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Chapter

# Changes in Quality and Risk Management in Logistics

*Marieta Stefanova*

*'There is nothing so useless as doing with great efficiency something that should not be done at all.'*

*Peter Drucker*

## Abstract

For organizations providing logistics services, dynamic changes in the external environment impact process performance risk and threaten effective integration of resources, coordinated management of operations and consequently, negatively impact customer satisfaction and loyalty. These processes call for an improvement of logistics service management and an integrated management concept combining the integration of satisfaction analysis processes and the risks that can negatively impact the delivery of a satisfying logistics service. The study focuses on the integration of quality and risk management in the supply chain to examine the theoretical and practical guidelines and address the main risks of non-compliance with the customer and legislative requirements that arise in a constantly changing external environment. The research approach is to look for the synergistic effect of quality and risk management by applying appropriate tools for their integration based on the definition of the applicable conditional variables in the specific existing situation. The analysis conducted to give us reason to believe that the development of a systematic approach, including both satisfaction analysis and risk factor analysis, may be sufficient grounds for initiating improvements in customer service.

**Keywords:** quality, risk management, logistics

## 1. Introduction

Drucker's postulate that the most serious mistakes are made not because of wrong answers but of wrong questions provoked the writing of this monograph. Every day, we are inundated with information about various leaders worldwide who have taken charge and solved yet another global problem in the right way. Solving any problem, unfortunately, can only restore the equilibrium that existed before the problem occurred. There is a lack of information on how crises arising from dynamic changes and emerging risks in the external environment can create favorable conditions for other leaders who see these as an opportunity to seek the path of innovation, develop their potential and transform into a more favorable outcome.

The positive effects of quality management have long been established in the scientific literature. If we compile a basic list of these effects, it would undoubtedly include cost reductions, better relationships with suppliers and customers, just-in-time deliveries, reduced waste, increased added value for customers, and better conditions for developing market potential. These benefits can also be applied to quality management in logistics.

Logistics is a key activity for any business idea. The challenges of market change require continuous improvement of supply chain performance and, in this process, quality improvement through risk analysis is important. Risk is always associated with uncertainty, therefore, to reach a new improved level of logistics services, processes must be managed and analyzed with appropriate methods. Quality management is based on conditional variables that are determined by the changing market conditions in a specific time span. Modern logistics firms are increasingly focused on improving supply chain performance, where improvement with quality management is the primary mechanism for achievement. This study seeks to identify the ways to achieve better business process performance in logistics services through the application of basic quality and risk management tools. There is no single correct approach or the best tool for quality management in logistics. It is necessary to find an approach that incorporates contingencies and the current market situation and to analyze and identify an effective service improvement strategy applicable to the changing circumstances. The research approach is to look for the synergistic effect of quality and risk management by applying appropriate tools for their integration based on the definition of the applicable conditional variables in the specific existing situation.

## **2. Factors influencing the imposition of changes in the attributes for assessing the quality of logistics services**

In late 2019, a new type of viral disease called coronavirus (COVID-19) was discovered in the provincial capital of Hubei [1–3] and within a few months, its spread spanned the globe. Many researchers support the view that urbanization and increasing population density are major catalysts for the spread of COVID-19 [3–5]. The outbreak of the COVID-19 pandemic has forced authorities worldwide to introduce restrictions and bans on the movement of people and goods throughout the supply chain. In response to these challenges, most countries have announced national travel and transport bans to certain regions [6]. The introduction of restrictions has become a huge challenge for all logistics stakeholders [2, 7], which include producers, municipal authorities, inspection bodies, medical practitioners, household purchasing decision-makers, managers deciding on the organization of order fulfillment in the supply chain, and many others [8–10]. The constraints and longer vehicle dwell times at border controls and entry and exit points in the country of delivery have necessitated an increase in shipping costs and prevented the necessary quantities of essential goods from being secured and stock reserves replenished. One of the conditions for quality management in logistics—those goods arrive on time—became an unenforceable condition for deliveries from locations where COVID-19 restrictions were imposed.

Quality management decisions in logistics activities during this period were driven by the importance of the role of logistics in supply management and the constraints introduced by government authorities. During a pandemic, stockpiling essentials and

personal protective equipment for the population is a difficult challenge for the entire logistics chain [2, 11–14]. The threat of the rapid spread of disease requires logistics organizations to respond quickly to ensure the seamless supply of personal protective equipment, disinfectants, medicines, medical supplies, essential foods, among others [2–4, 15, 16].

The constraints create risk-laden conditions managing the quality of logistics processes and making effective decisions related to capacity, choice, and use of means of transport, and compromise the performance of the supply chain processes [17–21].

The high population density in large population centers and living close to large retail chains have limited the ability to supply less accessible and remote areas with the same resources. A cost-effective method of redistribution through logistics was not implemented in the short term. The effort to limit the spread of the virus has created unaffordable conditions for the implementation of basic logistics activities and services. Household decision-makers reacted quickly to the changed conditions and stocked personal protective equipment and invested in commodities that had a limited shelf life, which required them to be discarded at a later stage. Fear of the shortage of goods anticipated due to the restrictions on the movement of vehicles created panic in the population [22–24] and, consequently, a glut of goods. This process triggered a new wave of shortages throughout the supply chain caused by the irregularity of consumption compared to the previous period and the depletion of goods due to overstocking [16, 25]. Households did not make purchase decisions based on their actual and expected consumption for future time periods.

The pandemic has forced households to increase their online purchases and reduce their visits to retail outlets [26–28], even for necessities and everyday purchases. Traditional order fulfillment approaches proved inadequate for the changed market conditions as consumers demanded that logistics service providers fulfill their orders within the day or within a few hours [29]. Some retail logistics chains have proved unprepared to provide their customers with full online real-time delivery traceability and prioritize task fulfillment by optimizing the solution of the same tasks on the fly. The introduction of various supply chain applications has allowed the most proactive in the industry to perform full supply chain traceability and help share information quickly with customers when deliveries are delayed.

The surge in essential goods has hampered all logistics operations in delivering on time [30–32] and resulted in an inability to meet planned and agreed quantities between the business partners managing them.

