

21st International Conference on Transport Science (ICTS 2024)

Humanitarian logistics: a framework for structuring and research

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Abstract

Growing challenges and crises in various areas around the world threaten a significant part of the population. Therefore, the importance and interest of the community in humanitarian logistics is growing, as an instrument for mitigating the negative consequences of these challenges on people, their property, etc. However, just as there is misunderstanding, misinterpretation, reduction or trivialization of the concept and meaning of logistics, there is not a sufficiently clear and comprehensive foundation, overview and systematization of that part of it that relates to the planning, organization and implementation of humanitarian processes and activities. The lack of analysis of the structure of flows and parameters of participants in humanitarian logistics is particularly pronounced. This paper tries to look at humanitarian logistics as a complex set of different and interconnected participants, processes and flows, through its structuring. In this way, the paper offers a framework for researching organizations that perform humanitarian logistics activities, which can be a valid basis and tool for analyzing their needs, identifying the problems they face and the directions for improvement.

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Peer-review under responsibility of the scientific committee of the 21st International Conference on Transport Science

Keywords: Humanitarian logistics; characteristics; participants; flows; logistics network; structuring

1. Introduction

Climatic, socioeconomic and geopolitical changes and earthquakes lead to an increase in humanitarian problems and crises in different parts of the planet. Human existence, health, safety, rights and/or property are threatened by natural hazards and disasters, such as earthquakes, floods, droughts, landslides, etc. but also diseases, epidemics, inequality, poverty, war conflicts, terrorism, etc. In such conditions, humanitarian work has and will have increasing importance. One of its vital parts is humanitarian logistics (HL), which represents the planning, implementation and control of the efficiency of material and immaterial flows, from the point of origin to the point of consumption, in order to alleviate the suffering of vulnerable people (Thomas & Kopczak, 2005). The goal of HL is to provide the right

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service or delivery of the right goods/materials, of the right quality, in the right quantity, at the right time and in the right place to people threatened by disasters or long-term crises (Cuzzolino, 2012). Logistics generates about 80% of the costs of providing humanitarian aid (Van Wassenhove, 2006), and a large part of the workforce in organizations that provide humanitarian aid is engaged in logistics activities and processes. Thus, almost a quarter of the staff of the International Committee of the Red Cross work in the logistics sector (ICRC, no date).

Humanitarian logistics operators (HLO) mean organizations and individuals that perform HL activities. These activities are not only carried out by humanitarian organizations and logistics companies, but also by entities for which humanitarian work and logistics are not their main activity (donors, governments, the army, etc.). The research of HLOs implies the identification of participants (parties with whom they cooperate) and categories of users, conditions for the implementation of activities, flows, network characteristics, procurement and distribution logistics parameters, etc. and represents the basis for a more detailed study of their work and logistics and thus for defining their goals, needs, problems, planning and designing systems and processes, ways of improvement, etc.

