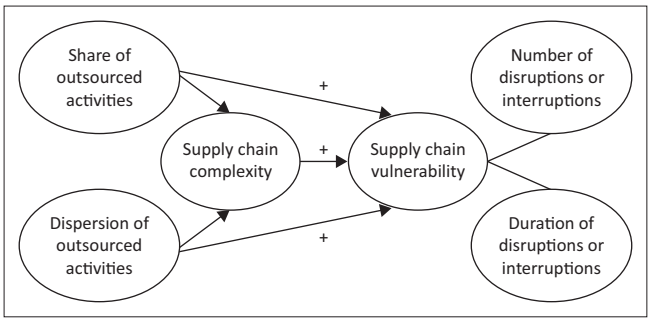


FIGURE 1: Research model.

TABLE 1: Limitation of previous studies.

No.	Study	Limitation
1	Behdani et al. (2012), Faisal (2009), Kazancoglu et al. (2024), Mishra et al. (2025)	Focus on global trends and efficiency; developed economies, without analysis of interactions between outsourcing dimensions
2	Abbasi et al. (2024), Ersahin et al. (2024), Laari et al. (2024), Zarghami and Dumrak (2024)	One-directional effects, focus only on intensity or dispersion; developed economies
3	Akbari (2024b), Karpagavalli (2022), Mahmoudi et al. (2020), Sharma et al. (2023)	Binary approach (outsourced or not), without consideration of network complexity
4	Maloni and Carter (2006), Monyake et al. (2019), Sharma et al. (2023), Tian and Guo (2019)	Focus on economic, strategic or organisational benefits; developed economies
5	Bakhtiari (2023), Chen and Xiao (2015), Sarvari et al. (2023), Shi and Ni (2021), Sugimoto and Tanimizu (2018), Wang et al. (2016)	View outsourcing as a risk-reduction tool, without integration of multiple dimensions
6	Barbieri et al. (2020), López and Ishizaka (2019)	Focus only on dispersion or location; developed economies

Note: Please see the full reference list of this article, Andjelkovic, A. (2026). Outsourcing in the supply chain as a driver of vulnerability – The case of the Republic of Serbia. *South African Journal of Business Management*, *57*(1), a5299. https://doi.org/10.4102/sajbm.v57i1.a5299, for more information.

builds on previous studies (Barbieri et al., 2020; López & Ishizaka, 2019) but extends them by integrating intensity, dispersion and network complexity into a single framework applicable to transitional economies.

Higher outsourcing intensity and greater partner dispersion are hypothesised to increase operational complexity, which in turn elevates supply chain vulnerability. Each component – intensity, dispersion and complexity – is explicitly operationalised to reflect both exposure to disruptions and limited adaptive capacity. Arrows indicate positive relationships between variables, meaning that an increase in one variable may lead to an increase in the next. This model provides a clear link between the theoretical framework and the hypotheses, integrating all three key dimensions of outsourcing with the two-dimensional concept of vulnerability.

The literature review indicates that outsourcing influences supply chain vulnerability through three key dimensions: the intensity of outsourced activities, partner dispersion and network complexity. The distinction between outsourcing intensity (the proportion of activities delegated) and partner dispersion (the geographic and organisational distribution of partners) is theoretically grounded. Higher outsourcing intensity can reduce internal control and diminish cross-functional competencies, thereby increasing vulnerability (Monyake et al., 2019; Sharma et al., 2023). Greater partner dispersion introduces coordination challenges and longer recovery times, further amplifying vulnerability (Ekanayake et al., 2020; Wang et al., 2016). Moreover, the interaction of high intensity and large dispersion creates emergent complexity in the supply chain, which directly affects the frequency and severity of disruptions. This framework provides a solid theoretical basis for the formulation of Hypotheses 1a, 1b and 2.

