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Analysis of Risk Factors in the Channels of Drug Distribution: Professional Perspectives

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Abstract: The subject of this paper is pharmaceutical companies and the risk factors that occur in the distribution of drugs. The paper will present guidelines for the risk management of changes in the environment of pharmaceutical distribution channels. To identify, analyse, and prioritise risks, we used a systematic literature review and the Delphi method. Identification and assessment of important risk factors in drug distribution channels were conducted based on opinions of experts from 10 international pharmaceutical companies operating in Southeast Europe. The purpose of the research was to get opinions from experts about the impacts of the risk factors on the distribution of drugs, which was accomplished through interviews and questionnaires that were conducted. Our study demonstrated a total of 78 risk factors in the distribution channels of drugs and pharmaceutical services. The results of the research combined separate evaluations for risk factors in all categories for easier data analysis. After data were obtained, results were arranged to show which risk factors had the biggest influence upon the distribution of drugs and to determine the negative effects they can produce. The research of risks was done primarily to help the representatives of distribution channels gain better insight into drug distribution.

Keywords: drug distribution; risk factor; pharmaceutical; identification; health

1. Introduction

The uncertainty of drug and medical service distribution channels is conditioned by the dynamic and complex market and pharmaceutical environment that leads to the realisation of new trends, new products, and services in a short time frame. Drug distribution today faces some of the toughest challenges in the market [1], such as the growth of new viruses and diseases, new drugs, use of advanced technologies, and increased customer demands. All these challenges generate risks that affect the sustainability of drug distribution, and it is necessary to provide effective support for the pharmaceutical industry. The pharmaceutical market in Southeast Europe is high tech and profitable. Changes in pharmacy are intense, the competition is powerful and carries a huge risk, and pharmaceutical companies must create new products, processes, and systems for adapting to the changing technologies, markets, and models of competition [2]. Pharmaceutical companies must follow the development of technologies that will increase the chances of penetrating new markets [3] to fulfil requirements and maintain the sustainable development of the drug industry.

Risks are present at all levels of the environment, especially in the processes of establishing new health channels and improving existing ones, introducing new drugs to the market in Southeast Europe, and distributing them for the final primary care of customers. Drug distribution channels are complex and compiled from entities such as pharmaceutical companies and employees, logistics organisations, pharmacies, hospitals, doctors, customers, governmental institutions, and others. The qualities of employees in the pharmaceutical companies may be important, such as intelligence, self-efficacy,

emotional stability, openness to experience, social support, emotion recognition, self-discipline, resourcefulness, and cognitive flexibility [4]. Drug distribution is a sequence of processes intended to improve primary care and includes procurement, manufacture, distribution, and waste disposal, transportation, storage, and delivery of drugs. Medicines are made and distributed from ingredients sourced from different countries and organisations. Drugs change hands many times between the manufacturer and patient. It is clear that a large number of participants generate a large number of risks. The aim of the study is the organisational and occupational analysis of the potential risk factors in the drug distribution channels of pharmaceutical companies in Southeast Europe. It is important to critically examine the health environment of pharmaceutical companies and collect needed information about risk factors. The information was obtained from historical data, facts, trends, attributes, theoretical analysis, business interests, opinions, experience, and audits. Broadly, hazards originate in active pharmaceutical ingredients, excipients, process, people, environment, and machines [5].

The essence of this research is the organisation and management of unpredicted situations in pharmaceutical companies, and it consists of an examination of risk factors and an analysis of their impact on the public health channels. The examination of risk factors in pharmaceutical companies is aimed at realising sustainable development in public health in order to avoid risky situations, increase the resilience of the organisation, and find mechanisms to defend against situations endangering the normal processes of functioning in the company. Improving the sustainability distribution channel must be based on the elimination or improvement of factors that may negatively influence the effectiveness of the pharmaceutical distribution channels. Therefore, the first step of this research is to identify the risk factors through a systematic literature review, and then, based on the opinions of experts from drug distribution channels, evaluate these factors and identify the most significant ones in order to provide a base for shedding new light on coping with the negative factors and the chain reactions between them in the process of sustainable development of the infrastructure [6]. The subjects of the research are the members of the drug distribution channels, employees in these organisations, and consumers. The significance of the research is reflected in the identification and solving of potential problems caused by the negative impacts of the identified factors, such as disruption of distribution channel functions, decreased product performance due to a low level of quality management systems in the distribution chain, delivery errors due to low levels of cooperation between drug distribution channel members, delivery delays, etc. In addition to causing business and financial problems, identified risk factors directly affect the health of users or participants in all sustainability aspects, and it is necessary that all of them work together to find effective solutions to these problems.

Context

In an attempt to identify potential threats in the distribution channels, it was necessary to examine the relationship between planning, management processes, and activities, as well as to assess the effectiveness of distribution [7]. We found that the environments of companies, government, and the integration of internal and external resources can have a significant impact on the sustainability of the distribution channel. We concluded that company operating environments increase the effectiveness of distribution channel security. Companies that recognise more security issues within their distribution channels tend to have higher levels of perceived distribution channel security effectiveness [7]. In some other circumstances, company operating environments can also decrease effectiveness.

Regardless of advanced technologies, new materials, and increased knowledge, key challenges are increasing drug effectiveness and placing drugs on the market as quickly as possible. Pharmaceutical companies with recent underperforming stocks implement more high-risk innovation strategies than firms outperforming their industry peers [8]. The high-risk projects that are mostly represented in drug distribution channels focus on the introduction of new drugs into the market because of short-cycle development and opportunities for testing. It is in a pharmaceutical company's interest to carry

this out, but the entire environment can also have benefits such as a healthier and more productive population [9].

Distribution channels must follow the development of technologies to meet the customer requirements and desired quality, and to provide security; to achieve this, it is necessary to build a technology platform that will satisfy the future requests of users. 'Technology platform' refers to the bundles of technologies that increase the chances of penetrating new markets [3]. It was important to critically examine the environments of drug distribution channels, and, above all, their participants' abilities in terms of resources, expertise, and knowledge of distribution processes to create more effective relationships and sustainable development among their members.

Because of a dynamic market environment, companies are conditioned to understand interdependencies through distribution channels, and to identify potential risk factors and their likelihood, consequences, and severity [10], as well as the consequences that may influence a company's sustainable environment. Risks caused by a low level of identified factors can have a negative impact on a company's sustainability and entire distribution channel. Therefore, it is important to establish collaboration among all participants in the network to identify and solve problems. In the initial stage of research, it was necessary to identify the risk factors in different aspects, such as resources, infrastructure, internal and external communication, and the extent of cooperation among all members in drug and medicament distribution.

The first step was to evaluate the risk factors in order to discover which factors have the most importance in the drug distribution channel and its members.