The COVID-19 pandemic forced rapid changes in logistics development and catalyzed the creation of new business models for query management. The path to adapt to the new normal requires the introduction of more automated processes and technologies to facilitate the processing of requests coming in via e-commerce [33]. There is a requirement to introduce a new, rethought supply chain business approach based on trust, value-added processes, and tolerance when contractual terms cannot be met because of restrictions. To achieve compliant logistics service performance is increasingly impossible without coordination between all stakeholders and real-time decision-making. Dynamic changes in the environment have become a major factor for quality process performance requiring a high degree of synchronization and collaboration [34–37].

These developments have positively impacted inventory turnover but caused a boom in order fulfillment wherein quality control processes for performance management have been limited and, in some cases, even neglected. Reduced process controls

have worsened the performance quality of set execution procedures. Quality management in logistics is concerned with delivering products on time, in the required quantity, and at the location specified by the customer. Due to the irregularity of deliveries resulting from the above reasons, warehouse space proved insufficient to cover the restocking of goods for increased consumption. The inadequacy of the existing infrastructure to conduct logistics operations, warehousing bottlenecks, and the breakdown of agreements between stakeholders on the supply and distribution of essential food and medical supplies are among the most debated topics in the literature [38, 39].

The increased frequency of emergency deliveries has necessitated the commitment of additional resources for the implementation of logistics processes, which are not always available during crisis situations and, therefore, has hampered the efficiency of processes and deteriorated the quality of their implementation. Accordingly, planned audits of the logistics quality management systems were not carried out and, in many cases, these were not carried out in their entirety and according to the planned measures. This created the conditions for impaired decision-making that ignored one of the basic data-driven principles of logistics quality management and caused confusion and delays in meeting agreed and contracted delivery quantities. Overstocking of products has also deteriorated the quality of value-added services, such as additional picking, repacking, and labeling. Overstocking of warehouse space has significantly impaired the implementation of replenishment policies as stock capacity is limited. The overloading of warehouse staff has delayed the decision-making about time schedules and workforce allocation.

Maintaining the quality of logistics services during a pandemic requires making the right and meaningful efforts to address the challenges posed by a dynamic changing environment. The application of a multidisciplinary approach and the coordination between all stakeholders actively involved in logistics processes have the potential to limit quality deterioration and other inconsistencies and are, perhaps, the only prerequisite for the success of these activities. Lack of coordination creates uncertainty in the fulfillment of customer requirements and implementation of planned quality management activities in logistics.

The risk of quality deterioration in logistics services increases manifold due to inefficient communication with customers in the event of delivery-related difficulties and reverse logistics of goods returned due to delays. Quality management in logistics has the potential to help ensure the proper distribution of essential goods during the period of retrenchment.

Some factors affecting supply chain management operations during a pandemic [40–42], have been the subject of many scientific publications and have been studied by several authors [43]. Quality assurance in logistics processes creates the prerequisites of a positive image for logistics brands to achieve a lasting trend of customer loyalty and competitive advantage [44, 45]. During the COVID-19 crisis, quality assurance was mainly related to the safety of supply and the reliability of supply chains.

Therefore, to build the resilience of logistics processes in the face of dynamic environmental changes and emerging supply security risks and threats, organizations need to more clearly and accurately analyze the factors that help establish and ensure logistics service quality and customer satisfaction.

The study identifies the key factors that help to make the right logistics decisions for quality management in times of risk and dynamic changes in the environment. During a crisis from the external environment, the results show that quality

management is introduced after the fact and is mainly related to corrective rather than preventive actions. This calls for a more in-depth investigation and concrete solutions for quality management through risk management in logistics, which is the main objective of the analyses in the different chapters of this study.

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### **3. Current aspects of quality management in logistics**

Considering the rapid changes in market conditions worldwide and as a result of the measures taken to physically distance and restrict access to ports due to the COVID-19 pandemic, there is no active physical communication between the user and the logistics service provider. Well-known quality assessment methods in most cases provide for such a communication and survey of user expectations. Some of the variables studied in these methods assess the logistics environment and evaluate the customers' direct communication at the physical level of the employees performing the services (e.g. uniform and appearance).

This chapter presents some of the main and most popular methods, their key parameters, advantages, and disadvantages in their application for discussion. The most applicable models that have the potential to be used for quality assessment, in particular for the assessment of logistics services, are studied.

The study of the different service quality management models aims to assess their suitability and adequacy or need for improvement. Different standards and good practices for quality management have been practically identified, which, of course, also have different objectives. This makes their application difficult because often no clear distinction is made between a specification (which sets out requirements) and codes of good practice (recommending a course of action) in their use.

Customers have been found to rate the quality of service whether it is good or poor [46–51]. Scholars opine that service quality is determined by the differences between expectations and perception of the service received [52–54]. It is undisputed that service quality is essential. What happens when the quality of logistics services is higher than expected and how to prevent the negative impact of various risk factors that could compromise high quality? Some researchers believe that customer satisfaction with the quality of certain services will determine the failure or success of a company [44, 55–64]. The main problem with measuring the quality of any service is related to its inherent characteristics: intangibility [65, 66], heterogeneity, and indivisibility. Accordingly, quality cannot be measured before the service is provided to the customer, unlike goods whose quality can be measured at any time [67]. Researchers agree that measuring the level of service quality is difficult but they have conflicting views on how logistics organizations overcome this difficulty in practice, regardless of what assessment methodology is used. Some researchers have segmented the market based on different types of logistics services [68, 69], some have studied the level of logistics services by different economic sectors [70], and others have studied the level of quality by geographical market segmentation, such as Vietnam [48], India [71], and Serbia [72].

Quality management activities are related to compliance with many standardization documents—various technical specifications, manuals, process management

codes, and guidelines by various international organizations [73]. An important difference between standards and other documents is the level of consensus required for their approval. Standards and technical specifications contain requirements to which processes or services must conform (normative requirements), whereas other types of documents contain only recommendations. The main problem associated with quality assessment in the service area is the contradiction between the customers' and service providers' perceptions of quality service. Customers want to receive services of the highest quality according to their perceptions of excellent quality and service providers are looking for solutions that match their requirements and expectations.

