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Structurization of mining companies

Background

The term *mining company* refers to an entity which performs the exploitation of mineral deposits. As a subject, it is described through its formal and legal situation as either a natural person's enterprise, a state-owned enterprise or a company, especially a capital company. As an object, it is an organized group of material and non-material components intended to be used in business operations (Engelhardt 2009). A mining company may be a one-unit mining company, or a multi-unit mining company. "*A mining company is defined as a technically and organizationally separated group of means that directly serve the exploitation of minerals from the deposit, including excavations, constructed objects and the related technological objects and processing installations*" (Geological and Mining Law of 1994).

The structurization of a company consists in designing its structure in such a way that each of the company's individual parts contributes to the success of the whole company. A structure is defined as a unification of processes and organizational cells through technological, procedural and official bonds (Kotarbiński 1983; Przybyła et al. 1995). Structure is a company management tool. The structures of mining companies comprise a dynamic and a static part, which are interrelated. The dynamic structures describe the operation of a mining plant, including technological processes serving the company's operational functions in mineral mining and processing. Dynamic structures are the basis and the point of departure for developing static structures, which describe the relationships between the or-

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ganizational cells serving the company's managerial and administrative functions in order to maintain proper technological processes.

The typology of structures is based on various criteria, especially on:

- official hierarchy (structures: linear, functional, matrix, project),
- organizational units classification (structures: functional, divisional, processing).

Structures may be also described through their characteristic features, e.g. specialization, hierarchization, centralization and formalization.

1. Characteristics of dynamic structures

Dynamic structures include material- and energy-related executive processes (actions), which may be represented in three groups relating to:

- the provision of production resources required for exploitation, technical preparation for exploitation and the maintenance of mining plant operations,
- proper exploitation of the deposit and potential processing of mined material,
- selling of the potentially processed mined material.

Performing above processes leads to the creation of an object-related exploitation process structure (Jasiński 2005; Antoszkiewicz 2007; Grudzewski and Hejduk 2008). The process of extracting minerals comprises basic and support technological processes, the type and number of which is adjusted to the deposit exploitation method. For example, the following processes are usually indicated in the case of underground mines (Pełka 1964; Wanielista 1986; Butra et al. 1999, 2010):

a) basic processes: opening the deposit, preparing the panels for extraction, extraction works, horizontal transportation of the worked material, vertical transportation of the worked material,
b) support processes: transportation of people, machines, devices, and materials, mine ventilation, drainage, geological and surveying works, etc.

Technological processes are characterized by:

- work technology,
- labor organization,
- labor system.

Work technology is defined by machines and devices used and by the competences of their operators. These are usually described with the so-called technological stages. From the structural point of view, a technological process is divided into **operations** and **actions.**

An **operation** is defined as a distinguished part of a technological process, characterized by a given technology and organizational works structure. An operation gives a defined work result. For instance, the "extraction works" process in copper ore mines comprises the following operations: drilling blastholes, blasting, extracting and transporting mined material, roof bolting.

