THE PROCESSES OF DECISION-MAKING IN INVENTORY MANAGEMENT IN CEMENT INDUSTRY COMPANIES IN POLAND

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The aim of the paper is to present the problems of decision-making in the field of inventory management of the cement sector in Poland. In the first part of the paper there have been characterized the problems of taking managerial decisions in the enterprise and there have been presented the instruments of decision-making in inventory management. In the empirical part there has been shown the technical and economic progress in the cement sector and the leading directions of development of the cement industry in Poland. There has been carried out the assessment of the economic situation of the cement sector in Poland and the quantification of decisions in the field of management of the selected operational inventory in the investigated company of the cement industry. In the final part of the paper there have been presented the prospects for development of the cement sector in Poland. The applied research method is descriptive analysis, trend analysis and inventory audit. Inventory audit is to verify the efficiency of management of operational inventory in the investigated enterprise.

Keywords: Decision-making, Inventory management.

Introduction

Cement industry companies in Poland operate in the turbulent environment. Therefore, the efficiency of decision-making processes is conditioned by the effectiveness of the applied decision-making instruments. From the point of view of the subject matter of the present considerations, the key instrument in the process of decision-making in the field of inventory management is inventory audit. In search of management optimization, inventory is indicated as one of many factors generating costs. Enterprises aim at rationalization of inventory management, which, on the one hand, amounts to inventory cost reduction and, on the other, to the necessity of maintaining safety stock level since it enables the continuity of production and sale. This task is performed by the auditor, who not only represents the audit function but also the processes and mechanisms implemented by the management staff of the enterprise. Inventory audit is an instrument arousing great interest of both theoreticians and pragmatists of management. The aim of the paper is to present some theoretical and practical aspects of decision-making in the cement sector companies in Poland. The problem of the management instruments in the field of inventory is important and up-to-date on account of the economic conditions in which cement industry companies in Poland operate.
The Processes of Decision-Making in the Enterprise

In the subject literature the process of decision-making is defined as “recognition and definition of the nature of the decision-making situation, identification of some alternative variants, selection of the best solution and its practical application” (Griffin, 2000, p. 291). According to P. F. Drucker, decision-making is indicating the solution which fulfills all specific conditions allowing for the compromise, in which the decision becomes acceptable (Drucker, 1994, p. 382). The decision must take into consideration the actions which implement it, which will trigger the phenomenon of feedback, allowing to check the accuracy and efficiency of the decision in the light of current events (see: Peterson, 2009, pp. 3-4). An important constituent of decision-making is both raising awareness that the problem is of the general nature and it can be solved by only such a decision which constitutes a rule, and defining specific conditions which the solution of the problem must satisfy. With reference to the above statements, it is acknowledged that the process of decision-making is the transformation of information into the managerial decision (Wanielista, Miłkowska, 1998, p. 193), which “should bring about the desirable result with the minimum of effort and the minimum of disturbances” (Drucker, 1994, pp. 376-377).

Decisions are accurate when the decision-maker, while searching for the alternative of choice, is able to think ex post and ex ante and use both ways of thinking (compare: Einhorn, Hogarth, 2006, p.143-14). This means that decision-making includes the indication of the solution, which satisfies all specific conditions, allowing to reach a compromise, in which the decision becomes acceptable. The process of decision-making must include different theories, concepts and ideas, and verify them in practice. Therefore, the basis for efficient decision-making is the transfer of the idea (Pentlanda, 2014, pp. 58-65).

The decision-making process, aiming at the achievement and maintenance of an increase in value for the buyer is connected with risk (Skowron-Grabowska, 2014, pp. 35−39). The risk in decision-making processes may be neutralized by following the principle of “proper order of strategic components” in accordance with the concept of “Blue Ocean Strategy” (Chan Kim, Mauborgne, 2007, pp. 42-43).

Decision-making is one of many managerial tasks but it is a very specific task (Drucker, 2004, p. 61), which encounters a lot of barriers. One of the barriers of the effective decision-making is lack of information but also excessive information or information of no value (Rausch, Anderson, 2011, pp. 2-4). The global economic crisis demonstrated weaknesses of decision-making processes while enforcing „management breakthroughs”, which consist in “the selection of the set of operating methods with the instruments of crisis management” (Romanowska, 2010, p. 12). Searching for modern management instruments is the result of permanent changes in the environment of enterprises, whose basic resource are the people (Barber, 2007 p. 66).