Logistics firms have long viewed logistics not just as an area for cost improvement, but as a key source of competitive advantage within the firm's overall marketing efforts. The quality performance of all these processes requires the integration of different activities and compliance control for pre-set criteria.

Researchers note that there are some basic and critically important indicators for the perception of consistent logistics service quality: timeliness [69, 74–77], availability [78], and order compliance.

#### **4. Quality assessment indicators**

Although many researchers support the view that logistics services complement the marketing efforts of sales organizations, there is a lack of well-founded evidence on the meaning of logistics service quality and its essential attributes for customer evaluation. Little research has been done to identify the differences in quality assessment attributes for different market segments and, consequently, how these attributes change under the impact of risks from the external environment. There is also insufficient research on the impact of dynamic environmental changes on quality management models and concepts in logistics in particular. The different attributes for assessing the quality of logistics services differ for each market segment and they are radically different for services that customers request over the Internet and through direct contact. This suggests that firms need to adapt their logistics services to changes in the external environment and customer orientation primarily toward Internet commerce during the pandemic.

Adding unobservable attributes that are essential to customers' perceived value of logistics services to the traditionally measured set of operational attributes to evaluate services.

Quality management involves the management of processes in a unified system. Logistics processes require efforts to be focused on the delivery of material flows by managing the selection and supplier performance improvement to just-in-time delivery of goods and customer service.

When measuring and analyzing quality in logistics, the first step is to determine the appropriate attributes for their corresponding level. Delivery time is the most used metric. There is no need for evidence confirming delivery delays as the most frequent cause of deterioration in the expected level of quality and customer dissatisfaction. Timeliness of delivery is cited by many researchers as the most important indicator for measuring quality [79–84]. Among the most important quality indicators in logistics, the following have been mentioned by various sources: the quantity of orders fulfilled (matching the requested items), the quantity of orders

processed per unit time, timely and complete product delivery information given to customers, personal contact with staff, the accuracy of fulfilled orders, the status of products received in orders, and prompt and timely response to order discrepancies. The impact of the logistics firm's corporate image, the ability to handle non-standard logistics services, and the ability to technically execute the service are examined as additional indicators to assess quality.

These metrics have priorities differing by industry, such as when logistics is part of the functional departments of manufacturing companies the metrics are related to on-time delivery, error-free delivery, and lead time. In transport logistics, the quality assessment attributes are mainly: reliability of delivery, assurance of performance, payment options, and transfer of insurance and other risks. An interesting indicator that has become increasingly important in recent years is the possibility of reverse logistics and buyback.

Logistics service quality indicators are associated with several possible attributes:

- Reliability of logistics [85–88]
- Value provided to the client [72, 89–91]
- Logistical flexibility [85, 86, 92–94]
- Quality of logistics services [8, 34, 35, 95, 96]
- Indicators related to export and import procedures. Nordås and Grosso have an interesting study on the impact of lengthy export and import procedures on logistics processes and the creation of strict trade barriers [97]
- Logistical errors in delivery [30, 98–101]
- Indicators related to lead time:
  - Timeliness of delivery [101, 102]
  - Query execution time [103, 104]
  - Just-in-time delivery [105–107]
  - Processing time for orders and requests [108]
  - Logistical lead time [78, 109, 110]
- Process performance indicators:
  - Quality of feedback and personal contact with employees in the logistics company [80, 111]
  - Conditions in the customer request related to minimum quantity or promotional offer [78]



- Accuracy of the prepared request in accordance with the customer's preferences [112]
- The use, acceptance, and exchange of information with customers [78, 113–115]
- The procedures for the preparation of requests [116]
- Increase the number of requests sent by customers [117, 118]



**Figure 1.**  
*Key indicators for measuring logistics service quality.*

- Quality of requests related to promotional items and value of the total requested quantity [74, 119]
- Speed and authority in handling discrepancies in the preparation of requests [111]
- Customer satisfaction [54, 67, 120–123]. Customer satisfaction depends on many factors related to the perceived quality of services provided, the emotional state of customers, social interaction, customer experience, and other specific subjective factors. Several researchers support the view that customer satisfaction with service quality is not an objective assessment of the actual situation but an emotional factor. Customer satisfaction is primarily associated with the evaluation of process outcomes and can be viewed as a positive evaluation of the service by the customer (**Figure 1**).

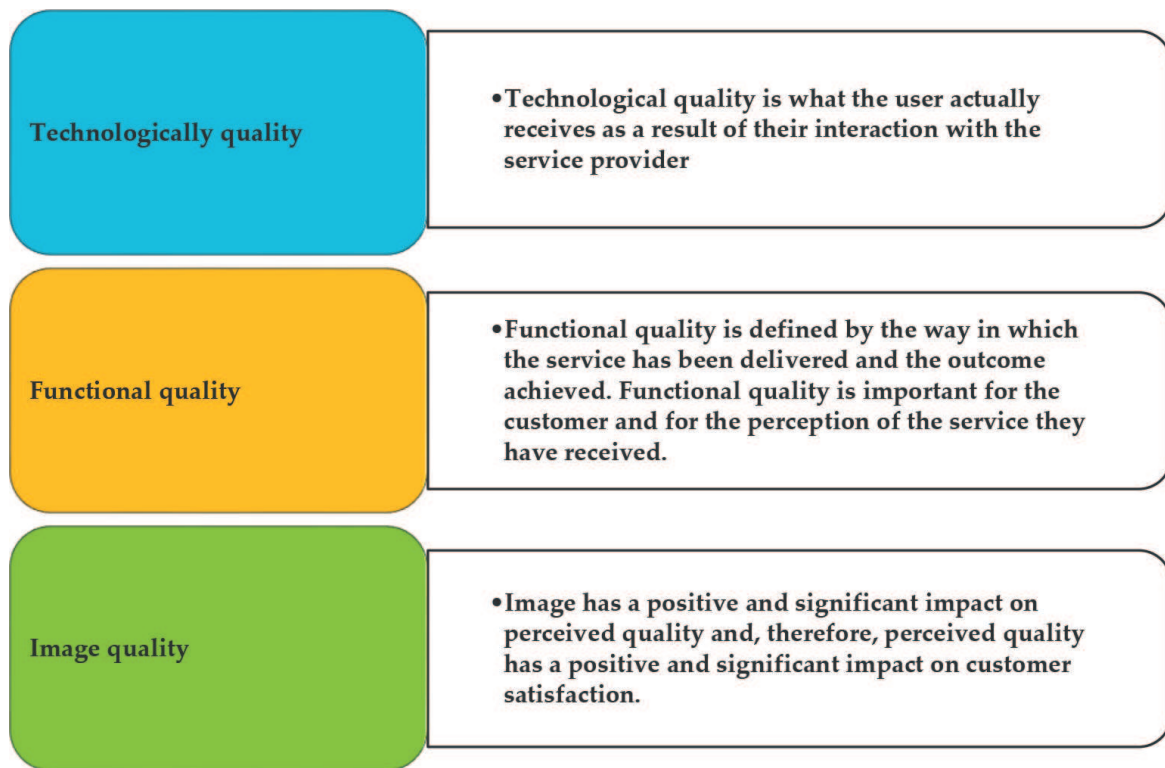
## 5. Service quality assessment models and methods

