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## BLOOD RESOURCES MANAGEMENT — NEW CHALLENGES FOR LOGISTICS

*С. Тварог. Нові напрями в логістиці: управління ресурсами банку крові.* Логістика є однією з тих галузей знання, що найдинамічніше розвиваються, виявом чого стають нові напрями її застосування. Викладено принципи управління ресурсами крові, яке є новим викликом для логістики. Ідентифіковано використання концепції логістики у галузі управління ресурсами крові, а також оцінки можливих вигід застосування оптимізованого матеріально-технічного забезпечення у вирішенні проблем, що виникають у цій галузі. Досліджено приклад конкретного ланцюга постачання, а саме, мережі кровопостачання. Також розглянуто системи кроволікування та системи донорства крові.

*С. Тварог. Новые направления в логистике: управление ресурсами банка крови.* Логистика является одной из наиболее динамично развивающихся отраслей знания, что проявляется в новых направлениях ее применения. Представлены принципы управления ресурсами крови, что является новым вызовом для логистики. Идентифицируется применение логистики в сфере управления ресурсами крови, а также оценки возможных выгод оптимизированного материально-технического обеспечения при решении проблем данной области. Исследование иллюстрирует пример конкретной цепи поставок — сети поставок крови. Также рассмотрены системы кровелечения и системы донорства крови.

*S. Twarog. Blood resources management — new challenges for logistics.* Logistics belongs to one of the most dynamic developing fields of knowledge. Its development is manifesting by new implementations of logistics. Our aim is to present the management of blood resources, which is a new challenge for logistics. Firstly identification of the logistics concept application in the management of blood resources as well as estimating possible benefits from the use of the logistics in solving emerging problems for this area of interest. Secondly the discussed subject was the specific supply chain — blood supply chain. Finally there was also considered presents of blood treatment system and blood donation system.

Resource Management in recent years becomes extremely complex and is a challenge for today's managers. More and more often, they tap into the logistics, which proposes a set of tools and methods for managing the flow of material resources and information.

Nowadays we can notice an increased usage of logistics. The perception of it as a factor in the success of the enterprise, the way to obtain and preserve competitive advantage and the search for cost savings resulted in the adaptation of logistics expertise in different, very distant from the traditional business areas and sectors of the economy (business, industrial). As the non-classical logistics application author mentioned: mass events logistics, high-altitude expeditions logistics, humanitarian assistance and management of blood stock logistic.

The last application located in the author's field of interest relates to management of extremely valuable, unusual, generated only by living beings, impossible to imitate and replace good/product — blood — medicine.

Therefore acquisition and distribution of blood and its constituents is essential for the maintenance of humanity as it cannot be replaced by anything else, that is why blood is defined as “the gift of life”. It is being provided in life emergency. Most modern and most complex surgeries would not be possible without blood. The demand for blood and blood components is usually stable and predictable for ongoing treatments or surgeries, but can be very unpredictable and variable in times of crisis. Moreover, this saving human health and life cure comes from donors (humans) and it also can be stable or variable depending on the current social campaigns, month, or response to an apparent crisis — a disaster [1].

### **Backgrounds**

Currently available studies on management of blood are not related to the logistics approach to the nature of emerging interference. Few studies made by western authors and published under sign of logistics, come down to considerations related to acquiring and motivating new blood donors Newman and Pyne (1997), or to create simulation models, for creating an optimal structure of blood supply Yang et al. (2003), Ryttilä and Spens (2006), Katsaliaki and Braisfold (2007) as well as Van Everdingen et al. (2007), or to looked at efficiencies in blond supply Spens (2001), but also relationships and integration of supply chain Grant (2010).

### **Logistic accommodation circumstances within blood resources administration**

Providing adequate medicine in the form of blood/components, in appropriate quantity, in good condition (subject to the strict conditions for storage and distribution of blood and its components), in the right place and time, to the right customers - the beneficiaries is definitely a necessary condition for effectiveness, efficiency and competitiveness of modern economic activities. Providing blood and blood components may pose many problems. These problems are usually associated with the flows of material resources, processes, processing etc., but also include difficulty in determining abstraction and scope of the acquired, processed and transmitted information [2]. In such a configuration, logistics experts immediately recognize the applicability of logistics, which has a range of methods and tools for optimizing the flows offered by the theory and practice.

### **Blood supply chain — definition, specification**

Flow of blood and its components are accomplished in the form of supply chains. Blood supply chains in the institutional dimension are composed of blood donor<sup>1</sup> and blood recipient, organizational units, which participate in the flow, processing, storage, marking, information processing of blood and blood components - Blood and Blood Treatment Centers, and hospital or other institution that decides what are the priorities of blood and its components usage (when and who received blood / blood components). This consideration and the nature are somewhat analogous to other process sectors dealing with sourcing and selling perishable products such as milk or fresh juice [1, 3].

