Chapter

Investigation of the Risks of Non-Conforming Services in Logistics: Failure Mode and Effects Analysis (FMEA)

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Abstract

After the analyses were performed using the SERVQUA model, the results were used for risk analysis (FMEA) to identify the causes, assessment, and consequences of logistics services that do not meet customer expectations. FMEA analysis was used as a method to investigate the consequences of emerging risks by quantifying the severity, likelihood of occurrence, and detection of non-conforming logistics services that further generated the RPN. Suggestions for specific actions to manage risks and opportunities that can be used for optimisation or improvement are also provided. From the analyses, it can be concluded that the main reasons for the decline in customer satisfaction are poorly managed logistics processes caused by the lack of sufficiently competent employees ready to deal with emerging risks and human errors.

Keywords: FMEA, logistics services, non-conformities, risk

1. Introduction

Although the need for risk management in logistics arises as an alternative to commercial insurance; a good practice is to adequately manage it as a form of contingency insurance in the normal practice of logistics organisations. Risk management is concerned with the development of a crisis management plan should an adverse event occur. Mikušová finds that senior management of smaller organisations is very sceptical about their ability to manage risks and consequently a crisis. Under a crisis, their solution is to dismiss employees and wait for more favourable conditions [1]. Most managers believe that preventing crises by planning specific actions in the event of an adverse event is costly and the benefits are not always proven [2–5]. Some studies have found that managers do not invest resources in crisis prevention because they believe that the crisis will, in most cases, unfold differently than their expectations [6, 7]. Other managers believe that there is no need to make such response plans [8] because their organisation is strong enough to overcome any risk and has the right strategic partner, the perfect product, or sufficient financial backing [9, 10]. A crisis

resulting from dynamic changes in the external environment has the potential to threaten the sustainability and put the survival of the company at risk [11] if adequate action is not taken to overcome it [12]. The positive impact of the analysis of potential risks to the business is the ability to uncover the means of optimising it. It should be

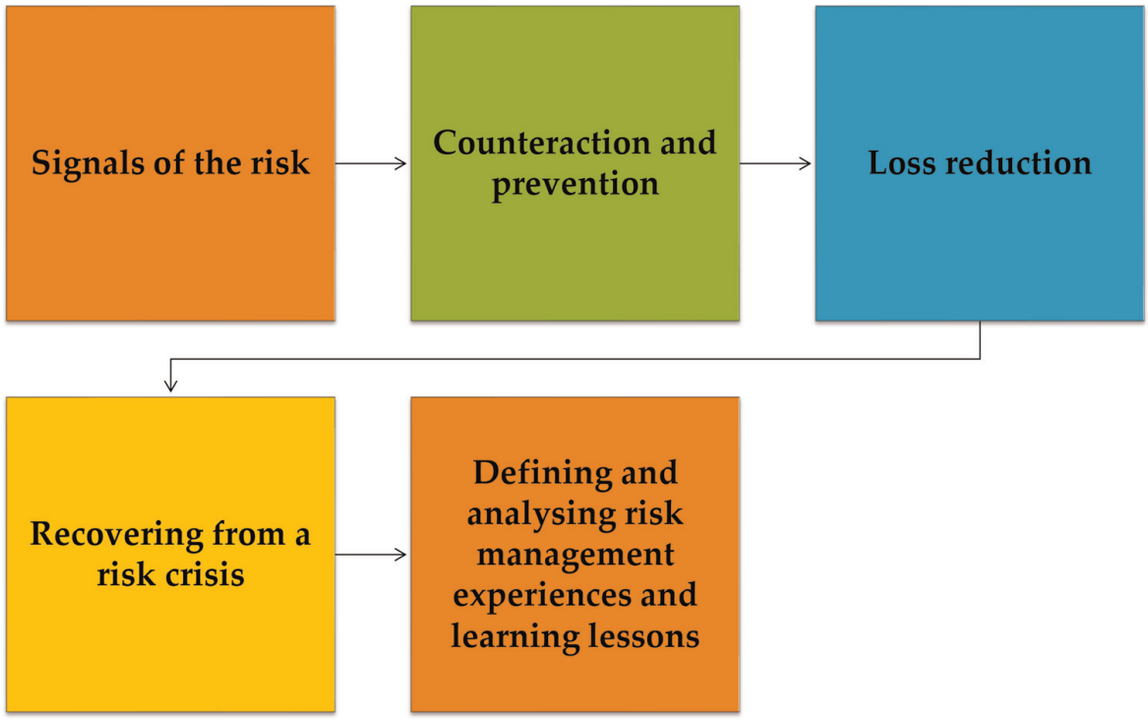


Figure 1.
Stages in crisis management (adapted from Pearson and Mitroff) [13].

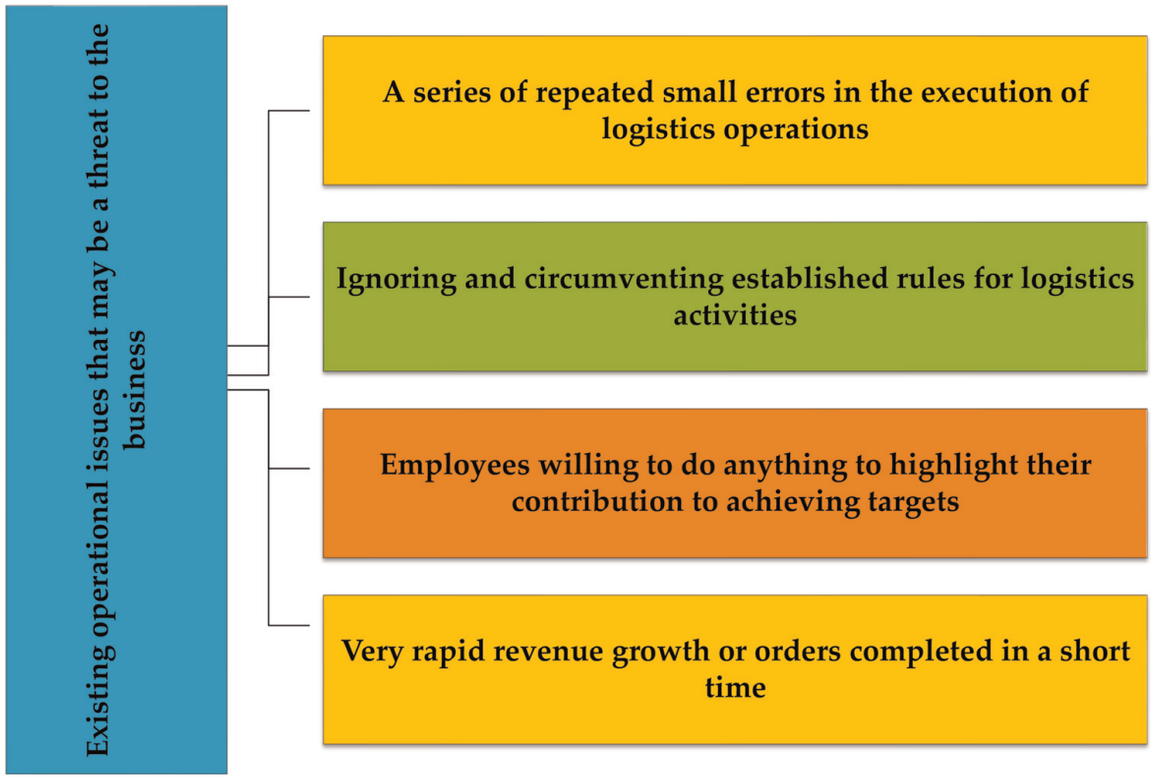


Figure 2.
Crisis warning signals (adapted from Pearson and Mitroff) [13].

noted that the causes of the same risk may be different—internal and external to the organisation. This study finds that most management crises start as small problems that are overlooked and ignored. In the longer term, these problems grow into crises that can deepen and threaten the reputation and survival of the business. To avoid this development, smouldering risks that have the potential to grow into a crisis for the business must be minimised. Several distinguishing features help to overcome and minimise risk in logistics, the most important of which is related to taking immediate measures that can jeopardise the performance of delivery contracts and unfortunately are not within the control of the logistics company. Pearson and Mitroff find that most crises go through several stages, as shown in **Figure 1** [13].

Several warning signs of major operational problems have been identified, which have the potential, in most cases, to escalate into a crisis for the business. These are presented in **Figure 2**.

2. Investigation of the risks of non-conforming services in logistics - failure mode and effects analysis (FMEA)

The risk analysis of non-compliant processes in logistics services using the FMEA analysis was conducted by the steps, shown in **Figure 3**:

2.1 Stage 1. Scoping

The main objective of scoping using FMEA analysis is to investigate the impact of risk factors that could affect the identified gaps between satisfaction and needs of customers or users of logistics services and that, as a consequence, negatively affect the financial performance of the FMCG logistics business. The results of the analysis can be used to prevent these factors from occurring or to reduce their impact and reach the required level of quality and efficiency.

The scope of the FMEA analysis includes the risk factors for the identified gaps between the satisfaction and needs of customers-users of logistics services, which directly or indirectly impact the prosperity of the organisation in the sample.

2.2 Stage 2. Define the constraints of the logistics processes and their corresponding inconsistencies

- The first set of constraints related to the application of qualitative analysis and whether there is a risk of non-compliance. Subsequently, only the identified risks are assessed, which implies that some risks are neglected.

- The second set of limitations relates to the timing of the analysis. For some risks, the estimate may be understated or overstated if the risk has a more significant short-term impact at that particular time.

2.3 Stage 3. Define and decompose the individual processes and sub-processes to be studied to obtain single components

Risk factors that can negatively affect customer satisfaction and needs can occur in any logistics service management process. Thus, we use FMEA analysis for the overall planning and management of processes related to logistics service quality

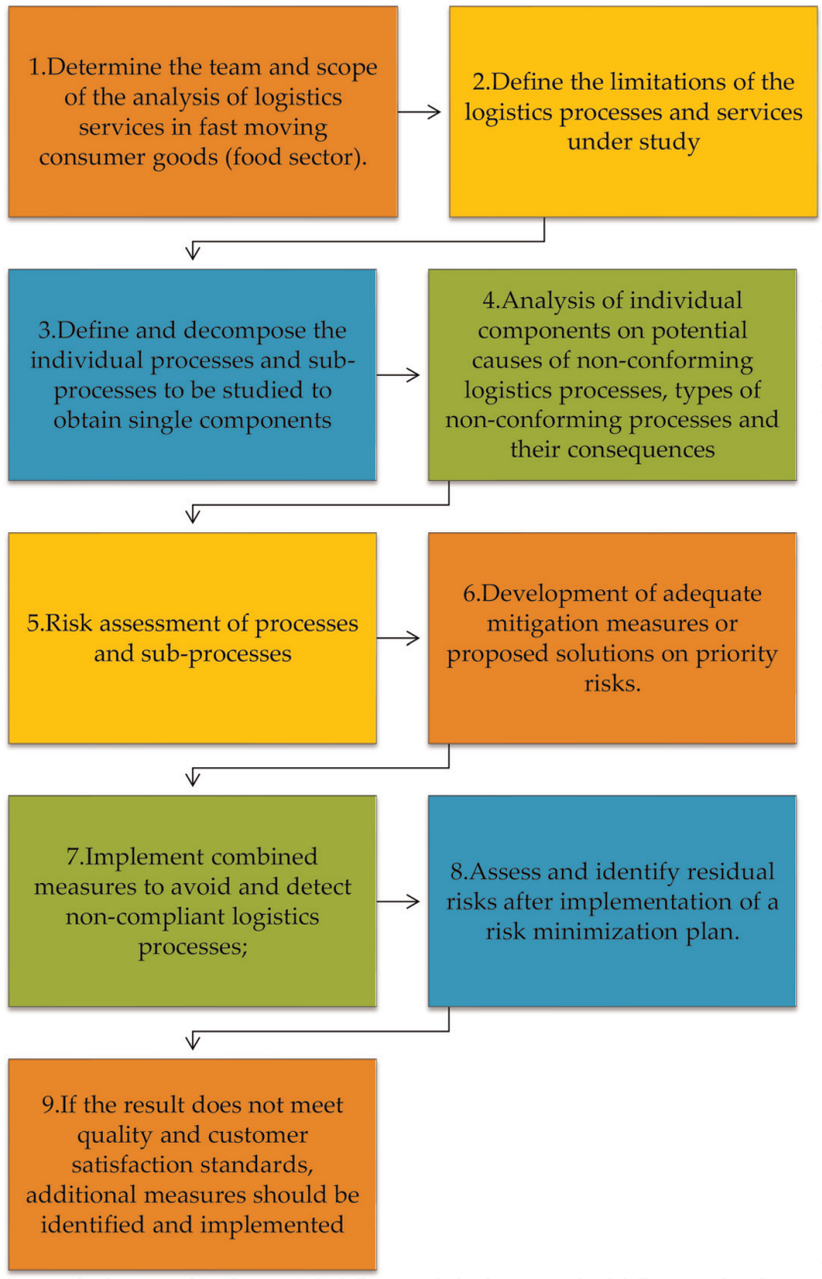


Figure 3.
Main stages of conducting FMEA in logistics services.

management. The processes for delivering customer satisfaction are divided into sub-processes and work operations. The steps of the overall process and the definition of the operations are summarised in a flowchart for greater visibility and accessibility during the analysis and are presented in **Figure 4**.

The relationships between the different units in logistics organisations are of primary importance to achieve the efficiency of any business. Within a logistics organisation, it is good practice to identify several centres of financial responsibility that aim to define the precise authority and responsibility of each unit and the strategic priorities to spend the incoming cash flows. Traditionally, four levels of financial responsibility are considered, as shown in **Figure 5**.

The financial responsibility for managing expenditure should rest with the department responsible for the entire range of services, which require the utilisation of the budget set by the higher-ups. Optimising the nomenclature of service offerings is,

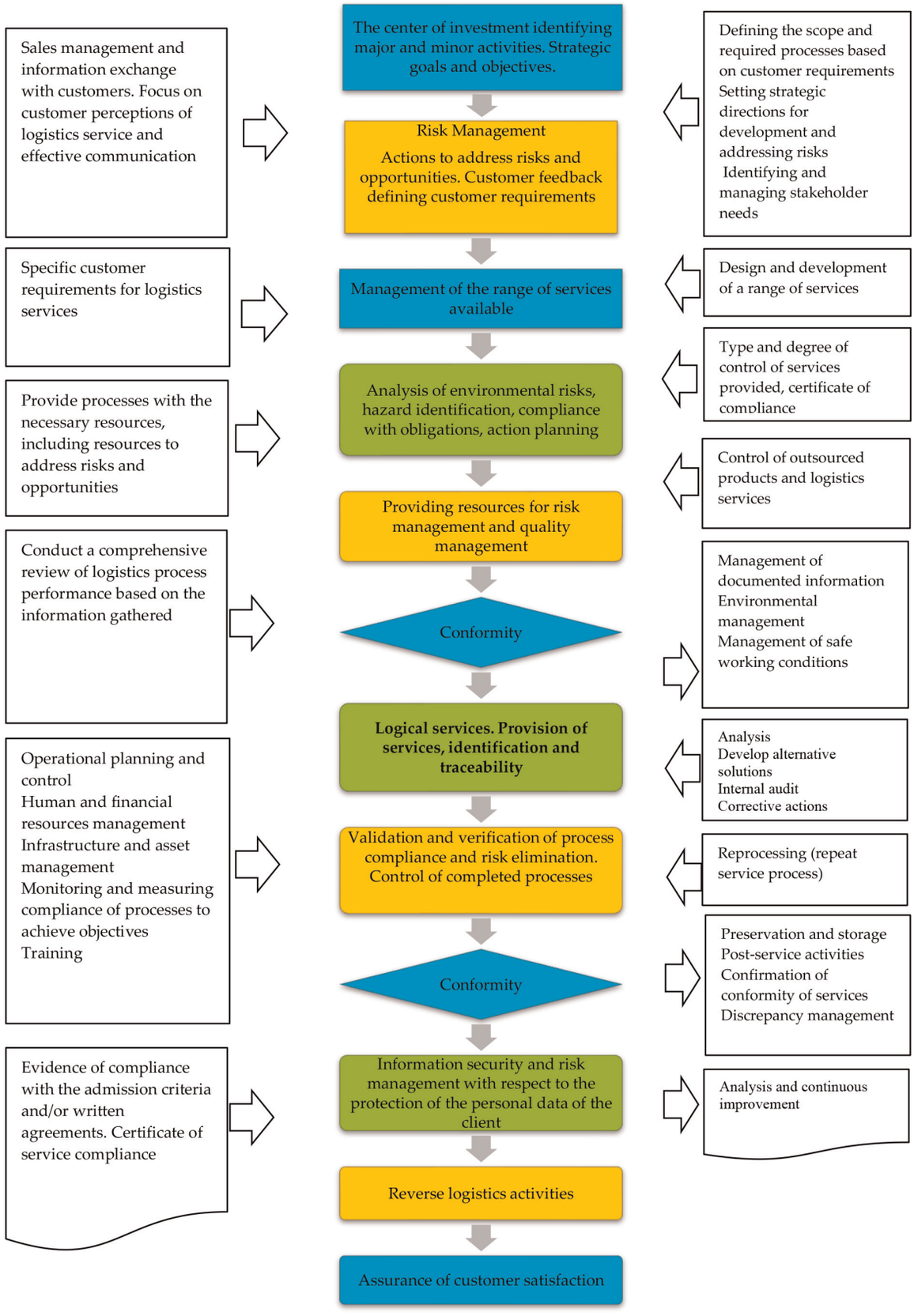


Figure 4.
Managing a compliant logistics service.

unfortunately, not in their remit, as at this level, they only implement strategic objectives. A very wide range or a rapid expansion of the logistics service portfolio is a common cause of financial insolvency for many organisations in the supply chain.