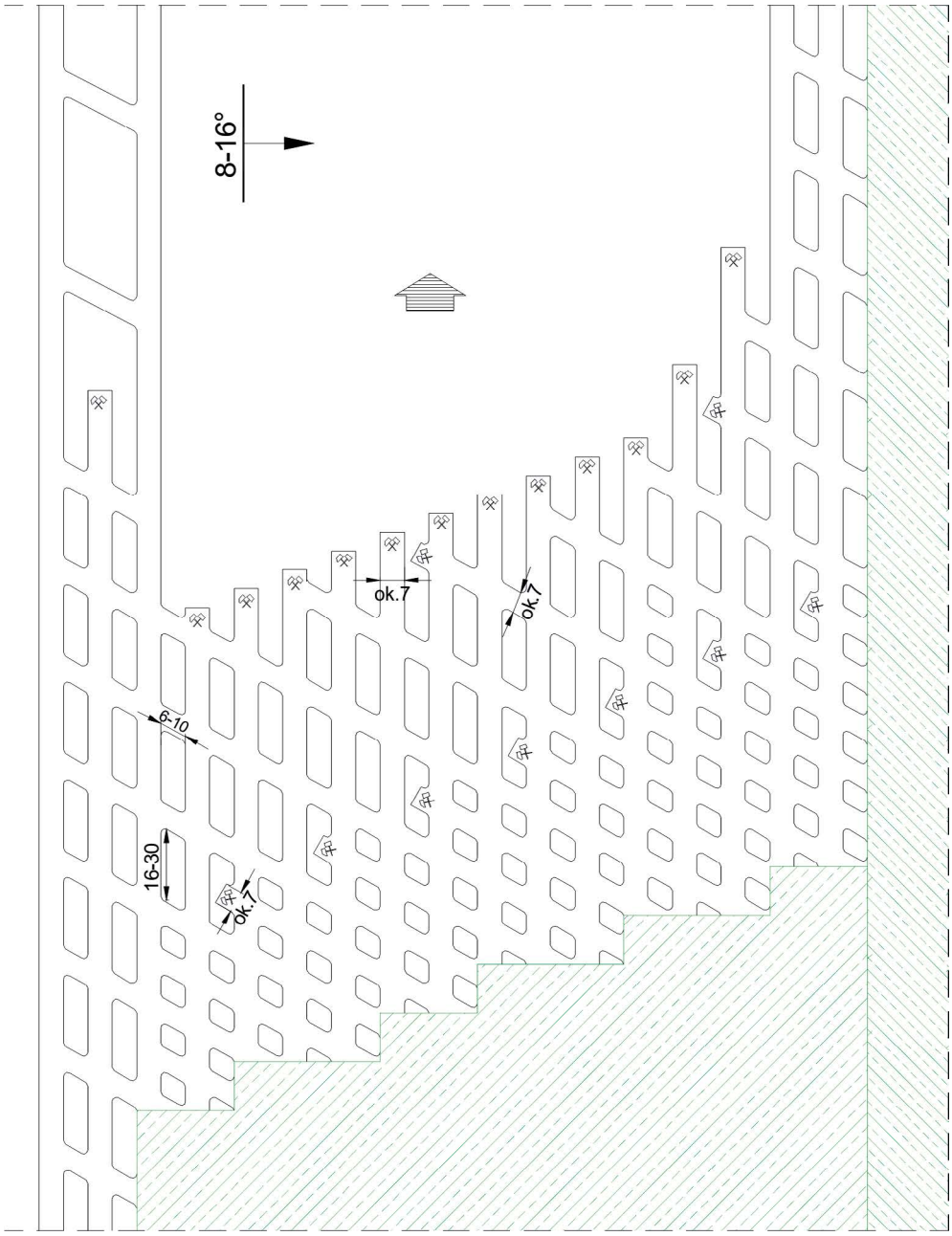
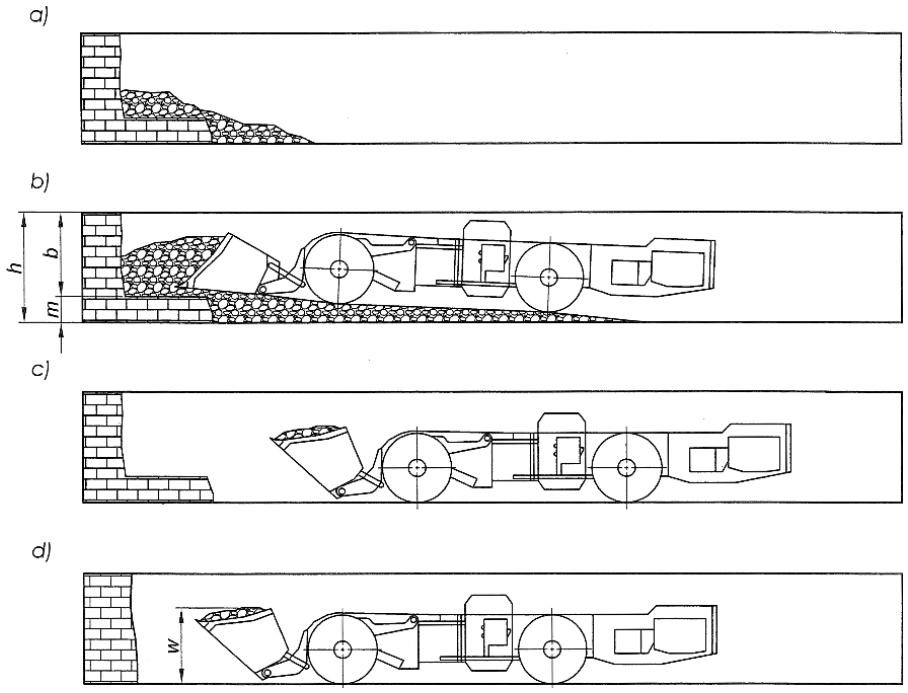