The process of blood supply flow between a donor and a recipient can be shown in *the form of limited number of variants* of supply chains, which is characterized by their own specific configurations (re to table). Those specific chains are different from business, traditional, classic supply chain.

A characteristic feature of the blood supply chain is an unusual and also diversified product, the product whose resources available to acquire and demand are largely unpredictable. It is a repetitive chain, which in terms of functional structure is stable; it does not have to do with postponing the pro-

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<sup>1</sup> The donor is a person from who the blood/blood components is collected for clinical purposes. There are four types of blood donors: autologous, voluntary, family and paid.

duction. It is relatively short and narrow distribution channel. Thus the blood supply chain can be defined as cooperating organizational units of blood service and blood donors and recipients carried out between which flows are blood, blood components and related information [3]. In turn, this type of chain management is the process of decision-making related to:

— integrating physical and information flows of blood and blood components implemented between the participants of the supply chain;

— synchronizing volumes of blood to obtain resources (collection from donors) to the size of the need for blood and its components, to produce health benefits (higher) for the final recipient of blood and blood components assuming high efficiency of the blood supply [3].

Administration of such specific chains<sup>2</sup> may therefore pose a significant challenge for managers, not only due to the specific nature of the subject involved or unpredictable demand for blood and blood components, but also because of the active participation of a number of entities interacting with each other. Thus, the universal principle of logistics, which refer to the proposed consideration, is the need to integrate processes and activities within the entities (cells), which make up the supply chain, as well as the integration of the entire chain. Very important, significant issue is the location of power (leader, integrator) in supply chains and identifies the tasks and the necessary competence. The main participant in the supply chain must be the strongest person in the group of companies that has the ability to influence other participants and encouraging them to take certain actions [4]. A company that meets these requirements in supply chains is a donation center, or you can also search the competence of the logistics outside — outsourcing.

*Traditional (business) chain versus blood supply chain*

Feature	SUPPLY CHAIN		
	TRADITIONAL - BUSINESS	BLOOD	
		FOR SURGERIES <sup>3</sup>	FOR RESCUE EMERGENCIES <sup>4</sup>
Aim/Target	Focused on maximizing profits	Focused on saving human lives	Focused on saving human lives
Main Principles	Economy and profits	Effectiveness	Effectiveness
Services /Scope of influence	Business	Commercial	Commercial
Supply Chain Structure Predictability	Predictable	Predictable	Unpredictable
Supply Chain Multiplicity	Disposable	Disposable	Frequent
Product Characteristics	Standard/varied	Atypical/varied	Atypical/varied
Product Diversity	Large	Small	Small
Product Values	Increasing	Stable <sup>5</sup>	Stable
Planning Technologies	Deterministic (based on skills of predicting future events)	Probabilistic (based on probability theory - experiences)	Unpredictable (catastrophe theory <sup>6</sup> )
Inventory Management	Reactive, based on real demand	Proactive, based on the forecasts and plans	Difficult to determine reactive/proactive
Stock Supplementing	Pull Strategy (Production corresponding with demand)	Pull Strategy (Production corresponding with demand)	Seasonality - gaps
Bull Whip Effect	Occurs - Reduction	Does not occur	Does not occur

<sup>2</sup> Specific character comprises, among other things, of different perspective with the majority decision of humanitarian element and organizational efficiency.

<sup>3</sup> The blood supply chain for surgeries is supply chain (resource) of blood which is predictable because of the needs for operations, treatments

<sup>4</sup> The blood supply chain for rescue is supply chain (resource) of blood which cannot be predicted because of the unpredictability of occurrences such as: natural disasters and catastrophes or technical failures

<sup>5</sup> The product value does not change while costs of productions (use the new technologies, new research methods) are being changed (increase)

