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Selected Determinants of Logistics System of the Assay Office

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Abstract. Translating the theoretical approaches of the contemporary understanding of the problem of logistics systems and their determinants, including most of all the resources and logistics processes in the entity, into their practical use in the activity of the selected entity has been presented in the paper on the example of the identification and analysis of these areas in one of the Polish Assay Offices. The article presents the problem of identification and analysis of selected determinants of the logistics system in management of the Assay Office in Poland, mainly its logistic processes and resources in the process of determination of gold content in jewelry alloys. On the basis of the analysis of the literature and internal materials as well as the research consisting in the observation and interview conducted in the Office, there have been indicated some basic tasks and relationships of the examined system.

Keywords. logistics system; logistic process; resources; management

1. Introduction

The applicable nature of the systems theory indicates the integral relationship with many fields of science, including logistics, constituting the basis for specifying the essence of the arising concept of the logistics system (Benedito et al. 2011). The application of the systemic approach in logistics allows entities to implement many strategic tasks, among others, achieving a higher level of customer service to compensate the existing advantage of competitors or maintaining own advantage (Romanowska,2009). Logistics systems may also be useful for creating barriers for competitors, preventing access to the market due to close cooperation in the field of logistics between the supplier and their customers (Khabbazi,2016).

The efficiency of the functioning of the logistics system of the entity, particularly determined by its resources and logistics processes as well as the economization of the activity are the necessary conditions to maintain the market position and gain competitive advantage of each enterprise. The management of these resources and processes in their integral understanding is also the domain of logistics and even, as emphasized among others by Chopra and Meindl (2004), Coyle, Bardi and Langley (2003), Fawcett, Ellram and Ogden (2007), Nowicka-Skowron (2001), Pfohl (2010), a type of the philosophy of logistics.

Translating the theoretical approaches of the contemporary understanding of the problem of logistics systems and their determinants, including most of all the resources and logistics processes in the entity, into their practical use in the activity of the selected entity has been presented in the paper on the example of the identification and analysis of these areas in one of the Polish Assay Offices. The activity of the selected organ of the assay office administration in Poland (Nogalski,2015)results from the basic objective of its logistics system which is the implementation of tasks associated with conducting testing, indicating the standard of fineness of articles of precious metal and products containing precious metals on the basis of contracts concluded with customers.

The aim of the present paper is to identify and analyze selected determinants of the logistics system in management of the Assay Office in Poland, mainly its logistic processes and resources in the process of determination of gold content in jewelry alloys. The objective of the paper was achieved on the basis of the analysis of literature sources, internal materials and the research consisting in observation and interviews conducted in chosen Polish Assay Office.

The method of data collection for qualitative research was personal in-depth interview with seven employees of the Assay Office, as well as drop and collect survey. The collected data was supported by information gathered during the process of observation of the staff work and analysis of internal documents and materials of the Assay Office. The research methods were selected in reference to the objective of depth, insight and understanding of determinants of the logistics system, mainly resources and logistic processes in management of the Assay Office.

In the first part of the paper the theoretical background the essence of logistics system, its elements, resources and processes are indicated. Then the logistics system, isolated for the purpose of the research including the field of its determinants in Polish Assay Office, as a system in a formal sense, is specified with the record. The main part of the paper is identification and analysis of determinants of the logistics system in management of the Assay Office in Poland, mainly its resources and processes.

2. The Essence of the Logistics System

The adaptation of the concept of "a system" as a set of interacting elements, variables, parts or objects which are functionally related and form a coherent whole (Coyle et al. 2003) to logistics contributed to breaking up with fragmentation and partial independent optimization of the components of the logistics systems (Ill et al. 2010). Therefore, logistics systems are based on a complex way of dealing with individual issues, isolating elements and indicating relationships between them (Dima et al. 2011), as the definitions of the essence of the logistics systems summarized in Tab. 1 emphasize.

Table 1. The essence of the logistics system

Author(s)	Definition
S.E. Fawcett, L.M. Ellram and J.A. Ogden [6]	The logistics system is an intentionally organized and interpreted – within a specific economic system – flow of materials and products and corresponding information enabling optimization in supply chain management.
P. Blaik [12]	The logistics system can be generally defined as a set of logistics elements whose relationships are specified through transformation processes. Between these elements with specific properties there take place close, specified, also in organizational terms, relationships.
H.Ch. Pfohl [8]	The logistics system is a set of elements such as: production, transport, warehousing, customer – along with relationships between them and between their characteristics conditioning the provision of the logistics service.