The Instruments of Decision-Making in the Field of Inventory Management

From the strategic point of view an important conceptual instrument of inventory management in the company is inventory audit. The audit in the field of inventory is to enable the managerial staff to make independent and objective assessment of the control system and inventory management with the consideration of risk management. The processes of inventory manufacturing and sale should be subject to evaluation.

The basis for making purchases in modern enterprises are the received orders. The confirmed order from the contractor is the basis for making a demand for materials. In the process of purchase, the objects of the audit will be: placing orders, accepting deliveries and their storage, considering returns and complaints, registry of supplies in the financial and accounting system and repayment of liabilities (Knedler, Stasiak, 2005, p 233).

The acquisition of inventories includes the development of previously specified demand. The audit of the procurement process is burdened with risk connected with the possibility of decision-making concerning making a purchase by a person who is unauthorized to perform such a type of activities, therefore, the prepared orders must be authorized by the person placing an order (Bragg, 2006, p. 94).
purchase is subject to verification in respect to the compliance of the purchase with the placed order. The documents confirming the purchase (invoice) should be compliant with the instructions of the flow of documents. They must be handed over to financial and accounting services to include them in the accounting records and to settle the purchase with supply and order. The auditor’s task is to establish if there are procedures for placing orders, and if so, if they function properly. It is necessary to verify the previously conducted inspections in the field of procurement on the basis of the selected sample. During the audit activities it is necessary to check the diversity in the power of authorization depending on the type of purchase and the amount the purchase amounts to. The audit activities in the area of purchase should assess the processes of ordering, including purchasing from regular and incidental suppliers. The selection of suppliers should be the subject to verification in terms of economy, quality and time. The procedures concerning single purchases can be omitted in case of repetitive purchases and vice versa, mandatory activities, while meeting regular orders, do not need to be applied during single purchases. It is important for the purchase procedures not to produce negative effects such as excessive, unjustified or unauthorized purchase. The studies of the purchase process should be finished with the verification of the purchase register with the received deliveries and recorded purchase invoices.

The acceptance of the delivery should be subject to verification in terms of quantity and quality. The delivery must be compliant with the authorized order. The audit activities in this field need to include the examination of the document of the acceptance to the warehouse with the order and the physical examination by the person accepting the delivery. The subject of the audit should include returns and complaints. Each return of the purchased inventories or the complaint concerning them ought to be included in the warehouse and financial and accounting records. It is necessary to explain the reason for returns and complaints and check whether the return/complaint procedures are proper.

Another stage of inventory audit is the verification of the storage processes and the movement of stocks. According to S. M. Bragg, the four categories ought to be subject to observation: the protection of input and output of inventory, acceptance and records of stocks, the ways of storing inventories and requesting for inventories (Bragg, 2006, p. 96).

The inventory accepted to the warehouse needs to be identified and registered in the warehouse tracking system. The received stocks must be verified in terms of quality and quantity. If the accepted inventory does not fulfill the standard requirements, it should be returned to the supplier. The level and the structure of the possessed inventory should be subject to continuous inspection. The information on stocks is the basis for the development of material requirements for the next period. The audit is to eliminate unnecessary or duplicate orders (Knedler, Stasiak, 2005, p 247). The person auditing the management of the warehouse ought to pay attention to the procedures of requisition, which may significantly reduce the level of redundant stocks. The audit of the storage of inventories ought to include checking the access to the warehouse and security systems. This type of inspection, carried out regularly, allows to reduce the risk resulting from the possibility of theft.

The audit of the accounting records refers to the risk connected with the recognition of transactions on the wrong account or in the wrong amount, lack of records of returns or checking the correctness of the description of the accounting documents. The audit activities, referring to the registry of the purchase documents in the financial and accounting system, need to concern the verification of the establishment plans, the analysis of records on accounts and the examination of the detailed records, the assessment of the flow of accounting documents, the correctness of the substance, the formal and accounting inspection in this field. The confirmation of balances with suppliers, the connection between the warehouse tracking system and the financial and accounting system, and the scope of duties and qualifications of the people responsible for depretation, records and establishing liabilities must be subject to verification.