Risk factor identification was carried out based on the literature research and through practical consideration of the work process in the distribution channels of pharmaceutical companies operating in Southeast Europe, such as Takeda, Ave Pharmaceutical, Hemofarm, Alkaloid, Krka, Merck, Actavis, Alvogen, Pharma S, and Sibex Line. Selected companies have the biggest market significance and influence, and they have the largest market representation in the Republic of Serbia. The importance of these companies is greatest by size and volume in the pharmaceutical market in the Republic of Serbia. The stated companies are foreign and domestic for their chosen market without distinction. Most of the companies are from the territory of Southeast Europe and, logically because of the geographical distance, they have the largest market share in the Republic of Serbia.

A systematic literature review (SLR) was used for identifying, collecting, and selecting risk factors in the field of drug distribution channels. As a result of the systematic literature review, initial risk factors were identified, grouped, and categorised. The systematic literature review partially used the method defined [11]. The first step prior to the literature review based on this model was defining the research questions.

Based on theoretical implications, two research questions were defined:

- Which risk factors have the greatest impact on drug distribution in the literature?
- Which aspects of risk factors exist in the literature?

Once the research questions were clearly defined, it was necessary to define other parameters for conducting a systematic literature review. These parameters included strategies for the literature review, criteria and procedures for the paper selection, quality check, extraction of data, and synthesis of results [11].

Keywords for the literature review were defined on the basis of research questions, and they are presented in Table 1. The literature research was done by searching electronic databases of scientific papers: Google Scholar, Science Direct, Web of Science, Scopus, EBSCO, Wiley Online Library, and Emerald Insight. A literature review based on the previously defined keywords generated more than 50 papers. There were three main criteria defined by the authors for a paper to be accepted for the literature review.

Table 1. Literature review keywords.

	Keywords for Literature Review
1	pharmaceutical (company) or South East Europe and (drug) distribution
2	risk (factors) and organisational (channel) and management (aspects)
3	risk (factor) and health (public or occupational or environmental)
4	risk and (identification or selection or grouping)

1. Original research was published in English;
2. Articles were published in journals in the Science Citation Index (SCI) (over 90% were present);
3. Articles were associated with risk factors in drug distribution channels.

Scientific journals that were from the SCI list made up 90% of those defining risk factors. In that matter, the manuscripts were compiled according to, defined by, and complied with measures that satisfied and fulfilled scientific standards.

2. Materials and Methods

Two methodologies were used within the research. To identify, analyse, and prioritise risks in drug distribution channels, a systematic literature review and the Delphi method were used to acquire expert judgment of the importance of identified risks (Table A1). The focus was put on the identification and evaluation of risk factors [12].

The problems that arise in the distribution of goods and services were not sufficiently addressed in the existing literature. Therefore, in addition to literature analysing the drug distribution channels, literature that covered the distribution topic in general was included. For that reason, expert judgment was an unavoidable step in the process of confirming the risk factors related to drug distribution channels, which were subject to further analysis and discussion. There were issues related not only to drug distribution, but also to distribution of a wider range of products. Therefore, only risk factors that were directly related to drug distribution channels were identified and confirmed through the Delphi method.

A study was performed between January and August 2019 among experts in these pharmaceutical companies: Takeda Ave Pharmaceutical, Hemofarm, Alkaloid, Krka, Merck, Actavis, Alvogen, Pharma S, and Sibex Line. A total of 43 people participated in this case study. This research included 24 women and 19 men holding professional positions in their companies. Invitees included all pharmacists who worked across the of Republic of Serbia. They represented four different cities from the Vojvodina region of Serbia. The experts who were recruited in this case study were highly educated. The sample consisted of pharmacists whose experience ranged between five and 15 years in the company. All participants in the present study had years of experience as representatives in pharmaceutical companies, which was useful for recording or utilising knowledge and facilitating new ways of thinking about problems and potential solutions [13]. Participants involved in risk assessment had extensive experience in marketing, customer relationships, and cooperation with doctors, and were well acquainted with the management of their drug companies, thus playing a very important role in the distribution of drugs to the market.

Based on the selected papers, we defined all the factors that were marked as risky for companies' distribution channels. The main result of the systematic literature review was a table of risk factors that were verified in 10 pharmaceutical company distribution channels. Risk factors represented input for analysing collected data using the Delphi method in order to assess the importance of these factors on the effectiveness of drug distribution channels.

Delphi Method

The Delphi method has been used in several diverse fields, although it is perhaps most commonly used in health research [14]. This method is useful for studying a wide range of research questions;

it has been utilised for cultivating data and information about a topic by documenting expert or stakeholder views, recording or exploiting collective knowledge that is shared among groups of professionals, and facilitating new ways of thinking about problems and potential solutions [13]. In this case study we took the outlined steps in the Delphi process to define a list of risk factors that affected drug distribution channels, including both literature-based risk factors and new ones defined by respondents [15].

This research was based on a Delphi study among experts from 10 pharmaceutical companies in Southeast Europe. The first step in this study that was applied from the Delphi method was the configuration of a questionnaire that represented a tool for the organisational analysis of the importance of risk factors in the distribution channels of drug companies. Creating a questionnaire implied configuring the risks in the group, defining ways of arranging them, and ranking judgments.

The questionnaire consisted of 78 risks divided into 10 categories. Each risk was represented by one question in the questionnaire. The questionnaire was answered by 43 representatives of 10 pharmaceutical companies in a range from 1 to 5, where a value between 1 and 2 defined a risk that had no impact on the distribution of drugs; between 2 and 3 defined a risk with a small impact on the drug distribution; between 3 and 4 defined a risk that had a middle impact on the distribution of drugs; and between 4 and 5 defined a risk that had a high impact on the distribution of drugs. This stage consisted of two rounds of questionnaires. In each of the first and second rounds, 43 experts completed the questionnaire. Questionnaires were sent by e-mail, and data were analysed and processed. The experts were asked to rank the highest scoring risk factors to create a table of the most important risks in the pharmaceutical distribution channel. Application of the Delphi method has multiple advantages, such as the collection of data from different sources, experts not influencing each other, and employees having more time to think about the questions and the ability to change their minds.

After interviewing professional associates, we obtained the results of the assessment of risk factors in the distribution channels, which was adjusted and corrected by the repeated questionnaire, and a final score was reached by calculating the average values of each risk, taking into account the answers of all participants. Most experts agreed on which items had a high impact on risk.

Findings

The research resulted in individual evaluations of all risk factors. Through the systematic literature review, the 55 most commonly represented risk factors were identified. Thus, in-depth interviews supplemented the factors identified in the previous researches by asking for the general risk factors [16], so 23 additional important risk factors were identified through the interviews. This study demonstrated a total of 78 risk factors in the distribution channels of drugs and pharmaceutical services (Table A1 shows the risk factors identified in the drug distribution channels of 10 different companies).