Kovács & Spens (2007) and Cuzzolino (2012) identified the main actors and characteristics of HL in relation to the different phases of disaster management: (mitigation) preparation, response and reconstruction/recovery, and the observation level (operational or strategic). Jahre et al., (2009) defined a framework for the analysis of HL networks in relation to its sustainability, coordination and centralization. Overstreet et al., (2011) defined a framework for HL research that takes into account its basic elements. Tomasini & Van Wassenhove (2009) defined 5 types of flows in HL (5b - boxes, bytes, bucks, bodies, brains). However, in the research of HL flows, their parameters have not been clearly and comprehensively identified. Trends, challenges and problems in HL have been discussed in numerous papers (e.g. Kovács & Spence, 2009). Davidson (2006) analyzed key performance indicators in HL. In recent years, there have been more and more papers dealing with HL centers, their location (Petrović et al., 2022), functions (Kaynak & Tuğer, 2014), etc. Special attention is paid to the logistics of evacuation during disasters, but research focuses more on the evacuation of people (Kovács & Spence, 2007) and animals (Lusková & Tomek, 2006), than on the flow of property, freight, goods, etc. In a smaller number of papers, long-term development and the fight against problems such as poverty, hunger, etc. were considered as areas of interest, along with disasters (e.g. Çelik et al., 2012), which is why these papers have so far the most comprehensive contribution to the foundation of HL. Safeer et al. (2014) identified some parameters of modeling flows of vulnerable people and distribution of resources (time, distance, quantity, etc.). In some papers, partial structuring of procurement in HL was carried out (e.g. Lamenza et al., 2019). However, they do not cover all parameters/criteria and structuring categories or their descriptions are not comprehensive and sufficiently expedient from the aspect of logistics. Although comprehensive structuring has been carried out in various areas of logistics: city logistics (Tadić & Zečević, 2016), intermodal terminals (Krstić et al., 2019), home delivery (Tadić & Veljović, 2021), etc., such an undertaking has not yet carried out in the field of HL. Also, according to the authors' knowledge and opinions, no valid connection between the flows, network and structure of procurement and distribution in HL has been established in previous research.

The goal and contribution of the paper is the establishment and comprehensive structuring of HL as a logistics system, which consists of different categories of participants, flows and processes. In addition, the paper can be a basis or framework for future extensive research on HLOs, such as has not been carried out in the previous considerations of humanitarian work and logistics. The paper is structured as follows. After the introduction, in the second section, the basic characteristics, participants and their role in HL are described, the classification of HLOs according to categories of users is given, and the conditions for the implementation of activities are described. In the third section, the flows of HL are classified and the characteristics of each category are given. Then, in the fourth section, the network of HL is described. The focus of the fifth section is the structuring of procurement logistics and distribution logistics of HLOs. At the end, concluding considerations and directions for future research are given.

2. Humanitarian logistics

As the name indicates, the center and backbone of HL are people (lat. *humanus* - human), on the one side, those who use goods and services, and on the other side, those who provide them (Fig. 1a). There are two categories of potential users of HLO: users of humanitarian aid/threatened persons and buyers of goods and services of HLO. The target group of humanitarian work is threatened persons. On the other hand, many HLOs sell their services or goods to users, in order to generate income that (together with possible other income) enables the realization of humanitarian

aid to threatened persons. Also, there are two categories of workers in HL, paid labor force and volunteers. Just as threatened persons are a more important group of users than buyers, so also from the aspect of the workforce, HL predominantly relies on unpaid, volunteer work. Although this is an advantage, on the other side it also contributes to certain problems in HL (high turnover, inability to respond to difficult physical and emotional demands, limited number of available and qualified personnel, etc.) (Tomasini & Van Wassenhove, 2009). The number of volunteers can vary, from companies that have no volunteers, to organizations such as The International Federation of Red Cross and Red Crescent Societies (IFRC), which have over 16 million volunteers (IFRC, no date).

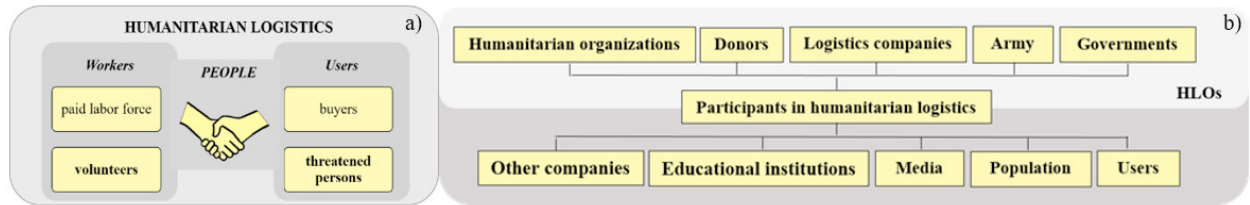


Fig. 1. a) The place of people in HL and (b) participants in HL.