Studies show that increasing outsourcing intensity leads to loss of control, reduced internal competencies and greater dependency on partners (Akbari, 2024b; Karpagavalli, 2022; König & Spinler, 2016; Mahmoudi et al., 2020; Monyake et al., 2019; Sharma et al., 2023). At the same time, excessive reliance on partners increases the risk of delays and disruptions (Chen & Xiao, 2015; Sugimoto & Tanimizu, 2018):

> **H1a:** *A greater share of outsourced activities increases the vulnerability of the supply chain.*

Partner dispersion introduces geographic and organisational complexity, which complicates coordination and control (Anđelković, 2017; Behdani, 2013; Ekanayake et al., 2020). Increasing the number of partners and their distance from the focal company raises the risk of delays and disruptions, especially for short-lifecycle products (Karwasra et al., 2024; Wang et al., 2016):

> **H1b:** *Greater dispersion of outsourced activities increases the vulnerability of the supply chain.*

A linear positive effect is expected because an increase in either the share of outsourced activities (intensity) or the geographic and organisational dispersion of partners is likely to proportionally increase operational complexity and reduce internal control, thereby elevating supply chain vulnerability (König & Spinler, 2016; Monyake et al., 2019).

Combining high outsourcing intensity and large dispersion of activities leads to *emergent complexity* in supply chains (Barbieri et al., 2020; Chauhan et al., 2015; Kersten et al., 2007; López & Ishizaka, 2019). Increased network complexity amplifies disruptions and complicates risk interpretation, directly influencing vulnerability:

> **H2:** *The complexity of operations as a result of outsourcing (share of outsourced activities and dispersion of operations) increases the vulnerability of the supply chain.*

Methodology

Sample analysis

As previous author's research showed that small- and medium-sized enterprises (SMEs) in the Republic of Serbia do not recognise outsourcing as a source of disruption in the supply chain (Anđelković, 2015), this study focuses on large enterprises. Similar conclusions were reached by Bakhtiari (2023), who found that companies typically outsource a larger percentage of activities as they mature, while outsourcing is less common in smaller firms.

For the purposes of empirical research, data were drawn from the *Report on the 100 Largest Companies in 2024*, published by the Serbian Business Registers Agency. Companies were selected according to net profit to eliminate the influence of poor business performance on supply chain vulnerability. Small- and medium-sized enterprises included in the initial list were excluded. The study was conducted between February 2024 and June 2024. Out of 92 distributed questionnaires, 52 valid responses were received, resulting in a response rate of 56.5%.

The data were collected using a structured questionnaire, developed specifically for the purposes of this research, based on previous studies and the methodological framework applied by the Business Continuity Institute (2024).

The questionnaire (Online Appendix 1) included both open-ended and closed-ended questions, as well as assessments on quantitative scales. Respondents were managers responsible for logistics, production or supply chain management and were asked to evaluate:

- *Outsourcing intensity* – the percentage of activities that are outsourced (transportation, warehousing, planning and control of logistics activities, manufacturing and packing);
- *Geographical dispersion of operations* – the percentage of procurement, production and sales carried out within the territory of Serbia and in other geographical areas;
- *Supply chain vulnerability* – expressed through the number of disruptions the companies faced over the past 12 months and the average duration (in days) required to restore stable operations after a disruption.

To ensure content validity, the questionnaire was reviewed by three academic experts and two experienced practitioners in the field of logistics and supply chain management. Based on their suggestions, minor linguistic and terminological adjustments were made to ensure that the questions were clear and adapted to the context of large enterprises in the Republic of Serbia. Prior to conducting the main study, a pilot test was carried out on a sample of five companies. The pilot study aimed to verify the clarity of the questions, the order of the items and the stability of the proposed scales. Based on the feedback received, it was confirmed that the instrument clearly operationalises the analysed dimensions and that respondents had no difficulties in providing answers. Complete survey instrument with operational definitions of all constructs is provided in Appendix 1 to ensure full research reproducibility.

Participation of respondents was voluntary and anonymous. All participants were informed about the purpose of the study and agreed that their responses would be used exclusively for scientific research purposes. No sensitive or personal data were collected during the study. Formal approval from the ethics committee was not required, as the research did not involve sensitive data or experiments with human subjects; it was conducted in accordance with the guidelines of the Ethics Committee of author's research institution.

In addition to the main variables, two control variables were included to account for structural differences among firms: industry sector and origin of capital (domestic, foreign or mixed). These variables were collected directly from the questionnaire and were used to control for potential sectoral or ownership-related effects on supply chain vulnerability.

The sectoral distribution of firms in the sample was as follows: manufacturing (44%), wholesale and retail trade (19%), electricity, gas and water supply (8%), transport, storage and communications (8%), agriculture, hunting and forestry (6%), construction (6%), community and personal services (5%), mining (2%) and extraterritorial organisations (2%). In terms of ownership structure, enterprises with foreign or majority-foreign capital accounted for 52% of the sample, while domestic or majority-domestic firms represented 48%.