Fig. 1. Room-and-pillar mining system with roof deflection for the deposit with an inclination up to 16° (Butra 2010)

Rys. 1. Schemat eksploatacji systemem komorowo-filarowym z ugięciem stropu dla złoża o zwiększonym nachyleniu do 16° (Butra 2010)

An **action** is defined as technologically uniform activities performed as part of an operation. For instance, the "drilling blastholes" operation comprises the following actions: arrival of the drill truck to the mining face, preparation of the drill truck, drilling, finishing drilling and preparation for the departure of the drill truck from the mining face, movement of the truck to the next mining face.

The process structure is characterized through exploitation scheme (Fig. 1) in connection with technological stages, as related to a basic operation, e.g. the mining face before and after ore extraction. The analysis of the above definitions leads to a clear observation that operations and actions define the undertaken activities, while stages refer to the states of mining faces. An example provided below shows technological stages used when working the deposit in three variants: with a low deposit threshold, with a rock shelf and with high deposit threshold (Figs. 2–4).



m – deposit thickness; w – loader height; h – excavation height;
b – thickness of waste rock in the excavation profile

Fig. 2. The technology of distribution mining of the room face. The variant with a low deposit threshold ($m \leq 0.1$ m, $b \geq w + 0.1$ m) a) winning of waste rock of thickness b; b) performing a run-up on a deposit threshold; c) extracting of broken waste rock; d) winning and extracting of a deposit threshold (Butra 2010)

Rys. 2. Technologia rozdzielczego wybierania przodka komorowego. Wariant z niskim progiem złożowym ($m \leq 0{,}1$ m, $b \geq w + 0{,}1$ m); a) urobienie skały płonnej o grubości b; b) wykonanie najazdu na próg złożowy; c) wybranie urobionej skały płonnej; d) urobienie i wybranie progu złożowego (Butra 2010)

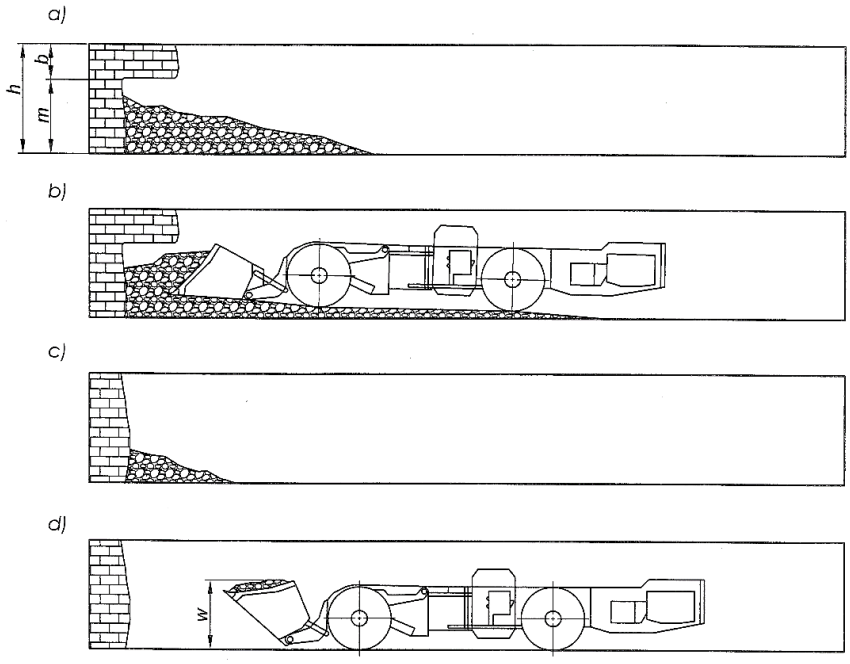


Fig. 3. The technology of distribution mining of the room face. The variant with a rock shelf
a) winning of deposit of thickness m; b) winning of ore; c) winning of waste roof shelf;
d) extracting of waste output (Butra 2010)

Rys. 3. Technologia rozdzielczego wybierania przodka komorowego. Wariant z półką kamienną; a) urobienie złoża o miąższości m; b) wybranie rudy; c) urobienie płonnej półki stropowej; d) wybranie urobku płonnego (Butra 2010)

Work organization in a technological process is defined as the location in time and space of the actions and operations that constitute the structure of a given process. The characteristic feature of work organization is their repeatability within production cycles. Work organization is shown on the so-called work schedules. Classic forms of work organization include: serial, parallel, multi-face, straight-line. Simplified work organization schedules are shown in Figures 5 and 6.