For risk factors identified by respondents, relevant articles were searched for additional references in order to confirm their importance within the existing literature. The overall number of risk factors that were validated in the initial literature was 15. Respondents identified eight risk factors that were not found in the relevant literature; however, these factors were not excluded from the research in order to check their practical relevance.

Involving experts in the process of risk factor evaluation was of great importance for creating a relevant list of risk factors that affected drug distribution channels. Risk factors that were identified through the literature review included factors of distribution channels in different industries. Based on expert opinion, this list was expanded by factors that specifically affected drug distribution channels.

The evaluation of risk factor importance resulted in a number of factors with important influence (rated above 2.5) and very important significance (rated above 4.5) in the social environment of a drug distribution channel. Using a Pareto chart (Figure 1), the percentage shares of the risk factors assigned to these three categories are shown:

- Category 1 (C1)—Risk factors rated from 0 to 2.5 (17.95%)
- Category 2 (C2)—Risk factors rated from 2.5 to 4.5 (62.82%)

- Category 3 (C3)—Risk factors rated above 4.5 (19.23%)

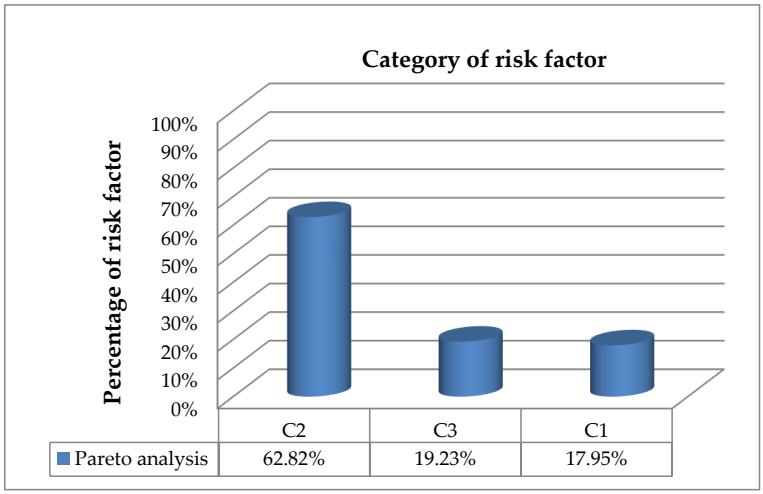

Figure 1. Pareto analysis of evaluated risk factors.

By using this method, it was concluded that over 80% of the risk factors were rated above 2.5, which further implied that a number of factors had a significant influence on the efficiency and effectiveness of the drug distribution channels.

3. Results

A total of 78 risk factors in the distribution channels of pharmaceutical companies were identified, after which they were classified using a systematic literature review. Risk identification involved grouping risk factors by category according to the literature cited in the journal.

After data were obtained, results were summarised to show which risk factors had the biggest influence on the distribution of drugs and to determine the negative effects they produced at the level of primary care. The results of the research were sorted by separate evaluations for all risk factors into categories for easier data analysis, as seen in Table 2.

Table 2. Results of each risk.

Category of Risk	Risk Factor	Risk Coefficient	Effect of Risk
Organizational risks	Not investing in new products	3.91	Middle
	Poor design of products	3.91	Middle
	The lack of ideas and innovations	3.55	Middle
	A narrow product line (i.e., a small number of types of drugs)	3.27	Middle
	Inadequate coordination of professional staff	4.55	High
	Lack of company reputation (i.e., brand unrecognizable)	3.64	Middle
	Insufficient promotion of the drug to the public	4.64	High
	The uncertain budgetary situation, incomplete financing of marketing campaigns	3.91	Middle
	Promotion of new products on the market	4.00	Middle
	Insufficient staff involved in promoting the product (i.e., lack of manpower)	4.36	High
	Insufficient number of experts hired	4.18	High
	Incompetent staff (i.e., lack of educational qualifications or specific interpersonal skills and competencies)	4.64	High
	The high cost of drugs	3.18	Middle
Risks arising between representatives of pharmaceutical companies and doctors	The ability of presenter to promote the drug to certain categories of the population (e.g., age, gender)	2.36	Small
	The unclear division of responsibility (e.g., doctor–pharmaceutical company representative)	4.00	Middle
	Personnel change in team	3.45	Middle
	Inexperienced representatives of pharmaceutical companies	3.36	Middle
	Insufficient information on the drug by a doctor	4.36	High
	Poorly established channels of communication between doctors and representatives of pharmaceutical companies	4.64	High
	Incompatibility between the attitudes of doctors and representatives of pharmaceutical companies	4.09	High
	Incomplete, poor information on the drug, preparation	2.00	No impact
	Personal conflicts between representatives of pharmaceutical companies and doctors	2.00	No impact

Table 2. *Cont.*

Category of Risk	Risk Factor	Risk Coefficient	Effect of Risk
Risks arising between doctor and user	Problems with work at a particular location	2.36	
	Incorrect assessment of users' demands	3.73	Middle
	Prescription of drugs (i.e., the existence of drugs that cannot be prescribed by a prescription)	3.73	Middle
	Mistrust of users	4.00	Middle
	Unrealistic data on the needs (i.e., users who think that they do not need a drug)	4.00	Middle
	Excessive expectations of users	3.09	Middle
	Education and the intention of doctors to prescribe a particular drug	3.64	Middle
	The dissatisfaction of users	3.91	Middle
	Poor awareness of users	3.64	Middle
	Change in user habits	2.18	Small
	Failure to adopt the recommended therapy	4.18	High
Risks of pharmacies	The choice of public or private pharmacies	3.73	Middle
	Inability to complain about the product	1.82	No impact
	The lack of the necessary amount of preparation	4.73	High
	The choice of pharmacies in the procurement of certain drugs from pharmaceutical companies	4.00	High
	A badly built network of distribution channels	4.45	High
Competitive risks	The existence of a product that is competitive (e.g., the appearance of substitutes, replacement products)	4.55	High
	Strengthening of other companies in the market	4.82	High
	The lower price of a competitive drug	4.64	High
	The spread of ideas that distort the company's reputation and create distrust among the public (e.g., the danger of taking dietary supplements, the harm of taking drugs)	3.00	Middle
	The emergence of new trends in consumption	2.18	Small
	The use of non-standardised therapy for the treatment and use of alternative medicine	2.00	No impact
	Loss of a previously built distribution network	4.09	High
	The existence of a monopoly on the market	4.55	High
	Market segmentation and product diversification	4.27	High
Technical risks	Lack of technical equipment	3.09	Middle
	The possibility of failure of information technology (i.e., accidental publication of incorrect or confidential data)	3.45	Middle
	Bad influence of the Internet and social networks	2.09	Small
	Lack of application of modern technology achievements	2.55	Small
	Excessive reliance on advertising via the Internet	2.70	Small
Legal risks	Lack of product quality control	3.91	Middle
	Changing legislation (e.g., new or existing regulations)	4.00	Middle
	Uneducated populations, inadequate health education	2.91	Small
	Poor economic conditions in the country, the low purchasing power of the individual	4.55	High
	Political influences (i.e., change of regime)	2.18	Small
	The absence of a license for a particular drug	4.82	High
	The impossibility of patenting the product	4.82	High
Logistic risks	Not knowing the location	1.64	No impact
	Unfavourable location	2.00	No impact
	Lack of necessary quantities of drugs	3.73	Middle
	Long time for drug delivery	4.09	High
	Problems with inventory (e.g., damage to goods, the impossibility of utilisation of inventories)	4.55	High
	Problems with transportation (e.g., inadequate storage, lack of means of transport)	3.91	Middle
Security risks	Creating an unsafe workplace	1.55	No impact
	Failure to comply with prescribed acts in the field of safety and health at work	3.00	Small
	The use of unsafe equipment and means for work	4.55	High
	Injuries and other types of violations of employees	3.73	Middle
	Environmental risks (e.g., air pollution, fire)	2.27	Small
	External fraud: pranks, misuse, theft (by employees, third parties)	3.91	Middle
	Emergency management (i.e., biological, geological and meteorological threats)	1.64	No impact
Risks of informing	Unclearly defined contractual relations (between companies and wholesale, companies and pharmacies, wholesalers and pharmacies)	3.91	Middle
	Loss of access to information (i.e., the company does not have access to information on the level of dealer inventories, the needs of the pharmacy)	3.27	Middle
	Unauthorised access to information (i.e., obtaining illicit business information)	3.71	Middle
	Inadequate decisions management (i.e., decisions based on unverified information)	4.00	Middle
	Undeveloped information structure (i.e., lack of information exchange)	4.64	High