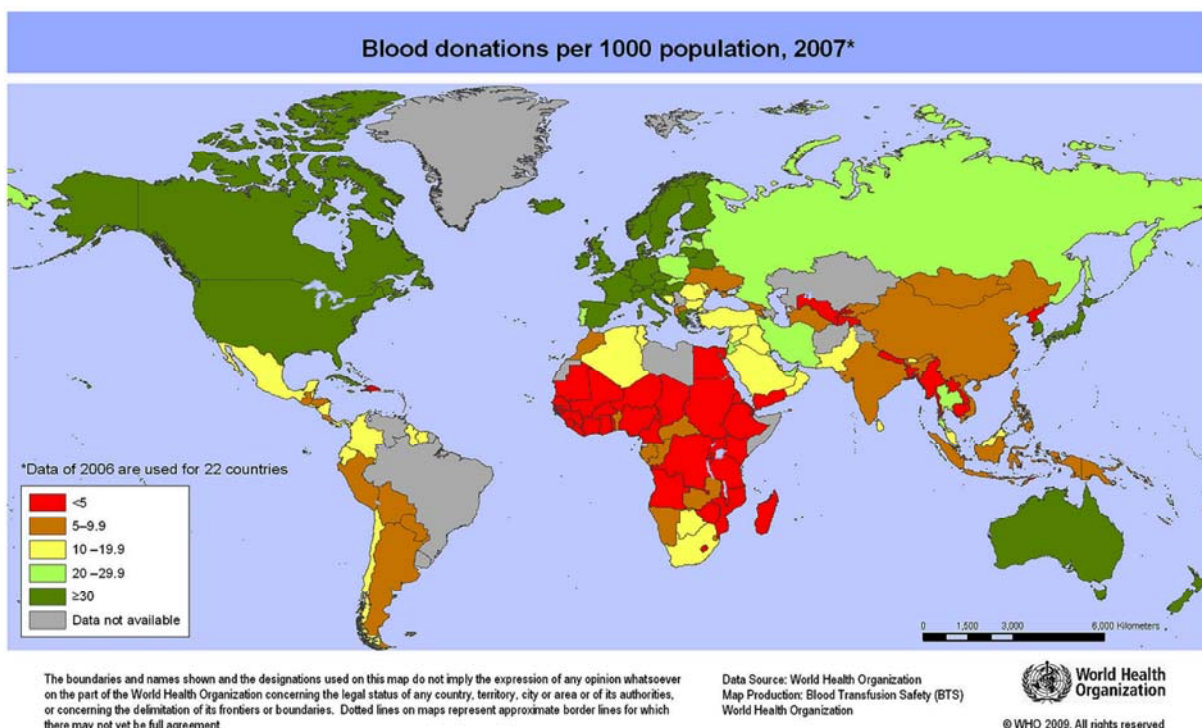
<sup>6</sup> R. Thom — (1923...2002) French mathematician, founder of catastrophe theory.

Feature	SUPPLY CHAIN		
	TRADITIONAL - BUSINESS	BLOOD	
		FOR SURGERIES <sup>3</sup>	FOR RESCUE EMERGENCIES <sup>4</sup>
Easiness of Supplier Change	Routine – if necessary it is easy to change a supplier	Difficult Change – One Supplier	Difficult Change - One Supplier
Uncertainty When Determining The Demand	Low	Considerable	Considerable
Intensity Of Reverse Logistics	High	Low	Low
Functional Structure	Variable (Postponement of Production)	Stable (no deferred production)	Stable (no deferred production)
Formal-legal restrictions	All transactors with freedom of economic activity	Formal-legal restrictions - law acts, statues	Formal-legal restrictions - law acts, statues
Final recipient	Consumer of goods	Every patient sent for surgery	Each risk

The expected result of implementation of the principles, methods and tools for logistics, in addition to faster delivery of blood to the needy person may be a better use of harvested resources and reduce operating costs of the blood system and thus improve the functioning of the blood donation and blood treatment in the country.

#### **Blood donation and blood treatment system, blood administration/management system**

Institutions involved in the processing of blood and its components as well as institutions supervising that process constitute a system of blood flow and blood treatment is an institutional dimension. The level of blood donation (as a system) in the country is indicated by the index of donations per 1000 inhabitants (fig. 1). There are no disparities between developed and developing countries in the level of access to blood and its components. However, in countries with more advanced health care systems the demand for blood and blood components is higher.



*Fig. 1. Number of donations per 1000 inhabitants in 2007*

(Source: [http://www.who.int/mediacentre/factsheets/donations\\_per1000\\_population\\_20091110.pdf](http://www.who.int/mediacentre/factsheets/donations_per1000_population_20091110.pdf))

— Out of the 85,4 million donations in 2007, about 65 % were collected in developed countries, home to just about 25 % of the represented population.

— Blood donations per 1000 population, which also reflect the general availability of blood in a country, vary widely and the lowest levels of availability are found in developing and transitional countries. The average donation rate in developed countries is 38.1 donations/1000 population (range 4,92...68,01); in transitional countries, this rate is 7.5 (range 1,07...35,18) and in developing countries an average 2.3 (range 0,40...7,46) donations per 1000 population were collected.

— 73 countries reported collecting fewer than 10 donations per 1000 population. Among them, 71 are either developing or transitional countries [5].

However, in terms of logistics processes related to the management of blood (quality and safety standards for the collection and testing of human blood, processing, storage and distribution when intended for transfusion to) we talk about the logistic system of blood management (fig. 2).