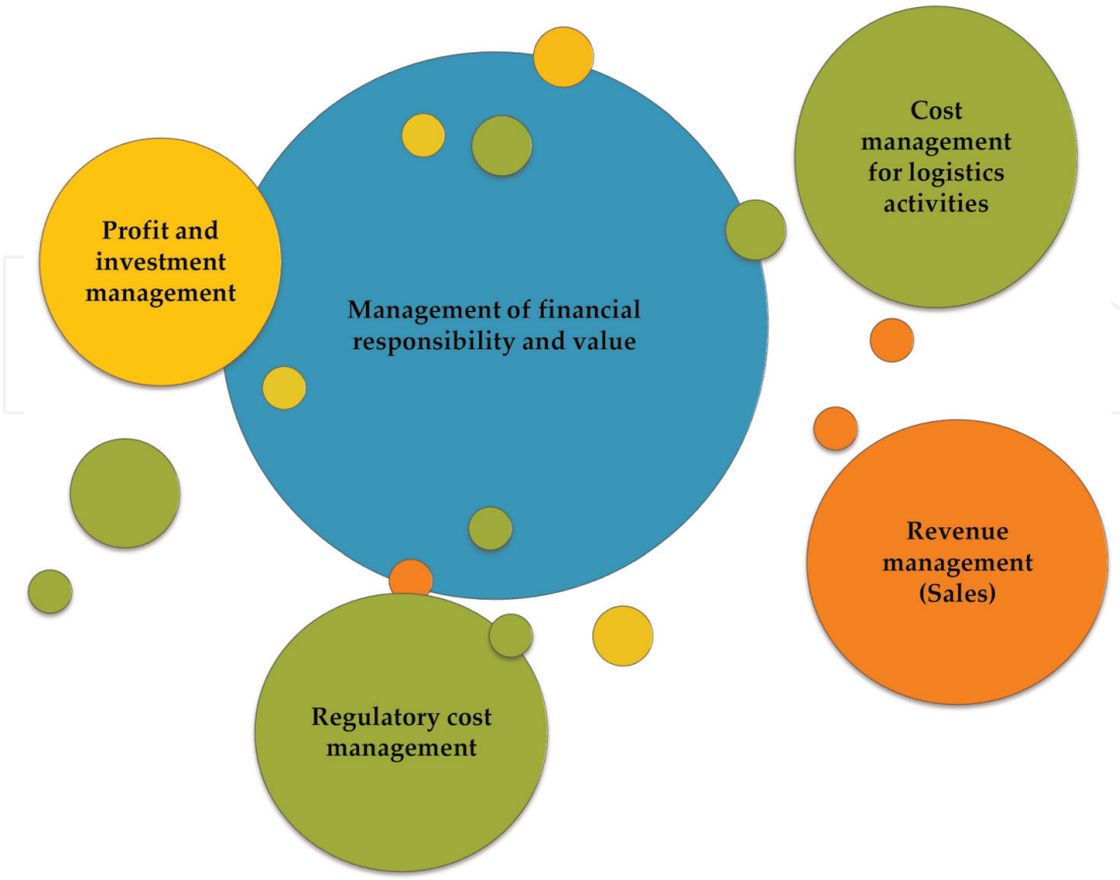


Figure 5.
Financial responsibility in logistics by department.

This is also the main reason for inconsistencies in sustainable service quality as too wide a range makes it difficult to control the activity and hinders specialisation in and improvement of the service delivery process. Management at this level is based on controlling deviations from pre-drawn higher-level budgets and the efficient use of working capital, which must be available to facilitate activity.

The financial responsibility for income management should rest with the department responsible for effective customer communication and providing the business with fresh funds to operate the organisation. Achieving compliance in the business is about building effective channels of communication and collecting receivables from customers based on sales volumes realised in value terms. The results of operations are related to the actual sales revenue collected, which is a significant contributor to the formation of profit or marginal income that is realised after deducting variable costs from the collections. In the context of quality management in logistics, this centre has the following priorities:

- Responsible for the development, implementation, and maintenance of the risk management framework.
- Presents and introduces the necessary actions to overcome risks and create opportunities.
- Undertakes specific activities to ensure organisational confidence that the logistics system can achieve intended results to improve desired trends and effects and prevent or reduce undesired trends and effects.

- Prepares information to analyse the effectiveness of actions addressing risks and opportunities and includes suggestions for improvement and risk treatment that require additional resources and (or) involve significant changes in the management of the logistics organisation's operations.

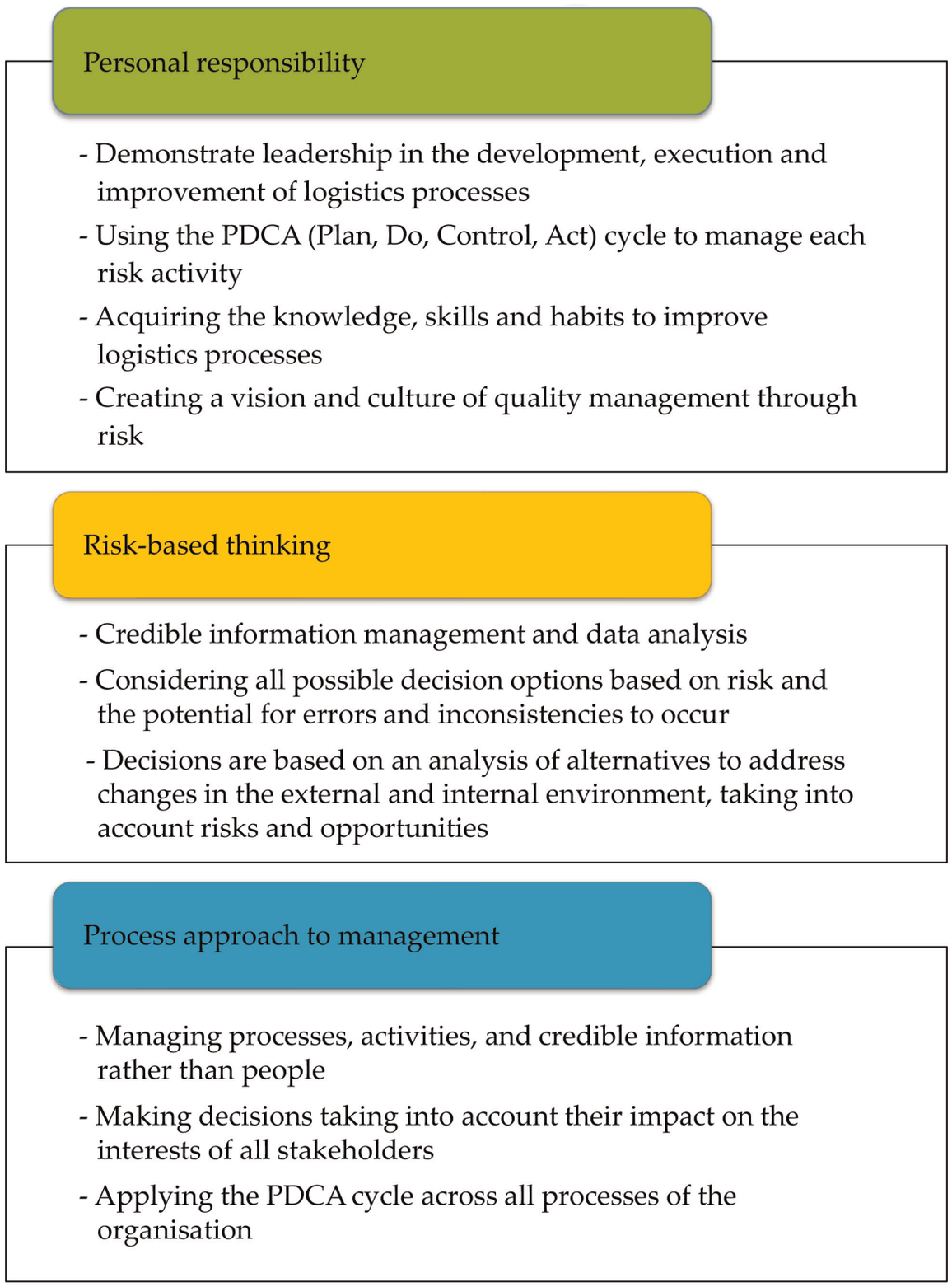


Figure 6.
Logical service quality management through leadership.

The financial responsibility for earnings management should rest with the department that has broader authority in making strategic decisions about target market definition, pricing policy, and asset management. It is good practice for this centre to make decisions on whether to outsource activities that are not typical and profitable for the organisation and hire, lease, or acquire the means of transport to perform the logistics services. It is unlikely that these centres will decide on funding sources and the basic nomenclature of logistics activities.

The financial investment management function has the greatest responsibility in the organisation and oversees the strategic effectiveness of logistics. The centre is the line decision-maker in selecting potential funding sources and determining directions, has the authority to manage assets.

The investment management department should define the risk management framework at each level of the organisation (**Figure 6**). The main aspects of focus are as follows:

- Understanding that the organisational context is the basic requirement for designing the risk management framework and defining risk levels and treatment criteria.
- Risk management principles are part of the logistics organisation's policy.
- Active internal communication between departments and control of documented information is used to communicate how risks and opportunities are being addressed.
- Adequate allocation of responsibilities and authority in actions to address risks and opportunities.
- The highest management level must ensure that:
- Risk management principles are part of the logistics service quality management policy.
- Based on its defined scope of organisational logistics activities, it formulates specific tasks to address risks and opportunities as part of the organisation's performance indicators.
- The defined framework and allocated responsibilities and powers are adequate to manage the framework.
- The resources provided and secured in the logistics activity to address risks and opportunities are adequate to the size and magnitude of the risks managed.
- Effective communication is applied to explain benefits and uncover beneficial opportunities in the interest of all stakeholders.
- Adequate actions are implemented to address quality management risks.

3. Actions to address risks and opportunities

Actions to address risks and opportunities are part of the logistics decision-making process at every level of the organisation and are a fundamental mechanism for

quality improvement and management. The risks studied by the experts are labelled from F1 to F100 and acquire different numerical values according to the methodology set out in Chapter 2. The results of stages 4–8 are tabulated and included in Section 3.1 of the study.

3.1 Risk analysis of inefficient process management and human resource management

Shortage of human resources (F4) and lack of skills (F1), experience, and competence in logistics have been identified as two key factors contributing negatively to competitive advantage [14–18]. Along with these key factors, we witness increased staff turnover (F2) due to insufficient material incentives and management [19, 20]. First, to analyse the risk of process and human resource management, the study identifies how perceived problems, uncertainties, trends, and solutions are handled in the daily employee management during process management. The risks (F1 to F10) listed in the following tables and graphs provide a basis for further building plans to minimise or manage them in the field of real logistics. Very often, these risks are ignored by the management of the logistics company and subsequently become the cause of the shrinking or increasing losses of the activity. The risk associated with the lack of skilled labour [21] should be addressed by increasing the effectiveness of training (F3). Training programmes should be tailored to the different levels of staff competence attained [22, 23]. However, according to the experts involved in the study, it is often schematic and too general, and without a specific focus on the real problems arising in day-to-day work. The risks are magnified and exacerbated when company management does not provide a sufficient budget for staff training. In the wake of the pandemic, which necessitated social distance and limited commuting activities, logistics firms faced the challenge of dealing with reduced or limited human resources due to staff morbidity (F6). Evidently, emerging risks are related to a lack of professional interest, motivation to perform [24] and complete tasks, and mismatch between the employee's and the organisation's goals. Many researchers have proposed specific models for their management, including McAfee, Kilibarda, Anastasia, Kompf, Kanev, and others [25–31]. The main implications of risks related to process management and human resource management are summarised in **Table 1**.

Consequences	Initial PRN (Figure 7)					Actions to manage risks and opportunities	Residual PRN (Figure 8)				
	No	T	B	O	PRN		No	T	B	O	PRN
The absence of staff competence to perform a specific assigned task	F1	9	7	8	504	Periodic analysis and review of staff competency requirements	F1	9	5	8	360
Increasing staff turnover	F2	6	6	4	144	Improve the recruitment process (recruitment of trainees)	F2	6	4	5	120
Reducing the effectiveness of training	F3	9	6	6	324	Expansion of programmes and forms of training.	F3	9	3	6	162
Shortage of personnel to meet the requirements associated with the task.	F4	9	7	7	441	Improve the recruitment process (recruitment of trainees)	F4	9	6	7	378

Consequences	Initial PRN (Figure 7)					Actions to manage risks and opportunities	Residual PRN (Figure 8)				
	No	T	B	O	PRN		No	T	B	O	PRN
Lack of budget for staff training.	F5	5	8	3	120	Annual budget planning	F5	5	6	3	90
Temporary physical and mental disability of the employee	F6	6	6	2	72	Conduct preventive health check-ups	F6	6	5	2	60
Lack of professional interest and motivation to perform and complete the task	F7	7	4	9	252	Improved staff motivation system; Improved staff appraisal process	F7	7	3	9	189
Misalignment between the employee's personal goals and the organisation	F8	7	5	5	175	Career growth planning; Improving working conditions	F8	7	5	2	70
The appearance of conflict in the performance of assigned work	F9	7	5	6	210	Improved staff appraisal process.	F9	7	5	5	175

Table 1.
Risk analysis in process management and human resource management.

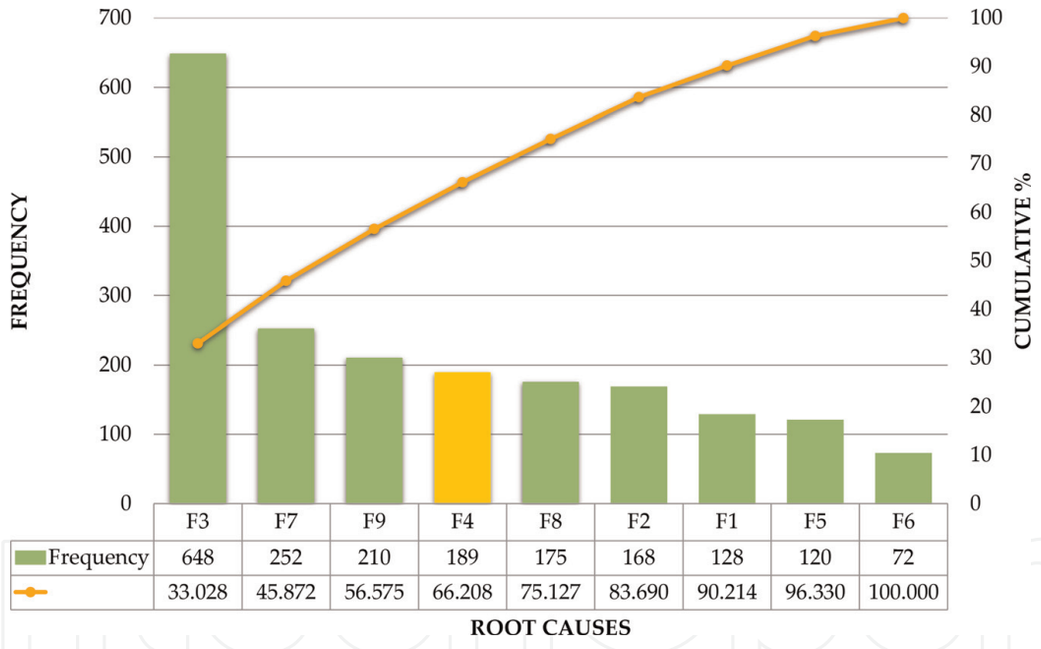


Figure 7.
Pareto analysis of initial PRN from F1 to F9.

In the analysis, the risk factor rated as the highest priority risk was the absence of staff competency to perform a specific assigned task (504) and after taking risk management actions, the risk of the residual PRN decreased (360). The new priority risk is to improve the process for searching and recruiting staff with PRN (378).

4. Analysis of risks associated with maintaining infrastructure and equipment

Logistics organisations must daily minimise the risk and impact of unforeseen damaging events associated with maintaining infrastructure and equipment. It does not

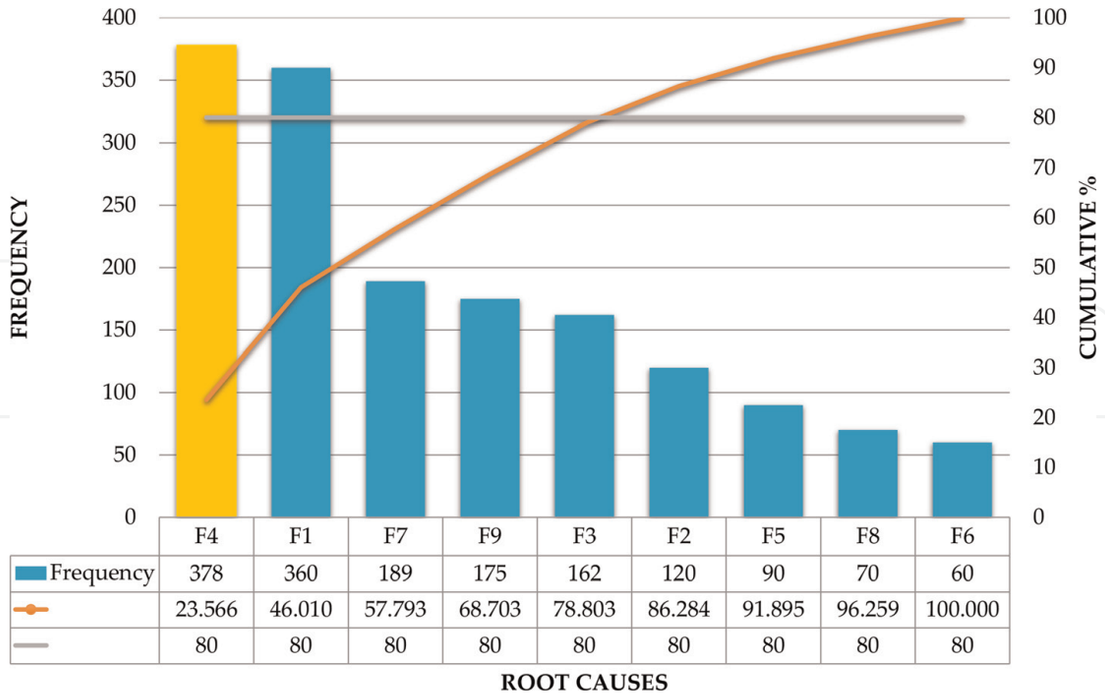


Figure 8.
Pareto analysis of residual PRN from F1 to F9.

need to be proven that a damaged transport vehicle could not complete the delivery. Therefore, various events, as well as inconsistent logistics and transport processes, may contribute to a deterioration in the quality of logistics services. Many researchers recommend various programmes or specific actions to minimise this risk [32, 33]. One potential solution is to implement an incentive model that can be utilised for scenario-based collaborative risk management [34, 35]. The main risks associated with infrastructure and equipment maintenance management are summarised in **Table 2**.

Consequences of risk	**Initial PRN (Figure 9)**					**Actions to manage risks and opportunities**	**Residual PRN (Figure 10)**				
	No	**T**	**B**	**O**	**PRN**		**No**	**T**	**B**	**O**	**PRN**
Failure of equipment or inadequate conditions for storage activities and infrastructure	F10	9	6	5	270	Improving the planning of repair and maintenance activities	F10	**8**	**3**	**5**	**120**
Failure to meet the schedule for infrastructure maintenance	F11	**8**	**4**	**5**	**160**	Establishing workable equipment maintenance schedules in coordination with external suppliers	F11	7	**3**	**4**	**84**
Failure to meet the repair schedule due to lack of qualified persons	F12	**8**	**5**	**6**	**240**	Increasing the competence of the staff carrying out the repair work or selecting a new provider for these services	F12	7	5	5	**175**
Shortage of material resources (technical equipment for the implementation of the process)	F13	**9**	**8**	**6**	**432**	Resource planning and improvement of technical equipment	F13	5	5	**6**	**150**

Consequences of risk	Initial PRN (Figure 9)					Actions to manage risks and opportunities	Residual PRN (Figure 10)				
	No	T	B	O	PRN		No	T	B	O	PRN
Repetitive failures, repetitive repairs	F14	6	7	5	210	Adjustment of the depreciation plan and life of the equipment	F14	6	4	4	96

Table 2.
Analysis of risks related to infrastructure and equipment maintenance.