Various organizations and individuals can be participants in HL (Fig. 1b). They may be involved directly or indirectly. Direct involvement in HL activities and a dominant role as HLOs are usually held by humanitarian organizations, donors, logistics companies and the army. The governments can be directly involved but they most often have a role in defining the regulatory framework, coordinating flows, etc. The media have a role in the distribution of information, educational institutions in the formation of a qualified workforce for HL, other companies (trade, hospitality, service) in the sale (not donation, as in the case of donors). The population can be directly involved in HL activities (aid to the vulnerable or HLOs) or be users of goods and services of HLOs. The degree of involvement of the participants may vary. Thus, a humanitarian organization can perform all HL activities independently. On the other side, it can engage logistics companies, donors or other companies for the performing of some activities.

Except about the basic activity and role, HLOs can be classified about the category of threatened persons to whom they provide assistance. HLOs can be completely or dominantly aimed at certain categories of users of humanitarian aid, about age (for helping *children*: e.g. UNICEF; *the elderly*: e.g. HelpAge International's, etc.) or gender (for helping *women*: e.g. Women Deliver), but the most important criterion according to which they can be classified is the type of problem, crisis or disaster (to help those suffering from *any disease*: e.g. World Health Organization, or *certain types of diseases*: e.g. International Cancer Foundation; *the poor*: e.g. Oxfam International; *the hungry*: e.g. World Food Programme; *migrants*: e.g. International Organization for Migration) etc. A large number of HLOs are aimed at helping *different categories of users*. They operate in different situations (e.g. IFRC, CARE International).

The conditions for the implementation of HL activities are very often specific and difficult. They may include: damaged infrastructure, natural safety risks (fragile soil, possibility of volcanic eruption, snow avalanches, extreme weather conditions, etc.), health risks (epidemic, infected persons, poor hygienic conditions, unfavorable weather conditions, etc.), anthropogenic security risks (possibility of attack, theft, kidnapping, deprivation of liberty, etc.), of which risks in wartime conditions are particularly important. The level of risk during the provision of humanitarian aid depends on natural, climatic, geographical, political, cultural, social, economic and other factors. Thus, in fragile areas there is an increased risk of earthquakes, in countries with a bad, unstable political and socioeconomic situation, there are pronounced security risks, etc.

3. Humanitarian logistics flows

Five types of flows (5B) are performed in HL (Tomasini & Van Wassenhove, 2009): flows of people (bodies); goods, materials, freights (boxes); services, knowledge and skills (brains); money (bucks) and information (bytes).

Flows of people include the labor movement, evacuation of people from threatened areas, humanitarian trips and pilgrimages and tourist trips, etc. Flows of the labor force are performed to supply users with goods, provide services, etc. Labor force parameters significant for HLO are number, age and gender structure, competence and professional

training, compensation for work, work dynamics, experience in humanitarian work, etc. Evacuation of people is performed before, during or after the occurrence of extraordinary adverse events and disasters. Some of the significant parameters of users are: number, location, age and gender structure, psycho-physical condition, economic status, etc., and in some situations, parameters such as education, religious, ethnic or national affiliation, etc. can be significant. Successful evacuation requires a well-defined and implemented evacuation plan, effective communication and cooperation of all parties, timely and accurate exchange of reliable information, coordination of flows by the governments or organizations responsible for emergencies (Lindell et al., 2011). There are also humanitarian trips, such as vacations or winters for children without parental care, and some humanitarian organizations organize pilgrimages and tourist trips, thus generating income or at the same time performing distribution flows to users.