To assess potential non-response bias, early and late respondents were compared based on their sectoral and ownership characteristics. Descriptive comparison showed no meaningful differences between these two groups, suggesting that non-response bias is unlikely to have affected the results. Although the response rate was moderate (56.5%), the obtained sample structure closely reflects the distribution of large enterprises in the Serbian economy by sector and ownership, which supports its representativeness and analytical validity.

The collected data were analysed using descriptive statistics (arithmetic mean, standard deviation and variance), which illustrated the levels of outsourcing and geographical dispersion. Subsequently, cluster analysis was applied to group the companies based on outsourcing intensity (up to 50% and over 50%) and the degree of operational dispersion. In the next phase, the χ^2 test was used to examine the relationship between the level of outsourcing, dispersion and supply chain vulnerability. All analyses were performed using SPSS software.

Variables

The aim of this research is to assess the degree of vulnerability of companies in the supply chain with the increase of outsourcing activities. The dependent variables were defined based on widely accepted definitions of vulnerability in the literature while also considering the methodology employed by the Business Continuity Institute in its long-standing analyses of global supply chain vulnerability. In this context, the degree of vulnerability is evaluated based on the number of disruptions that companies in the sample faced over the past year, as well as the time required to establish a stable state after these disruptions in the supply chain. Of the total number of companies in the research sample, 33% reported that their managers indicated they had not faced any disruption in the previous 12 months; 27% faced

1–5 disruptions; 14% were exposed to disruptions 6–10 times and 25% faced 11–20 disruptions. The smallest number (1%) encountered disruptions more than 20 times during the year. The results achieved, compared to the findings of the Business Continuity Institute (2024) regarding the number of disruptions faced by companies globally (0 disruptions 13.9%, 1–5 disruptions 53.5%, 6–10 disruptions 13.9%, 11–20 disruptions 5%, 21–50 disruptions 3%, over 51 disruptions also 3%, while the percentage of those without this data is 7.9%), indicate that the situation in the Republic of Serbia is satisfactory. The intervals used to assess the number of disruptions in the supply chain were determined based on research and methodology that has been carried out for many years by the Business Continuity Institute in evaluating the resilience of global supply chains. The independent variables relate to the level of outsourcing, specifically the percentage of outsourced activities in the company, as well as the dispersion of operations. It is assumed that a higher participation of both independent variables increases the vulnerability of the supply chain.

Additionally, the dependent variable duration of disruption was determined based on the experience of the managers participating in the study. Managers estimated the average number of days required to overcome disruptions in the supply chain. Based on their responses, companies were classified into one of five groups (0 days, 1–5 days, 6–10 days and over 10 days). This scale was defined in the same way as for the previous dependent variable, based on the research and methodology of the Business Continuity Institute (2024). In the analysed sample, 29% of companies reported a disruption duration of 0 days (either because the disruption was resolved immediately or because they did not experience any disruptions during the analysed period), 40% reported disruptions lasting 1–5 days, 16% reported disruptions lasting 6–10 days and 15% reported disruptions lasting more than 10 days.

The assumption that a higher percentage of outsourced activities leads to an increase in the vulnerability of the entire supply chain arises from the growing number of functions or activities delegated to other partners, which simultaneously become globally widespread, making the supply chain more complex. In this context, there is a need to analyse the degree of the outsourcing trend among companies in the Republic of Serbia. Based on their experience and personal assessment, managers indicated the percentage of various activities that they outsource. On a scale from 0% to 100%, managers reported the outsourcing percentage for the following activities: transportation, warehousing, planning and control of logistics activities, manufacturing and packing. Based on these responses, Table 2 was compiled.

Based on Table 2, it can be concluded that, among all analysed activities, transportation is the activity that is outsourced in most cases, while production is the least commonly outsourced. As many as 18 companies in the sample (35%) reported that they delegate 100% of their transportation activities to partners for whom this activity is a core competency. Based on the assessments of outsourced activities, companies were further grouped in the analysis using cluster analysis according to whether they outsource up to 50% of activities or more.

TABLE 2: Descriptive statistics of outsourcing specific activities (N = 52).