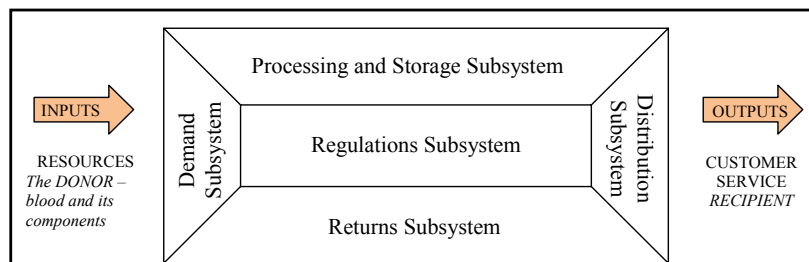


Fig. 2. The logistic system of blood management

This system defines a set of functional tasks, which include operations centers and the acquisition and storage of blood processing, formulation of policy on storage of blood supply, supply and implement the necessary infrastructure to perform these tasks. The system enables management of the blood system between individuals and the final recipient [6]. Activities related to the administration of blood are regulated by the European Community directives, guidelines of the Council of Europe or the World Health Organization.

#### Blood management system in Poland

In Poland, the blood management system is unitary and relies on a uniform rules valid across the country and the whole EU, fair, unified supervision of blood treatment, which will probably have the effect of lower incidence of related complications as well, and most importantly self-sufficiency in the country's blood supply and components. According to the World Health Organization (World Health Organization), Poland is a self-sufficient country when it comes to the supply of blood and its components, which means that hospitals demand for blood and blood components is covered at 100%. There are however some periodic shortages, in certain regions of the country, particularly of red blood cell concentrate. Especially difficult in terms of shortage of blood, not only in Poland but all over the world, is a holiday period, when the number of people to donating blood is decreasing. [7].

The only units in Poland entitled to the collection of blood for transfusion and further processing, involving the separation of its components are:

- Regional Center of Blood Donation and Blood Treatment
- Military Center for Blood Donation and Blood Treatment
- Ministry of Internal Affairs and Administration Centre for Blood Donation and Blood Treatment.

Each province has its The Regional Centre of Blood Donation and Blood Treatment unit, in some of them there are two. In total, today (2010) there are 21 such units. The Regional Centre of Blood Donation and Blood Treatment tasks of a logistics are as follows: blood collection, the collection, maintenance, storage, issuing and receiving reimbursements, supply health care (hospitals) in the blood and its components, or to supply pharmaceutical factory in the plasma. Within its region, each The Regional Centre of Blood Donation and Blood Treatment has branches called regional branches, there are 184 such regional branches, which are responsible for testing and candidates qualification and for blood donation. However, blood processing, collecting and other actions take place in The Re-

gional Centre of Blood Donation and Blood Treatment, because such work organization can provide more efficient use of specialized equipment, harmonization of working methods and better control over the quality of the research, produced blood components and their storage conditions, which can ensure greater security of transfused blood components.

The Regional Centre of Blood Donation and Blood Treatment collect blood in their premises, within regional branches and the crew/team system, which is to run the mobile collection of blood, such system runs for several hours or several days in a year and is supported by a team consisting of qualified staff from The Regional Centre of Blood Donation and Blood Treatment or regional branches. Crew system donation points can be located in a rented room (i.e. in school, church, workplace, etc.) or in a special ambulance equipped with the position for testing and blood donation. Starting the point of mobile blood donations looks the same in Western Europe and North America. Crew system allows you to reach out to donors in their places of work or near their place of residence.

## References

1. Grant, D.B. Integration of supply and marketing for a blood service / D.B. Grant // *Management Research Review*. — 2010. — Vol. 33, № 2. — P. 123 — 133.
2. Twaróg, S. Instytucjonalne implikacje integrowania łańcuchów dostaw krwi w Polsce / S. Twaróg // *Gospodarka Materialowa i Logistyka*. — 2010. — № 5. — S. 9 — 14.
3. Szołtysek, J., Twaróg, S., Gospodarowanie zasobami krwi jako nowy obszar stosowania logistyki / J. Szołtysek, S. Twaróg // *Gospodarka Materialowa i Logistyka*. — 2009. № 7. — S. 12 — 17.
4. Sołtysik, M. Podstawy zarządzania łańcuchami dostaw / M. Sołtysik, A. Świerczek. — Katowice: Wydawnictwo Akademii Ekonomicznej w Katowicach, 2009.
5. World Wide Web: <http://www.who.int/mediacentre/factsheets/fs279/en/>.
6. Szołtysek, J. Przesłanki i zakres stosowania logistyki w gospodarowaniu zasobami krwi / J. Szołtysek, S. Twaróg // *Logistyka*. — 2010. — № 3. — S. 40 — 44.
7. Twaróg, S., Logistyka w gospodarowaniu zasobami krwi w Polsce / S. Twaróg // *Logistyka — nowe horyzonty. Przesłanki i przykłady wdrożeń / praca zbiorowa pod red. J. Szołtyska; Instytut Logistyki i Magazynowania, 2010. — S. 69 — 90*

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