Flows of goods, materials and freights include the flows of procurement, distribution and return of products or property. Lamenza et al., (2019) classify commodity humanitarian aid into: consumable goods (food, water, hygiene products, medicines, etc.), operational non-consumable goods (mobile phones, computers, vehicles, construction materials, etc.) and non-operational non-consumable goods (tents, mattresses, blankets, etc.). From the aspect of the life-cycle stage, goods can be new or used (second-hand). Also, the degree of quality of goods can be different, from very high (highest standards of commercial trade, logistics, etc.) and which must be provided to buyers, to very low. Bearing in mind the circumstances in which HL activities are carried out and its goals (alleviation of human suffering, elimination of existential threats, etc.), it is natural that the quality of goods for threatened persons does not have to be top-notch, but it must be satisfactory. Nevertheless, one of the basic problems of HL is the large amount of donated unnecessary second-hand and low-quality goods (Çelik et al., 2012). The goods can be packaged or unpackaged. HLO can purchase packaged goods or pack them independently. HLO independently usually packs prepared food, most often using disposable packaging. In the case of unpackaged goods that are donated to threatened persons, most often the user provides the packaging independently (e.g. users of some soup kitchens provide containers for the food).

The knowledge and skills of the workforce in HL enable the performing of **service flows**: logistics, construction, household assistance services and other services. Although they are more often aimed at threatened persons, HLOs can offer some of the services to buyers, in order to generate income. Logistics services include supply services and reverse flows (e.g. waste removal), evacuation services (to a safe location) and return flows (to the initial location) and other logistics services (e.g. transport of agricultural products for sale). Construction services include participation in the demolition, rehabilitation or construction of all or parts of the user's facilities. Some of the household help services are help for the elderly and disabled, help with hygiene, kitchen, handyman and other tasks etc. In addition to the above, HLO can provide services for the sale of agricultural or handicraft products of threatened persons, legal and administrative assistance services etc. On the other side, HLO can offer buyers various services, among which the most common are participation or attendance at cultural, entertainment or sports events (concerts, tournaments, etc.).

Flows of money include flows of money from donors, sponsors and buyers, purchase of goods, financial assistance to the threatened persons, etc. Flows of cash, electronic money and crypto-currencies are performed. HLO can receive money from: donations, donations with participation, sponsorship, sale of goods, sale of services. Donating money means giving away money. It can be done electronically, in person, using money boxes, etc. Donation of money with participation means giving money to HLO, with active participation in a humanitarian event (e.g. payment for participation in a humanitarian tournament). Sponsorship, in contrast to a donation, obliges the HLO to provide the sponsor with some counter-service (e.g. advertising). HLO can sell goods of its own production or those of other companies (clothing, food products, souvenirs, etc.), thereby providing income. HLO can also generate income by selling various services (e.g. theater performances, concerts, sports events, logistics services, etc.).

Information flows include HLO's communication with the public and promotion, calls for donations and sponsorship, transfer of orders, invoices, etc., coordination of other categories of flows and other forms of communication and information exchange between HL participants. Communication with the public and promotion, making calls for donations and sponsorship can be done through websites, social media, telephone, radio and television, billboards and posters, flyers, newspapers and magazines, personal contacts, etc. Internal, communication with partners and users, exchange of documents can be done via email, social media, phone, but also dedicated information and communication systems.

Often there is integration and consolidation of different categories of flows. Flows of people and flows of goods, materials, freights and/or services can be performed together (e.g. evacuation of people and property, pilgrimage and procurement/distribution flows), flows of people and flows of money (e.g. pilgrimage during which financial resources

are collected or delivered), flows of goods, materials, freights and flows of money (e.g. collection or distribution of goods and financial assistance to threatened people) etc. Although information flows are inevitably performed before, during or after other categories of flows, since they do not have a physical character, it is not possible to speak about integration and consolidation in the same way as in the case of other categories of flows.