Outsourcing activities	Mean	SD	Variance
Transport	64.1346	39.00379	1521.295
Warehousing	15.8654	30.91293	955.609
Planning and control of logistics activities	10.5769	23.38203	546.719
Manufacturing	8.2692	20.07058	402.828
Packing	11.3462	27.86725	776.584

SD, Standard deviation.

TABLE 3: Frequency of geographical dispersion of business operations.

Geographical dispersion	Supply		Manufacturing		Sale	
	Frequency	%	Frequency	%	Frequency	%
Without answer	1	1.9	4	7.7	-	-
Serbia 100%	13	25.0	38	73.1	20	38.5
Serbia over 50%, the rest Europe	12	23.1	3	5.8	10	19.2
Serbia over 50%, the rest Europe and Asia	7	13.5	-	-	2	3.8
Serbia over 50%, the rest Europe and America	3	5.8	-	-	1	1.9
Europe 100%	2	3.8	3	5.8	1	1.9
Europe over 50%, the rest Serbia	5	9.6	2	3.8	1	1.9
Europe over 50%, the rest Serbia and America	-	-	1	1.9	4	7.7
Europe over 50%, the rest Serbia and Asia	6	11.5	-	-	7	13.5
Europe over 50%, the rest Asia	-	-	1	1.9	2	3.8
Europe over 50%, the rest Asia and America	-	-	-	-	1	1.9
Asia over 50%, the rest Serbia and Europe	1	1.9	-	-	2	3.8
Asia over 50%, the rest Europe	1	1.9	-	-	-	-
Asia over 50%, the rest Europe and America	1	1.9	-	-	-	-
America over 50%, the rest Serbia and Europe	-	-	-	-	1	1.9
Total	**52**	**100**	**52**	**100**	**52**	**100**

To determine the second independent variable, managers of the companies included in the study evaluated the geographical dispersion of their operations, specifically the percentage of supply from different geographical areas, as well as the production and distribution of finished products or services. In particular, managers estimated the percentage of procurement, production and distribution carried out within the territory of the Republic of Serbia and in other geographical regions.

Based on Table 3, it can be concluded that the majority of companies in the sample source (67.4%) produce (78.9%) and distribute (63.4%) their finished products and services primarily within the territory of the Republic of Serbia. However, there is also a percentage of companies that exhibit a pronounced geographical dispersion of operations. The managers' assessments of the geographical dispersion of operations were used to determine the second independent variable. Using cluster analysis, companies

were grouped according to the degree of operational dispersion, which will be discussed in more detail in the following section.

Results

Analysis and discussion of the results of the empirical research

To group companies based on the percentage of outsourced activities that were the subject of analysis, a cluster analysis was conducted. After carrying out the clustering process on the sample, two clusters were defined. The first cluster includes companies that outsource a small percentage of the analysed activities, while the second cluster consists of companies that are willing to delegate the majority of the analysed activities (more than 50%) to their partners. In this context, the first cluster consists of 42 companies, while the second cluster includes 8 companies from the analysed sample. Only 15% of the companies in the sample were willing to take advantage of outsourcing to a significant extent.

To test Hypothesis 1a, which posits that a higher share of outsourced activities increases supply chain vulnerability, a χ^2 test of independence was conducted. This analysis examines whether the proportion of outsourced activities (low vs. high outsourcing intensity, as determined by cluster analysis) is statistically associated with two indicators of supply chain vulnerability: the number of disruptions experienced and the duration of recovery periods. Table 4 summarises the results of the χ^2 tests examining whether the share of outsourced activities is statistically associated with supply chain vulnerability indicators. This table provides an overview of the relationship between outsourcing intensity and both the number and duration of disruptions.

As shown in Table 4, neither the number of disruptions ($p = 0.695$) nor the duration of disruptions ($p = 0.556$) was significantly associated with the share of outsourced activities. These results indicate that outsourcing intensity alone does not contribute to increased supply chain vulnerability in the Serbian context. Consequently, the hypothesis that outsourcing business activities leads to greater vulnerability can be rejected.