Risk factors that were rated above 4.5 (very high impact) were: The impossibility of patenting the product (4.82), lack of a license for a particular drug (4.82), strengthening of other companies in the market (4.82), lack of the necessary preparation (4.73), insufficient promotion of the drug to the public (4.64), incompetent staff (4.64), badly established channels of communication between doctors and representatives of the pharmaceutical companies (4.64), lower price of a competitive drug (4.64), undeveloped information structure (4.64), problems with supplies (4.55), use of unsafe equipment and means for work (4.55), inadequate coordination of professional staff (4.55), existence of

a monopoly in the market (4.55), the existence of a product that was competitive (i.e., the appearance of substitutes, replacement products) (4.55), poor economic conditions in the country (4.55), and the low purchasing power of the individual (4.55). Results of the research by category were: organisational risks (3.94), legal risks (3.89), the risks between the company and the doctor (3.81), competitive risks (3.79), pharmacy risks (3.75), risks of informing (3.75), the risks between the doctor and the user (3.61), logistic risks (3.32), security risks (3.02), and technical risks (2.78).

Risk Classification and Categorisation according to Defined Areas

Risk factor perception and communication research were necessary in the process of community work integration across the various fields of risk factors [17]. The categories that served as a conceptual framework for classifying risk factors were the organisational risks in the company, company–doctor risks, doctor–user risks, risks of pharmacies, risks of informing, and competitive, technical, legal, security and logistical risks.

Analysing the areas in which the risk factors were grouped, we concluded that finding solutions to organisational risks within a company was key to the successful distribution of drugs and that they should be given the utmost attention. Categories that received high coefficients were: legal, the risks between doctors and companies, and competitive risks. Political, institutional, and regulatory uncertainty in most countries in Southeast Europe made the process of doing business more difficult, especially in the field of organisation and law. Doctor–user risk, risk of informing, and pharmacy risk were categories that had importance but not crucial significance for drug distribution. Risks grouped in logistic, technical, and security categories were shown to have the least impact on the distribution of drugs, and they had a minor influence on customers. Management of security risks referred to the development of the work plan of the Committee for Safety and Health at Work [18]. The results of the research of risk by category are shown in Figure 2. Results of the research by category were: organisational risks (3.94), legal risks (3.89), the risks between the company and the doctor (3.81), competitive risks (3.79), pharmacy risks (3.75), risks of informing (3.75), the risks between doctor and user (3.61), logistic risks (3.32), security risks (3.02), and technical risks (2.78).

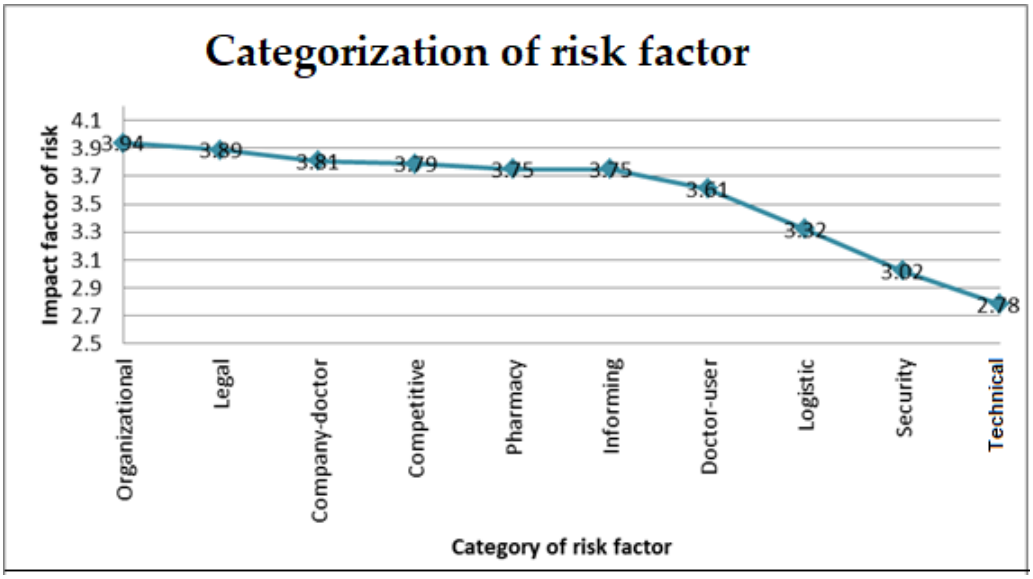

Figure 2. Results of the research of risk by category.

4. Discussion

The research showed that drug distribution channels mainly face the problem of patenting a product and obtaining a license for the application and use of drugs in a particular territory

(Table A1—Risk factors 58 and 59), so these risk factors have a great influence on drug availability to customers and on the sustainable development of drugs in general. Drug distribution channels follow a strict legal framework and are, therefore, faced with an array of risk factors related to legal issues in the distribution of products (Table A1—Risk factor 54). Complex interactions between risks and society call for better risk 'governance' [19]. Top management initiatives and compliance with government regulations appear to be the key drivers to supplying management sustainability efforts and procurement of licenses [20]. This depends on the laws in a specific country and on the way that they are implemented [21]. If the laws are not written well, they may cause many problems of organisation and management in public health. Not all countries have a clear governmental vision of the future of primary care. In a majority of countries, important governance functions (for example, priority setting and supply planning) have been decentralised to regional and/or local authorities [22]. The time required to patent a medicament and obtain a license depends on laws in specific countries (Table A1—Risk factor 54), communication between research centres and company managers (Table A1—Risk factors 17, 19, 38), and post-patent expiration price competition becoming more intense and rough (Table A1—Risk factors 8, 13, 56), compelling mainline drug companies to either innovate or fade away [23].