The enumerated list of audit activities, referring to the records of the purchase process, is not finished. The positive result of the preliminary assessment of the system of the accounting records allows to shorten the audit work. The detection of any irregularities brings about the detailing of the inspection. The audit in the area of liabilities needs to be conducted regularly but randomly to provide information.
which is necessary to assess the records of purchase and, at the same time, not to lengthen the time of inspection and not to generate unnecessary costs.

The consequence of the purchase process is the repayment of liabilities. This process is associated with the risk of repayment of liabilities with a delay, in the wrong amount and on the wrong account. Timely settlement of liabilities is strictly connected with the financial liquidity of the company. The liabilities which are both delayed and paid prematurely need to be subject to the examination. The interest paid for the late payment of liabilities is reflected in the financial costs, the liabilities paid prematurely ought to be checked for possible benefits. Otherwise, it is necessary to verify the validity of making early payment. Referring to the risk of payment of liabilities in the wrong amount, the auditor must verify the procedures of establishing balances, check the source documents with the accounting records, establish the reasons for irregularities and the people responsible for their occurrence. The properly operating computer system having connections between the module of registry of invoices and the payment module can be very helpful in reducing this type of errors (Kościelniak, 2001, pp. 54-60).

The examination of liabilities registered on the wrong account is conducted as in the case of payment in the wrong amount. Accounts payables should be agreed with bank statements. It is necessary to carry out the assessment of the security of information systems and check the qualifications of people with the access to database. The audit activities ought to include monitoring of the confirmation of balances and the ways of notification of the payment made. Making a payment on the wrong account amounts to the payment of liabilities without arising liability. The payment of liabilities should take place after meeting all the requirements such as: the posted invoice, the authorized order, the acceptance of the purchased inventory, the indication of the destination.

The Technical and Economic Progress in the Cement Sector

At present, the owners of the cement plants in Poland are the largest cement concerns. The application of modern management methods in the cement industry allowed to increase economic efficiency of the cement sector in Poland and the modernization produced the results in the form of savings of the used natural resources and reducing the burden of the environment. Currently in Poland there are 11 plants operating at full production cycle, another three are the cement grinding plants.

The cement production is a technologically complex process. The implementation of new furnace lines enforced the application of technological advancements. The basic raw material to produce limestone meal is limestone. The output of limestone is produced with cut-and-cover method. The extraction of deposits is conducted with the use of an excavator. The extracted limestone is transported to the crusher. When the stone is grinded, it is stored in the raw material hall. The stone and other additives are loaded with overhead cranes to the hopper tanks located over the raw material mills.

The grinded stone is given from the hopper tanks to the drying-grinding mills with the batching scales. The obtained limestone meal, being an intermediate product, is transported with pumps to the homogenizing tanks of limestone meal or the storage tanks of bituminous meal. The meal is passed from the homogenizing tanks to the storage tanks of the limestone meal, from there it is transported to the hopper tanks over the rotary kilns. The meal is given to the kilns as the charge. It consists of limestone, grinded in the crusher, granulated slag and additives correcting the chemical composition.

As a result of the rotation of the kiln and the inclination of the boiler drum of the kiln, the limestone meal moves along the kiln in accordance with its inclination. In the rotary kilns, there takes place the process of clinker burning from the limestone meal under the action of hot combustion gases produced by the burner. The kilns for burning clinker, which is another intermediate product, are directly coupled with the coal pulverizer and the slag drying oven. This allows to use off-gases from the rotary kilns to dry the granulated slag in the slag drying ovens or to dry the limestone in the raw material mills. Hot gases extracted from the kiln head are used for the preparation of coal dust. To illustrate the process of manufacturing cement, there is presented the explanatory diagram 1, presenting the individual stages of the production process.
Diagram 1. Flow diagram of the cement production