The rejection of the first hypothesis is not consistent with previous studies, which have demonstrated the opposite relationship (Abbasi et al., 2024; Ersahin et al., 2024; Laari et al., 2024; Monyake et al., 2019; Sharma et al., 2023; Zarghami & Dumrak, 2024). However, the discrepancy between this and earlier research may stem from the relatively low percentage of outsourced activities. The limited degree of outsourcing specific activities could be attributed to an economic and political environment that is not sufficiently conducive to outsourcing (Monyake et al., 2019). Moreover, the low level of outsourcing may also result from ongoing economic and legal reforms in transition economies (Monyake et al., 2019). Previous research on the extent of outsourcing in this group of countries has shown that such reforms can influence decisions regarding the adoption of this strategy (Mukherjee et al., 2023).

A possible solution lies in ensuring legal certainty and improving contractual frameworks to reduce uncertainty and promote efficient outsourcing, as well as in developing partnerships that enhance collaboration, reduce transaction costs and increase the likelihood of successful outsourcing.

Furthermore, the rejection of the first hypothesis may also be explained by the degree of outsourcing across different activities. In the Republic of Serbia, companies included in the sample predominantly outsource transportation activities. It is noteworthy that only a small proportion of the sample – slightly over 8% – outsources manufacturing. If this ratio were reversed, it would be worth examining whether the results would remain the same.

Previous studies indicate that different types of outsourcing entail varying levels of risk and contribute to performance in distinct ways (Akbari, 2024a; Charles & Ochieng, 2023; Mokrini & Aouam, 2022; Tian & Guo, 2019, p. 218). Therefore, it is not surprising that there is a growing trend of reshoring in manufacturing activities (Kazancoglu et al., 2024; Suresh & Ravichandran, 2022). Additionally, the recommendation that the host country should remain central to innovation and the production of high-quality products underscores the strategic importance of decisions to outsource such activities (Bettiol et al., 2023).

This study examines the assumption that greater geographical dispersion of business operations increases the vulnerability of the supply chain, meaning its exposure to disruptions. To prove this assumption, cluster analysis and the χ^2 test will be applied. The cluster analysis confirmed the presence of two clusters. The first cluster includes 34 companies, or 65% of the sample, which do not have significant geographical dispersion of operations. The second cluster comprises 18 companies or 35% of the sample, which have significant geographical dispersion of operations. To test Hypothesis 1b, which assumes that greater geographical dispersion of

TABLE 4: Relationship between the degree of outsourced activities and supply chain vulnerability.

Statistical test	χ^2 test of outsourcing activities and the number of disruptions			χ^2 test of outsourcing activities and the duration of disruptions		
	Value	*df*	Asymp. sig. (two tailed)	Value	*df*	Asymp. sig. (two tailed)
Pearson's Chi-square	2.222	4	0.695	2.079	3	0.556
Contingency coefficient	0.202	-	0.695	0.196	-	0.556
Likelihood ratio	2.526	4	0.640	3.382	3	0.336
N	52	-	-	52	-	-

df, degrees of freedom; Asymp. Sig., asymptotic significance.

business operations increases supply chain vulnerability, a χ^2 test of independence was performed. The analysis compares firms grouped according to the degree of geographical dispersion (low vs. high) and their corresponding levels of supply chain vulnerability, expressed through the number of disruptions and the duration of recovery periods.

Table 5 presents the relationship between the geographical dispersion of operations and supply chain vulnerability. It shows how greater dispersion across regions corresponds with higher exposure to disruptions and longer recovery periods, confirming the assumptions outlined in Hypothesis 1b.

As presented in Table 5, both χ^2 values (14.906 for the number of disruptions and 13.953 for the duration of disruptions) are statistically significant at $p < 0.05$. This confirms a strong relationship between the geographical dispersion of business operations and the level of supply chain vulnerability. In other words, companies operating across multiple regions or countries experience more frequent and longer-lasting disruptions compared to firms whose operations remain primarily within national borders.

These results validate Hypothesis 1b and support the view that spatial dispersion amplifies supply chain risks by introducing additional coordination challenges, logistical delays and exposure to external shocks. Consequently, while international diversification can enhance market reach and flexibility, it simultaneously increases systemic fragility. This underscores the need for stronger risk management mechanisms and comprehensive geographical risk assessment when implementing outsourcing strategies. The findings are consistent with previous studies emphasising that global operational dispersion heightens vulnerability through reduced transparency and control (Barbieri et al., 2020; Ekanayake et al., 2020; Guchhait & Sarkar, 2024; Kabus et al., 2022; Suresh & Ravichandran, 2022; Wang et al., 2016). Given the impact of outsourcing partner dispersion in the context of increased risk, it is essential to maintain a sufficiently dense network of suppliers – even in cases of reshoring or internal outsourcing (Canello et al., 2022).