A competitive factor that was at the very top of the impact scale was the strengthening of pharmaceutical companies in the market, from which the authors concluded that pharmaceutical companies face tough competition. The emergence of market competition (Table A1—Risk factor 40) is a typical problem of drug distribution channels. Healthy competition enables lobbying and lower prices of products (Table A1—Risk factor 41). Competitiveness can be observed through different health care products that are distributed differently and vary in their cost, are critical to delivery of patient care, and have potential impact on service improvement (Table A1—Risk factor 65). The existence of monopolies (Table A1—Risk factor 46) and the replacement products' growing influence (Table A1—Risk factor 47) on patient associations [24] also belong to the potential threats from permanent competition. Due to increased competition, it is necessary to deliver health service more efficiently and effectively [24].

Drug distribution channels are faced with organisational risks such as the lack of promotion (Table A1—Risk factors 6, 7, 9, 10), incompetent staff (Table A1—Risk factors 11, 12, 14), and inadequate coordination of staff (Table A1—Risk factors 5, 16) during the distribution of drugs. It is worth considering the role of employee participation in pharmacy risk management. Lack of promotion can impact information about the danger of using the drugs that is necessary to customers. In the case of incompetent staff, this may cause distribution problems such as stagnation in transport (Table A1—Risk factor 36), insufficient communication with other distribution participants (Table A1—Risk factors 15, 34, 37), misleading drug information (Table A1—Risk factors 42, 49, 50), the impossibility of presenting products, and many others. It is necessary to improve employees' interpersonal competencies, skills in empathy, customer service capabilities, communication skills, problem-solving skills, product knowledge, and perspective-taking skills to help them attain customer trust and loyalty [25,26]. Pharmaceutical companies must increase the effectiveness of the organisation's structure and processes, and management strategies [27].

Pharmaceutical companies are faced with risks related to logistics and security, including the transport of drugs, problems with the supply of inventory, and risks related to the very site of delivery. Logistics is all about managing the flow of materials and information from source to customer across the entire range of material handling and movement functions throughout the organisation and its supply channels [28]. This implies the determination and implementation of safety protection at work (Table A1—Risk factors 66, 69, 71) and a policy of controlling the distribution of drugs and staff (Table A1—Risk factor 53), as well as procedures that ensure the health and well-being of all involved in the drug distribution channels (Table A1—Risk factor 67). Use of unsafe equipment can cause problems such as bad product handling and contamination of different materials (Table A1—Risk factor 70), inadequate storage, transport, etc. To define and provide the necessary number of products in a

safe environment is a main challenge and a requirement of successful and quality distribution. Risks in this area include issues that may occur on the way from the producer to the user and those related to the transport of drugs (Table A1—Risk factor 65), problems with inventory supply (Table A1—Risk factor 64), as well as risks related to the very site of delivery (Table A1—Risk factors 60, 61). In seeking ways to manage higher levels of external turbulence, organisations need to monitor distribution channel risks through appropriate performance metrics [29]. Also, distributing drugs to pharmacies is of great importance because without well-developed organisation and management in public health the network of drug distribution cannot thrive. Building a network of pharmacies includes selecting vendors and negotiating procurement of raw materials; arranging product distribution; accepting, checking, and transferring products; authorising payments; and customer reception [30].

The research showed that communication channels between doctors and company representatives plays an essential role in the distribution of drugs (Table A1—Risk factor 19). The doctor acts as a perfect agent for the health system and, hence, he or she makes prescription choices based on the drug price effectiveness and availability [31], and on the risk to the patient. Contacts between doctors and pharmaceutical companies are associated with the success of those companies [32]. Additionally, contrary to most other industries, promotional spending is not targeted at consumers, but rather at prescribing doctors. While this can be explained by the important role of the doctor as the patient's agent, another important reason lies in the regulatory restrictions (Table A1—Risk factor 25) on direct-to-consumer advertising of prescription drugs that are present in most countries [33]. Improving the collaboration between supply chain pharmaceutical partners reduces uncertainty and risk [34].

The availability of information (Table A1—Risk factor 77) is critical to the effectiveness of drug distribution channels. It is related to collecting information and data from the health environment of pharmaceutical companies, organising and managing data in a way that ensures their easier and more efficient retrieval, developing distribution channels that facilitate the exchange of information, determining the appropriate methods for storing information, and establishing policies and procedures that protect information from loss or corruption. Information technologies are deployed in various areas of the healthcare sector [35–37] that allow availability of information. The main challenge among distribution channel participants is to get the right information at the right time (Table A1—Risk factors 73, 76), which is the main challenge in a business environment [38]. In this way, problems such as the lack of networked information (Table A1—Risk factor 78), and policies and procedures that protect information from loss or corruption (Table A1—Risk factors 52, 74, 75) will be eliminated or reduced and the transfer of information will speed up.

Risks that occur between doctors and users are external, so the pharmaceutical company cannot have a big impact on primary care. Here, the doctors play a main role. The doctor acts as a perfect agent for the health system (which includes both patients and the health authority), and hence, he or she makes prescription choices based on the price-effectiveness of the drugs and their availability [31]. The doctor's task is to establish contact with clients and to act psychologically, stressing the benefits of using a particular drug as a representative of the pharmaceutical company (Table A1—Risk factors 15, 17, 21). Technological change risk comprises improvements in technology that render current technology and development efforts obsolete [39]. Adjusting to changes in technology represents the inevitable challenge to all pharmaceutical companies that want to keep up with modern methods of management and achieve maximum results when introducing a product.

5. Conclusions

The purpose of introducing this analysis was primarily to reduce the negative effects of risk when organising and managing the distribution channels of pharmaceutical companies. In this study, the primary risk factors in drug distribution channels were identified and their level of importance and impact on stakeholders were determined. The necessity for sustainability in distribution channels is more pronounced in environments characterised by the intensity of new diseases and higher demands for sustainable development and distribution of drugs. The research results should contribute to

developing an environment that will provide the smooth functioning of drug distribution channels, and to ensuring that appropriate actions are taken in cases of the appearance of negative risk factors within these channels [40].

In this study of pharmaceutical companies' distribution channels, we obtained the opinions of expert associates who were direct participants in primary care. We also obtained estimates of the risks, on the basis of which we made conclusions about the highest-impact risk factors on the distribution of drugs using a new risk assessment tool for risk management strategies in the field of sustainable infrastructure development management [6]. Most authors agreed that the establishment of cooperation based on effective communication and trust among participants in distribution channels is key in preventing the existence of risks.