The literature describes many quality assessment methods that can be used to help service providers understand whether they are partially or fully meeting client requirements. The differences in methods are based on different criteria for assessing the mismatch between clients' expectations of the service and their perception of the service consumed. It is generalizable about all methods that to conduct them, information from the customers' service evaluation needs to be analyzed, which means that customers are actively involved in the process. How can prospective customers who have not yet received the service evaluate it? These surveys, therefore, involve customers who have already received services. The whole market is relevant for the logistics organization, specifically, why did the other customers in logistics choose the competitor's company? Another question that arises is how the opinion of those who do not use logistics companies but build their own logistics departments within production sites can be investigated.

### 5.1 Grönroos (1984) technical and functional quality model

The Grönroos model surveys a sample of business managers who are users of an existing and used service to test its perceived quality [46, 124]. Grönroos' study supports the view that quality indicators are interrelated and there is a causal relationship between them. Quality assessment under this model compares the customer's expected and perceived quality of service to measure user satisfaction. Grönroos identifies three components of service quality, namely: technical quality; functional quality; and image quality [124] (**Figure 2**).

The main criticism of Grönroos model is that this model does not assign different weighting factors to the overall evaluation of the service delivered, but only emphasizes the importance of functional quality. This critical flaw prevents the result of the measurement by the model to be an objective evaluation with practical application, but only stating the factors are interrelated. Several researchers have studied the method [125] and others have explored its practical application [126, 127]. Some researchers have criticized the method, empirically proving that there is no causal relationship between technical quality, image, and perceived quality and the relationships between these three aspects of quality are not significant [128]. To date, the paper describing the method has been cited 12,219 times in other scientific publications according to the Google Science website.



**Figure 2.**  
*Components of the Grönroos model (adapted [124]).*

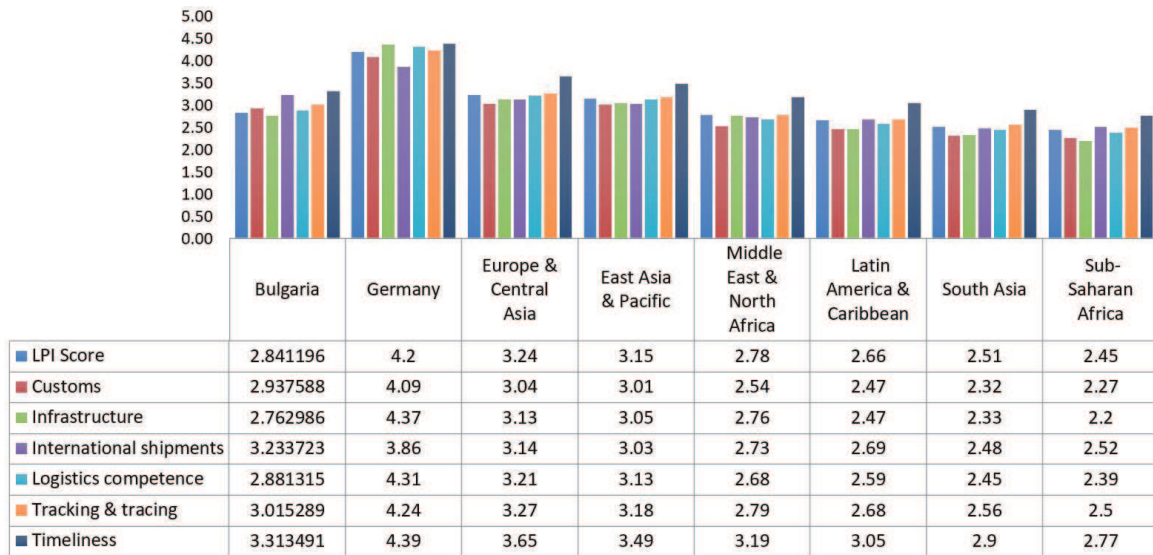
## 5.2 The European customer satisfaction index model

The European Customer Satisfaction Index (EPSI) model, first introduced in 1999 as a method for modeling and predicting customer satisfaction, has been extensively studied by many researchers in the field of quality management [129–134]. This method is based on the seven indices of the EPSI summary index. Sweden was the first country to introduce the index as the main method to measure customer satisfaction in different industries (SCSB). In 1994, the method was adapted to the American Customer Satisfaction Index (ACSI) [134, 135]. A few years later, after several publications and recommendations from the EOQ (European Organization for Quality) and EFQM (European Foundation for Quality Management), the EPSI was established as the main tool for measuring customer satisfaction in Europe [136–138]. When customer satisfaction is measured through surveys, several key issues arise, the main one being the collection and aggregation of survey data.

This issue is defined more clearly and determined by the structure and content of the satisfaction survey questionnaire and the method by which the sample size will be determined.