To conduct a detailed analysis of the impact of outsourcing on supply chain vulnerability, the author linked the geographical dispersion of business operations and the degree of outsourcing of business activities into a single variable. Based on the percentage of outsourcing of the analysed business activities at each company level, the average percentage of outsourcing was determined. Subsequently, companies were categorised into three groups:

- The first group consists of companies with no recorded outsourcing of business activities.
- The second group includes companies with outsourcing participation of up to 50%.
- The third group comprises companies with an outsourcing percentage exceeding 50%.

By connecting clusters based on the geographical dispersion of business operations (where companies were grouped into two clusters, with the first consisting of companies with low geographical dispersion) and considering the participation of outsourced business activities, a new cluster analysis identified two additional clusters. In this way, a connection was established between the geographical dispersion of business operations and the outsourcing of business activities. The first cluster included 32 companies, characterised by low geographical dispersion of operations and a small percentage of business activities transferred to other partners. The second cluster comprised 20 companies, which not only exhibited significant geographical dispersion of operations but also engaged a large number of partners in activities that are not their core competencies.

Table 6 presents the results of the χ^2 analysis, showing whether higher operational complexity is statistically associated with greater vulnerability across both indicators. A χ^2 test was conducted on the defined clusters to examine the impact of business complexity – resulting from greater geographical dispersion and outsourcing of business activities – on the vulnerability of the entire supply chain.

TABLE 5: Chi-square test of geographical dispersion of business operations and supply chain vulnerability.

Statistical test	χ^2 test of geographical dispersion of business operations and the number of disruptions			χ^2 test of geographical dispersion of business operations and the duration of disruptions		
	Value	*df*	Asymp. Sig. (two tailed)	Value	*df*	Asymp. Sig. (two tailed)
Pearson's Chi-square	14.906	4	0.005	13.953	3	0.003
Contingency coefficient	0.472	-	0.005	0.460	-	0.003
Likelihood ratio	17.399	4	0.002	13.810	3	0.003
N	52	-	-	52	-	-

df, degrees of freedom; Asymp. Sig., asymptotic significance.

TABLE 6: Chi-square test of supply chain complexity and vulnerability.

Statistical test	Supply chain complexity and the number of disruptions			Supply chain complexity and the duration of disruptions		
	Value	*df*	Asymp. Sig. (two tailed)	Value	*df*	Asymp. Sig. (two tailed)
Pearson's Chi-square	12.515	4	0.014	12.138	3	0.007
Contingency coefficient	0.440	-	0.014	0.435	-	0.007
Likelihood ratio	14.143	4	0.007	12.496	3	0.006
N	52	-	-	52	-	-

df, degrees of freedom; Asymp. Sig., asymptotic significance.

As shown in Table 6, both relationships are statistically significant ($\chi^2 = 12.515$, $p = 0.014$ for the number of disruptions; $\chi^2 = 12.138$, $p = 0.007$ for the duration of disruptions). These results confirm that higher supply chain complexity – arising from the combined effects of outsourcing and dispersion – leads to increased vulnerability.

Companies operating within more complex supply networks not only face a higher frequency of disruptions but also require more time to restore operational stability. This finding validates Hypothesis 2 and highlights the interactive effect of outsourcing intensity and geographical dispersion on supply chain performance.

While the χ^2 test indicated significant associations between the independent and dependent variables, we conducted a regression analysis to quantify the magnitude and significance of the effects of supply chain complexity on the number and duration of disruptions.

The application of linear regression analysis to examine the impact of supply chain complexity on the number and duration of disruptions is justified based on the tested assumptions of the regression model. For the dependent variable number of disruptions, standardised residuals range from –1.689 to 1.889, with a mean approximately 0 and a standard deviation of about 0.99, indicating an approximately normal distribution of residuals. The variance of residuals does not depend on the predicted values, confirming the homoscedasticity of the model.

Similarly, for the dependent variable duration of disruptions, standardised residuals range from –1.512 to 1.862, with a mean of 0 and a standard deviation of approximately 0.99, also indicating a normal distribution. The variance of residuals remains constant, confirming homoscedasticity.