The identification of the objectives of the logistics system, understood in accordance with the terminology proposed in Tab. 1., is the indication of the objectives of logistics and the goals within the meaning of the systems theory, taking into account the general objectives adopted by the entity. The overall strategic objectives of the company, in accordance with the adopted mission and strategy, most frequently refer to reducing the operating costs of the entity with an increase in its efficiency, with the major synchronization of all its activities around the needs of customers and increasing the level of customer service (Wang et al. 2011). On the other hand, the main objectives of the system are cooperation and creating synergic effects between its elements. Therefore, eventually, the logistics system aims at achieving many non-uniform objectives which simultaneously enforce a complex integration of activities and occurrence of the phenomenon of synergy.

Nowicka-Skowron (2001) makes a division of the objectives of the logistics system into two basic groups (Fig.1.). In the first group, there is indicated the overall objective of the entity which is to fully satisfy customer market needs at optimal costs. On the other hand, the other group includes sub-targets with the division into the ones considered in terms of the entity and the ones which directly formulate customer service in terms of their demands and the assessment of their satisfaction.

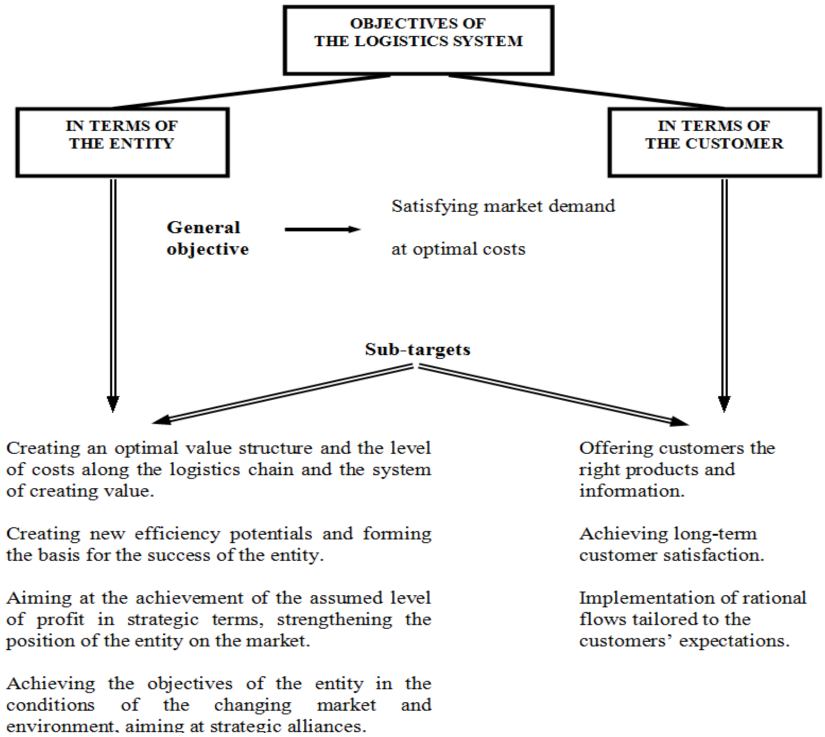

Fig. 1. Objectives of the logistics system

As illustrated by Fig. 1., the objectives of the logistics system simultaneously identify sub-targets and the objectives resulting from the needs and expectations of customers with reference to customer service. Customer satisfaction with the highly assessed service, in the long-term, determines their commitment to the entity bringing higher profits, i.e. it meets the objectives of the logistics system included in the objectives in terms of the entity (Chopra et al. 2004). The integrated activities within the logistics system of the entity, necessary for the adoption, preparation, implementation and financial and information fulfillment of customer orders, serve to ensure the appropriate level of customer service according to the expectations while increasing satisfaction and loyalty of customers. The final consumer of goods and services is simultaneously the central part of the logistics system whose all actions are directed to meet the demands of the service (Fawcett et al. 2007).