4. Humanitarian logistics network

The geographical coverage of HLO activities can be different, from a small area (one municipality, city, village, etc.) to the global level. Humanitarian work in a certain geographical area is made possible by the existence of a network of locations used by HLO, which consists of a procurement part and a distribution part. HLO most often has a headquarters, i.e. a central organizational hub of activities, but it can also have branches, i.e. other nodes of the network. Network sizes can be different, from smaller HLOs that own one or a small number of facilities and serve a local area, through HLOs that operate at the national or regional level, to those that operate throughout the world. The most common example of HLO of a local character is local governments that provide assistance to vulnerable populations. An example of an HLO of national character is the Red Cross of Serbia, which has 190 branches and 6 resorts (RC Serbia, no date). The largest global network of HL is the International Federation of Red Cross and Red Crescent Societies, with a network of 197,000 nodes (branches) in over 190 countries of the world (IFCR, no date).

In the case of regulated systems of HL, nodes are logistics centers, which can have different characteristics from organizational, operational, physical/spatial and technological aspects (Tadić et al., 2019). Thus, they can have a collection, distribution, collection-distribution or transit function (Zečević, 2006). In other words, they can be used for the aggregation or consolidation of procurement flows, decomposition, fragmentation, or deconsolidation of distribution flows, for both processes at the same time, as well as for accompanying services (storage, VAL services, etc.). Therefore, the distinction between procurement and distribution in the network does not necessarily mean complete organizational and geographical separation of procurement and distribution activities. Moreover, nodes of HL networks are often used simultaneously for procurement and distribution processes. One of the possible examples and models of the organization of the HL network is shown in Fig. 2. The network contains a hub ("sun"), which has all four mentioned functions, and other nodes, through which logistical flows as "rays of humaneness" reach the users.

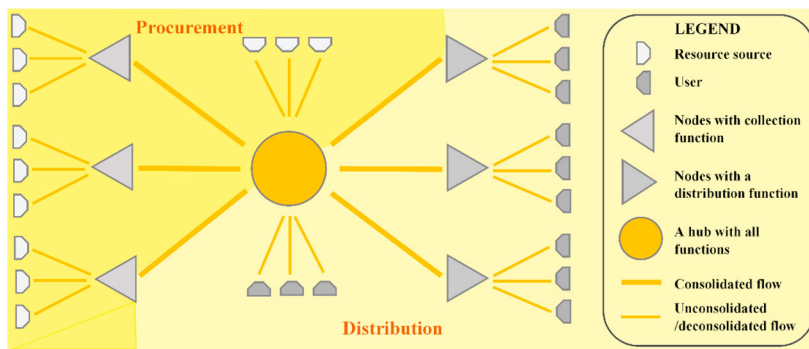


Fig. 2. Humanitarian logistics network.

5. Structure of procurement and distribution in humanitarian logistics

In order to comprehensively see the complexity, diversity and characteristics of the process in HL, it is necessary to structure procurement logistics and distribution logistics according to certain important parameters, i.e. criteria. Based on the relevant literature, as well as the author's reflections on the practice of HLOs, criteria for structuring procurement/collection logistics are: type of crisis, resource source, financier, dynamics, activity, supervision, integration with distribution, type of goods, area etc. (Fig. 3).

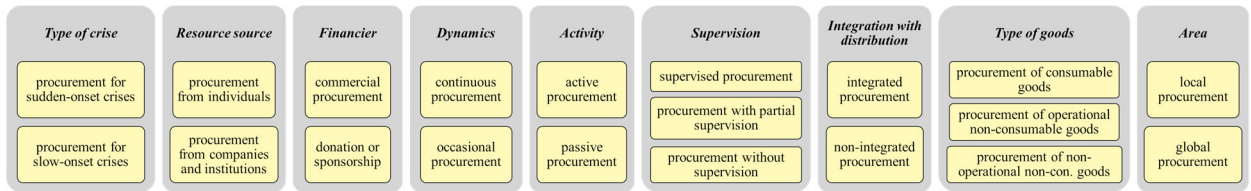


Fig. 3. Structuring procurement in humanitarian logistics.