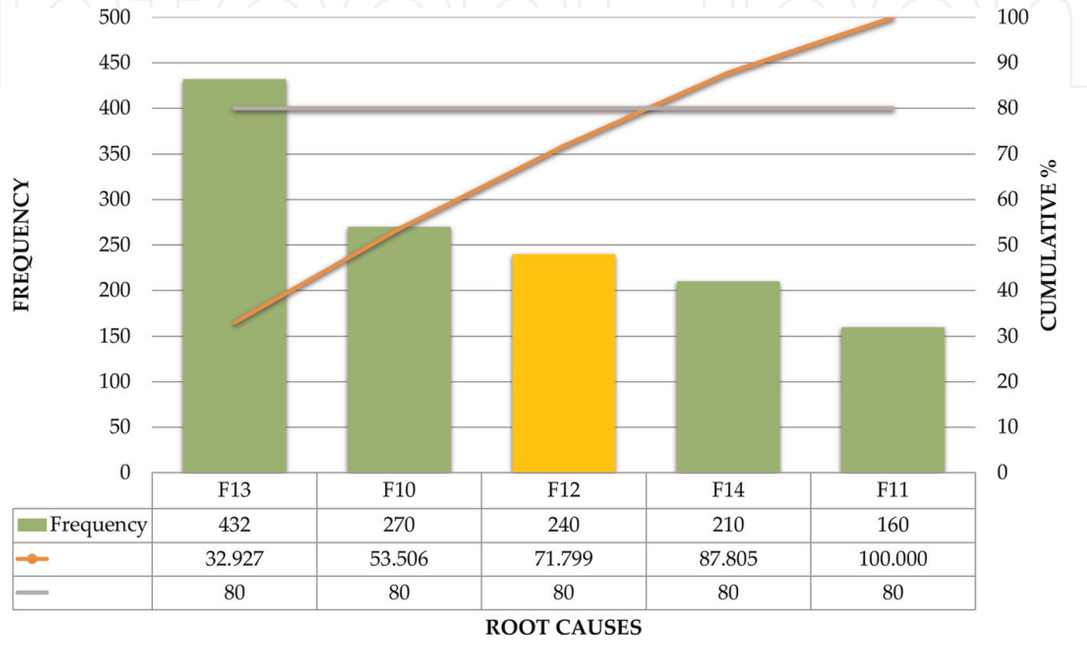


Figure 9.
Pareto analysis of initial PRN from F10 to F14.

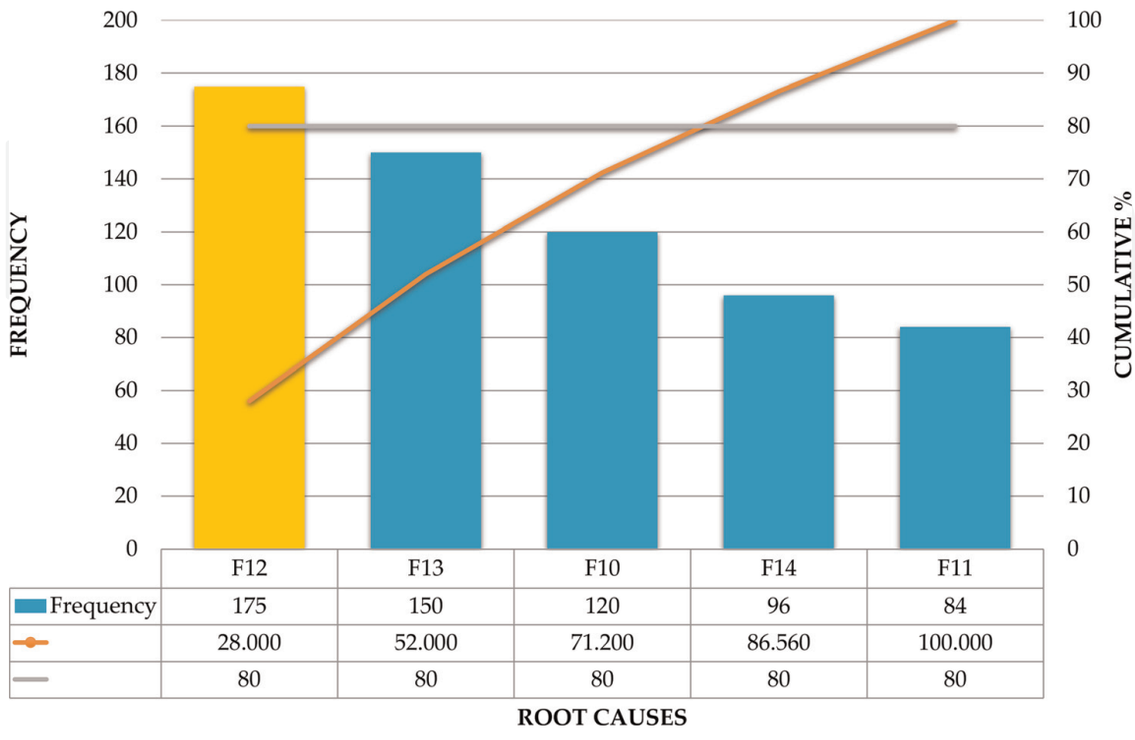


Figure 10.
Pareto analysis of residual PRN from F10 to F14.

In the analysis, the risk factor assessed with the highest priority risk was a shortage of material resources to perform the process (432) and after taking the risk management actions, the residual PRN has decreased to 150. The new priority risk is from failure to meet the schedule for repairs due to a lack of skilled personnel (PRN 175).

5. Managing risks associated with process control, monitoring, and measurement tools

Almost every logistics activity involves inventory management and inventory control. This necessitates the use of various monitoring and measurement tools that are affordably reliable to accurately account for the monitored items. The main activities involving monitoring and measuring tools are counting stock and collecting information on quantities of goods ordered, on hand, and dispatched. Some of the commodities handled in logistics must be stored under certain temperature and humidity conditions. Undoubtedly, if the measuring equipment did not correctly report these parameters and action was not taken when deviations from these parameters occurred, the company would suffer huge losses. The decision on what constitutes the appropriate means of measurement is based on each activity. Even when the means of measuring temperature is sufficiently reliable, it may not be suitable for the usage conditions. For example, thermometers that monitor temperature fluctuations in storage conditions in vehicles are not suitable for use in storage areas. The most complex task associated with measurement tools for inventory management is the purchase of a good data management system [36, 37] that processes the transaction data and generates reports and analyses in real time [38]. Many studies solve this problem; some researchers have also studied the existing inventory and stock management systems with their advantages and disadvantages [39–42, 43]. Choosing the right measurement tool for stock and inventory can help to improve the efficiency and execution of timely deliveries [44] while fully utilising the capacity of the delivery vehicle and warehouse. The main risks are maintaining optimal inventories under dynamically fluctuating order and delivery schedules [45–47], managing stock build-up in the warehouse as a result of fluctuations in demand [48], inadequate performance of logistics services when warehouses and transport facilities are not fully utilised [49], and containers for international transport [50]. The utilisation of full vehicle capacity deteriorates due to poor demand planning if the vehicle is empty in one direction for longer distance deliveries [51]. An interesting study by Wantanakomol optimises the decisions taken related to the sizing of delivery batches according to demand forecasting and inventory level [52].

Table 3 summarises the main risks of inefficient process management and management of monitoring and measurement tools.

Consequences	**Initial PRN (Figure 11)**					**Actions to manage risks and opportunities**	**Residual PRN (Figure 12)**				
	No	**T**	**B**	**O**	**PRN**		**No**	**T**	**B**	**O**	**PRN**
Control, monitoring and measurement error (biased control)	F15	**6**	**8**	**4**	**192**	Improve methods for identification and verification of measuring equipment	F15	**6**	**7**	**4**	**168**

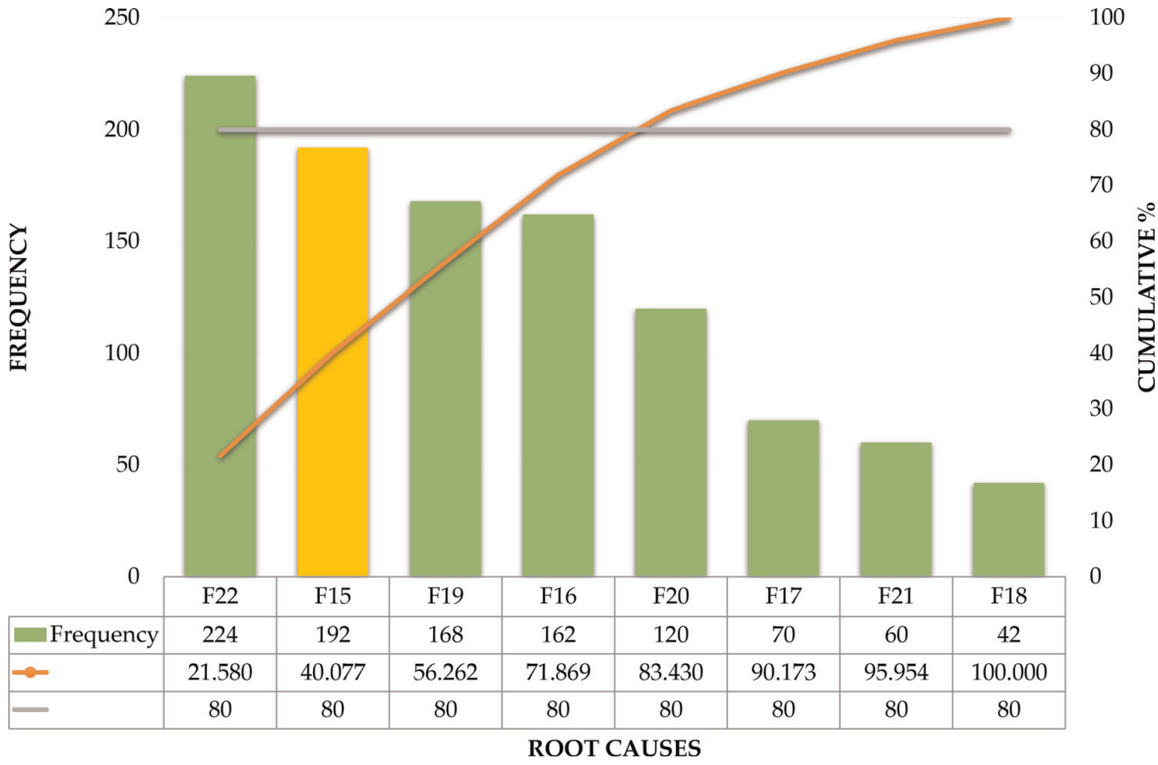
Consequences	Initial PRN (Figure 11)					Actions to manage risks and opportunities	Residual PRN (Figure 12)				
	No	T	B	O	PRN		No	T	B	O	PRN
Performing control with untested or uncalibrated measuring equipment (biased control)	F16	**9**	**6**	**3**	**162**	Periodic review of monitoring and measurement techniques and methods	F16	5	4	3	**60**
Measurement uncertainty (high uncertainty of process measurement)	F17	7	5	2	**70**	Improve methods for identification and verification of measuring equipment	F17	7	3	2	**42**
Failure to comply with measurement conditions (temperature range, humidity)	F18	7	3	2	**42**	Improve methods for identification and verification of measuring equipment	F18	7	3	2	**42**
Incorrect interpretation of measurement results	F19	7	4	6	**168**	Improve competence of those carrying out monitoring and measurement	F19	7	4	3	**84**
Damage to measuring equipment during the measurement	F20	5	3	8	**120**	Availability of spare measuring equipment	F20	5	3	4	**60**
Damage to measuring equipment during transportation	F21	5	4	3	**60**	Periodic monitoring of ME storage and transport conditions	F21	5	4	3	**60**
Metering equipment failure incidents	F22	7	4	8	224	Occupational safety compliance programmes	F22	7	4	5	**140**

Table 3.
Risk analysis of inefficient process management: management of monitoring and measurement tools.

In the analysis, the risk factor assessed with the highest priority risk was incidents related to meter equipment failure (224), after taking the actions to manage the risk the residual PRN has decreased (140). The new priority risk is control, monitoring, and measurement Error (biased control) with a PRN of 168. Decisions to purchase new and more appropriate controls and process management software must be made considering the potential benefits, to the logistics firm and its customers, from the joint use of inventory control and warehouse management system in constrained systems.

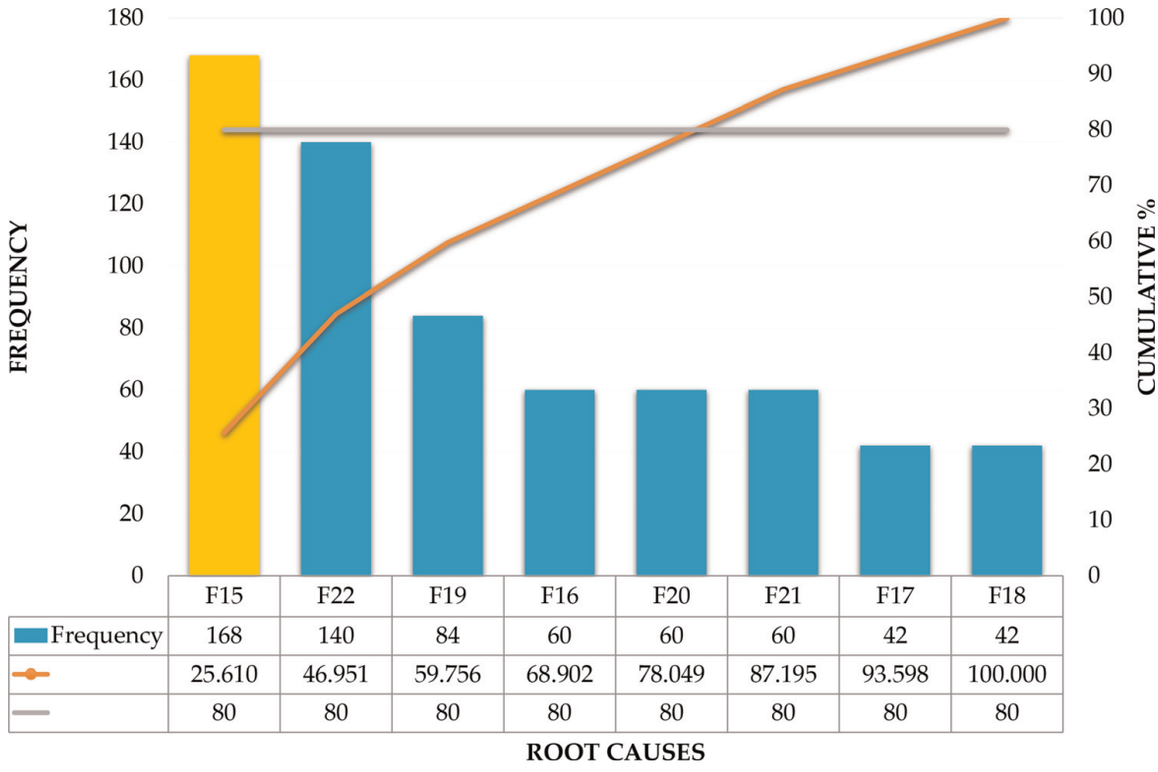
6. Risk management of organisational knowledge

Organisational knowledge management risks arise from the contradiction that organisational knowledge is acquired, developed, and can be disseminated by employees, and logistics organisations can only create the necessary condition for defining, expanding, and protecting the malicious leakage of this knowledge. Nonaka has made great progress in defining a framework for organisational knowledge creation, which has been referenced by others 28,000 times [53]. Many researchers have conducted and, consequently, published studies on the positive effect in the



	F22	F15	F19	F16	F20	F17	F21	F18
Frequency	224	192	168	162	120	70	60	42
	21.580	40.077	56.262	71.869	83.430	90.173	95.954	100.000
	80	80	80	80	80	80	80	80

Figure 11.
Pareto analysis of initial PRN from F15 to F22.



	F15	F22	F19	F16	F20	F21	F17	F18
Frequency	168	140	84	60	60	60	42	42
	25.610	46.951	59.756	68.902	78.049	87.195	93.598	100.000
	80	80	80	80	80	80	80	80

Figure 12.
Pareto analysis of residual PRN from F15 to F22.

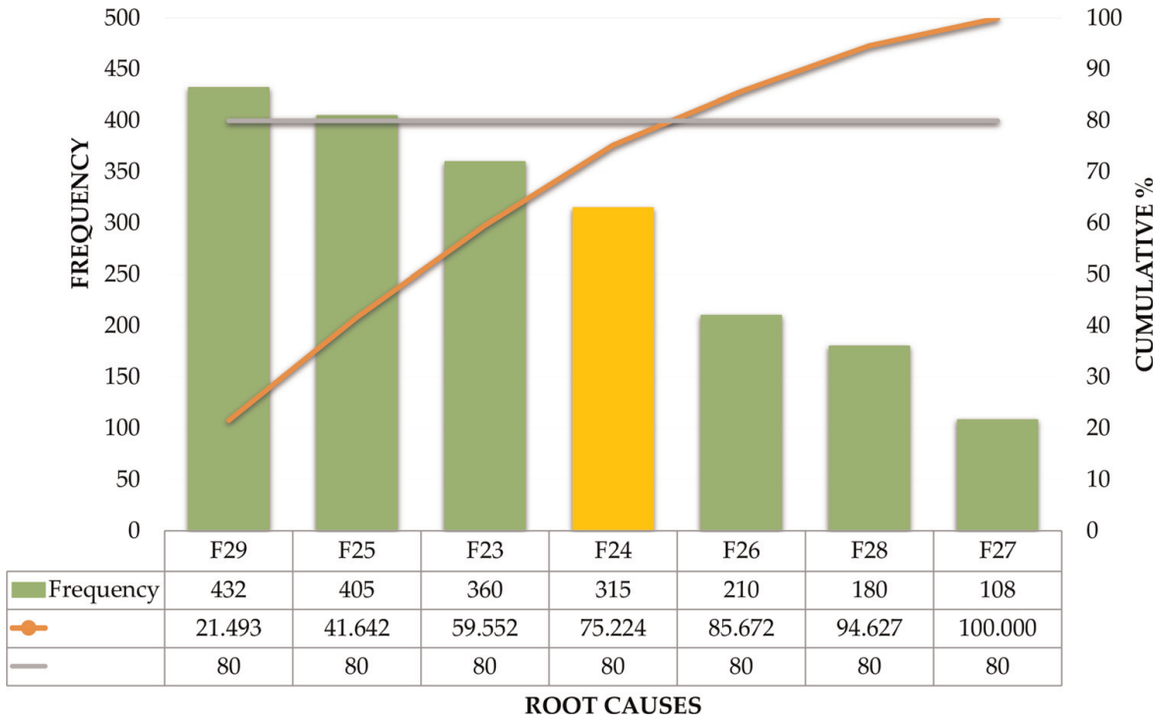
management of knowledge sharing but the negative effect of knowledge leakage, including knowledge in the management of logistics processes, are still not adequately studied. There has been extensive research on the impact of protecting knowledge and

information by developing a portfolio of measures [54–58]. A summary of the risks of ineffective management of the organisational knowledge management process is presented in **Table 4**.

Experts assigned the highest priority risk scores to two factors—lack of information to analyse the problem and use of incomplete information from the organisation's database. After actions were taken to manage the risk, the residual PRN decreased from 405 to 225 for the first factor and 432 to 288 for the second. Despite the actions and measures taken to manage risks, the risk factors of not having information to analyse the problem and using incomplete information from the organisation's database remain at a high level, which requires these factors to be monitored as a priority in the future. Minimising the risk of organisational knowledge leakage is essential for any logistics firm as a key factor in maintaining the organisation's competitive advantage.