The identified risk factors and their systematisation by importance and plane of influence can be used as the basis for evaluating distribution channels and determining risk levels for participants in the process and in society in general. Prioritising of risk factors helps a pharmaceutical company focus its decision-making and risk management efforts on the most important risks [41]. Considering that this research was implemented for southeast Europe, it is possible to adjust for other regions. Depending on the social–economy environment, the list of identified risk factors can be expanded or narrowed for future research. These factors highlight the need to develop local studies of supply chain risk issues, to understand the industry progress, and to assist in the development of strategies by governments and companies [42]. The limitation of the study is that some risk factors were suited, customised, and adjusted only for the pharmaceutical industry and cannot be applied to other fields in science. However, most of the risk factors can be enforced and connected to other distributive channels.

Some of the advantages of studying the risks in the distribution channels of pharmaceutical companies are: the ability to prevent and to solve risk situations, the reduction of unnecessary losses in the organisation, the increase in quality control, the maintenance of business continuity, and an increase in the flexibility of the company.

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Appendix A

Table A1. Review of identified risk factors.

Categories	Factors of Risks	Literature Review
Organisational risks in the company	1. Not investing in new products	Innovation is creating the required new products, processes, and systems for adapting to changing technologies, markets, and models of competition [3]. Negative effects of risk factors are: other companies developing at market, lobbying of competitive companies, smaller range of sales, lost trust from customers.
	2. Poor design of products	Customer demands and requirements are different. Companies change product designs to meet customer wishes. Changes in products or services can determine that suppliers also make the appropriate modifications to their raw materials or sub-assemblies [43]. Negative effects of risk factors are: customer complaints, developing of other companies at market, bad company reputation.

Table A1. *Cont.*

Categories	Factors of Risks	Literature Review
	3. The lack of ideas and innovations	Innovation is creating the required new products, processes, and systems for adapting to changing technologies, markets, and models of competition [3]. Negative effects of risk factors are: developing of other companies at market, lobbying of competitive companies.
	4. A narrow product line (i.e., a small number of drug types)	Product lines and narrow product lines have high risk values [44]. Negative effects of risk factors are: indifference of customers, smaller range of sales.
	5. Inadequate coordination of professional staff	Focuses on resources and people in firms. It considers the knowledge, capabilities and roles of people, as well as the team structure and organisational units associated with the daily schedule [45]. Negative effects of risk factors are: worker dissatisfaction, unproductivity in performing employee activity, long delivery times, customer complaints, communication problem between employees.
	6. Lack of company reputation (i.e., unrecognisable brand)	It is necessary to talk about marketing risks [46]. Negative effects of risk factors are: bad information for customers, smaller range of sales.
	7. Insufficient promotion of the drug to the public	It is necessary to talk about marketing risks [46]. Negative effects of risk factors are: customers are uninformed about the bad influence of a drug, developing of other companies at market, lobbying of competitive companies.
	8. Uncertain budgetary situation, incomplete financing of marketing campaigns	It is necessary to talk about marketing risks [46]. Negative effects of risk factors are: developing of other companies at market, lobbying of competitive companies, bad information for customers, unrecognizable company at market.
	9. Promotion of new products on the market	It is necessary to talk about marketing risks [46]. Negative effects of risk factors are: lack of customer trust, high expenses.
	10. Insufficient staff involved in promoting the product (e.g., lack of manpower)	It is necessary to talk about marketing risks [46]. Negative effects of risk factors are: bad information for customers, smaller range of sales, customers are uninformed about the bad influence of a drug, developing of other companies at market, lobbying of competitive companies.
	11. Insufficient number of experts hired	Focuses on resources and people in firms. It considers the knowledge, capabilities, and roles of people, and the number of people in a company. It also considers the team structure and organisational units associated with the daily schedule [45]. Negative effects of risk factors are: bad information for customers, smaller range of sales, customers uninformed about the bad influence of a drug, long delivery times, making solutions for problems.
	12. Incompetent staff (i.e., lack of educational qualifications or specific interpersonal skills and competencies)	It is necessary to improve employees' interpersonal competencies, skills in empathy, customer service capabilities, communication skills, problem-solving skills, product knowledge, and perspective-taking skills to help employees attain customer trust and loyalty [25,26]. Negative effects of risk factors are: wrong medical treatment, communication problems, drug storage problems, transport problems.
	13. The high cost of drugs	Consumers want to buy the best for the least money or 'best value for money' cost–value ratio. They are no longer willing to pay more for the same product if they can get it cheaper elsewhere. [47]. Negative effects of risk factors are: losing customers, smaller range of sales.
Risks arising between representatives and doctors	14. Ability of presenter to promote the drug for certain categories of the population (e.g., age, gender)	Quality of job-related training and competencies among employees [27] affects improving the skills of employees in the pharmaceutical company. Negative effects of risk factors are: nonexistent educational training sessions, incompetent workers.
	15. The unclear division of responsibility (e.g., doctor–pharmaceutical company representative)	Many studies have shown that contacts between doctors and pharmaceutical companies are associated with the success of those companies [32]. Negative effects of risk factors are: unavailability of some type of drugs, medical staff having no valid information about drugs, bad communication, bad information for customers, wrong application of medicaments, drug storage problems, transport problems.
	16. Personnel change in team	Focuses on resources and people in firms. It considers the knowledge, capabilities, and roles of the people and their number in the company. It also considers the team structure and organisational units associated with the daily schedule. [45]. Negative effects of risk factors are: unavailability of some type of drugs, medical staff having no valid information about drugs, bad communication, bad information for customers, wrong application of medicaments.