One of the basic distinctions in HL are sudden-onset (e.g. earthquake) and slow-onset crises/disasters (e.g. famine), so one of the basic criteria for structuring procurement in this area is the **type of crisis** (Taupiac, 2001). Procurement for sudden-onset crises can be performed before or after their occurrence, whereby in the first case it takes place at the strategic level during the preparation phase, and in the second case it is limited to the tactical and operational level during the response phase and is characterized by a greater number of problems (Lamenza et al., 2019). On the other side, in the case of slow-onset crises, there are no significant differences between procurement before or after their occurrence. From the aspect of **resource sources**, procurement/collection can be from individuals or companies and institutions (governments, religious organizations, trading companies, logistics companies, etc.). In term the **financier**, there is a difference between commercial and procurement through donations or sponsorship. In the first case, HLO finances procurement, i.e. purchases goods, services, etc. Donation means giving money, goods, services, etc, while sponsorship obliges the HLO to render some counter-service to the sponsor. From the perspective of **dynamics**, the procurement of resources can be continuous or occasional. In the first case, there is a continuous possibility of receiving goods, materials, freight, money. An example of a continuous supply of resources is a long-term system of locations where users can drop off goods or cash aid every day (e.g. religious facilities with cash donation boxes). Occasional procurement can be classic commercial purchases, which are performed periodically and/or according to the needs of HLO, or different types of actions, campaigns in which during a short period various subjects (individuals or companies) are encouraged to donate or sponsor. From the aspect of **activity**, procurement can be active or passive. Active procurement means procurement through visiting or actively animating potential sources of resources (e.g. media campaigns, sending letters to potential donors, personal acquisition of donations at stands, in shopping centers, on the street, etc.; visiting trade and other businesses to purchase goods, etc.). Examples of passive procurement are a permanent call for donations on the HLO website, permanently sponsored advertisements on social networks or in the media, boxes for collecting money or goods, etc. Therefore, in the case of passive procurement, there are certain initial activities (placing invitations, advertisements, boxes, etc.), but the collection of resources itself takes place passively. In terms of **supervision**, procurement can be with full/direct, partial or no supervision. Procurement with full supervision implies the involvement or direct presence of the workforce in the collection of funds. An example of this is the collection of cash contributions, with the workforce collecting the money and recording the donations. Procurement with partial supervision is carried out in a controlled space, but without the direct participation of the workforce (e.g. boxes for collecting money or goods in religious facilities, schools, bakeries, shops, etc.). Examples of this type of procurement are boxes for collecting cash or goods (e.g. candy, toys, etc.) in public places, without manpower. Another of the procurement classification criteria is **integration with distribution**. Although it is more often unintegrated, there are examples of integration of procurement and distribution (e.g. drop-off and pick-up points for books, clothes, food, etc. in public places). From the aspect of the **type of goods**, there are procurements of consumable goods, which are necessary for vulnerable persons, procurements of operational non-consumable goods, which can be important for organization, communication, etc. during the crisis, and procurement of non-operational non-consumable goods, which are most often used after the crisis response phase (Lamenza et al., 2019). The procurement **area** can be local or global. Local procurement stimulates the domestic economy, has low transport costs and enables quick response, but is often of low quality, less availability and higher resource prices, while the advantages and disadvantages of global procurement are generally the opposite of those listed (e.g. high transport costs, higher quality etc.) (Duran et al., 2013).

The structuring of distribution logistics is similar to the procurement logistics. The structuring criteria are: type of crisis, user, financier, dynamics, activity, supervision, integration with procurement, type of goods, area etc. (Fig. 4).

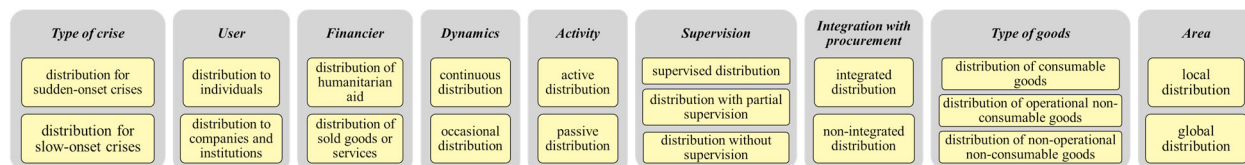


Fig. 4. Structuring distribution in humanitarian logistics.