In both cases, the assumptions of linearity, independence of errors (Durbin–Watson = 1.573 for the number of disruptions and 1.752 for the duration of disruptions) and absence of multicollinearity (Variance Inflation Factor [VIF] = 1.000) are satisfied. Based on these checks, linear regression is an appropriate method for analysing the impact of supply chain complexity on vulnerability.

The analysis of variance (ANOVA) results demonstrate the statistical significance of the regression models for both dependent variables: number of disruptions and duration of disruptions. As shown in Table 7, the predictor supply chain complexity is significant for the dependent variable number of disruptions ($F = 10.214$, $p = 0.002$), and a similar effect is observed for duration of disruptions ($F = 4.799$, $p = 0.033$).

These results confirm that the predictor included in the model (supply chain complexity) significantly explains the variability in both dependent variables. However, a substantial portion of the total variance remains unexplained, indicating that additional factors – such as operational practices, external disruptions or organisational characteristics – may also influence disruptions. Future research could investigate these factors to provide a more comprehensive understanding of supply chain vulnerability.

The coefficient analysis (Table 8) allows for the assessment of both the magnitude and statistical significance of the effect of supply chain complexity on the number and duration of disruptions. Specifically, supply chain complexity has a statistically significant positive effect on the number of disruptions ($B = 1.025$, $\beta = 0.412$, $p = 0.002$). Similarly, for the duration of disruptions, supply chain complexity is a statistically significant predictor ($B = 0.681$, $\beta = 0.296$, $p = 0.033$).

The positive value of the constant indicates that even when supply chain complexity is at a zero level, a baseline level of disruptions remains, suggesting that the supply chain possesses inherent vulnerability. Moreover, the increase in the unstandardised coefficient (B) with rising supply chain complexity – reflecting the degree of outsourced activities and geographical dispersion – confirms higher vulnerability, with statistical significance ($p < 0.05$).

The assumption that a higher percentage of outsourcing of business activities leads to greater supply chain vulnerability has not been confirmed. Considering the numerous benefits

TABLE 7: Analysis of variance.[a]

Model		Sum of squares	*df*	Mean square	*F*	Sig.	Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	12.931	1	12.931	10.214	0.002[b]	5.712	1	5.712	4.799	0.033[b]
	Residual	63.300	50	1.266	-	-	59.519	50	1.190	-	-
	Total	76.231	51	-	-	-	65.231	51	-	-	-

df, degrees of freedom; Sig., significance.

[a], Dependent variables: Number of disruptions; Duration of disruptions.

[b], Predictors: (Constant), Supply chain complexity

TABLE 8: Coefficients.[a]

Model		Unstandardised coefficients		Standardised coefficients	*T*	Sig.	Unstandardised coefficients		Standardised coefficients	*t*	Sig.
		B	SE	Beta			B	SE	Beta		
1	(Constant)	0.850	0.471	-	1.806	0.077	0.287	0.456	-	0.630	0.532
	Supply chain complexity	1.025	0.321	0.412	3.196	0.002	0.681	0.311	0.296	2.191	0.033

SE, standard error; Sig., significance.

[a], Dependent variables: Number of disruptions; Duration of disruptions.

of implementing an outsourcing strategy, it is not surprising that, in the Republic of Serbia, managers do not perceive the risks associated with this strategy, contrary to previous studies (Abbasi et al., 2024; Bakhtiari, 2023; Ersahin et al., 2024; Laari et al., 2024; Sarvari et al., 2023; Shi & Ni, 2021; Zarghami & Dumrak, 2024). In contrast, when business activities are outsourced across different geographical areas, with greater physical distance from the focal company, a higher degree of supply chain vulnerability is expected, as confirmed by earlier research (Barbieri et al., 2020; López & Ishizaka, 2019). Moreover, the analysis of the simultaneous impact of geographical dispersion of business operations and outsourcing on increased vulnerability revealed a high degree of interdependence. This finding suggests that outsourcing business activities within national borders does not necessarily increase supply chain vulnerability. Therefore, decisions regarding outsourcing should not be made solely based on its benefits, nor in isolation from other relevant factors.