Table A1. *Cont.*

Categories	Factors of Risks	Literature Review
	17. Inexperienced representatives of pharmaceutical companies	Quality of job-related training and competencies among employees [27] affects improving the skills of employers in the firm. Negative effects of risk factors are: unavailability of some type of drugs, medical staff having no valid information about drugs, bad communication, bad information for customers, wrong application of medicaments.
	18. Insufficient information on the drug by doctor	The prescribing behaviour of doctors is influenced by visits from pharmaceutical sales representatives [48]. Negative effects of risk factors are: unavailability of some types of drugs, medical staff having no valid information about drugs.
	19. Poorly established channels of communication between doctors and representatives of pharmaceutical companies	Many studies have shown that contacts between doctors and pharmaceutical companies are associated with the success of those companies [32]. Negative effects of risk factors are: unavailability of some type of drugs, medical staff having no valid information about drugs.
	20. Incompatibility between the attitudes of doctors and representatives of pharmaceutical companies	Pharmaceutical products have long development life cycles and this presents a challenge for supply-chain managers, who have to manage their internal relationships with doctors [1,49–52]. Negative effects of risk factors are: unavailability of some types of drugs, medical staff having no valid information about drugs, bad communication, bad information for customers.
	21. Incomplete, poor information on the drug, preparation	The prescribing behaviour of doctors is influenced by visits from pharmaceutical sales representatives [32]. Negative effects of risk factors are: bad information about the negative effects of drugs, bad communication.
	22. Personal conflicts between representatives of pharmaceutical companies and doctors	Pharmaceutical products have long development life cycles and this presents a challenge for supply-chain managers, who have to manage their internal relationships with doctors [1,49–52]. Negative effects of risk factors are: unavailability of some types of drugs, medical staff having no valid information about drugs, bad communication, bad information for customers.
Risks arising between doctor and a patients	23. Problems with work at a particular location	Dealing with work problems at particular locations consists of four general steps: identification of locations and threats for each key location, estimation of probabilities and potential losses, evaluation of countermeasures, and selection of countermeasures [53]. Negative effects of risk factors are: unfamiliar location, transport problems, long delivery times.
	24. Incorrect assessment of user demands	There is a need to explore risks that develop in relationships with customers [54]. Negative effects of risk factors are: bad information about negative effects of drugs, bad communication.
	25. Prescription of drugs (i.e., drugs without state control that cannot be prescribed by a prescription)	Drugs without prescriptions lead to possibly high-risk situations [55]. Negative effects of risk factors are: developing of other companies at market, smaller range of sales.
	26. Mistrust of users	This risk factor considers the knowledge, capabilities, and roles of the people from pharmaceutical companies to contact customers and develop trust [45]. Negative effects of risk factors: bad reputation, bad communication, bad information for customers.
	27. Unrealistic data on user needs (i.e., users who think that they do not need a drug)	There is a need to explore risks that develop in relationships with customers [54]. Negative effects of risk factors: bad communication, bad information for customers, drug storage problems.
	28. Excessive expectations of users	There is a need to explore risks that develop in relationships with customers [54]. Negative effects of risk factors: bad communication, bad information for customers, drug storage problems.
	29. Education and the intention of doctors to prescribe a particular drug	There is a need to explore risks that develop in relationships with customers [54]. Negative effects of risk factors: bad communication, bad information for customers, drug storage problems, indifference of doctors to prescribing drugs.
	30. The dissatisfaction of users	There is a need to explore risks that develop in relationships with customers [54]. Negative effects of risk factors are: bad information about negative effects of drugs, bad communication, developing of other companies at market, smaller range of sales.
	31. Poor awareness of users	Pharmaceutical companies are legally required to disclose full information to their users regarding their products' potential outcomes with the intention that such disclosures will lead to normatively better decisions when buying drugs [56]. Negative effects of risk factors are: bad information about negative effects of drugs, bad communication, developing of other companies at market, smaller range of sales.
	32. Change in user habits	The requirements of patients are determined by assessments of their prognosis, which are continually changing [1,49–52]. Negative effects of risk factors are: lack of new products, uninterested customers.

Table A1. *Cont.*

Categories	Factors of Risks	Literature Review
	33. Failure to adopt the recommended therapy	There is a need to explore risks that develop in relationships with customers [53]. Negative effects of risk factors are: bad communication, bad information for customers, losing customers.
Risks of pharmacies	34. The choice of public or private pharmacies	Experts talked about problems and solutions in public and private pharmacies [57]. Negative effects of risk factors are: representation deficiency at market, developing of other companies at market, smaller range of sales, bad reputation.
	35. Inability to complain about the product	Pharmacies are institutions that have a contractual obligation to supply and return drugs if users make complaints [58]. Negative effects of risk factors are: unsatisfied customers, loss of customers, bad company reputation.
	36. The lack of the necessary amount of preparation	Research describes problems during the distribution of products [10]. Negative effects of risk factors are: impossibility of delivering drugs, creating of stock, impossibility of providing needed amount of drugs, transport problems.
	37. Selection of drugs for procurement	In many countries, selection of drugs needs to be done by government at all levels, by choosing the source of supply and ensuring the quality and stability of drugs [59]. Negative effects of risk factors are: deficiency of representation at market, developing of other companies at market, smaller range of sales, and bad reputation of company.
	38. Badly built network of distribution channels	Building a network of distribution channels includes selecting vendors and negotiating procurement of raw materials, arranging product distribution, accepting, checking, and transferring products, authorizing payments, and customer reception [30]. Negative effects of risk factors are: representation deficiency at market, large expenses, loss of customers.
Competitive Risks	39. The existence of a product that is competitive (e.g., the appearance of substitutes, replacement products)	Pharmaceutical companies are operating in evolving competitive markets and are faced with the appearance of substitutes and replacement products [60]. Negative effects of risk factors are: new drugs with different characteristics, companies are forced to reduce the price of drugs, existing substitutes for drugs.
	40. Strengthening of other companies in the market	Under pressure to compete in both domestic and international markets, companies need to develop and create conditions that enable them remain competitive [61]. Negative effects of risk factors are: lobbying of competitive companies, new drugs on the market, hiding information at all levels from companies to doctors.
	41. Lower price of competitive drug	Consumers want to buy the best for the least money or 'best value for money' cost–value ratio. They are no longer willing to pay more for the same product if they can get it cheaper elsewhere [47]. Negative effects of risk factors are: appearance of drugs with different characteristics but lower price.
	42. The spread of ideas that distort the company's reputation and create distrust among the public (e.g., the danger of taking dietary supplements, the harm of taking drugs)	Studies deal with questions about the reputation of companies [62]. Negative effects of risk factors are: bad reputation, lost customers.
	43. The emergence of new trends in consumption	Innovation is creating the required new products, processes, and systems for adapting to changing technologies, markets, and models of competition [3]. Negative effects of risk factors are: company is not able to respond to market demands, stagnation of company.
	44. The use of non-standardised therapy for the treatment and use of alternative medicine	Studies talk about the advantages of alternative medicine [63]. Negative effects of risk factors are: loss of customers, bad information for customers.
	45. Loss of previously built distribution network	Supply distribution network is a function of supply network design, supplier relationships, supplier selection processes, supplier order allocation, and supply contracts [64]. Negative effects of risk factors are: less profits in company, loss of customers, bad conditions for work.
	46. The existence of a monopoly on the market	Under pressure to compete in both domestic and international markets, companies need to create conditions that enable them to remain competitive and to progress and develop [61]. Negative effects of risk factors are: lobbying of competitive companies, new drugs on the market, hiding information at all levels from companies to doctors.
	47. Market segmentation and product diversification	The research describes segmentation and product diversification [65]. Negative effects of risk factors are: lobbying of competitive companies, new drugs on the market, hiding information at all levels from companies to doctors.