Organization of labor – usually presented in labor schedules – is defined as the division of labor and the cooperation between employees aimed at the adopted work organization. Forms of labor organization include, for example, single-profession teams, multi-profession teams performing several operations or actions, universal teams performing all actions in the work cycle. Four situations in the organization of labor may be distinguished in terms of the effectiveness and efficiency of processes, operations and actions (Trocki 2001):

1) partnering, i.e. the maintenance of processes in a company,
2) insourcing, i.e. the inclusion of the processes previously performed outside the company into the company's structure,

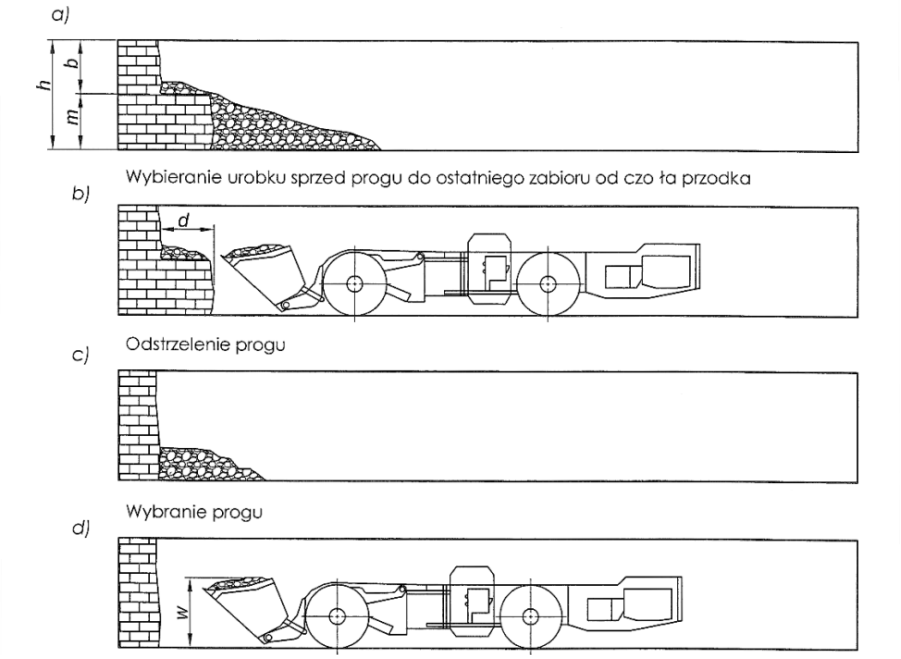


Fig. 4. The technology of distribution mining of the room face. The variant with a high threshold (m ≥ 1.0 m) a) winning of waste rock of thickness b; b) winning of waste rock; c) winning of a deposit threshold; d) winning of ore (Butra 2010)

Rys. 4. Technologia rozdzielczego wybierania przodka komorowego. Wariant z wysokim progiem (m ≥ 1,0 m); a) urobienie skały płonnej o grubości b; b) wybranie urobku płonnego; c) urobienie progu złożowego; d) wybranie rudy (Butra 2010)

3) separation of the processes from the company's structure and entrusting them to an external partner (cost outsourcing),
4) separation of the processes from the company's structure as a subsidiary company (capital outsourcing).

The labor system is the division of the staff into teams and the daily workload. The technology and organization of works, as well as the technology and organization of labor describe the dynamic structure, i.e. the technological processes.

2. Characteristics of static structures

Static structures describe the relationships between separate organizational units in the company in order to enable performing managerial and administrative functions (planning, organizing, motivating and controlling) as well as executive functions (processes).