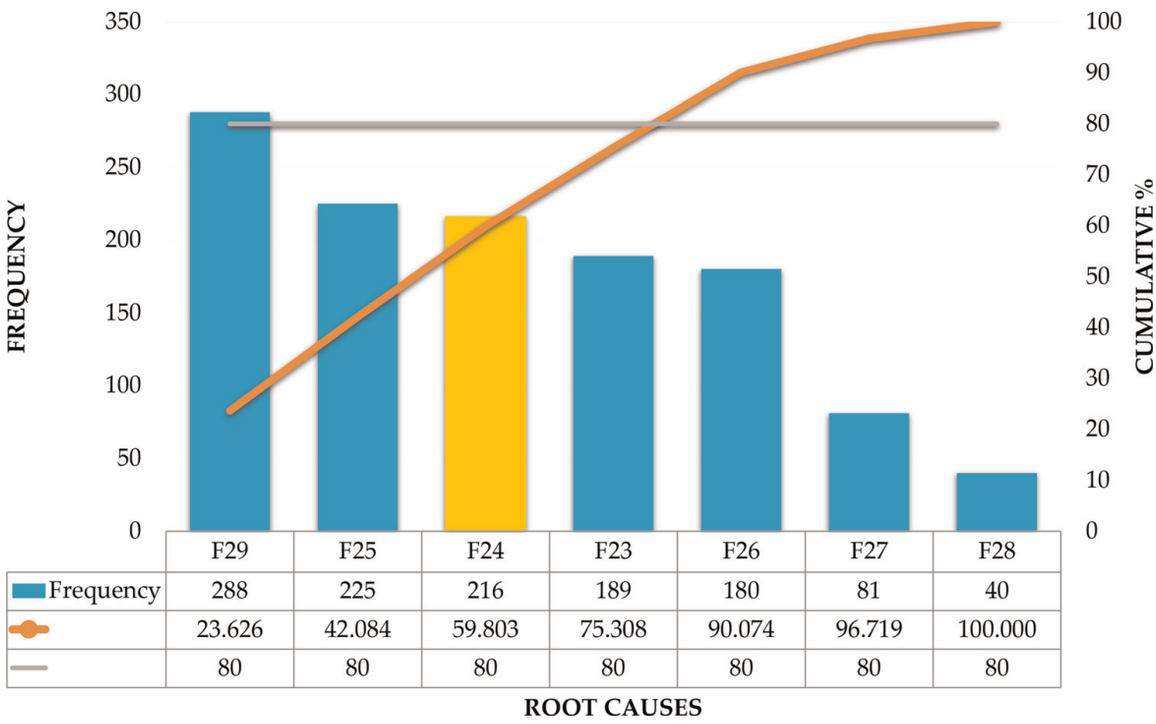
Consequences	Initial PRN (Figure 13)					Actions to manage risks and opportunities	Residual PRN (Figure 14)				
	No	T	B	O	PRN		No	T	B	O	PRN
Leakage of information from the organisation's database.	F23	9	5	8	360	Increase the organisation's information security, implement ISO/IEC 27001:2013.	F23	9	3	7	189
Dissemination of false information within the organisation	F24	9	5	7	315	Preparation and periodic updating of the list of the organisation's information assets	F24	9	4	6	216
Lack of information to analyse the problem.	F25	9	5	9	405	Involve experts to develop the database in the organisation	F25	9	5	5	225
Lack of information needed to solve the problem.	F26	10	7	3	210	Improve the system for collecting and analysing data from external sources	F26	10	6	3	180
Deliberate dissemination of inapplicable information and knowledge within the organisation.	F27	9	4	3	108	Conduct an expert assessment of the currency, completeness, and order of information from the organisation's banking sources	F27	9	3	3	81
Unauthorised use and dissemination of information in the organisation's knowledge base.	F28	9	5	4	180	Increase motivation through information security training in the organisation	F28	5	2	4	40
Use of incomplete information from the organisation's database.	F29	9	8	6	432	Conduct expert assessment of the update, completion, and order of use of information from the organisation's banking sources; Conduct expert assessment and document control prior to approval.	F29	6	8	6	288

Table 4.
Ineffective process management.



	F29	F25	F23	F24	F26	F28	F27
Frequency	432	405	360	315	210	180	108
	21.493	41.642	59.552	75.224	85.672	94.627	100.000
	80	80	80	80	80	80	80

Figure 13.
Pareto chart analysis of initial PRN from F23 to F29.



	F29	F25	F24	F23	F26	F27	F28
Frequency	288	225	216	189	180	81	40
	23.626	42.084	59.803	75.308	90.074	96.719	100.000
	80	80	80	80	80	80	80

Figure 14.
Pareto chart analysis of residual PRN from F23 to F29.

7. Management of documented information

Achieving quality in logistics operations requires documented information on the status of the units to be managed at each stage of the process and transport of goods between logistics warehouses. This flow of information becomes larger and more

complex as the product physically approaches the end user. In recent years, with the free movement of goods, the required information documentation accompanying the goods has become more detailed and voluminous. Many researchers have explored the strategic potential of effective interaction between logistics and information technology for customer value creation and process performance management [59–64]. Some researchers have also proposed specific models to manage and promote the implementation of an effective sustainability risk management system in the logistics network [56, 65–68]. These prerequisites create risks that must be managed to prevent the destruction, total loss, or tampering of documented information between logistics operators and manufacturers or customers. The most significant risk, identified by the experts involved in the study, was the inconsistencies related to the complexity of the requirements or the competence of the staff to process them and the loss of documented information during the execution of logistics activities. The increased risk of loss of transport documents has been investigated by several researchers, some of whom have suggested specific improvements to minimise this impact [69–73]. Achieving a higher quality of logistics services can be sought through the creation of an adequate documented information management system, which has the potential to contribute and solve the ongoing tasks of delivering various goods just in time and prevent and reduce possible logistics loss risks in the future. **Table 5** presents the results of the risk analysis related to the ineffective management of documented information.

In the analysis conducted, the risk factor rated with the highest priority risk was the loss of documented information (504); after actions were taken to manage the risk, the residual PRN decreased (324). The new priority risk is a breach of confidentiality of documented information with PRN (378).

Consequences	Initial PRN (Figure 15)					Actions to manage risks and opportunities	Residual PRN (Figure 16)				
	No	T	B	O	PRN		No	T	B	O	PRN
Incorrect or incomplete completion of record forms.	F30	9	6	4	216	Timely updating and programming of documented information	F30	8	5	4	160
Records management errors.	F31	6	5	4	120	Control of training on documented information	F31	4	5	4	80
The use of outdated documented information (including that of external origin).	F32	9	8	4	288	Improve methods for managing documents of internal and external origin, including search engines	F32	8	8	4	256
Inconsistency in documented staffing, competency, and/or complexity of requirements.	F33	9	6	5	270	Increase information security in accordance with ISO 27001:2013 requirements	F33	9	5	5	225
Lack of access to the full set of documents at the point of use.	F34	9	7	7	441	Preparation and periodic updating of the list of the organisation's information assets	F34	9	6	3	162
Delayed receipt of documented information.	F35	9	8	7	504	Prepare and periodically update the organisation's information assets	F35	9	6	6	324

Consequences	Initial PRN (Figure 15)					Actions to manage risks and opportunities	Residual PRN (Figure 16)				
	No	T	B	O	PRN		No	T	B	O	PRN
Lack of documented information.	F36	9	6	5	270	Timely software and database updates	F36	9	5	5	225
Loss of documented information	F37	9	7	5	315	Improving document management methods	F37	9	7	3	189
Breach of confidentiality of documented information.	F38	9	8	6	432	Increase motivation through information security training in the organisation	F38	9	7	6	378

Table 5.
Management of documented information.

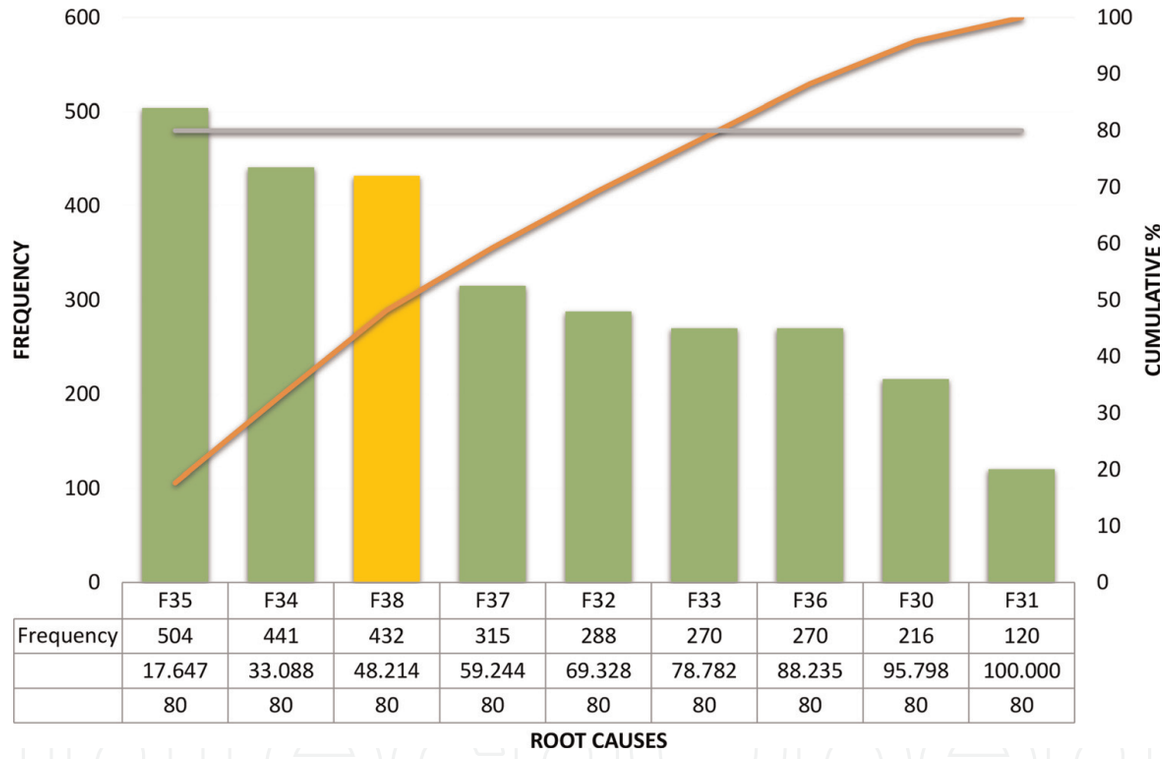


Figure 15.
Pareto analysis of initial PRN from F30 to F38.

8. Ineffective process management: marketing (including customer communication)

The link between logistics activities and marketing must be made in line with the decision-making for each specific logistics service. Marketing activities are linked to decision-making not only on how to deliver the products but also the choice of the types of outlets where the products will be delivered and the form in which sales will take place. Particular attention should be paid to promotional activities. Internet commerce has developed at a significant pace in recent years, which has also allowed potential business opportunities to grow. The policy chosen for the distribution of

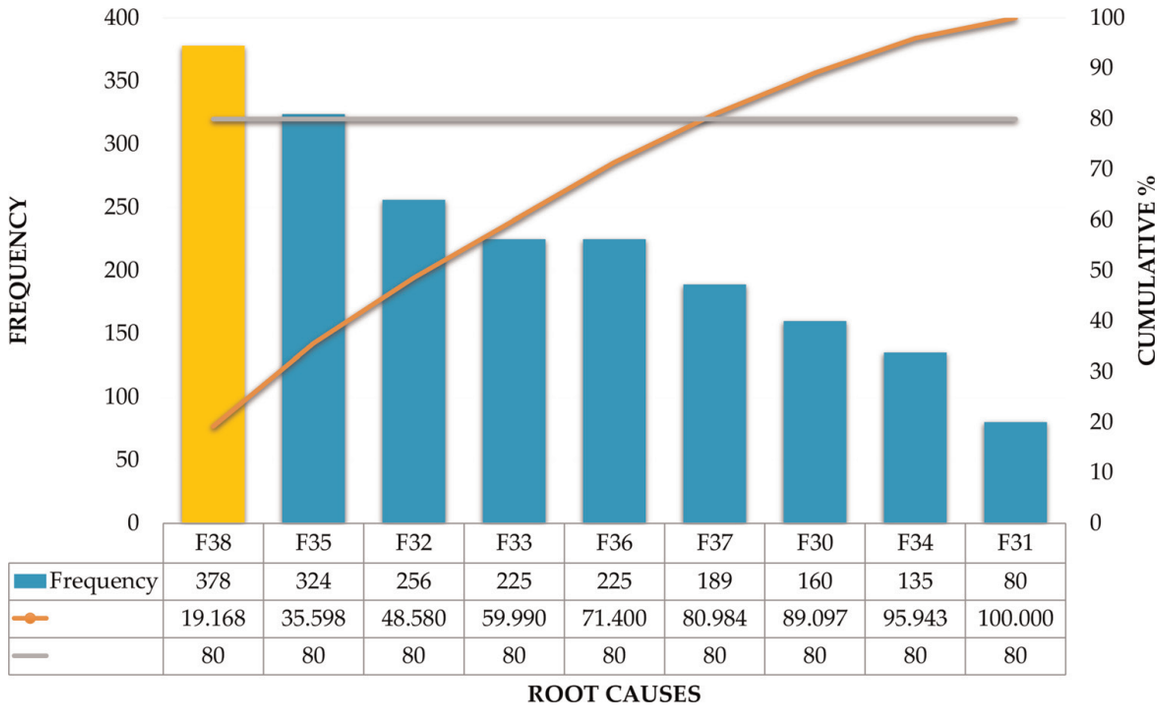


Figure 16.
Pareto analysis of residual PRN from F30 to F38.

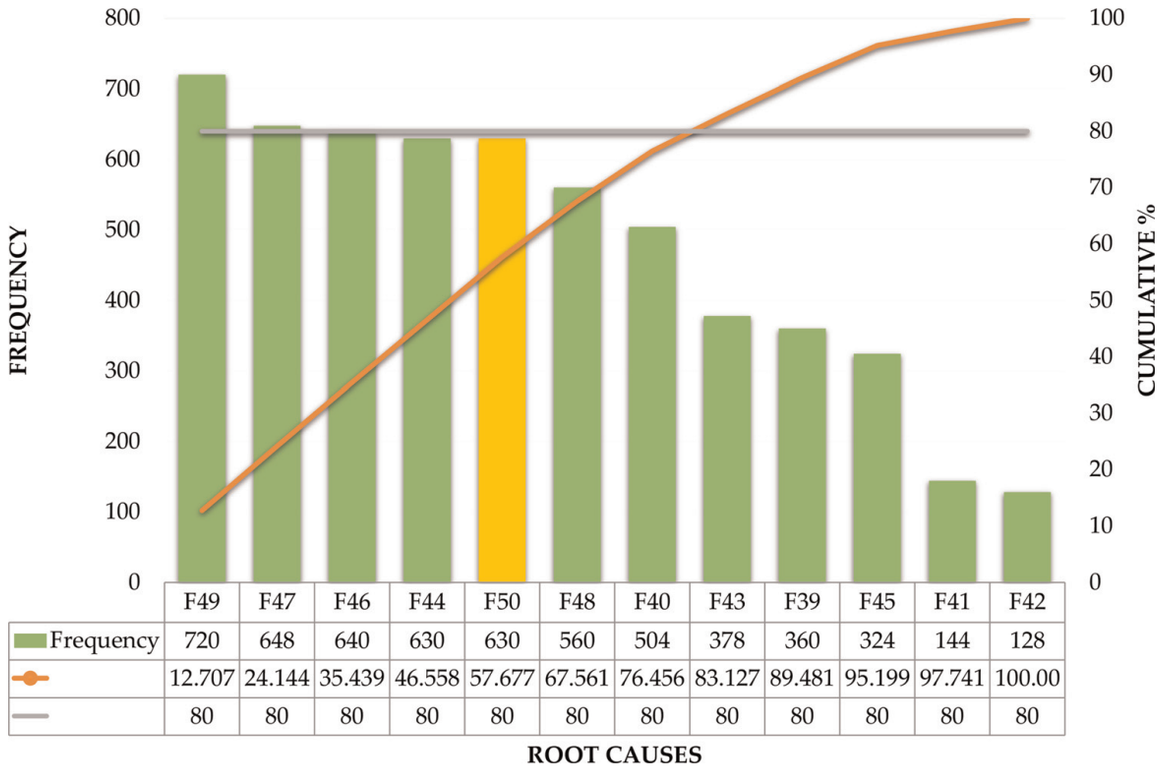
goods is a high priority and has a direct bearing on increasing customer satisfaction with logistics services. The integration of logistics and marketing functions allows the expansion of market opportunities and assortment. Internal integration between logistics processes helps to eliminate functional errors and improve coordination between functional areas. Gimenez and Ventura's study on external integration of logistics [74] concludes that internal integration does not lead to better absolute performance and does not contribute to cost reduction, production availability, or lead time (the article has been cited over 650 times). Flynn's study [75] builds on this view by exploring the reasons for the lack of positive effect and demonstrates that the integration approach needs to be contingency-driven. His study concludes that internal and customer integration are more strongly associated with performance improvement than supplier integration.

Experts find that the highest risk in this area is an unidentified properly positioned market segment and capacity. To minimise this risk, organisations must reorient logistics services to customers who contribute the most and have the greatest potential for growth, while reducing or even eliminating customers who do not contribute to prosperity. The inconsistency with the greatest negative effect is the acceptance by logistics organisations that the market is homogeneous, and the same services are provided to different groups of customers who have different backgrounds and different logistics needs. **Table 6** presents the results of the risk analysis related to Ineffective Process Management: Marketing.