The sub-targets specified in terms of the customer require close correlation with the other objectives of the logistics system. The mechanism of their achievement must be subjected to systematic assessment due to changeability of the environment in which the customer and customer service occupy a dominant position (Ill et al. 2010). The environment of each system, including the logistics system, are the elements which are not the part of it but they are related to it.

3. Elements of the Logistics System

Logistics systems, while cooperating with the environment, exchange the matter, energy and information with it. Therefore, according to Krawczyk (2011), they stay open systems. It is also necessary to take into account the element of the environment along with the general standing of customers to multidimensionally characterize the logistics system , which, in methodological procedures, requires the adoption of the following elements (Nowicka-Skowron 2001):

- the objective: directed to the operation of the whole system;
- inputs: adopted as the objective function in the form of the results of the system operation;
- outputs: determining the powering of the system;
- the process of transformation: specified with the sequence of basic actions of processing;
- the environment: created by customers, suppliers, banks etc.;
- the equipment: machinery, buildings, means of transportation etc.;
- human resources: number and structure of employees, their qualifications, skills.

According to Grant et al. (2007), the logistics system is considered in the right environment using the right equipment and human resources for the specific purpose, from the elements of the input, through their transformation, to the elements of the output. The processing occurring during the production of goods and services requires constant referring to tasks identified with logistics (Dormer,2011). These tasks consist in providing the right service to the customers of the products of the entity which, according to Mesjasz-Lech (2011), constitutes the output of the logistics system and results from the cumulated effects of the operation within the elements of logistics-mix. All the spheres of these actions are important to establish the required level of the implementation of customer service. Moreover, they are interdependent: if the action collapses the system also does, leading to errors and distortions in other spheres and, at the same time, to low effectiveness of the system as a whole.

In the opinion of most authors of publications in the field of logistics systems, among others, Ficoń (2008), Goetschalckx, Vidal and Dogan (2002), Krawczyk (2011), Sowade, Rippel and Schulz-Reiter (2012), one of the basic concepts for its essence is the concept of the process. The term "process" means the sequence or partially ordered set of activities that are united by a common goal, and integrated by the time, costs and assessment of the quality of performance (Vidal and Dogan , 2002).

As illustrated by Fig. 2., the contemporary understanding of logistics processes is the integration of material and information streams and the efficiency of their flow. The identified tangible and intangible components of logistics processes should enable satisfying the needs of customers at any place, time and in the desired amount (Lambert et al. 2001).

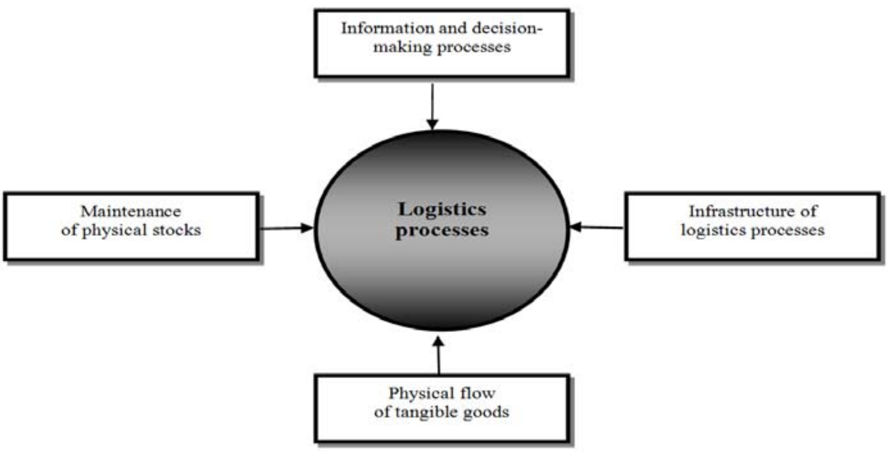

Fig. 2. The basic components of logistics processes

The appropriate specification of the process, among others, requires (Sowade et al. 2012):

- indicating elements essential for its beginning,

- specifying the desired or expected final results,
- indicating recipients,
- identifying constraints,
- assigning the necessary contractors and measures to achieve them,
- assigning permissions to monitor and control the course of the process,
- considering possible activities enabling adequate response to unplanned deviations.

When the scope of activities covered by processes is relatively small and there is not their simultaneous implementation, the coordination of processes is a standard management task (Xuezhong et al, 2011). For its correct course it is necessary to identify:

- preparatory activities, essential for initializing and handling the fundamental process,
- the basic process, taking into account its breaking down into sub-processes and tasks.