Table A1. *Cont.*

Categories	Factors of Risks	Literature Review
Technical Risks	48. Lack of technical equipment	Technology risk considers the overall availability of the technology with its practical use [43]. Negative effects of risk factors are: undeveloped informative structure, bad information for customers.
	49. The possibility of failure of information technology (i.e., accidental publication of incorrect or confidential data)	Focuses on the hardware and technology associated with the software used and their cohabitation [45]. Negative effects of risk factors are: poorly built informative structure, bad information for customers, bad communication.
	50. Bad influence of the Internet and social networks	With technological advancements, global Internet and social networks reach almost every country [66,67]. Negative effects of risk factors are: poorly built informative structure, bad information for customers, bad reputation, smaller range of sales.
	51. Lack of application of modern technology achievements	Technology is comprised of improvements that render current technology and development efforts obsolete [39]. Negative effects of risk factors are: poorly built informative structure, bad information for customers, bad communication.
	52. Excessive reliance on advertising via the Internet	With technological advancements, global Internet and social networks reach almost every country [66,67]. Negative effects of risk factors are: poorly built informative structure, bad information for customers, bad reputation, smaller range of sales, spreading wrong information.
Legal Risks	53. Lack of product quality control	Management of security risks refers to the development of the work plan in pharmaceutical companies [18]. Negative effects of risk factors are: unsatisfied customers, bad company reputation.
	54. Changing legislation (e.g., new or existing regulations)	Changing legislation is the sustainability-related issue with the greatest impact on businesses [68]. Negative effects of risk factors are: breaking on the market with new drugs.
	55. Uneducated populations, inadequate health education	The research describes social aspects and risk [69]. Negative effects of risk factors are: uninterested customers, impossibility of selling company products.
	56. Poor economic conditions in the country, the low purchasing power of the individual	Many studies describes financial risks [70]. Negative effects of risk factors are: uninterested customers, impossibility of selling company products.
	57. Political influences (i.e., change of regime)	The studies explain political risk [71]. Negative effects of risk factors are: changing strategy in company, lobbying of competitive companies.
	58. The absence of a license for a particular drug	Top management initiatives and compliance with government regulations appear to be the key drivers to supply management sustainability efforts and procurement of licenses [20]. Negative effects of risk factors are: long period for licensing the product, impossibility of doing research, bad communication between scientist and organisation.
	59. The impossibility of patenting the product	The pharmaceutical industry is subject to a wide variety of powerful institutional and regulatory pressures such as drugs coming off patent and the impossibility of patenting the product [1,49–52]. Negative effects of risk factors are: long period for licensing the product, impossibility of doing research, bad communication between scientist and organisation.
Logistic Risks	60. Not knowing the location	Issues associated with physical and infrastructure facilities are considered [45]. Negative effects of risk factors are: impossibility of delivering drugs, creation of stock.
	61. Unfavourable location	Focuses on geographic location. Issues associated with physical and infrastructure facilities are considered [45]. Negative effects of risk factors are: impossibility of delivering drugs, product damage.
	62. Lack of necessary quantities of drugs	Managing the flow of materials and information from source to customer across the entire range of materials handling and distributing the necessary quantities of drugs [72]. Negative effects of risk factors are: lobbying of competitive companies, new drugs on the market, hiding information at all levels from companies to doctors.
	63. Long drug delivery time	Firms may derive more benefit from establishing inventory policy parameters, increasing coordination, and reducing supplier lead times [73]. Negative effects of risk factors are: impossibility of providing needed amount of drugs and proper handling, damage to drugs.
	64. Problems with inventory (e.g., damage to goods, the impossibility of inventory utilisation)	Firms may derive more benefit from establishing inventory policy parameters, increasing coordination, and reducing supplier lead times [73]. Negative effects of risk factors are: impossibility of providing needed amount of drugs and proper handling.
	65. Problems with transportation (e.g., inadequate storage, lack of means of transport)	Different healthcare products are distributed differently and vary in their cost, critical to delivery and potential impact on service improvement [74]. Negative effects of risk factors are: impossibility of providing needed amount of drugs, damaging of drugs, safety issues.

Table A1. *Cont.*

Categories	Factors of Risks	Literature Review
Security Risks	66. Creating an unsafe workplace	Management of security risks refers to the development of the work plan in pharmaceutical companies [18]. Negative effects of risk factors are: health risk for people employed in company, inability to do standard work in company.
	67. Failure to comply with prescribed acts in the field of safety and health at work	Management of security risks refers to the development of the work plan in pharmaceutical companies [18]. Negative effects of risk factors are: ban on business for company, paying penalties and fines.
	68. The use of unsafe equipment and means for work	Health system pharmacists often struggle with issues related to patient safety with bad instruments and other work products [75]. Negative effects of risk factors are: health risk for people employed in company, inability to do standard work in company, possibility of damage.
	69. Injuries and other types of violations of employees	Negative effects of risk factors are: health risk for people employed in the company, difficult conditions in workplace.
	70. Environmental risks (e.g., air pollution, fire, etc.)	The exploration mentions environmental risks [76]. Negative effects of risk factors are: health risk for people employed in the company, damage of workplace and equipment.
	71. External fraud: pranks, misuse, theft (by employees, third parties, etc.)	The research describes the influence of large companies and their miserable behaviour [77]. Negative effects of risk factors are: health risk for people employed in the company, difficult work conditions.
	72. Emergency management (i.e., biological, geological, and meteorological threats)	Global sourcing that causescatastrophic risks [78]. Negative effects of risk factors are: health risk for people employed in company, damage of workplace and equipment.
Risks of informing	73. Unclearly defined contractual relations (between companies and wholesale, companies and pharmacies, wholesalers and pharmacies)	Transparency and information sharing among the supply chain partners foster collaboration between companies and wholesale, companies and pharmacies, wholesalers and pharmacies [79,80]. Negative effects of risk factors are: mistakes and delays in distribution of drugs.
	74. Loss of access to information (i.e., company does not have access to information on the level of dealer inventories, the needs of the pharmacy)	Information has been deployed in various areas of the healthcare sector, including structure [14,35–37]. Negative effects of risk factors are: long time to distribute products, impossibility of distribution.
	75. Unauthorised access to information (i.e., obtaining illicit business information)	Course of information influences relations between managers and team [81]. Negative effects of risk factors are: revealing business secrets, using illegal information for gain/profit, violation of legal regulations.
	76. Inadequate decision management (i.e., decisions based on unverified information)	By sharing supply information, firms can alert to a disruption at an upstream stage, derive the correct early warning time, and make proper decisions to offset the negative impact [82]. Negative effects of risk factors are: mistakes in business, stagnation of company.
	77. Undeveloped information structure (e.g., lack of information exchange)	Information has been deployed in various areas of the healthcare sector, including structure [14,35–37]. Negative effects of risk factors are: there is no system for exchanging information.
	78. Poorly designed information system	Focus on addressing the content, structure, and relationships associated with information data [45]. Negative effects of risk factors are: there is no system for exchanging information, bad communication.

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