In the analysis, the risk factor assessed with the highest priority risk was the failure to satisfy customer requirements in the long term (720); after actions were taken to manage the risk, the residual PRN has decreased (648). One of the consequences of the risks is related to the insufficient expansion of the range of services offered and failure to provide new and innovative logistics services. As a result of being

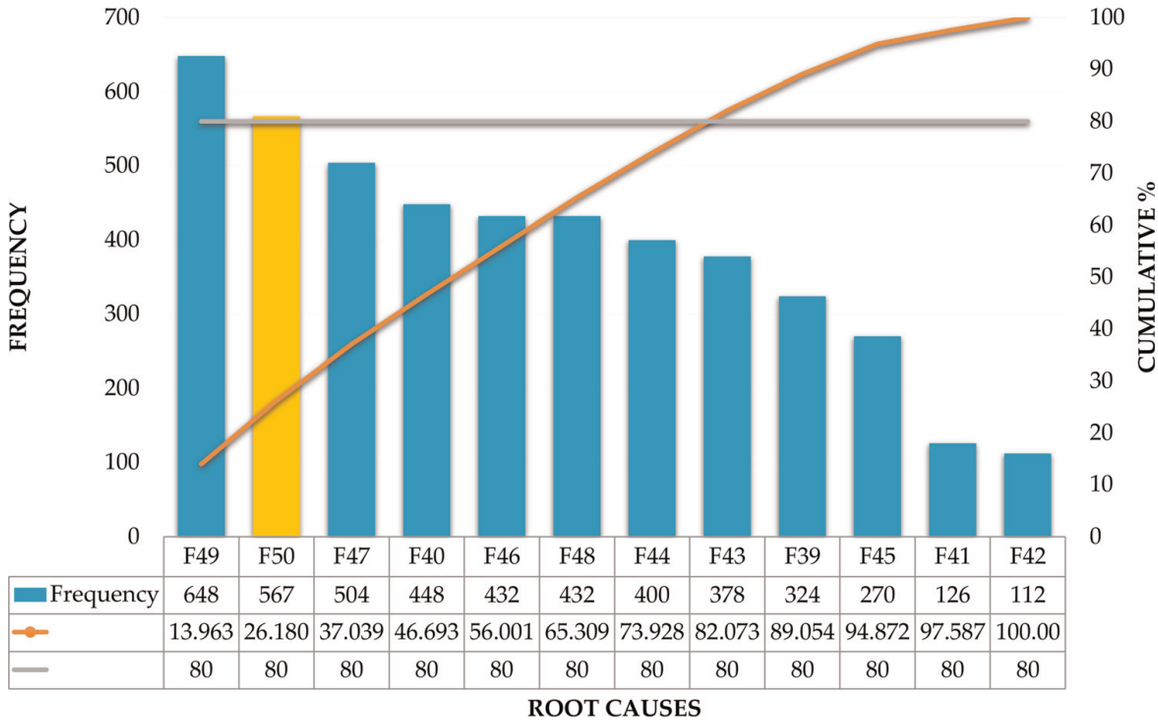
Consequences	Initial PRN (Figure 17)					Actions to manage risks and opportunities	Residual PRN (Figure 18)				
	No	T	B	O	PRN		No	T	B	O	PRN
Shortage of marketing department staff with competence to solve marketing problems	F39	10	9	4	360	Improves the employee search and recruitment process (hiring trainees) and periodic competency analysis of marketing department staff	F39	9	9	4	324
Omission of commercial information	F40	9	7	8	504	Increase the competence of the marketing department staff, including training, internship program	F40	8	7	8	448
Lack of budget for marketing activities	F41	8	6	3	144	Improve the planning of marketing activities and increase the frequency of execution of plans	F41	7	6	3	126
Lack of motivation and effective communication between the client and the organisation	F42	8	8	2	128	Analysis of communication channels	F42	8	7	2	112
Loss of brand loyalty	F43	9	7	6	378	Improve marketing activity planning	F43	9	7	6	378
Market segment and positioning capacity not properly identified	F44	10	7	9	630	Improve marketing activity planning	F44	10	5	8	400
Ignoring internal communication at the expense of external	F45	9	6	6	324	Improve internal communication between departments	F45	9	6	5	270
Customer relationship management only, without considering the entire supply chain	F46	10	8	8	640	Improve planning with consideration of the entire supply chain	F46	9	8	6	432
Underestimate the potential of emerging markets	F47	8	9	9	648	Improve planning to consider the potential of emerging markets	F47	8	9	7	504
Satisfy unrealistic demands that are important for the logistics company but not for the customer	F48	10	8	7	560	Improve planning with consideration of actual customer requirements	F48	9	8	6	432
Failure to meet customer requirements in the long term	F49	10	9	8	720	Improve planning with consideration of actual customer requirements	F49	9	9	8	648
Lack of expansion of the range of services offered and failure to provide innovative logistics service	F50	10	9	7	630	Improving planning to consider innovation in the sector	F50	9	9	7	567

Table 6.
Ineffective process management: marketing.



	F49	F47	F46	F44	F50	F48	F40	F43	F39	F45	F41	F42
Frequency	720	648	640	630	630	560	504	378	360	324	144	128
	12.707	24.144	35.439	46.558	57.677	67.561	76.456	83.127	89.481	95.199	97.741	100.00
	80	80	80	80	80	80	80	80	80	80	80	80

Figure 17.
Pareto analysis of initial PRN from F39 to F50.



	F49	F50	F47	F40	F46	F48	F44	F43	F39	F45	F41	F42
Frequency	648	567	504	448	432	432	400	378	324	270	126	112
	13.963	26.180	37.039	46.693	56.001	65.309	73.928	82.073	89.054	94.872	97.587	100.00
	80	80	80	80	80	80	80	80	80	80	80	80

Figure 18.
Pareto analysis of residual PRN from F39 to F50.

reclassified from fifth in priority to second, the logistics organisation's efforts must be directed towards its priority monitoring with minimisation of risk consequences (PRN 567).

9. Ineffective process management: contract analysis

The rapid development of logistics services does not correspond to standard contracts for freight forwarding, logistics, and transport. Many researchers have identified emerging issues between the service offered, its legal function, and the risk of sales uncertainty associated with the transfer of ownership of goods and product liability to the logistics provider [76–79]. The main challenges are related to closer cooperation and relationship between the logistics company and the law firm, which establishes a contractual relationship with customers and defines the legal consequences. The inconsistencies in this process are related to the failure to understand the full legal impact and implications of even minor changes in the contractual relationship.

Contracts are an appropriate tool not only for managing logistics risks but also for managing customer relationships and for establishing and facilitating communication, coordination, motivation, and control between business partners. Well-managed contractual relationships can have a positive impact in preventing problems, reducing litigated claims, and regulating and governing relationships that would be difficult to achieve without contracts [80, 81]. The concepts of supply chain vulnerability and risk management require a more precise definition [82] by negotiating actions when incidents and emergencies occur.

Table 7 presents the results of a risk analysis related to ineffective process management: contract analysis.

Consequences	Initial PRN (Figure 19)					Actions to manage risks and opportunities	Residual PRN (Figure 20)				
	No	T	B	O	PRN		No	T	B	O	PRN
cExceeding the processing time for customer enquiries	F51	10	10	8	800	Improve methods for scheduling and handling customer enquiries	F51	10	10	6	600
Inconsistencies in the drafting of the contract	F52	10	8	7	560	Development and use of standard forms for contract drafts	F52	10	8	5	400
Incorrect expert opinion on the draft contract	F53	9	8	6	432	Increase the competence of the experts reviewing the contracts proposed for approval and simplify the contract drafting procedure	F53	9	7	4	252
Not all amendments are made when product (service) requirements change	F54	10	8	8	640	Use of corporate information systems for contract design and review	F54	10	7	7	490
Ineffective process of establishing long-term stable and trusting relationships with customers	F55	7	8	4	224	Increase the competence of the experts responsible for validating contracts and simplify the contract drafting procedure	F55	6	8	4	192
Underestimating the risk to the outcome of a lawsuit with non-compliant logistical processes	F56	9	7	6	378	Review of the actuality of the claims handling budget	F56	9	7	5	315

Consequences	Initial PRN (Figure 19)					Actions to manage risks and opportunities	Residual PRN (Figure 20)				
	No	T	B	O	PRN		No	T	B	O	PRN
Failure to take adequate and timely action to address complaints	F57	9	8	7	504	Develop a programme and procedure for dealing with complaints	F57	9	7	6	378
The occurrence of a risk in the supply chain that is beyond the company's control	F58	10	10	9	900	Establish a risk management and information control program and supply chain changes	F58	10	9	8	720
Changes to regulated rules on compensation for injuries and damages	F59	10	8	8	640	Establish a risk management and information control program and supply chain changes	F59	10	7	8	560
Changes to the rules governing forwarding agency and customs clearance	F60	10	9	8	720	Establish a risk management and information control program and supply chain changes	F60	10	7	8	560

Table 7.
Ineffective process management: contract analysis.

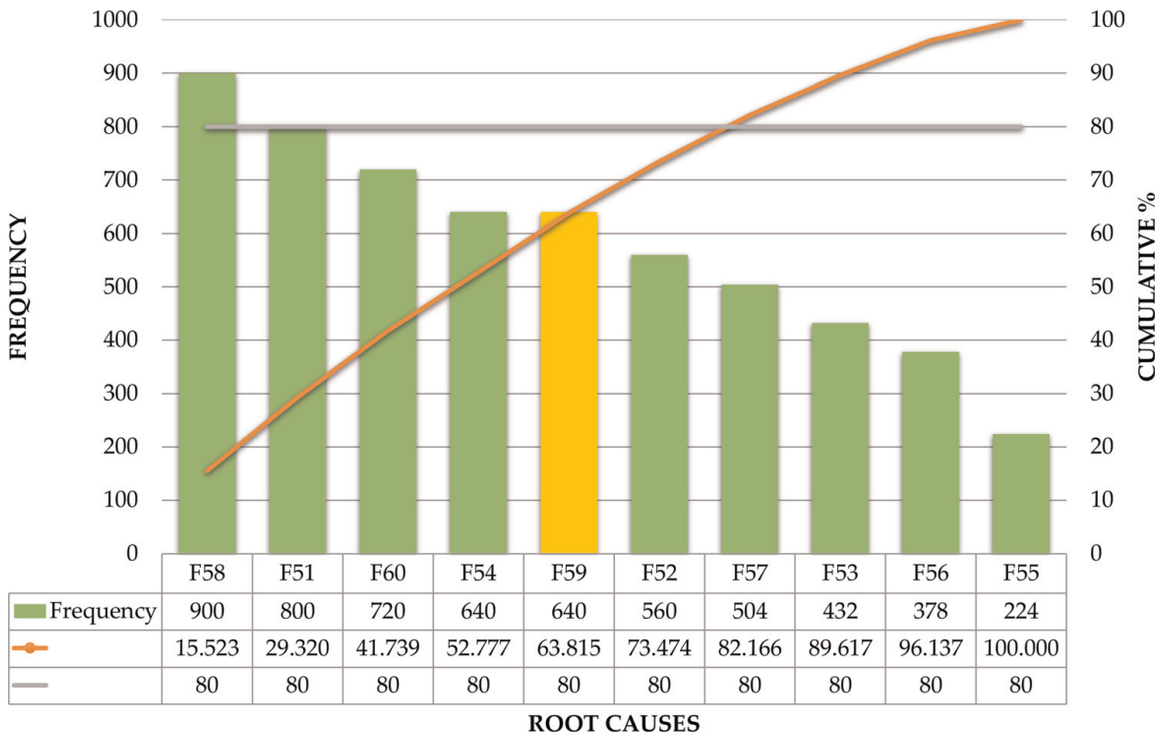
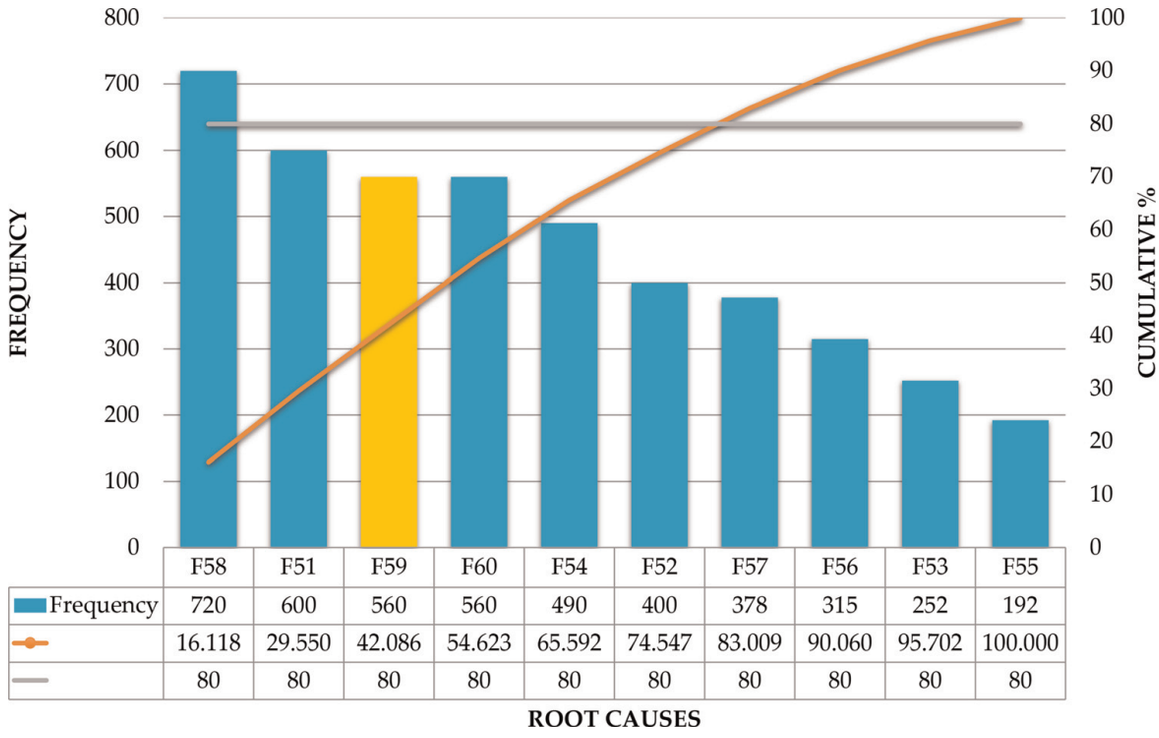


Figure 19.
Pareto analysis of initial PRN from F51 to F60.

To prevent these risks of legal claims and litigation and seek a path to effective resolution of disputes before they reach the courts, a legal framework should be established to regulate these relationships. The risk of not taking adequate and timely action to address claims was assessed as the greatest risk of non-compliance in the



	F58	F51	F59	F60	F54	F52	F57	F56	F53	F55
Frequency	720	600	560	560	490	400	378	315	252	192
	16.118	29.550	42.086	54.623	65.592	74.547	83.009	90.060	95.702	100.000
	80	80	80	80	80	80	80	80	80	80

Figure 20.
Pareto analysis of residual PRN from F51 to F60.

process. In the analysis, the factor assessed with the highest priority risk was the occurrence of a supply chain risk that is outside the control of the organisation. Making adequate and informed decisions to minimise this risk should become a top priority for the organisation. The increased frequency and severe consequences of past supply chain disruptions, as witnessed during the COVID-19 pandemic, set the stage for the deterioration of many logistics organisations' financial performance.

The risk management actions set out in **Table 7** are about making appropriate decisions; however, their effect, similar to any event, is associated with a degree of uncertainty and indeterminacy. It should be noted that the process of taking action to manage any risk should be continuous because misjudgements of risk factors can lead to unforeseen developments that can have negative consequences when identified too late. The consequences will be greatest for logistics organisations with only one warehouse or only one single supply channel. To prevent these severe consequences of external risks from threatening the company's control, plans must be put in place to manage them and, if possible, move towards diversification before or as changes in the environment occur. This process becomes more difficult to manage when negative changes occur in the external environment. In such cases, risk factors may outweigh mitigation strategies. The occurrence of risks in the supply chain as a result of unpredictable events that occur suddenly and are high impact, which are not within the control of the company, can lead to the potential loss of the organisation's efficiency and effectiveness targets. Thus, the process of reassessing control measures for the most highly rated risk by experts must be continuously monitored and managed.

10. Inefficient process management: design and development of new services

Risk management issues in logistics projects are primarily related to resourcing. These problems can be resolved by introducing internationally accepted quality

standards for risk management (ISO 9001; ISO 31000; ISO 31010) in project management by using a systematic approach. It is a globally accepted good practice to integrate risk management into corporate sustainability management as a stand-alone functional unit.

Resourcing can be provided through support contracts with resource providers to mitigate risk. The potential to significantly reduce risks in the implementation of project activities is defined by good logistical coordination in the receipt and execution of requests and rapid response to negative changes in the environment and supply chain. **Table 8** presents the results of a risk analysis related to ineffective process management in the design and development of new services.

The factor rated with the highest priority is failure to meet design objectives. It need not be proven that the management and resourcing of design logistics risks and risk management in operational logistics activities should be integrated to achieve the objectives and minimise the waste of resources. The risk of human resource shortage

Consequences	Initial PRN (Figure 21)					Actions to manage risks and opportunities	Residual PRN (Figure 22)				
	No	T	B	O	PRN		No	T	B	O	PRN
Failure to meet design objectives	F61	8	8	7	448	Enhancing competencies for the management and implementation of project activities	F61	8	6	7	336
Failure to meet the design deadline	F62	7	6	4	168	Improve planning methods	F62	7	4	4	112
Design cost over-runs	F63	7	5	4	140	Optimise the frequency and depth of analysis phases for design performance	F63	7	3	4	84
Shortage of material resources for the implementation of the logistics project	F64	9	3	5	135	Provide material resources or secure them through resource support contracts	F64	9	3	4	108
Shortage of human resources for the implementation of the logistics project	F65	10	10	4	400	Provision of human resources with employment programmes or through resource support contracts with organisations providing this type of service	F65	10	8	4	320
Shortage of material resources for the implementation of the logistics project	F66	6	5	6	180	Ensure financial resources or secure them through resource support agreements with lending institutions	F66	6	5	4	120
Lack of financial resources to implement the logistics project	F67	5	4	5	100	Provide material resources or secure them through resource support contracts	F67	5	2	5	50
Unproductive processes that hinder project implementation	F68	4	4	4	64	Optimise the frequency and depth of analysis phases for design performance	F68	4	4	4	64
Implementation of processes that do not add value	F69	6	5	6	180	Optimise the frequency and depth of analysis phases for design performance	F69	6	4	6	144

Consequences	Initial PRN (Figure 21)					Actions to manage risks and opportunities	Residual PRN (Figure 22)				
	No	T	B	O	PRN		No	T	B	O	PRN
Poor coordination between the members of the logistics project team	F70	7	8	5	280	Actions to increase coordination: workshops and operational meetings	F70	7	8	3	168

Table 8.
Ineffective process management: design and development of new services.