The processes indicated above refer to the transformation of logistics resources, that is, most of all, all physical resources, i.e. raw materials, materials etc., but also human resources, financial resources and information resources. The transformation of these resources takes place on the basis of logistics infrastructure, among others, including the infrastructure of the flow of materials and information flows.

4. The Logistics System in the Official Terms of the Examined Assay Office

The logistics system of the chosen Polish Assay Office is a set of elements of this administrative body, isolated and integrated to organize the flow of materials and products within it. The elements of the logistics system are those elements of the system that take part in the implementation of the processes of movement in time and space.

The logistics system, isolated for the purpose of the research including the field of logistics in the chosen Assay Office, as a system in a formal sense, can be specified with the record:

$$SL = < s^l, R_w, R_z > \rightarrow C, \qquad (1)$$

where:

SL – the logistics system of the chosen Polish Assay Office,

sl = <L, U, Z, W> is the subset of those elements of the set of s elements of the Assay Office that do not take part in the implementation of tasks of the logistics system,

L – people performing specific logistics tasks,

U – devices, tools, materials etc. that people use in the process of performing logistics tasks,

Z – tasks for the performance of which the logistics system was established,

W – implementation of tasks constituting the target of the existence and functioning of the logistics system,

Rw – the set of relations between the elements of the sl subset,

Rz – the set of relations between the elements of the sl subset and the other elements of the s set or the environment,

C – the objective of the functioning of the logistics system.

Internal relations - Rw are the relations occurring between (Krawczyk et al. 2011):

- people and devices specifying a set of measures creating operating conditions,
- tasks for which the logistics system was established and the implementation of those tasks,
- the measures specified above and tasks and results of the operation of the system.

External relations - Rz express the ties of the system with the environment, among others (Krawczyk et al. 2011):

- binding the implementation of tasks of the logistics system with the needs of the superior system (the economic system),
- controlling the logistics system by the superior system,
- the impact of the logistics system on creating the elements of the environment, i.e. the natural environment and individual components of the superior system.

Internal and external relations bind material, information and financial and economic relations.

Material relations specify technical and organizational measures necessary for the flow of objects, tools etc. The adopted solutions introduce the quantitative and time limits, they also specify necessary financial resources (Romanowska,2009).

Information relations serve passing the information concerning the processes during the implementation, changes in the condition of devices, staff and resources the entity disposes of. The obtained information is currently used in the coordination of subsequent operations, it is the basis for cost management (feedback); it is also used to create and complement the database necessary for planning and designing subsequent operations. The implementation of those tasks requires the creation of the system for collection, transmission, storage and processing information, adequate to the possibilities and objectives it is to serve (Romanowska,2009).

Economic and financial relations are created on the basis of the above information and serve financial management. The main task is the management of the flow of funds in the framework of cost management that, most of all, includes the regulations and control of expenses and costs in individual links of the logistics system (Romanowska,2009).

5. The Identification of the Aims of the Logistics System in Management of the Chosen Assay Office

The objectives of the operation of the chosen Assay Office in Poland, result from the basic objective of its logistics system which is the implementation of tasks connected with conducting the research, marking products made of precious metals and goods containing precious metals in their composition on the basis of contracts concluded with clients. The objectives of the logistics system of the chosen Polish Office particularly refer to:

- accepting and issuing precious metal products and goods, which contain precious metals in their composition, submitted for chemical analysis and marking them with special hallmarks,
- accepting charges for testing activities, according to the price list,
- examining precious metal content in jewelry products with the cupellation method and other similar methods,
- issuing examination certificates,
- marking jewelry products with hallmarks.

Individual elements of the system of material, information and economic and financial flows that determine the scope of tasks for the logistics system of the Body and the sets of relations are subjected to the above objectives.

The sphere of regulations is directly related to the process of logistics management, that is, planning, implementation and control of the processes taking place in the system. The flow of logistics information, understood as a set of mutually cooperating people, devices and procedures is the most important element of this sphere, determining the quality of logistics management (Ill et al. 2010). For this purpose there is necessary the information, among others, concerning:

- control of accepting and issuing goods,
- current technical and technological evaluation of the performed tasks associated with conducting the examination and marking products,
- current assessment of the observance of the applicable environmental requirements,
- current economic assessment,
- maintaining necessary inventories.