After cooling, the clinker is transported to the clinker store house where it is passed with the overhead crane to the hopper tanks over the cement mills, which process clinker into cement. In the mills for the cement production, there simultaneously takes place grinding clinker with raw materials adjusting the cement setting time. Depending on the type of cement which is desired to obtain, other ingredients are added such as granulated slag or flue dust. In order to obtain cement with a higher degree of fragmentation there are applied the mills installations equipped with the separators operating in a closed cycle. The achievement of high performance of the cement mills is possible due to the installation of the water system at the outlet of each mill. It allows for lowering the cement temperature by water injection into the mill. The cement, obtained from the cement mills, which is a finished product, is transported to the concrete tanks, i.e. cement silos.

The cement is sold in bulk or in sacks. The loading of cement in bulk takes place with the special terminal which supplies cement directly to vehicles or rail cars. The packing machine is used for sack filling. The sacked cement is palletized on the foiled pallets. The cement production in terms of quality is controlled by the independent research and certification centers.

All the investments realized in the cement industry companies brought about the improvement in the economic and technical indicators of the whole sector. The modernization of the cement plants caused that they are technologically advanced, which brings about high productive and economic efficiency.

The cement industry companies strive for technological progress enabling the implementation of the principle of sustainable development. The achievement of economic goals must go hand in hand with the care for the natural environment. It is manifested in the achievement of measurable effects in the form of: reduction in dust and gas emissions, reduction in waste emissions, rational water management, noise emission reduction, reduction in waste water emission. As a result of the elimination of the cement production with wet method there was a decrease in energy consumption and reduction in the amount of...
the emitted waste gases. In comparison with the 1990s, there has been a decrease in the emission of \( \text{CO}_2 \) by about 40% per unit of the burnt clinker. The care for ecology amounts to the application of alternative fuels in the process of the cement manufacturing. Year by year there has been an increase in the use of waste, which, on the one hand, allows to keep the reserves of fossil fuels and natural resources and, on the other, allows to eliminate waste from the environment.

Currently, in the cement industry companies there are seventeen kilns operating on the basis of the energy-saving dry method. All the plants of the cement sector have implemented the directive - IPPC 96/61/WE and the Law on Environmental Protection. The improvement in the quality of the produced cement as well as the replacement of the machinery brought about that the concerns possessing the cement plants in Poland achieve positive financial results.

The Leading Directions of the Development of the Cement Industry in Poland

The cement industry companies in Poland are a well-organized economic branch. The global concerns, being the owners of the cement plants in Poland, apart from the production activity in the field of cement production, conduct the complex activities connected with providing service to the construction sector. The object of the business activity of the cement industry companies, apart from the production and sale of cement, are: production and sale of aggregates, production and sale of concretes, sale of chemical additives, laboratory and transport services.

On the basis of the latest solutions in the field of technology of concrete, the cement industry companies offer a full range of concretes complying with high qualitative requirements. The concrete is produced with modern computer-controlled batching plants. The modernization of the concrete plant allowed for the production of concrete mix in winter conditions. The manufacturing of concrete takes place in the closed cycle thus the risk of producing law-quality concrete is reduced. The concrete plants apply equipment for recycling in the production cycle to enable the segregation of the remains of the fresh concrete mix into aggregate and water, which return to the manufacturing process. Such solutions bring about the reduction in the environmental impact and improve the efficiency of the operation of individual units.

Growing competition of new building materials which are alternative to cement brought about the extension of the commercial offer proposed by the cement industry companies. Chemical additives are used in the construction to modify concrete mixes. The most frequently, chemical additives are used for ready-mixed concrete, precast concrete, vibro-pressed elements and masonry mortars. The offered products fulfill the requirements of the certification bodies and research and development centers.

In the offer of the cement industry companies there are also the gypsum drywall systems. They include gypsum boards, gypsum-based adhesives, mastics, accessories for walls and ceilings. Gypsum products are also: molding, Japanese plaster and decorative elements. The systems based on drywalls are subject to quality tests, which allows for their constant improvement.