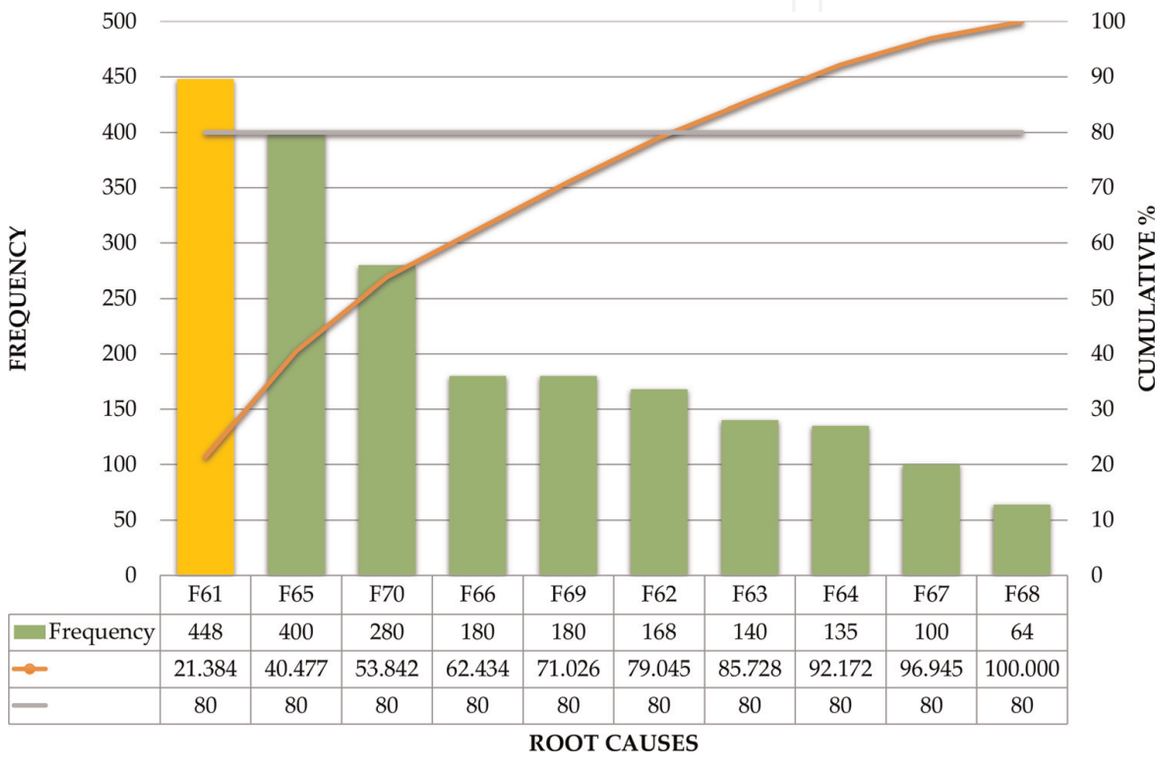
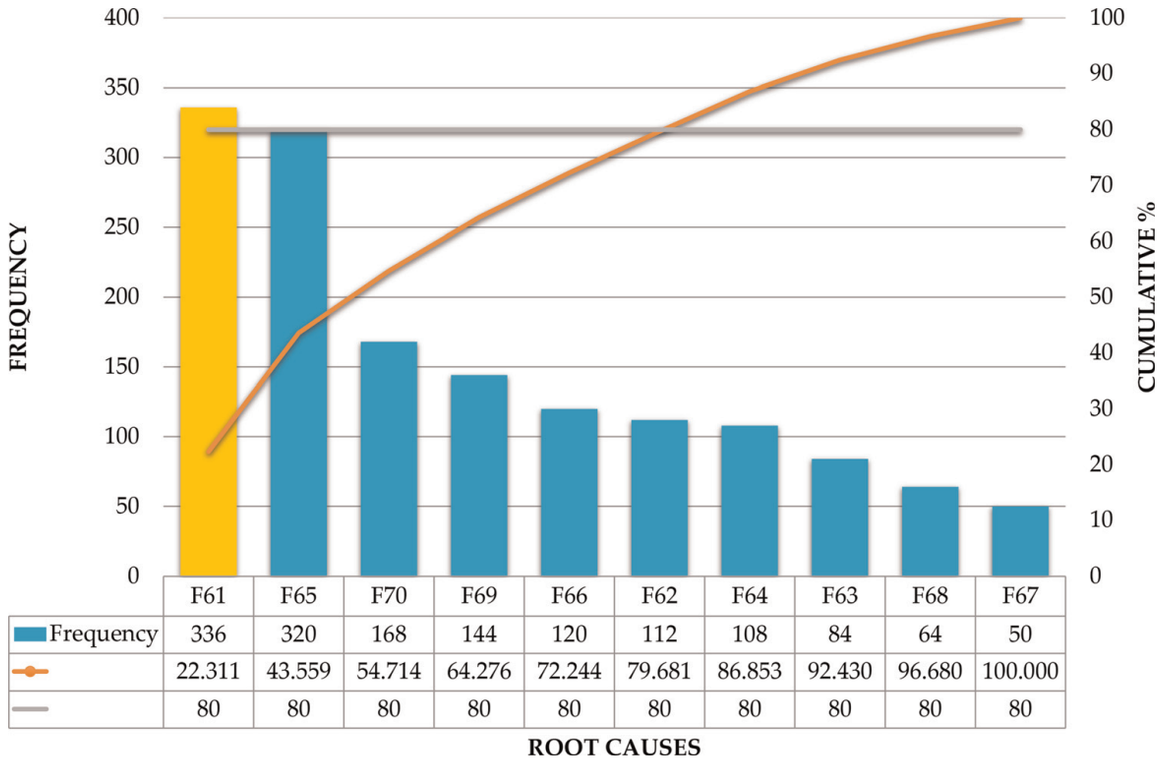


Figure 21.
Pareto analysis of initial PRN from F61 to F70.

for logistics project implementation is highly appreciated. In addition to resourcing logistics projects, there is a need to establish a mechanism and develop programs to manage the vulnerability of project activities and implications for management throughout the implementation chain, while eliminating unproductive activities that do not add value to the organisation or customers.

11. Inefficient process management: management of processes, products, and services by external suppliers

The processes and products provided to the organisation by external suppliers are driven by the growing trend towards outsourcing of secondary logistics activities—transportation, packaging, and warehousing. The rationale for the demand for outsourcing logistics services is related to improving competitiveness by streamlining business activities and concentrating entirely on core competencies.



	F61	F65	F70	F69	F66	F62	F64	F63	F68	F67
Frequency	336	320	168	144	120	112	108	84	64	50
	22.311	43.559	54.714	64.276	72.244	79.681	86.853	92.430	96.680	100.000
	80	80	80	80	80	80	80	80	80	80

Figure 22.
Pareto analysis of residual PRN from F61 to F70.

Many researchers are focused on identifying the factors for reaching outsourcing selection decisions. Most research publications identify the following factors:

- access to expertise from classified staff and experts [83, 84].
- reduce or stabilise costs [85–87].
- concentrate on core competencies [88, 89].
- financial restructuring [90, 91].
- overcome organisational problems [92].

Table 9 presents the results of a risk analysis related to ineffective process management of processes, products, and services from external suppliers.

Consequences	Initial PRN (Figure 23)					Actions to manage risks and opportunities	Residual PRN (Figure 24)				
	No	T	B	O	PRN		No	T	B	O	PRN
Irregular deliveries	F71	10	8	9	720	Establish a supplier management program. Negotiate with alternative suppliers of the same commodity	F71	10	8	5	400

Consequences	Initial PRN (Figure 23)					Actions to manage risks and opportunities	Residual PRN (Figure 24)				
	No	T	B	O	PRN		No	T	B	O	PRN
Lack of resources for effective supply planning	F72	8	7	4	224	Improve staff competency to execute project activities and pre-agree budget to meet objectives and Adequacy Analysis of design resources	F72	8	7	3	168
The impact of changes on the achievement of design objectives	F73	6	3	4	72	Analysis of all implications, introduction of changes as a result of the design	F73	6	3	4	72
Failure to meet delivery deadlines for external processes, products, and services	F74	10	7	9	630	Expand the list of approved suppliers and reduce the timeframe for their approval and validation	F74	10	7	8	560

Table 9.
Management of processes, products, and services from external suppliers.

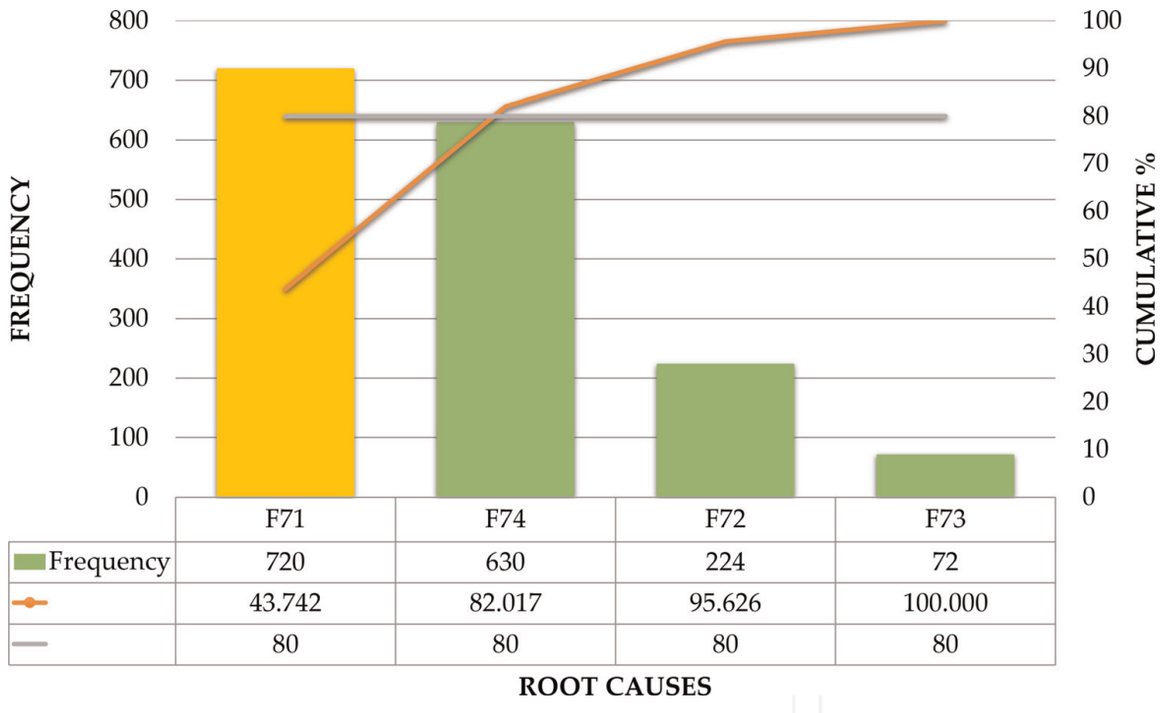


Figure 23.
Pareto analysis of initial PRN from F71 to F74.

Irregularity of supply has been identified as the greatest risk in processes related to services from external suppliers (PRN 720). This risk arises from the lack of control over processes that are under the supplier's control. Typically, the issues related to the supplier's management experience and skills, which may be less than expected, and their inability to meet the performance requirements for the services.

Lack of outsourced process supplier capability can also negatively impact the risk of missing delivery deadlines. After the action was taken to manage the risk and the potential impact of failure to meet delivery deadlines was assessed by the experts with high scores; the risk is now ranked as priority one.

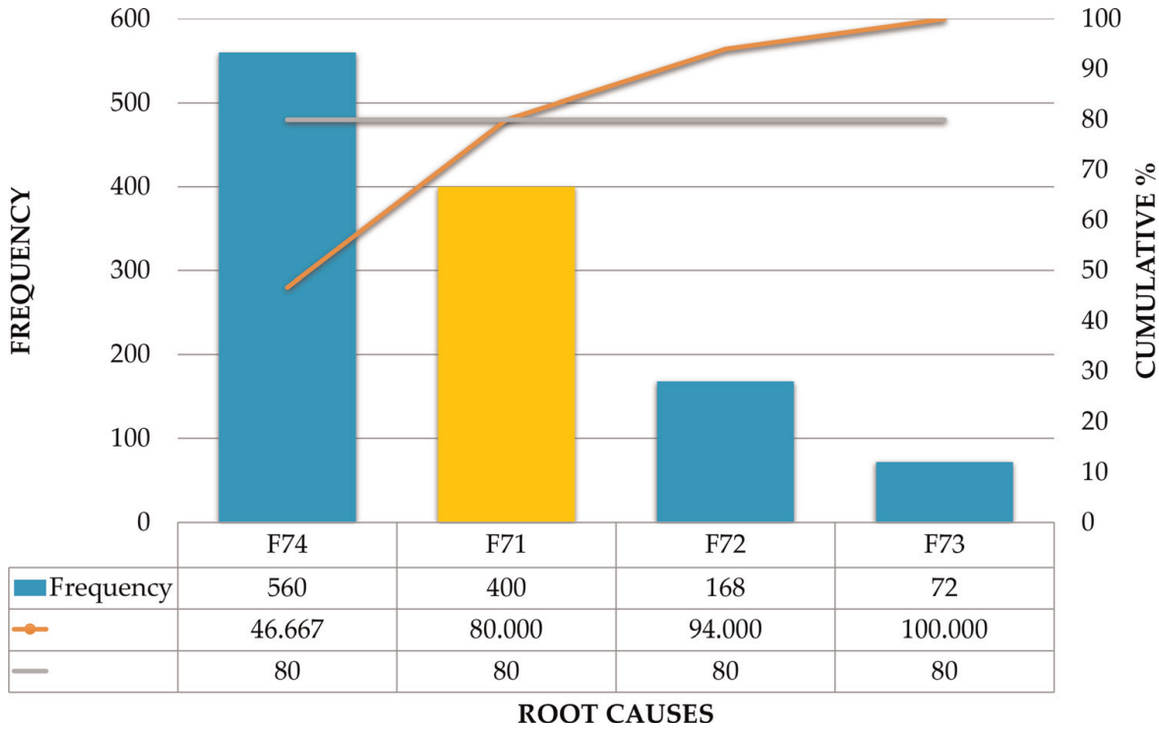


Figure 24.
Pareto analysis of residual PRN from F71 to F74.

12. Ineffective process management: service delivery

Logistics activities, such as inventory and order management, warehousing, and transportation, can be managed through the opportunities provided by technological developments to organise supply chain relationships. Customers have identified the timeliness of requested deliveries as one of the most significant factors in their satisfaction. The present study found that the quality of logistics services has significantly impacted satisfaction and loyalty. Thus, logistics organisations must invest resources to improve quality management and share these improvements throughout the supply chain. **Table 10** presents the results of the risk analysis on ineffective process management—external suppliers' processes, products, and services.

Consequences	Initial PRN (Figure 25)					Actions to manage risks and opportunities	Residual PRN (Figure 26)				
	No	T	B	O	PRN		No	T	B	O	PRN
Discrepancies between the characteristics of the services provided and those specified in the contract.	F75	10	7	6	420	Analyse the adequacy of resources for service delivery and expand the list of established outsourcing providers	F75	10	6	5	300
Error in the preparation of the proposed contracts to be agreed, including incomplete and incorrect information;	F76	10	4	4	160	Introduce a requirement to use legal advice to improve the wording of clauses in contracts with external suppliers	F76	10	3	4	120

Consequences	Initial PRN (Figure 25)					Actions to manage risks and opportunities	Residual PRN (Figure 26)				
	No	T	B	O	PRN		No	T	B	O	PRN
Inaccurate completion of the requirements for the characteristics of the products supplied and/or incomplete description of the service or process supplied.	F77	10	7	6	420	Improve the system for processing requests for products and services delivered	F77	10	6	6	360
Failure to meet a product or service delivery deadline.	F78	9	5	4	180	Regularly monitor and improve the service delivery techniques (technology documentation) and Improvement of planning methods	F78	9	3	4	108
Provision of service in breach of procedure or failure to comply with an established service provision procedure	F79	10	7	6	420	Training and competence of the process owner and operators	F79	10	4	6	240
Failure to comply with the general conditions laid down in the approved contracts	F80	10	4	4	160	Training and competency of process owner and operators and optimising the frequency and depth of management review in the service delivery process	F80	10	4	3	120
Lack of human and material resources for service delivery	F81	10	7	6	420	Resource adequacy analysis for service delivery	F81	10	5	4	200
The logistics services provided do not meet the agreed specification	F82	8	5	4	160	Training and competency of process owner and operators and optimising the frequency and depth of management review in the service delivery process	F82	8	4	4	128

Table 10.
Ineffective process management.

Several consequences of the risk are rated high by the experts (F75, F77, F79, and F81). Business planning and management software and resource and process optimisation may have a positive impact on improving the request process by facilitating and meeting delivery terms agreed with the customer. Business software to plan and manage transport activities may have a positive impact on the on-time delivery of orders by meeting the delivery deadline agreed with the customer (factors from F78, F80, and F82). The shortage of classified customer liaison staff in logistics is a growing risk and organisations should, therefore, focus on training and improving the skills of employees needed to provide a high level of customer service (F82). The organisation's management must address the shortage of human resources to execute processes along with specific actions to manage the risks.

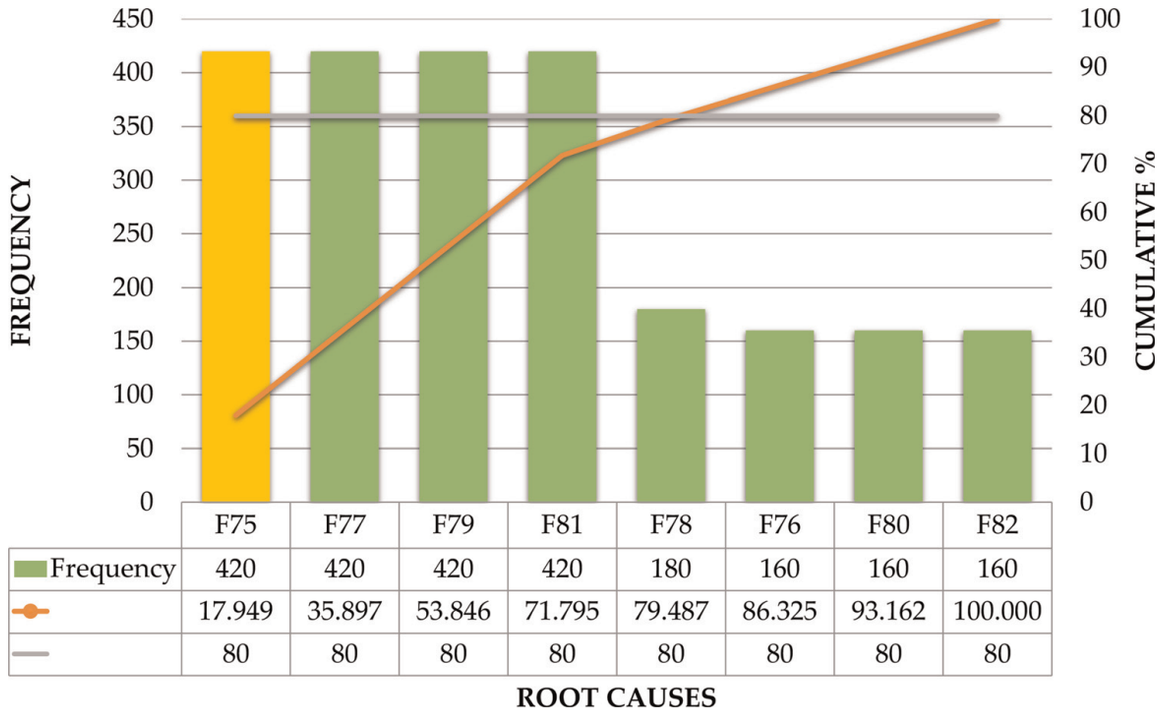


Figure 25.
Pareto analysis of initial PRN from F75 to F82.