6. Identification of the Basic Process and its Sub-processes in Logistics System of the Chosen Assay Office

In the basic structure, as the environment of the basic process developed by the logistics system of the chosen Assay Office, there must be identified:

1). belonging to the President of the Central Office of Measures, the District Assay Office in and other divisions of the Assay Office,

2). department of accepting orders and contacts with the market,

3). laboratory and warehouse.

The infrastructure of the basic process in the logistics system of the examined office consists of:

1).infrastructure of the department of accepting orders and contacts with the market:

- a room for accepting orders,
- office and communication equipment (computers, communication links etc.);

2). laboratory infrastructure:

- laboratory rooms,
- specialized apparatus, equipment and laboratory instruments (specifically listed in the subsequent part of the article);

3). storage facilities:

- storage chambers,
- storage, measuring and control devices, fire-fighting equipment.

The basic process developed in the logistics system of the chosen Polish Assay Office is the process of determination of gold content in jewelry alloys. In the basic process there must be identified two main sub-processes, depending on fineness of the product:

- sub-process 1: determination of gold content in jewelry alloys in which fineness is maintained,
- sub-process 2: determination of gold content in jewelry alloys where fineness is not maintained.

The annotation to sub-process 1. In sub-process 1, from among the listed tasks the most important ones are:

- beginning the material flow of products at the moment of accepting an order by an employee of the Office,
- weighing the subject of the contract,
- subsequently, the object is placed in a special bowl with the information card that, being an essential attribute of the information flow, contains the data on the customer, the weight of the product and the exact number of pieces, and goes to the post of an assayer,
- the assayer carries out the examination of the test sample with a touchstone,
- then, the assayer passes goods to the hallmarking room,
- if fineness of the product has been tested and its value is maintained, all the pieces from the examined batch are the subject to hallmarking,

- when hallmarking has been performed, the customer (the recipient in the system) may take their product back (Częstochowa,2015).

The annotation to sub-process 2. The other case is when, after the examination by the assayer, the test sample does not maintain its value (sub-process 2). In such a situation, the range of the implemented tasks, applied equipment and relations taking place in the logistics system is significantly wider, among others, including testing with a cupellation method.

7. Identification of the Resources and Preparations for the Sub-Process of the Logistics System of the Selected Assay Office Including Testing Using The Cupellation Method

The cupellation method belongs to destructive methods (Hornik et al. 2006), since it requires taking samples for the analysis in the first task of the developed sub-process 2. There are usually identified the following types of samples ((Częstochowa,2015)):

- general (a certain number of products taken from a batch),
- laboratory (a single product or its part),
- analytical (a specific amount of alloy taken from the laboratory sample),
- comparative (the amount of alloys the products submitted for testing are made of, attached for comparative purposes).

Laboratory test samples are taken by the employee of the laboratory usually by cutting or drilling, on account of accuracy and determination of content of precious metals. Laboratory samples are taken from:

-pipes, wires, rods - by cutting off the material at both ends,

-sheets, tapes - by cutting off two opposite corners,

-bars - by cutting off the material from the opposite corners of the diagonal,

-beakers of cylindrical, cone, bowl, prismatic or irregular shape - by cutting off the material at the opposite ends of their longest dimension,

- granulated products – coning and quartering method - the material is poured so that it takes a conical shape, then it is flattened out into a circular shape, divided into quarters, the two quarters are discarded and the other two which are opposite one another are subjected to the process again and again until the sample of 5 g is received.

While collecting laboratory test samples there are applied the following tools:

- jewelry shears,
- side- and front cutting pliers,
- guillotine shears,
- scrapers,
- polished hammer and anvil,
- jewelry rolling mill,
- table electric drill, equipped with a set of drills of 2 to 7 mm.

Preparatory activities of the examination with the cupellation method include (Hornik et al. 2006):

- lacquer, adhesive and polishing agents must be removed with solvents; usually, the method of filing of electrolytic coating or superficial layer of the alloy is used for this purpose,
- the sample must be the subject to mechanical working – by cutting or rolling.