It is necessary to conduct an assessment of country-specific and outsourcing partner risks (Monyake et al., 2019). This process would include quantifying the risks associated with the decision to outsource activities and incorporating these risks into the criteria for selecting an outsourcing partner. The quantification of risks depends on several factors, including the assessment of the size and complexity of outsourced activities, their significance (Rajini & Kaluarachchi, 2024), as well as the importance of the supplying market or region (Mokrini & Aouam, 2022). In cases where a high level of risk is identified in selecting an outsourcing partner, which is also the only available solution, increasing the outsourcing partner's capacity is suggested as one potential solution.

Conclusion

This study contributes to the theoretical debate on supply chain management by providing empirical evidence from a transitional economy context, illustrating how firms in Serbia navigate the trade-off between efficiency and resilience when making outsourcing decisions. While prior studies have predominantly examined mature economies, this research fills a contextual gap by offering insights from a transitional market setting, thereby extending existing theories of supply chain vulnerability.

The results indicate that managerial efforts to mitigate vulnerability should not focus solely on reducing the volume of outsourcing but rather on managing its structural and spatial dimensions. While outsourcing can generate cost savings and improve operational efficiency, it may also increase systemic risk if partners are geographically dispersed or insufficiently capable, highlighting the inherent tension between efficiency-driven decisions and the need for supply chain resilience. Therefore, cost savings and greater efficiency in decision-making regarding outsourcing must not be considered in isolation from other factors when making supply chain management decisions. Such results will certainly not eliminate outsourcing from the list of managerial decisions in the Republic of Serbia, but they should serve as a starting point for defining recommendations and guidelines when making decisions about the selection of outsourcing partners. Therefore, the analysis of supply chain vulnerability as a consequence of outsourcing should emphasise the seriousness of partner selection decisions, considering the potential consequences in the event of a risky occurrence. In summary, the findings reinforce the perspective that supply chain resilience depends not on the extent of outsourcing per se, but on the configuration and governance of interorganisational relationships within geographically dispersed networks.

Business implications

As the decision to outsource is inevitable in the modern business environment, managers may be advised to minimise risk events that could increase the vulnerability of supply chains through some of the following tools:

Risk mitigation through partner management: Managers can mitigate outsourcing-related risks by implementing structured partner selection processes based on capacity, reliability and strategic fit. Long-term contracts with clear service-level agreements (SLAs) and performance metrics help ensure accountability and reduce uncertainty.

Building collaborative resilience: Developing collaborative partnerships through resource sharing, joint problem-solving and co-sourcing arrangements enhances mutual trust and responsiveness. Strengthening partners' financial, operational and legal capacities is essential for achieving sustainable resilience.

Strategic diversification and localisation: To further minimise risk, managers should consider balanced multisourcing and regional diversification strategies. Where reshoring is not feasible, hybrid models combining domestic and international outsourcing can preserve efficiency while safeguarding resilience.

Overall, the study emphasises that outsourcing decisions should be guided by an integrated perspective balancing efficiency optimisation with proactive risk governance.

Research limitations

Considering the conducted research and its results, the author identifies certain limitations and opportunities for improvement in examining the impact of outsourcing on supply chain vulnerability. The study did not differentiate between specific types or strategic importance of outsourced activities across companies, which may influence the degree of vulnerability. Therefore, future research needs to focus on assessing specific risks and their likelihood of occurrence in the supply chain when outsourcing business activities, considering the differences in the consequences they bring. Future research could extend the analysis to encompass other Western Balkan countries, enabling regional comparisons and improving the external validity of the findings. Involving more transitional economies from the region would make the results easier to apply.

This would help researchers gain a clearer picture of the role of outsourcing strategies and their impact on supply chain vulnerability. By integrating a broader regional sample and differentiating between types of outsourced activities, future studies could deepen our understanding of how outsourcing configuration shapes supply chain vulnerability across varying institutional environments.

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CRediT authorship contribution

Aleksandra Andjelkovic: Conceptualisation, Formal analysis, Investigation, Methodology, Resources, Software, Supervisions, Writing – original draft, Writing – review & editing. The author confirms that this work is entirely their own, has reviewed the article, approved the final version for submission and publication and takes full responsibility for the integrity of its findings.

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of Niš, Faculty of Economics Research Ethics Committee (07.124).

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Data availability

The data that support the findings of this study are not openly available and are available from the corresponding author, Aleksandra Andjelkovic, upon reasonable request.

Disclaimer

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