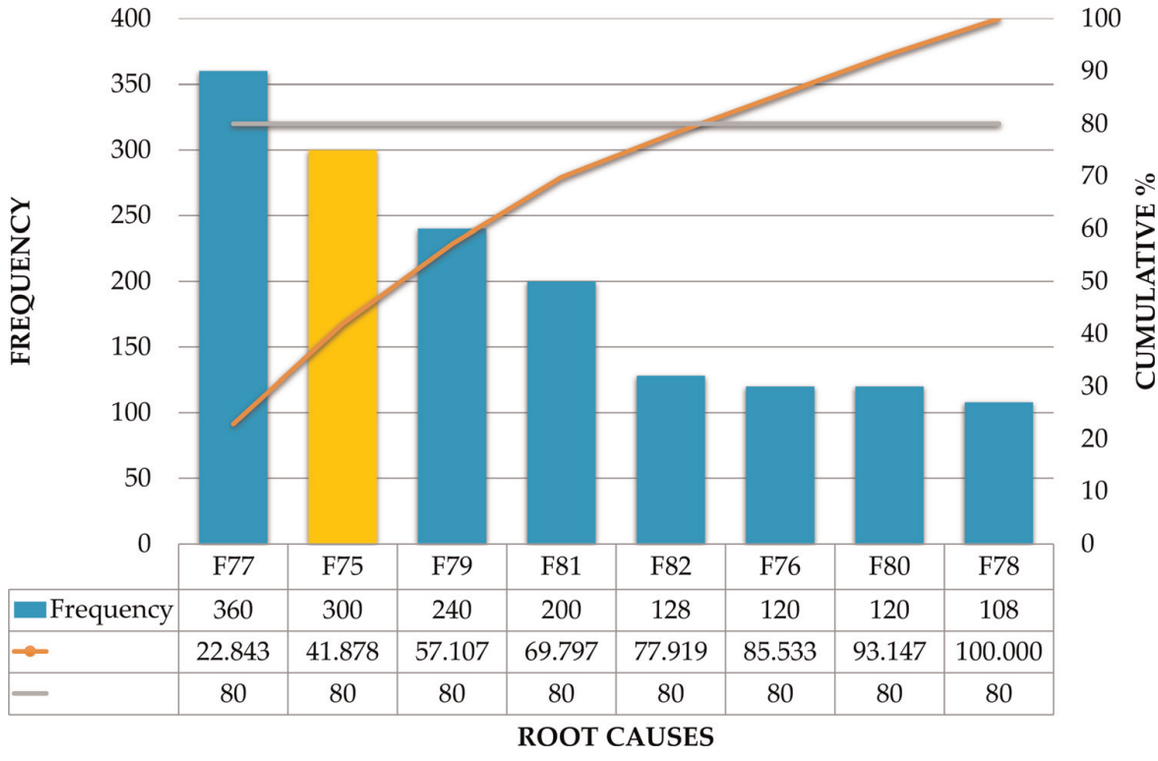


Figure 26.
Pareto analysis of residual PRN from F75 to F82.

13. Ineffective process management: emergency management

The provision of logistics services involves interrelated processes and relationships between goods suppliers, distributors, transport organisations, wholesalers, and

retailers. A logistics system can only operate effectively and efficiently when all processes throughout the customer's product supply chain are functioning properly. Failure of any process in the supply chain has the potential to negatively impact the entire system and threaten the achievement of the set objectives. It is undeniable that logistics systems internationally are becoming increasingly vulnerable and open to many sources of threats. The high uncertainty in supply and demand due to the spread of the pandemic has further worsened the conditions for the smooth functioning of the supply chain and triggered the need for urgent commodity deliveries and, in some cases, threatened overall food security. Disasters, accidents, and catastrophes of various kinds create challenges for logistics systems to respond quickly and to repackage activities. **Table 11** presents the results of a risk analysis related to ineffective process management—inconsistencies and emergencies.

The experts determined the highest levels of initial PRN for factor F86, which is associated with an undefined non-conforming score. The consequences of contingency-induced risks triggered by events that are often beyond the company's control can severely compromise logistics operations and business existence. Unfortunately, managing them is not always about the logistics organisation taking measures and decisions to manage them but about taking the necessary measures at the source of the event and countermeasures in the whole economy. These negative events can occur both accidentally and as a result of permanent minor changes. Taking this into account, it is possible that, once the risk has been contained, a return

Consequences	**Initial PRN (Figure 27)**					**Actions to manage risks and opportunities**	**Residual PRN (Figure 28)**				
	No	**T**	**B**	**O**	**PRN**		**No**	**T**	**B**	**O**	**PRN**
Changes in the internal and/or external context of the organisation (increase or decrease in scope without a plan to implement the changes)	F83	9	8	6	432	Analyse any possible implications of the changes and Improve forms of communication with clients in the contract implementation process, e.g., regular joint (service delivery) workshops	F83	7	8	6	336
Failure of the service delivery process	F84	9	8	8	576	Resource adequacy analysis and development and implementation of an ISO 45001 HSE management system	F84	7	8	8	448
Sabotage in the delivery process or loss of customer loyalty during the service delivery process	F85	8	5	9	360	Enhance staff motivation and develop and implement elements of the ISO 10002 complaints handling system	F85	6	5	9	270
Unidentified non-compliant result	F86	10	9	8	720	Improve control methods and non-compliant process of labelling production or service delivery protocol; increase staff motivation through training	F86	8	9	8	576

Table 11.
Ineffective process management: inconsistencies and emergencies.

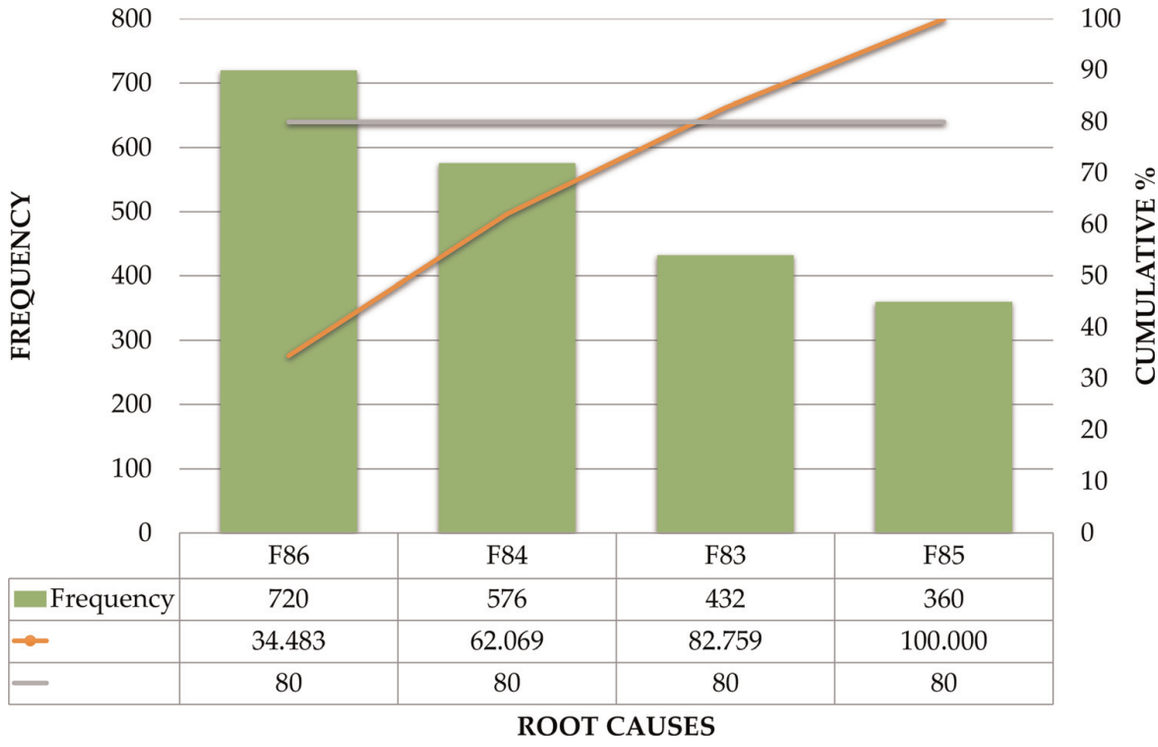


Figure 27.
Pareto analysis of initial PRN from F83 to F86.

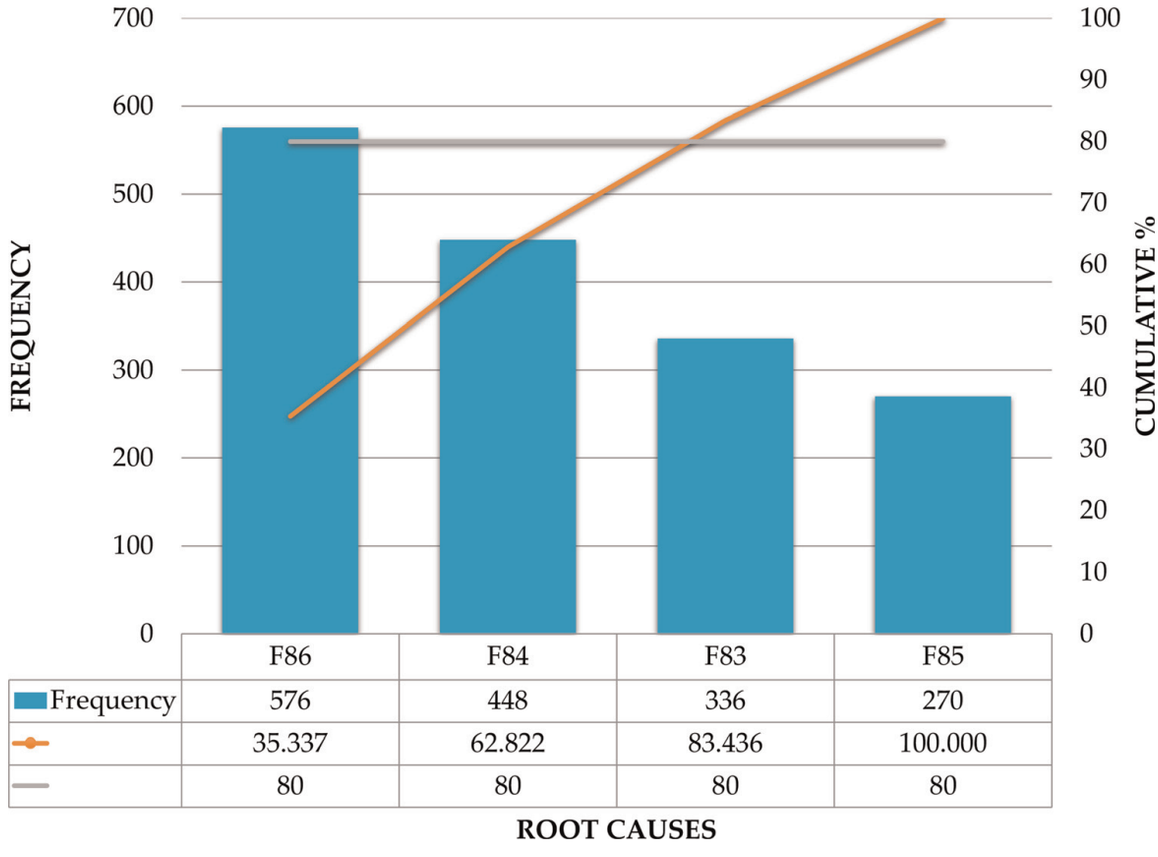


Figure 28.
Pareto analysis of residual PRN from F83 to F86.

to the original state of logistics activity may not be an adequate solution to the changed circumstances. Therefore, from the perspective of the organisation's strategic interest, it may be more appropriate not to adapt to change and rather create a new development opportunity and a completely changed logistics service delivery system.

This would be an appropriate solution in the drastically changed operating environment and conditions such that the original situation has become unfavourable, and adaptation of the system is not possible.

14. Ineffective process management: Internal audits

The ineffectiveness of internal audits of management systems in logistics is related to the fact that auditors are focused on compliance against a standard applicable to the system and documentation demonstrating such compliance, rather than on identifying opportunities for improvement. Better audit performance can be achieved when the audit programme is focused on identifying opportunities for improvement and adding value over and above the control of compliance against a standard. **Table 12** presents the results of a risk analysis related to ineffective process management: internal audits.

The highest level of initial PRN was determined by the experts for factor F88, related to the lack of qualified persons to conduct the audit. During an internal audit, unqualified auditors would find it difficult to identify and prioritise the problems and ascertain their root causes. Preventive actions against risk should be planned and implemented after an internal audit. It is good practice to re-audit the process where problems have been identified and establish the effectiveness of the corrective actions taken. In cases where the problems are not yet resolved, rather than new corrective actions, a root cause analysis by experts in the field must be conducted to avoid the consequences of identified non-conformities being compounded. Effective internal audits can help to optimise processes and, consequently, provide an effective mechanism to implement changes and improvements and contribute to increased competitiveness.

Consequences	Initial PRN (Figure 29)					Actions to manage risks and opportunities	Residual PRN (Figure 30)				
	No	T	B	O	PRN		No	T	B	O	PRN
Incorrect definition of the scope and programme of the audit	F87	7	5	3	105	Increase the competence of internal auditors and motivate internal auditors	F87	7	4	3	84
Lack of qualified persons to conduct the audit	F88	7	8	4	224	Train internal auditors. Hire auditors from external organisations	F88	5	7	2	70
Failure to state a discrepancy	F89	7	6	3	126	Increase the competence of internal auditors and motivate internal auditors	F89	6	5	3	90

Table 12.
Ineffective process management: internal audits.

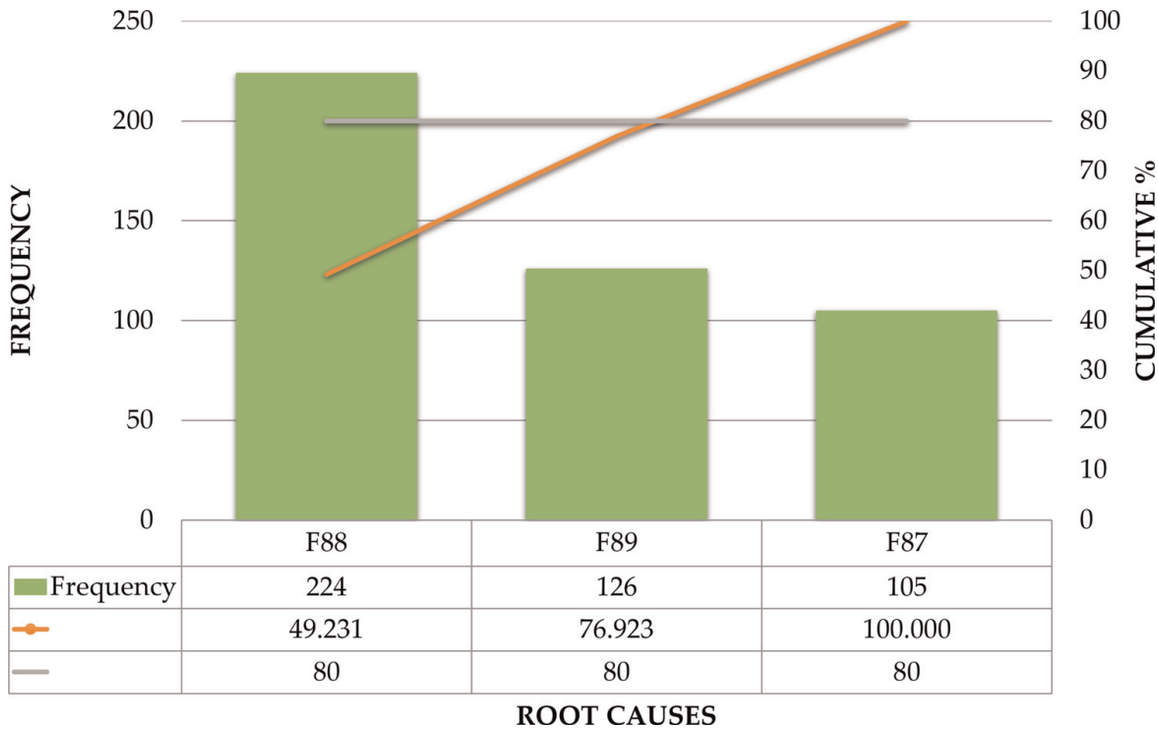


Figure 29.
Pareto analysis of initial PRN from F87 to F89.

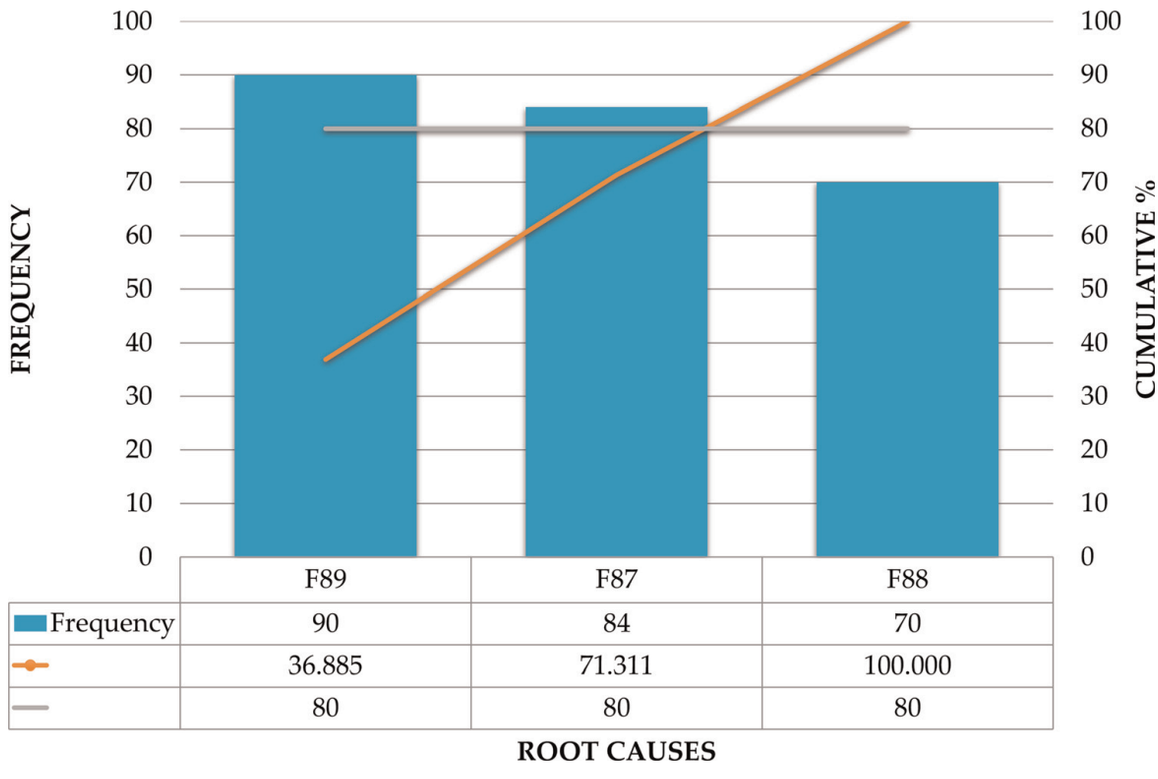


Figure 30.
Pareto analysis of residual PRN from F87 to F89.