The cement sector companies provide professional services of the modern concrete laboratories. These services are provided for the optimum selection of the composition of concrete mixes and mortars. The concrete laboratories make an assessment of technical parameters of the raw materials used for manufacturing concretes and mortars made on the basis of cement. The specialized tests are conducted in the field of specifying the quality of the set concrete and concrete finished products.

The consulting services supplement the production operations of the cement industry companies. The technical and technological consultancy is run by professional consultants having current information on the legal regulations and standards concerning cement, concrete and aggregates. The technical and technological service provides services in the field of development of the technological part of the tenders for specific objects, while currently informing on the parameters of the offered concretes. The consultancy refers to the selection and application of individual types of cement, archival information, and current information referring to the technique and technology of production of goods using cement.
The service includes organizing workshops, training and scientific conferences for the people interested in apprenticeship in the laboratories. Figure 1 presents the characteristics of products of the cement sector.

Figure 1. The share of products of the cement industry in the total sales structure

Source: The author’s own study.

Post-sale services are another element enriching the offer of the cement industry companies. They refer to the transport of cement and concrete. The enterprises of the cement sector modernized the logistics system, which allows for fast and efficient supply of the ordered products to the contractors. The transport service includes modern logistics trends. It is based on the thorough and constant analysis of the supply chain and the examination of the customer’s needs. The logistics services include the motor or rail carriage for: raw materials (smoke-box dust, slag, stone, marl, chalk) and finished products (cement in bulk, sacked cement, fuels, aggregates). There is provided the technical and shipping service and transport services by the specialized fleet for transporting loose materials.

The cement industry companies pay attention to creating new products but they do not forget about the development of the staff. The need for investments in human capital results from the expansion of the cement concerns into the global markets. The development of the cement industry is determined by the qualifications of the workers it employs. All the cement plants in Poland belong to the global cement concerns which provide their employees with training, courses, studies, interpersonal training and international exchange. To develop the policy of mobility of workers, the cement companies develop the planning tools and staff development.

The aim of the cement industry companies is to implement some innovative solutions. By applying innovation, the cement sector significantly has raised the level of customer service and safety of workers. A great emphasis is placed on the quality and availability of products. The cement companies have a well-organized distribution network. They developed the strategy of reducing the consumption of fossil fuels, which allows for cost reduction. The producers of building materials are a demanding group of customers. To satisfy the requirements of customers, the cement industry systematically expands its commercial offer with new products for the construction industry. The cement companies aim at increasing production capacity of the whole sector, which is highly significant in the perspective of the development of sports and road infrastructure. An increase in the production capacity will allow to satisfy the demand for the domestic production and it guarantees that there will not occur handicaps in deliveries of cement, concrete and aggregations.
The Assessment of the Economic Situation of the Cement Sector

In 2001 there was a severe downturn in the demand for products of the cement industry in Poland (Figure 2). The amount of the domestic sale of cement amounted to 11.3 million tons, i.e. 20.5% less than in the year 2000. The amount of export in 2001 dropped by about 20%, and it amounted to 790 thousand tons. The total sale decreased by more than 3 million tons of cement compared to the year 2000 and in 2001 it amounted to 12.09 million tons of cement. The production volume of cement in the cement industry companies fell proportionally to the volume of sale and in 2001 it amounted to 12.3 million tons.

The decline continued in 2002. The domestic demand for building materials was still decreasing, which was reflected in the fall in the use of cement by 1.5% and reduction in the volume of the domestic sale by 4.5%. 40% less cement was exported than in 2001. Simultaneously, the import of cement rose by more than 30%. It is estimated that in 2002 the total sale (domestic and foreign) fell by 7%. Figure 3.6. shows the evolution of the volume of cement sale in the analyzed period.

The cement industry companies sold 10.5 million tons of cement on the domestic market in 2003. It was another fall of sales by about 2%. The domestic cement use decreased by 150 thousand tons and it amounted to 11.2 million tons in 2003. The year 2003 brought about the constraints in the volume of the cement production, which amounted to 11 million tons. A downward trend in the export of cement was maintained (277 thousand tons) with 30% increase in the import of cement from the East.

Figure 2. The volume of cement sales in years 2001-2014 in thousand tons

Source: The author’s own study.