## 5.3 Logistics Performance Index

The Logistics Performance Index (LPI) is an indicator that measures the performance of retail supply chains or logistics performance and is produced by the World Bank every 2 years. Comparative data on the composite indicators of the index for the last 5 years are presented in **Figure 3**. The data defining the index was collected through a survey of international academic institutions, organizations, and individuals active in the global logistics market. Respondents assign scores by rating the result



**Figure 3.** Logistics performance index. Source: Compiled from World Bank data (database: LPI), last updated: 10/29/2019, available at: <https://databank.banquemondiale.org>.

on a scale from 1 (worst) to 5 (best). Each of the indicators measured relates to an assessment of the overall level of skills and quality of logistics services and the scores are averaged across all respondents.

Trade and transport have been found to stimulate economic development and improve national competitiveness. The index allows these developments to be compared against the same reliable logistical criteria. The World Bank’s Logistics Performance Index (LPI) is this unique comparative tool. For example, the aggregated Logistics Efficiency Index (2018) ranks Bulgaria 52 out of 160 countries with an average score of 3.03. Some of the examined parameters by year, assessed on a 5-point rating scale, are presented in **Figure 3**.

The competence indicator of those engaged in logistics services at the national level throughout the reporting period has little variation in the scores awarded by the experts. The report, published after the survey, examined the direct correlation between deteriorating service quality indicators as a trade barrier and foreign direct investment in the sector [139].

The assessment of the logistics quality level must, of course, be evaluated by each market segment and, as a prerequisite, customer satisfaction must be surveyed. Negative assessments of quality are, in most cases, caused by risks that have not been sufficiently managed, for which a root cause analysis is necessary. Opportunities exist to assess user satisfaction and take prompt corrective action in cases with understated ratings. Quality is defined as “the degree to which a set of intrinsic characteristics of an object satisfy requirements” and a necessary condition for measuring quality is to define these requirements.

The requirements for logistics services originate from not only customers but also legislation applicable to the activity, stakeholders, and many others. The task is to ensure compliance with quality requirements and eliminate or minimize the impact of risks from logistics services or processes.

The need to integrate a multitude of activities requires quality management to focus on rapid change and flexibility in addressing the risks for the logistics organization to adapt to rapidly changing external circumstances.

## 5.4 The SERVQUAL model

In the last decade, the SERVQUAL model has been the most popular method for assessing service quality, which was first stated by Parasuraman, Zeithaml, and Berry in 1985 [67]. One of their articles, of only 14 pages, has nearly 6000 references to date [120] and the original article of 9 pages has nearly 37,000 references [67], while the improved methodology 3 years later has 40,000 [121].

The SERVQUAL model is a framework for service management [140] incorporating the core tasks of quality management with a focus on service quality. The main purpose of the SERVQUAL model is the comparison between perceptions and expectations that determine quality assessment and customer satisfaction.

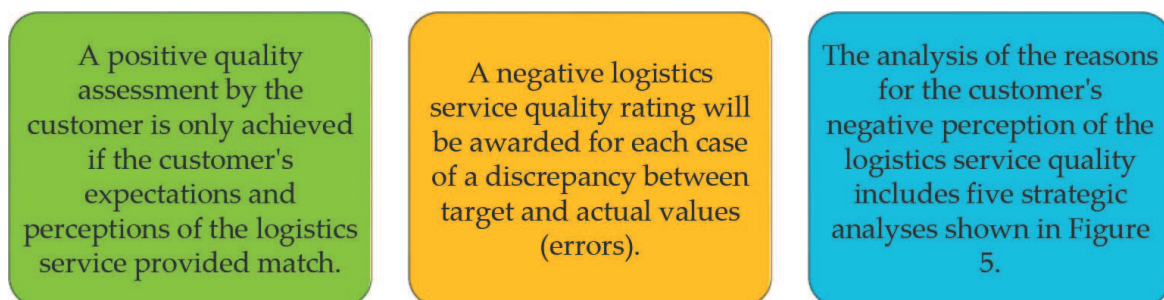
The issue at hand is to measure customer expectations of logistics services given that the manifestation of these expectations is directly dependent on how customers interpret the environmental factors influencing the formation of expectations. The problems are exacerbated by the fact that some influencing factors may be within the control of the logistics firm, and therefore predictable, but other factors, such as psychological factors, are directly dependent on the customers themselves. Thus, logistics companies are challenged to ensure a clearer picture of their customers' expectations, which can be the basis to chart a concrete path toward meeting it more fully. The SERVQUAL model may be applied to achieve this goal, which refers to the following three main postulates (**Figure 4**).

The main analyses to be performed by logistics firms when applying the model are shown in **Figure 5**.