The collected sample must be representative of the batch of goods. For products made of gold, platinum or palladium there are collected two test samples (weighed amount). Samples must be weighed on the analytical balance with a reading accuracy of 0.01 mg. The sample should be taken from anywhere in the product, in case of too little weight of the product or item, the test sample should be taken from several products. In the case that the product consists of a few elements, the sample should be taken from each of them (Żołok, 1999).

The mass of the examined alloy should be sufficient to provide two test samples, to prepare at least two test samples for umpire analysis or to preserve the comparative sample for possible further comparative purposes. The weight of the tested alloy should at least amount to:

- for gold and silver alloys: 1.5- 2.0 g,
- for platinum alloys: 2.5- 3.0 g,
- for palladium alloys: 2.0 g.

To conduct the test with the cupellation method, apart from the sample, there are required the following reagents:

- nitric acid solution 68% pure p.a., p_{20}= 1.41 g/cm^3, halide-free,
- aqueous nitric acid, p_{20}= 1.2 g/cm^3,

- aqueous nitric acid, p_{20}= 1.3 g/cm^3,
- sulfuric acid solution 98% pure p.a., p_{20}= 1.83 g/cm^3, halide-free,
- lead oxide PbO, free of bismuth and precious metals, as foil or tablets,
- pure silver for inquartation, minimum purity - 0.9999,
- pure gold for standard proof samples, minimum purity - 0.9999,
- copper, minimum purity - 0.999, as foil or wire,
- distilled water or water of equivalent purity,
- sodiumtetraborate ($Na_2B_4O_7$), anhydrous,
- magnesite or bone meal,
- an agent which prevents overheating of nitric acid solutions and, during cooking, stays close to the surface of the solution.

At this point, an important issue becomes the process of storing chemical reagents (especially acids and lead), which are particularly dangerous when the processes take place improperly or are handled in a manner that is not compliant with the rules of safety. The storage of the ordered chemical reagents is performed in a small storage room situated next to the laboratory. This room is secured with a metal anti-theft door and the monitoring system which, in case of theft, will protect goods or identify the people responsible for the burglary. Acids are stored in metal drums of the capacity of 3 liters. Only rarely used hydrochloric acid is kept in containers made of polyethylene which is resistant to chemicals. In the case of the storage of lead foil, it is wound around a cylinder of small diameter, which is then inserted into the can, which prevents the access of unauthorized persons or people not adapted to work in the harsh environment. The chief laboratory assistant or a person in charge of their duties is responsible for the supply of the Assay Office, inventories of chemical reagents and placing orders with the warehouse of chemical products (Częstochowa ,2015).

To examine the content of precious metals in jewelry alloys, apart from reagents, there is also required the following specialized apparatus and instruments (Częstochowa,2015):

- muffle furnace with a fume hood, with operating temperature of 1200^{0}C and the possibility of temperature control,
- magnesite cupels of diameter 26 mm to absorb 10 g lead and of diameter 22 mm to absorb 6 g lead,

- clay and chamotte bowls,
- flat nose pliers, pliers to grip the flasks, laboratory tongs, long arm steel pliers,
- tweezers,
- annealing crucibles of diameter 50 mm,
- assay cleaning brush, of stiff bristle or nylon,
- anvil and steel hammer, polished,
- metal trays with slots for cargo,
- hand or electric rolling mill,
- laboratory gas burner,
- flasks for boiling cornets,
- fume cupboard, removing nitrogen oxides.

Both the District Assay Offices and the Central Office of Measures are responsible for the procurement processes of the Assay Office with the above mentioned equipment as well as the modernization and repair of the apparatus. The Head of the Assay Office is responsible for the condition of machinery and equipment in a particular Assay Office.

8. Identification of Task-Based Stages of the Sub-Process of the Logistics System of the Selected Assay Office Including Testing Using the Cupellation Method

After the preparation of the above listed reagents, test samples and properly prepared apparatus, there takes place determination of gold in alloys. Fig. 3. presents the main task stages performed in a sequence during the cupellation method.