In 2004 for the first time there was recorded an increase in cement sales (Figure 2). On the Polish market the volume of cement sales amounted to 11,061.7 million tons, i.e. by 4.7% more than in 2003. There was an increase in the export of cement by 23.7%. The use of cement on the domestic market amounted to 11.47 million tons, which means that the level of the import of cement was still high. However, in 2004 the import of cement was successfully stopped, which decreased by 30% compared to the year 2003. 2004 brought about the improvement in the economic situation of the cement sector. An increase in the export with a simultaneous fall in the import of cement caused that, for the first time in three years, the level of the inventory of cement in the industry decreased.

In 2005 the cement industry started to recover. There was an increase in the cement sales in 2005 by 2.2% compared to 2004. Also, the domestic cement production rose by 3.9%. In 2005 the production capacity of the cement sector in the field of the production with the dry method amounted to 13,900
thousand tons of cement clinker annually. The use of cement on the domestic market rose by 1.1%, which means that about 300 thousand tons of cement came from the import. However, it should be noted that the level of import in years 2004-2005 maintained a downward trend. On the other hand, the export of cement in 2005 was the highest in three years and it amounted to 487.6 thousand tons, aligning the level of 2002.

The cement industry in 2006 recorded another increase in sale by about 15% compared to 2005. The volume of the production amounted to 14.6 million tons of cement and it rose by 16%, compared to the previous year. However, an increase in the production in 2006 was slower than an increase in sales. The domestic use of cement rose by 21.4%. The share of cement from the import in 2006 was on the lowest level since 2001. The unfavorable phenomenon was the fall in export by 145%. Due to the modernization of the cement plants in 2006 the production capacity of the cement industry was increased by 7%.

An upward trend in the domestic cement sales was maintained in 2007 and it rose by another 12%. There was an increase in the production by 15%. The export of cement fell by 30% to the level of 320 thousand tons. At the same time, there was recorded an increase in the import of cement, in spite of an increase in the production capacities in 2007 by another 5% as a result of installing modern cement mills in a few plants. An increase in the level of cement from the import resulted from an increase in the demand for cement on the domestic market, with insufficient level of the production capacity in Polish plants.

Analyzing the economic situation of the enterprises of the cement sector in years 2005-2013, it should be noted that in years 2005-2008 there was a steady increase in the volume of the domestic cement sales. In 2009 the cement industry companies were affected by the infected market due to the global crisis, which brought about a decrease in the level of the domestic cement sales. In 2010 the cement industry companies started to recover slowly to achieve the highest level of the cement sales in the whole research period in 2011. The years 2012-2013 are characterized by the fall in the volume of the domestic cement sales. In 2014 there has been recorded an increase in the volume of the cement sales in Poland.

The cement industry companies in Poland are characterized by the seasonality of the demand for their products. The seasonal nature of the activity of those entities causes that the enterprises operating in the cement sector search for the ways of optimization of the inventory management system. To characterize the fluctuations in the level of inventories of the finished products in the cement industry companies, the analysis of the production and sale is presented below.

**The Quantification of the Audit Process in the Field of Inventory Management in the Cement Industry Companies**

The empirical study was conducted in the cement plant belonging to one of the largest cement concerns in the world. The range of the empirical data included in the study refers to the level of inventory. To quantify the audit process in the field of inventory management in the cement industry companies, the set of the empirical data has been presented in terms of quantity. The audit covered the period of twelve consecutive calendar months for several reasons. Firstly, the examination of inventory in the twelve consecutive months presents the seasonality of production and sales in the cement sector. Secondly, the volume of the production, wear and sale of the inventory in consecutive years is analogous in all the cement industry companies. Thirdly, the audit is to provide information ex ante, therefore the inventory analysis over the twelve consecutive months will provide current information on the level of inventories.

The audit process in inventory management in the cement industry companies under research will be conducted in terms of quantity. On account of the quantitative share of individual types of inventory in the cement sector, the clinker – the intermediate product and the cement – the finished product have been selected as the object of the research.
The clinker is the basic intermediate product for manufacturing all types of cement. The clinker is manufactured in the process of burning limestone meal. In the course of clinker-making high temperature is required. The clinker is stored in the open storage area (dumps) or the open roofed one.