15. Ineffective process management: leadership, management, and control

The results of the customer satisfaction survey and the opinion of experts involved in risk analysis validate the rule that to improve the quality of logistics services, it is

necessary to identify and comply with customer service expectations and service performance, which positively affects customer satisfaction. Problems in management arise in cases where performance cannot meet inflated service expectations. To take action and minimise the risk of this non-conformance involves building a robust system to track orders from receipt of a request to delivery feedback such that problems and conditions that compromise satisfactory customer performance can be acted upon quickly. Management, including the control of customer-compliant logistics services, is the complete cycle of planning, executing, and controlling the efficient, cost-effective flow of raw materials, supplies, and commodities from point of origin to customer delivery and reverse logistics. The competitiveness of services can be achieved through control of the organisation's available strategic resources (including human resources) or value-creation activities [93–95]. Logistics organisations should concentrate their efforts not only on the physical delivery of the goods but on resolving any issues that arise, which are of significant concern to the customer, during delivery. Notably, different customers have different essential requirements for logistics services, which are also dynamic over time. This requires a process of continuous improvement and control of service performance. Increased control must be established in response to every case of disruption and complaint. The areas that require continuous improvement are operational efficiency and integration throughout the supply chain. **Table 13** presents the results of a risk analysis related to ineffective process management: management, service delivery process management, and strategic control.

Experts identified the highest levels of initial PRN as a factor for providing non-conforming goods or services to customer requirements. In the satisfaction analysis, this risk factor was analysed in detail. The experts, who conducted the analysis, have suggested increasing the implemented process control measures and improvements to

Consequences	**Initial PRN (Figure 31)**					**Actions to manage risks and opportunities**	**Residual PRN (Figure 32)**				
	No	**T**	**B**	**O**	**PRN**		**No**	**T**	**B**	**O**	**PRN**
Mixing mismatched and matched results	F90	9	9	9	729	Review and update the list of controlled process parameters and continuously improve the qualifications of process operators	F90	9	8	4	288
Providing non-conforming output and providing non-conforming service to customers	F91	10	10	9	900	Analysis and improvement of process control and monitoring methods and process management improvement	F91	10	10	6	600
Increased after-sales service and claims costs	F92	10	6	4	240	Process resource adequacy analysis	F92	10	6	2	120
Conflict with stakeholder interests	F93	8	6	6	288	Alignment of decisions with stakeholder interests	F93	8	6	4	192
Failure to achieve a strategic objective	F94	10	9	8	720	Optimise the frequency and depth of analysis of the organisation's decision-making context	F94	10	9	5	450

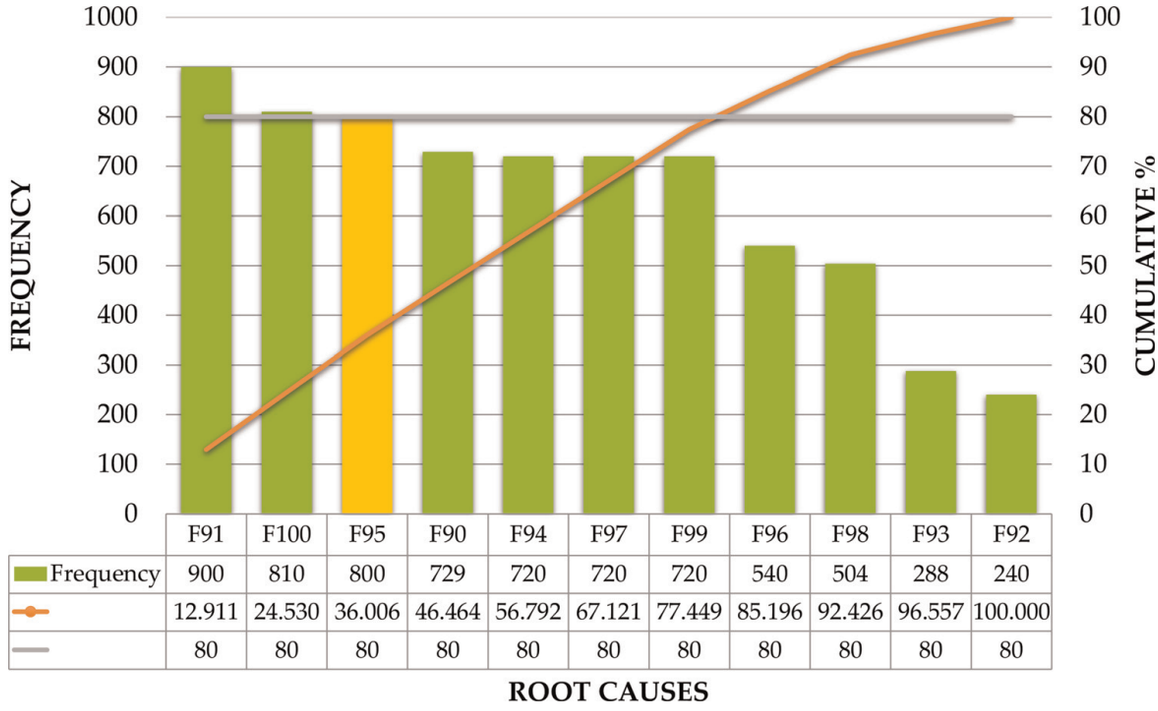
Consequences	Initial PRN (Figure 31)					Actions to manage risks and opportunities	Residual PRN (Figure 32)				
	No	T	B	O	PRN		No	T	B	O	PRN
Failure to meet quality objectives for compliance with customer requirements	F95	10	10	8	800	Improving methods for planning and analysing the adequacy of resources in processes	F95	10	10	7	700
Contraction of activity or delay in development	F96	10	9	6	540	Analysis of all possible consequences of the changes	F96	10	9	5	450
Failure to comply with the general conditions laid down in the approved contracts	F97	10	8	9	720	Resource adequacy analysis for service delivery	F97	10	8	5	400
Lack of human resources to manage and control processes	F98	9	7	8	504	Train and improve the competency of process owners and operators and optimise the frequency and depth of management review in the service delivery process	F98	9	6	4	216
Failure to comply with decisions taken	F99	10	9	8	720	Improve planning methods and optimise management review frequency	F99	10	6	6	360
Untapped market development opportunities (emerging niche markets)	F 100	10	9	9	810	Optimise management review frequency and programme to monitor changes in market conditions	F 100	10	8	8	640

Table 13.
Ineffective process management.

minimise the risk. The main area for development and sustainability is the improvement of any logistics process. Improvement processes should be linked to identified areas where non-conformities have been raised during internal audits. Certain criteria should be considered to prioritise their implementation: economic—reducing logistics costs, technological—reducing storage and transport time, organisational—improving communication and information flow, social—improving customer service, and environmental—reducing waste [96–100]. The experts involved in the study highly rate determining the residual risks for the factor related to the failure to meet quality targets for compliance with customer requirements and the risk now occupies the first position.

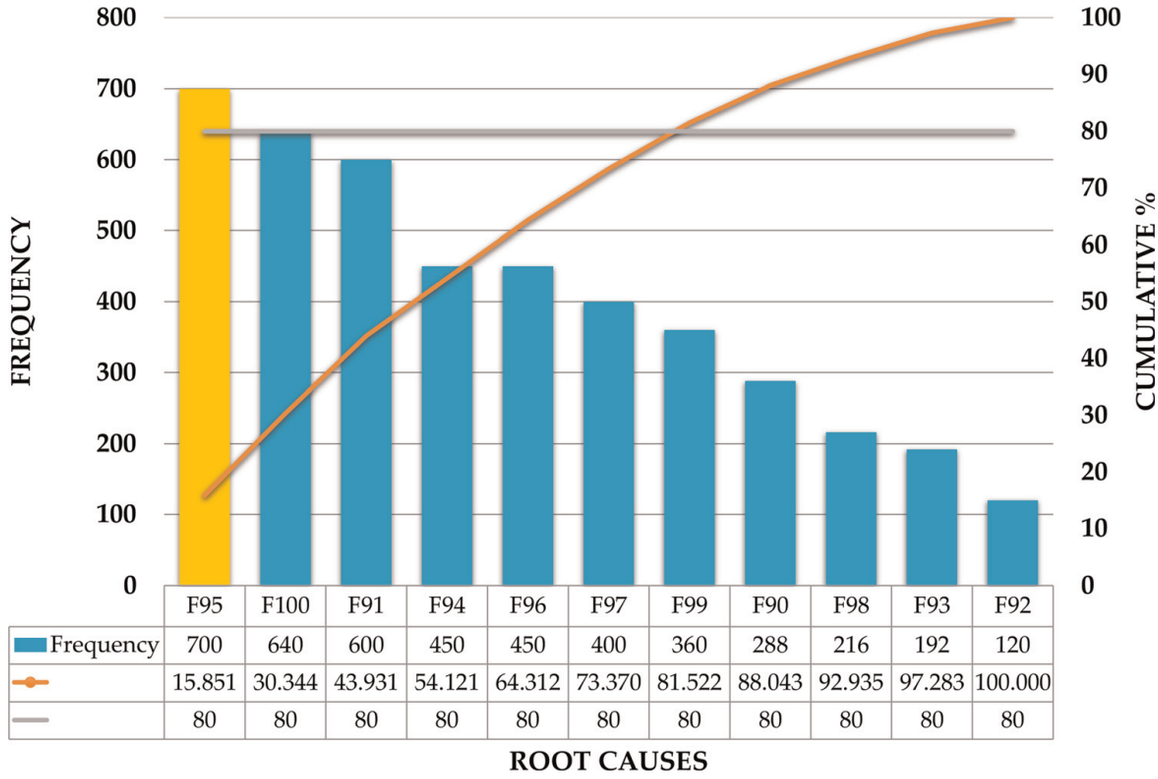
16. Managing common risks

Quality of service and, consequently, increasing customer satisfaction is a difficult process to standardise and depends on many factors. Non-conforming services should be avoided because they may cause a negative customer reaction that is not under the



	F91	F100	F95	F90	F94	F97	F99	F96	F98	F93	F92
Frequency	900	810	800	729	720	720	720	540	504	288	240
	12.911	24.530	36.006	46.464	56.792	67.121	77.449	85.196	92.426	96.557	100.000
	80	80	80	80	80	80	80	80	80	80	80

Figure 31.
Pareto analysis of initial PRN from F90 to F 100.



	F95	F100	F91	F94	F96	F97	F99	F90	F98	F93	F92
Frequency	700	640	600	450	450	400	360	288	216	192	120
	15.851	30.344	43.931	54.121	64.312	73.370	81.522	88.043	92.935	97.283	100.000
	80	80	80	80	80	80	80	80	80	80	80

Figure 32.
Pareto analysis of residual PRN from F90 to F 100.

control of the logistics organisation. The FMEA analysis of the risk factors that contribute to non-conformities can be used to design programmes and take actions to minimise the effects of the 100 (F01 to F100) risks investigated.

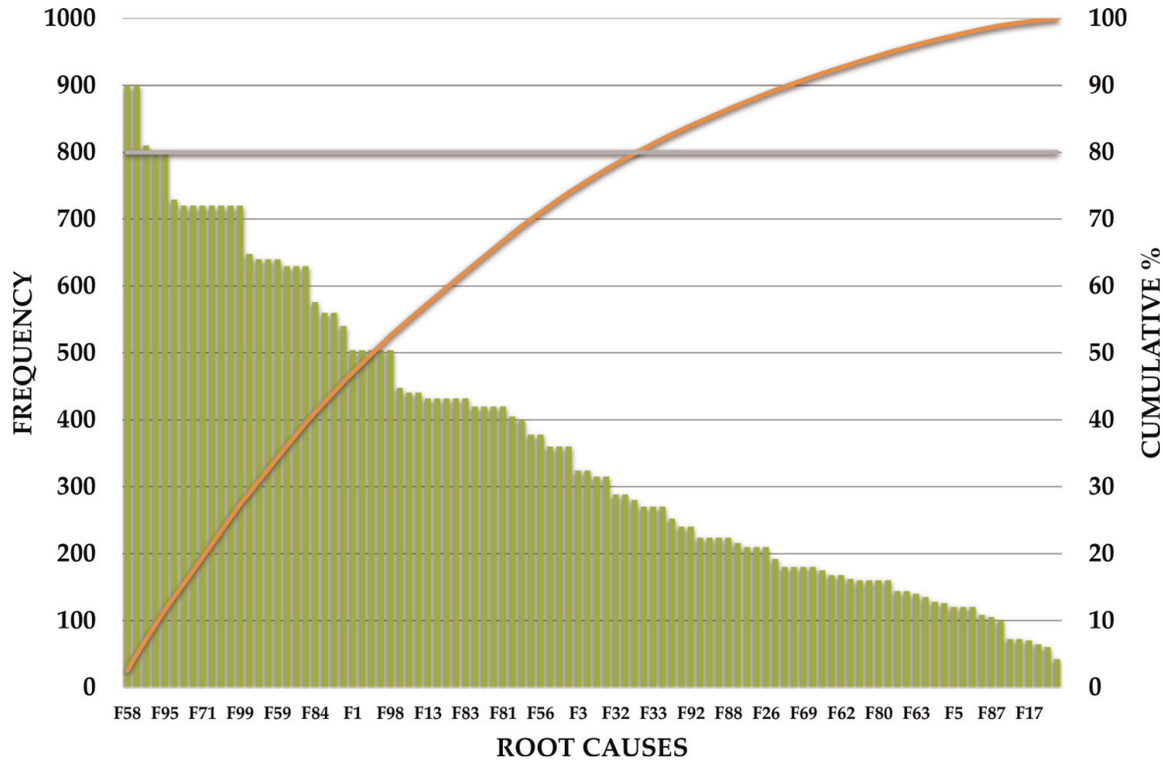


Figure 33.
Pareto analysis of initial PRN from F01 to F100.

The summary data from the initial and residual PRN analysis are presented in **Figures 33** and **34**. Results from the analysis identify the reasons that are most likely to contribute to the deterioration of the quality and satisfaction of logistics services—specifically, the occurrence of supply chain risk that is beyond the control of the

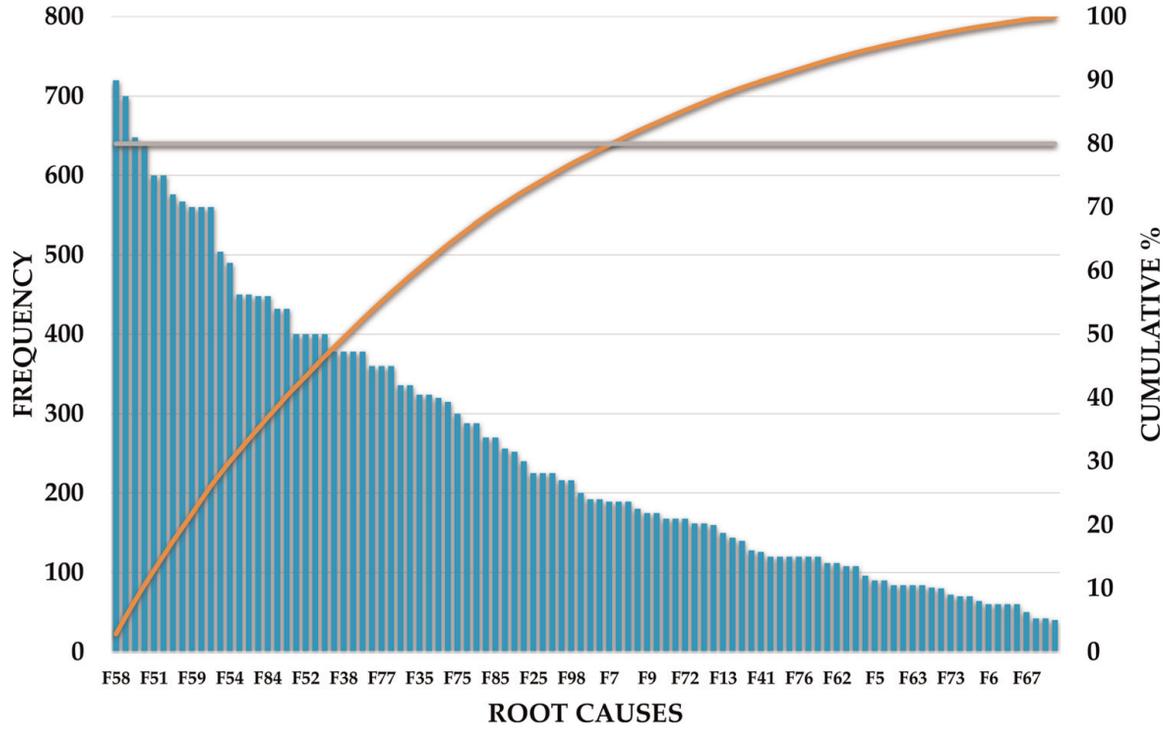


Figure 34.
Pareto analysis of residual PRN from F01 to F100.

logistics company and the provision of inadequate service to customers. All factors are analysed in more detail by main indicators.

Applying FMEA to non-conforming logistics processes and services, which have the potential to reduce satisfaction, can significantly shorten the analysis of the causes of non-conforming service quality to take timely and adequate measures before the negative impact of risk. Therefore, to improve the overall quality of logistics services through the FMEA analysis, it is necessary to identify not only the significant risks that arise from customer complaints but also specific actions to manage risks and uncover opportunities, and, subsequently, take risk management measures after corrective actions are in place.

17. Conclusion

For organisations 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 in the food sector 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.

Due to the increasing market competition, a necessary condition for increasing customer satisfaction is the provision of qualified services that help to organise timely deliveries of the goods requested by the customer. The analyses 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.

The management of improvement processes and the containment of service failure must be based on the current knowledge base and new innovative technologies. In cases where identified risks cannot be managed, a strategic development direction can be taken to outsource processes and minimise risk. Processes to improve customer satisfaction should only be undertaken after a thorough analysis to identify the root cause and determine specific actions to reduce the negative impact of potential customer service inconsistencies. Through process controls, these processes could help to prevent non-conforming services from occurring prior to customer requirements.

Logistics management has the misconception that reducing complaints would increase satisfaction to the same extent. Models for positively influencing satisfaction should contain much more than one variable. The customer satisfaction model used in this study contains six latent variables. Four observed variables are the causes of satisfaction analysis—perceived quality, value, image, and customer expectations, while the consequences of satisfaction are—complaints and loyalty. The study of customer opinion in relation to their satisfaction with logistics services and the associations between observed and latent variables are described using a set of equations with unknown coefficients. The estimated coefficient estimates were obtained using Partial Least Squares Path Modelling (PLS-PM). The calculations were performed by using XLSTAT 2021.4.1 software, which was used to determine path coefficients and the magnitude of the impact of the variables on each other and their significance.

After the analyses were performed using the SERVQUA model, the results were used for risk analysis (FMEA) to identify the causes, assessment, and consequences of logistics services that do not meet customer expectations. FMEA analysis was used as a

method to investigate the consequences of emerging risks by quantifying the severity, likelihood of occurrence, and detection of non-conforming logistics services that further generated the RPN. The data from the analysis are summarised in tables by process and the results show the factors that could contribute most to potential non-conformities. Suggestions for specific actions to manage risks and opportunities that can be used for optimisation or improvement are also provided.

From the analyses, it can be concluded that the main reasons for the decline in customer satisfaction are poorly managed logistics processes caused by the lack of sufficiently competent employees ready to deal with emerging risks and human errors. Service improvement must go through an assessment and prioritisation of each element for improvement, take corrective action to manage risks, revise plans and processes in line with changes and in accordance with customer requirements, and, subsequently, examine whether the improvements have had a significant impact on satisfaction levels with the logistics services.

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Conflict of interest

The author declares no conflict of interest.

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