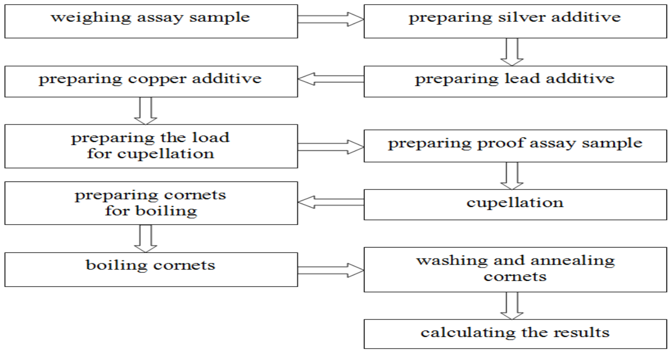

Fig. 3. Task stages of the cupellation analysis of gold

As noted above, as shown in Fig. 3., there should be prepared two proof assay samples of 125-250 mg of the tested alloy. To each of the prepared samples there should be added pure silver in such an amount that the ratio by weight of the gold contained in the sample to the total weight of the silver is 1:2.5. When this ratio of silver to gold by weight is used there is an optimal process of separation silver from gold while pickling silver in nitric acid. The gold preserves the shape given to it before pickling. Adding an excessive amount of silver will cause the loss of coherence of the strip whereas too little amount - its incomplete pickling of gold. This contributes to overstatement of the results - overstatement of the sample. When calculating the mass of the added silver there should be taken into account the silver contained in the alloy by identifying the fineness from the needle which can be used to test the alloy on the touchstone. The silver mass can be calculated using the following formula (Żołok, 1999):

$$m_{Ag} = m_1 * (2,5 * a - b), \qquad (2)$$

where:

mAg- the mass, in milligrams, of the added silver,

m1- the mass, in milligrams, of the test sample of the tested alloy,

a-fineness of gold in the alloy, determined with the approximation method, presented with place value of four digit numbers,

b-fineness of silver identified on the needle,

2.5- the ratio (of gold to silver).

Another stage is adding an appropriate quantity of lead (depending on the fineness of gold alloy). The lower the fineness of gold the more of the base metal must be removed from the sample. At the same time, it is required to add a larger amount of lead. Below, in the Tab. 2., there is presented a sample lead content for the weighted amount of 250 mg.

Table 2. Amounts of lead additive for the weighted amount of 250 mg

Fineness of the tested gold alloy	Lead additive in grams
0 - 350	8
350 - 600	7
600 - 750	6
750 - 875	5
875 - 920	4
920 - 999	3

While determining the gold of fineness of 900-999, to the weighted amount, there should be also added, apart from silver and lead, 50 mg of copper, which prevents the fraying of samples when rolling.

After weighing the test samples, adding silver, lead and copper, there should be prepared the load for cupellation. The lead foil should be rolled so as to obtain the shape of a bag on the bottom of which there is placed the lead button. On the button, there should be placed the weighted amount of the tested alloy and silver and copper additives. The whole is covered with another lead button with the foil tightly wrapped. The prepared sample is placed on a tray in a numbered slot.

Along with the alloy samples there should be prepared two standard samples using the same materials, namely gold, silver and lead. The composition of samples should correspond with the composition of the alloy whose samples are the most numerous in the series. The content of base metals should be replaced with copper. Standard samples are placed on a tray in the numbered slots and treated the same as the samples of alloys.

The cupellation process takes place in a muffle furnace, gas or electric furnace connected with the extractor (Częstochowa, 2015). The bottom of the muffle should be sprinkled with bone meal or magnesite (to extend the lifetime of the muffle). The process is conducted at a temperature of 1050 - 11500C.

Cupellation, after the preparation of samples, takes place in many stages, in accordance with 5 tasks indicated in Tab. 3.

Table 3.Task stages of the cupellation process after the preparation of test samples

Stage	Task
I	The right amount of cupels is inserted into the furnace muffle, the door of the furnace is closed and the cupels are heated to about 1000^0C.
II	After heating up the furnace its door is open and the loads (samples) are inserted into the cupels with long metal pliers.
III	After about 2-3 minutes, there should be supplied oxygen essential for oxidizing base metals.
IV	It should be observed that the liquid silver-gold alloy does not transmit light emission of lead.
V	The process lasts 15-25 minutes – depending on the weighted amount and fineness of the tested alloy. After cupellation the cupels should be moved to the front of the muffle and when the bead dries, the cupels should be removed from the furnace.

After the completion of stage V indicated in Tab. 3., the bead should have smooth, convex and glittering surface. The cooled bead should be crushed with tongs, cleaned with a brush and flattened with a hammer on an anvil.