The finished goods in the cement industry companies are all types of cement. The cement is mainly designed for sale to the external customer, however, considering the fact that all the domestic cement companies belong to the international concerns, the finished goods, intermediate products and sometimes raw materials become goods and can be mutually sold to other companies.

Inventory management in the cement industry companies is conditioned by the factors such as: the seasonal nature of the business activity, the demand, the level of production capacities. The above factors have direct impact on the level of inventories in the cement industry companies. The seasonal nature of the activity of these companies results from the climatic conditions, which influence the demand for cement in the construction industry. The demand for the cement industry products affects the level of inventory of intermediate products and materials. The activity of the cement sector companies is limited by the possessed production capacities. These constraints in the investigated company mainly refer to: the capacity and the number of the silos of limestone meal and cement, the efficiency and number of raw material mills, the efficiency and number of kilns for burning clinker.

The research area of the audit of the clinker and cement inventories will be the processes of manufacturing, storing and depleting these inventories. Producing inventories chosen for the subject of the research occurs in the production process. The storage of stocks takes place in the company’s own open or closed storage area. The depletion of the inventories of materials and intermediate products takes place by means of their dispensation for wear in the production process, and in case of finished goods – by means of their sale. The aim of the audit is to obtain reliable evidence that inventory management is run properly, the inventory management procedures are effective and the inventory control system operates smoothly.

The stage of the audit implementation (Table 1) consists in conducting some cognitive activities enabling the solution of the research problem which is to verify the audit model propositions for decision-making in the field of inventory management in the cement industry companies in practice and the assessment of the possibilities of its application. The object of the audit is irregularity, the object of the control is the area in which this irregularity occurs. In the audit process the actual state was compared with the planned state, verified for the compliance of inventories and the inventory management procedure with the consideration of risk.

<table>
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<tr>
<th>Area: The process of producing, storing and depleting inventories</th>
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<td>The objects of the (operational) audit: Verifying efficiency of clinker and cement inventory management.</td>
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<tr>
<td>The planned research: actual analytical test – trend analysis.</td>
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<td>The research period: 12 months.</td>
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Source: The author's own study.

The implementation of the audit processes (Table 1) is focused on the items of the inventories which pose the highest risk, confirmed during the preliminary analysis. The choice of the clinker and cement inventories as the object of the research was determined by the horizontal approach to the economic categories.

The level of the clinker inventory rises in the winter season (Figure 3). The investigated cement company reduce the volume of production in the first and fourth quarter due to the fall in the cement sale. In this period there takes place the compiling of clinker inventories in the closed and open storage areas.
The growth rate of the clinker inventories in the winter season to the average production capacity of the clinker burning is determined by the possibility of increasing the cement production in the summer. At the same time, an increase in the level of these inventories brings about higher costs of storage. The risk resulting from the decision of compiling clinker inventories is the possibility of fluctuations in the demand for cement in the summer, which may cause an essential rise in the inventory costs. In the second and third quarter, the level of the clinker inventories falls in spite of an increase in its production. This results from the fact that the cement plants are characterized by the higher capacity of clinker milling than its burning.

Figure 3. The level of the clinker inventories and its production and wear in a year

Source: The author’s own study.

The clinker inventories significantly affect the volume of the annual cement production. The level of the cement production depends on the level of the compiled clinker. Therefore, the clinker inventory is the bottleneck in most cement industry companies.

The level of the cement inventories is conditioned by two factors (Figure 4). The first one is the limited capacity of the cement silos. The other factor is the demand for cement in a specific period. In the winter season the sale of cement is at the lowest level, which brings about an increase in its inventories. In summer, the cement production and sale reaches the maximum level, bringing about fluctuations in the level of the cement inventories.
In the winter season the cement inventories are maintained at the maximum level. If, in the winter, it is predicted that the demand for cement in the second and third quarter will be low compared to the capacity of the cement milling, it is possible to reduce the level of the cement inventory in that period. If the cement companies expect the high demand in the summer season, they maintain the high level of the cement inventories at the end of the winter season. The cement inventory maintenance at the upper level of the silos capacity enforces a special care for the proper air circulation in the silos. The long-term cement storage in the silos generates the risk of costs due to the loss of the cement value in use (the possibility of the cement lumping on account of not emptying a specific silos).