The **type of crisis** largely determines the distribution of aid. Distribution for sudden-onset crises, compared to distribution for slow-onset crises, is more often characterized by difficult conditions, greater risks, damage to infrastructure, etc. (Kovács & Spence, 2007). From the aspect of the **user**, distribution can be to individuals or companies, organizations and institutions. Although the users of HLO are more often individuals, they can also be organizations (schools, hospitals, NGOs, etc.). From the aspect of the **financier**, there is a difference between the distribution of humanitarian aid and the distribution of sold goods or services. In the first case, HLO provides goods, materials, freights or services to vulnerable persons without compensation, that is, it finances humanitarian aid, while in the second case it sells them to buyers. From the perspective of **dynamics**, the distribution of resources can be continuous or occasional. In the first case, there is a continuous distribution, that is, the possibility of receiving goods, materials, freights, money by the user. Examples of this form of distribution usually include integrated distribution and procurement (open points for dropping off and picking up goods in public places). However, examples of occasional distribution (periodic and/or supply to users according to needs) are much more common. From the aspect of **activity**, distribution can be active or passive. Active distribution implies the implementation of distribution flows to users (e.g. delivery to users' households). Passive distribution means providing humanitarian aid in HLO facilities (e.g. sharing meals in soup kitchens). From the aspect of **supervision**, distribution as well as procurement can be with full/direct, partial supervision or without it. Distribution with full supervision implies the involvement or direct presence of the workforce when providing goods to users. This is the most common form of distribution of humanitarian aid, because with the others there are risks of abuse from the aspect of security of goods. Namely, in the case of partial or non-existent supervision, there is a possibility that goods or services are used by persons for whom they are not intended and thus not be available to the most vulnerable. The last procurement classification criterion is **integration with procurement**. Examples of procurement and distribution integration are listed in the part on structuring procurement logistics. From the aspect of the **types of goods**, the distribution of consumable goods is most often the most important, but non-consumable operational goods can also have a high degree of importance and urgency, considering that they can be a significant instrument in overcoming a disaster, as well as non-consumable non-operational goods that are important for overcoming the consequences of a disaster/crisis. The **area** of distribution is most often local, given the necessity of quick action, but there are also examples of organizations that distribute humanitarian aid on a global level. For example, during the COVID19 pandemic, the state of Serbia donated a significant amount of vaccines against the virus to some African countries.

6. Conclusion

In this paper, a comprehensive foundation and structuring of HL was carried out. The participants of HL and their roles are described, the flows are classified, the characteristics of the HL network are described, the procurement and distribution are structured according to important parameters, criteria and the connection between flows, network and structuring of HL is established. This achieved the goal and contribution of the paper, but also created a good basis for future theoretical research and case studies of specific HLOs.

Apart from the mentioned parameters, based on which the logistics of procurement and distribution of HLOs were structured, there are other important parameters of the flows, as well as their generators (sources of resources, HLOs, users) and their mutual relationships that need to be analyzed in future research: frequency and size of flows, number and location of resource sources and users, number, size and location of HLO facilities, etc. The paper describes certain characteristics of the HL network and some parameters of the procurement and distribution flows, but not the return flows, their causes, methods of implementation, etc. which should also be the focus of future research. After

the theoretical completion of the HL frameworks and parameters, they could be a useful instrument for analyses and case studies of specific HLOs, their operations and logistics, and thus for the improvement of their work. Different categories of risks in HL are mentioned in this paper, but in future research, it is necessary to conduct a more extensive analysis of them, try to define models for their assessment, etc.

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