The prepared sample should be annealed and subjected to the rolling process to obtain the plate which is 0.15 – 0.20 mm thick. After re-annealing, the plates should be coiled and cooked in the solution of nitric acid to separate silver from gold. The coiled sample should be poured with the solution of nitric acid of a density of 1.2 g/cm3 in the amount of 20 cm3, heated and kept at boiling point until the end of emissions of nitrogen oxides. Subsequently, the solution should be poured with silver nitrate.

The sample in the flask should be cleaned with hot water, poured with the solution of nitric acid of a density of 1.3 g/cm3 in the amount of 20 cm3. To the flask there should be added the agent preventing overheating and the solution with the sample should be kept at boiling point for about 15 minutes.

If the initially determined fineness of gold is more than 750, the sample should be re-boiled in the solution of nitric acid of a density of 1.3 g/cm3. After boiling the sample should be rinsed several times with hot water to remove silver nitrate. Then, the flask should be poured with distilled water and the sample should be moved to the clay and chamotte bowl. In the case when the ratio of gold to silver is less than 1:3, the sample must be boiled twice in 15 cm3 of nitric acid of a density of 1. 84 g/cm3 (Częstochowa, 2015).

The etched sample should have a matt brown color. Such a sample should be annealed in the cupellation furnace at 700 – 7500C for about 5 minutes. After cooling the sample to ambient temperature, it should be weighed on the analytical balance and then there should be estimated fineness of the tested alloy.

In the case of the estimation of fineness after performing chemical analysis, the laboratory assistant passes products to the room of marking staff where the products are given appropriate hallmarks. Marking staff label the received goods with hallmarks with markers and hammers and they count and weigh products. Marked, weighed, counted and packed products are passed to the safe where they are awaiting pickup by the customer.

While highlighting the overall process with its division into sub-processes, there occurs the opportunity for conducting costs analysis taking into account the management requirements of the logistics control of the process. Undoubtedly, the essence of the issue should be subjected to the thorough analysis in a subsequent piece of work in order to fully develop the discussed problem.

9. Conclusions

Logistics systems are determined differently in entities. The specificity of the activity of the one chosen for conducting the research in the present paper indicates the scope and nature of the implemented elements of the logistics system, resources and logistics processes related to the physical transformation and logistics activities of a regulatory nature.

The identified logistics system of chosen Polish Assay Office indicates the complexity of its determinants. The presented objectives and tasks of the unit specify general regularities characteristic of logistics systems and its management but also taking into account the specificity of the Body subjected to the analysis and determinants of its logistics system. They are an initial attempt of assessment and they require the continuation. The basis for the conducted research was mainly observations and interviews with the employees of the Office supported with the analysis of internal materials and literature sources.

On account of the problem of the research, undertaken in the present paper, in the logistics system in management of Polish Assay Office, specified as the system (1), there was made the division of the basic process into two sub-processes including determination of gold content in jewelry alloys in which fineness is maintained (sub-process 1) and determination of gold content in jewelry alloys when fineness is not maintained (sub-process 2).

Each of the processes has its specific set of elements (sl), a set of internal (Rw) and external relations (Rz). This results from tasks (Z) for which the sub-process was established to fulfill the purpose of the existence and functioning of the logistics system (W) of the Body.

All the processes taking place in sub-systems of the logistics system in management of the chosen Assay Office are associated with specific logistics activities, most of all, concerning:

- providing synchronous cooperation with the system of the Assay Office in Poland,
- processing orders,
- examination of content of precious metals in jewelry products,
- issuing examination certificate,
- marking jewelry products with hallmarks,
- inventory management.

Relations combining the elements of the logistic system in management of the Assay Office, their scope and complexity, result from the specificity of the performed activities between the elements of the system. These relations arise between the set of measures creating the conditions of the system operation, i.e. people and equipment (L+U) and tasks and results of the operation (Z+W), between people performing particular tasks (L) and permanent and information elements of the system, and also between the tasks of the logistics system of the Body (Z) and implementation of these tasks (W).

Therefore, the indicated determinants of the logistics system consists of a wide range of elements, resources and logistics processes subjected to mutual coordination. The support function in this area is played by information flows whose efficiency and effectiveness determines the capabilities of logistics management and their optimization.

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