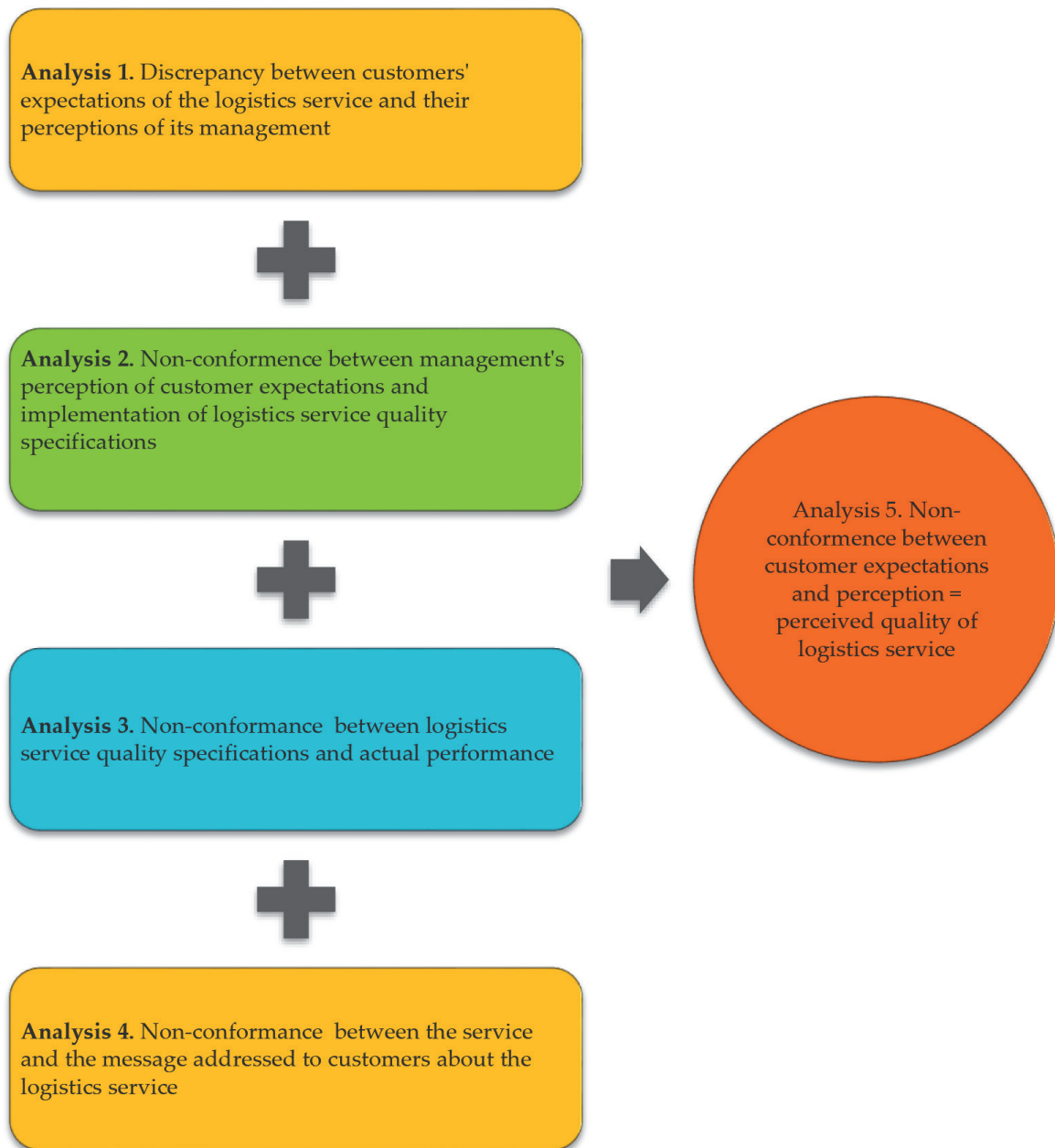
The model used to conduct the main analyses and which can be used by logistics companies are shown in **Figure 6**.

## 5.5 Contemporary aspects of service quality measurement in logistics

There are many different views on quality management in logistics. Perceptions of consistent quality in logistics services are quite different from the perspective of the activity manager and customer. Too often the quality criteria of the customer are quite different from those of those providing the logistics service. These reasons necessitate an exploration of different perspectives and appropriate means and methods to resolve the differences in these perceptions. Defining service quality is even more difficult than product quality. The main criteria for service quality are reliability and individual treatment by the organization providing them. To achieve compliance with



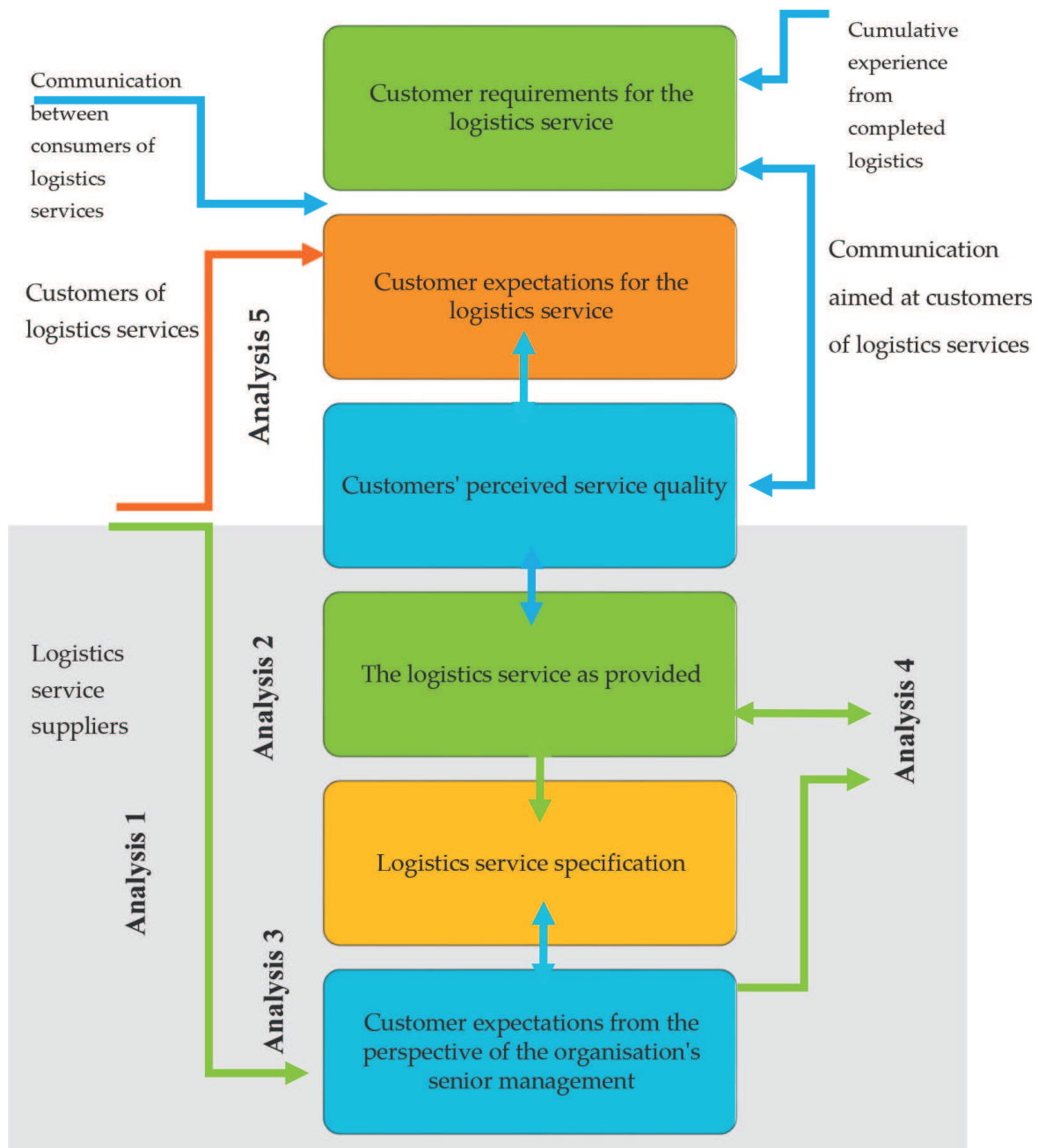
**Figure 4.**  
*Main postulates of the SERVQUAL model source: [121].*