To satisfy the demand in the summer season, the cement industry companies can store the cement temporarily (for a short period of time) in warehouses, pallet area or in the open storage areas for the foiled palletized cement in the winter. The storage of the sacked cement is connected with the risk of the expiry in case of the lower demand, the risk of the loss of the inventory value and the risk of the cost increase.

The wear of intermediate products in the process of the cement production exceeds the volume of their production (Figure 4). This means that the cement companies, first of all, use the compiled inventories (this fact is also determined by the technology of the cement production). The volume of wear of raw materials and intermediate products results from the production capacities. The volume of the cement sales is conditioned by the demand and the possibilities of the inventory storage. In case of the demand for the cement being larger than the capabilities of the clinker burning, the cement industry enterprises can purchase this intermediate product from the plants having it in the excessive amount. In the situation when the inventories of intermediate products generate high costs and the expected demand can be subject to the collapse, it is necessary to sell the excess of the inventory leaving the safety stock.

The results of the inventory audit were included in the reports on the performance of the audit task, which contains the concise information on the object of the research. Each report was divided into several parts. The first part refers to the criteria by which the investigated object was assessed. The second part includes the presentation of the actual state. The third one is about the reasons of the occurrence of irregularities or disturbances. In another part there are listed the risks which can appear in the investigated area. The last part includes the recommendations which are to improve the investigated object in the future and prevent the occurrence of irregularities in the future. If the actual state is compliant with the presumed criteria, the subsequent parts of the report can be omitted.

In the light of the above considerations, it should be noted that in the area of the operational activity of the investigated cement industry company there are some bottlenecks which enforce planning and
development of production well in advance in relation to the expected volume of sales. Gathering inventories in the winter season is economically irrational since it brings about an increase in the inventory maintenance costs, however, the need for satisfying the demand and minimization of production costs in the summer season justifies the necessity to produce inventories in the cement sector. The information obtained during the current audit at the turn of the first and the second quarter will support the fast reaction in the situation of change of external factors. The findings of the audit can enable making accurate decisions in the field of strategic operational inventories existing in the cement sector.

Conclusions

The aim of the paper is to present the inventory audit in the investigated cement industry company in Poland. The empirical study was conducted on the basis of the descriptive analysis, trend analysis and inventory audit of the selected operational inventory. The range of the empirical data included the production, sale and inventory of intermediate products and products. The research period for the inventory audit were 12 consecutive months of the calendar year.

Summing up the results of the conducted research, it is necessary to state that the processes of inventory audit in the investigated enterprise detect and eliminate disturbances in the information flow on inventory. The investigated company of the cement industry makes an attempt to maintain the inventory at a relatively low level in relation to the current demand for cement. On the one hand, it means that the enterprise aims at the inventory cost reduction and, on the other, it is connected with the possibility of generating opportunity costs. At the moment of the occurrence of the high demand for cement in the second and third quarter, the enterprise is not able to satisfy the demand since the current production is too small and the cement inventories are insufficient. The problems of inventory management in the cement sector result from the climatic conditions and technical constraints connected with the storage of cement. Another constraint in inventory management in the cement industry is the fact that the cement plants have the higher capacity of clinker for cement milling than the ability to produce clinker.

The occurrence of the economic crisis in the world markets did not spare the cement sector in Poland. Cement industry companies in Poland, in order to cope with price competition, while maintaining the high quality of cement, will consider the decision-making variants, connected with transfer of activities outside the European Union (so called carbon leakage). Decision-making efficiency in the field of inventory management in the investigated cement industry company is conditioned by the quality and usability of the possessed information, rapidity and accuracy of the decisions taken and changeability of economic phenomena in the environment of the company. Therefore, the recommendation for the investigated company, coming from the conducted research, is the selection of appropriate instruments of modern management, among which the particular attention is drawn to inventory audit to maintain high efficiency of the decisions taken.
References

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