**Figure 5.** CAP analyses of the SERVQUAL model in logistics services source: Adapted [121].

these indicators, all employees must be involved in its management to conduct the activity, which meets the customer's expectations. Unfortunately, there are fundamental differences between the ways that different departments of an organization perceive quality. The main reason for the emergence of non-conforming logistics processes is precisely this difference in perceptions of conforming quality as well as underestimation of its importance to the prosperity of the company.

The ways to solve these problems are related to effective communication and smoothing the differences between the different functional areas to achieve a service that meets the customer's needs. The task becomes more complex when you add the impact of external and internal environmental changes on the matching quality criteria for a particular supply, service, or process by regulators and stakeholders.



**Figure 6.** SERVQUAL model processes in logistics services. Source: Adapted from Parasuraman, Zeithaml, Berry [121].

## 6. Risk management in logistics

Risk management in logistics and supply chains has been studied by many researchers. Their results confirm that mitigation opportunities depend on multiple interrelated factors and each of them can be the cause of drastic risk reduction if used wisely.

Most studies agree that adequate planning for the diversity of service offerings is the critical causal factor and can unlock a series of risk mitigation responses throughout the supply chain [141–144]. The next most important cause is the flexibility of supply contracts [142, 145–148].

These major risks can be managed if, based on the cause-effect relationships between different factors, work is done to reduce the overall impact of the risk.

Risk management actions make it possible for the support function of logistics services to remain in the background and become a crucial factor for the market success of the business operation. According to Fuchs and Wohinz [149], it is also necessary to clarify that research does not often clearly distinguish between the concepts of supply chain-wide risks and logistics risks.

Risks are described as unplanned events in the scientific literature, which does not imply a lack of preparation to manage them. For supply chains, logistics risks are related to the main service objectives: the lack of appropriate and customer-required goods, in the required delivery time, in the specified location, in the required quality.

Quality management activities and their associated risks identify the likelihood of risks before they occur and may, accordingly, affect the conditional allocation of losses in advance. The costs of remediation can be summarized in three main groups:

- Financial costs: once the non-conformity has been identified and action is taken to rectify it, the logistics organization must cover any damages to the customer. Studies find that the cost of correcting non-conformities is greater than what could have been spent on prevention in the planning process. The costs of recalling products and covering all reverse logistics activities are often excluded from the selling price of logistics services and are covered by the contingency and extraordinary costs line item.
- Survival costs: in most cases, inconsistencies in processes entail, at least, legal consequences. Larger inconsistencies can be a challenge to business survival as restitution damages can drag a logistics organization into insolvency.
- Reputation costs: inconsistencies in logistics operations and processes will, in most cases, result in customer backlash and a reduction in profit to cover losses from a reduction in planned sales.

Risk minimization and opportunity identification activities can be carried out in four phases:

- Plan risk management actions by setting the risk management framework.
- Implement actions to address risks in each logistics process.
- Monitor and analyze performance management actions to minimize risks and uncover opportunities by monitoring and analyzing the strategic risk management framework.
- Continuous improvement.

Logistics risks are generally associated with disruption of the planned material flow for any period [150–152]. Unexpected events or the reasons for their occurrence affect and hinder the supply of material flows of goods at an acceptable price.

Risk management in logistics is needed as an alternative to commercial insurance in cases where insurance coverage is limited or very costly. Preventive measures to manage risks are a form of insurance applied to assumed but unspecified events for

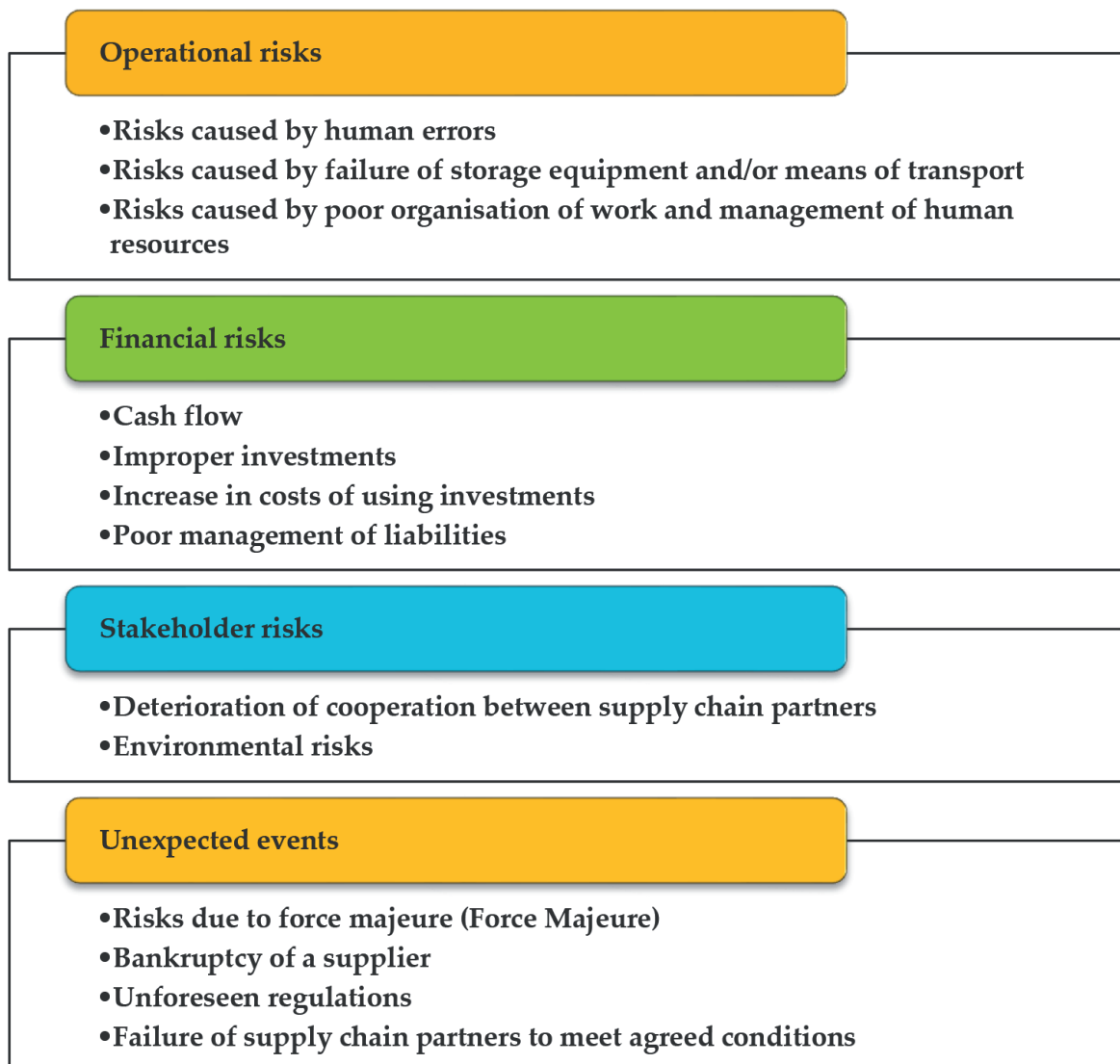


which the probabilities and financial consequences are unknown. Various authors have studied the classification of the causes of supply chain risks in particular logistics, such as Essaber and Fuchs, whose work is one of the most generalized [149, 153, 154]. Based on these studies, four main causes of risk in logistics are outlined as shown in **Figure 7**.

Operational risks are caused in the normal course of logistics operations and are often related to disruptions in the supply chain of the goods to be transported and stored [155–159]. This risk creates insurmountable conditions that make the delivery of the goods in the volume and assortment desired by the customer impossible.

Operational risks can be caused by the malfunction or insufficiency of warehouse equipment and transport vehicles and also by external factors, such as incorrect choice of transport of the supplier of goods, excessive complexity in transport routes, failure of transport infrastructure, incorrect choice of transport packaging of supplies, failures, malfunctions, and accidents during the delivery of cargo [155–158].

Financial risks have been studied in many aspects along with different ways to overcome them by researchers who consider several main causes, such as poor cash



**Figure 7.**  
*Causes of risks in logistics services.*

flow management, investments in inappropriate time periods under restrictive conditions, inflating costs for the use of investments, and falling out of interest rates that do not meet market conditions, poor management of liabilities [159]. Financial risks adversely affect the firm's overall operations and financial stability. These risks are often related to inadequate management of cash flows between organizations, excessive investments to enter new market segments, mismanagement or lack of coordination between the repayment of liabilities and expected receivables, the movement of cash between subsidiaries and related companies, sudden changes in tariff rates and tax legislation in the country of the raw material supplier.

Stakeholder-related risks stem from a deteriorating collaboration between supply chain partners. Environmental risks in logistics have the potential to negatively impact the environment [160, 161]. Stakeholder risks arise from supply chain disruption resulting from unanticipated rapid changes in the political environment and regulations, such as changes in tax rates, bans imposed by decree, embargoes, government bans and seizures, litigation, hacking, theft, and many others [162–165].

Risks associated with unexpected events arise primarily from risks posed by force majeure (e.g. natural disasters; international terrorist actions; economic crises; and port, terminal, and land border closures and strikes). The severity of the risk is calculated by the outcome of the adverse event, which often affects the financial stability of the company and its ability to deliver services, the timeliness of delivery of goods, and impairs the quality of performance of commitments made [166]. Another type of risk is the increasing degree of cooperation between supply chain partners which can make it difficult to take quick and adequate decisions due to the different interests and priorities of the partners involved. Risks that lead to a breakdown in performance can also be caused by the bankruptcy of a supplier, deterioration of quality control by the supplier, a series of planning errors, and overly complex automated decision-making systems for delivery routes. Another risk that is difficult to predict relates to the failure of supply chain partners to meet their commitments and/or agreed terms.

## **7. Conclusions**

Although many researchers support the view that logistics services complement the marketing efforts of sales organizations, there is a lack of well-founded evidence on the meaning of logistics service quality and its essential attributes for customer evaluation. Adding unobservable attributes that are essential to customers' perceived value of logistics services to the traditionally measured set of operational attributes to evaluate services. Quality management involves the management of processes in a unified system. Logistics processes require efforts to be focused on the delivery of material flows by managing the selection and supplier performance improvement to just-in-time delivery of goods and customer service.

An important condition for the measurement and analysis of quality in logistics is the determination of the appropriate attributes for its measurement and their respective weights in the complex assessment. A review of the more common attributes in the scientific literature is made, highlighting that delivery time is the most used metric and delivery delays are the most common cause of deteriorating customer satisfaction. A critical review of the main models for assessing logistics service quality is provided.

The main aspects of logistics risk management are discussed. It is found that risk reduction opportunities depend on multiple interrelated factors and each of them can be the cause of drastic risk reduction if used wisely. It focuses on the four stages that should be followed as a continuous process to minimize the negative impact of risks and identify opportunities for improvement.

Risk management in logistics and supply chains has been studied by many researchers. Their results confirm that mitigation opportunities depend on multiple interrelated factors and each of them can be the cause of drastic risk reduction if used wisely. These major risks can be managed if, based on the cause-effect relationships between different factors, work is done to reduce the overall impact of the risk.

The study focuses on the integration of quality and risk management in the supply chain to examine the theoretical and practical guidelines and address the main risks of non-compliance with the customer and legislative requirements that arise in a constantly changing external environment.

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