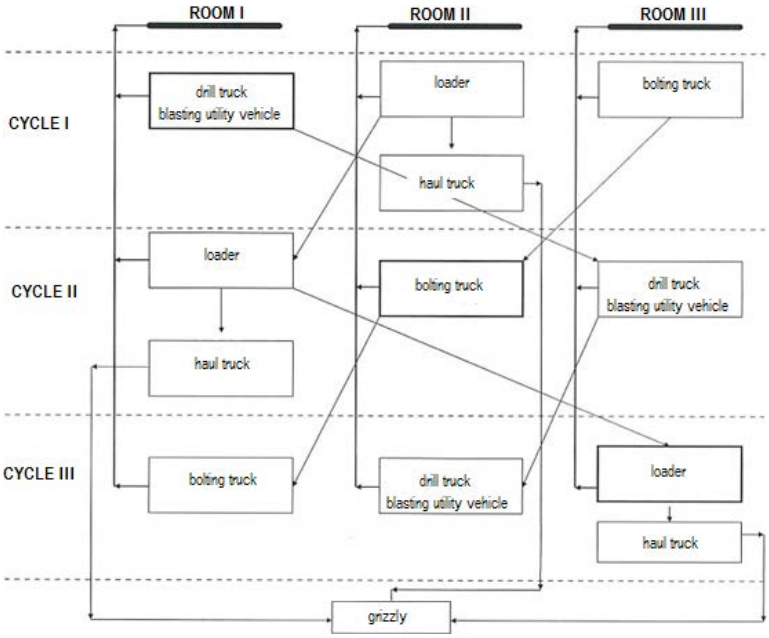


Fig. 5. Schematic diagram of mechanized unit with a haulage truck (Butra 2010)

Rys. 5. Schemat działania zestawu mechanizacyjnego z wozem odstawczym (Butra 2010)

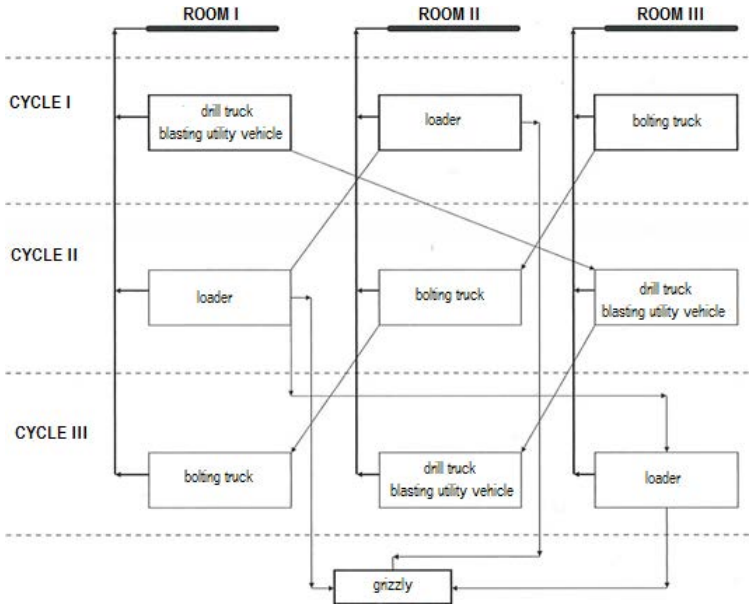


Fig. 6. Schematic diagram of mechanized unit without a haulage truck (Butra 2010)

Rys. 6. Schemat działania zestawu mechanizacyjnego bez wozu odstawczego (Butra 2010)

The idea behind and the basis for the development of static structures is dividing tasks in such a way to ensure the effective functioning of the company and the carrying out of its tasks. The point of departure for the construction of a static structure is the dynamic structure along with the characteristics of the basic processes as well as technological, organizational and economic indicators, especially the level and allocation of mineral extraction. The typology of a mining company's organizational structures includes two criteria:

- official hierarchy,
- organizational units classification.

2.1. Characteristics of structures regarding official hierarchy

Official hierarchy includes (Czerwiński and Trzciniecki 1994; Przybyła et al. 1995; Kudełko 2012):

- linear structures (Fig. 7),
- functional structures (Fig. 8),
- matrix structures (Fig. 9),
- project structures (Fig. 10).

In a linear structure, an employee reports to one supervisor, while in a functional structure an employee may report to several functional supervisors. Linear structures are supported by staffs: such a structure is referred to as a linear-staff structure (Fig. 11).

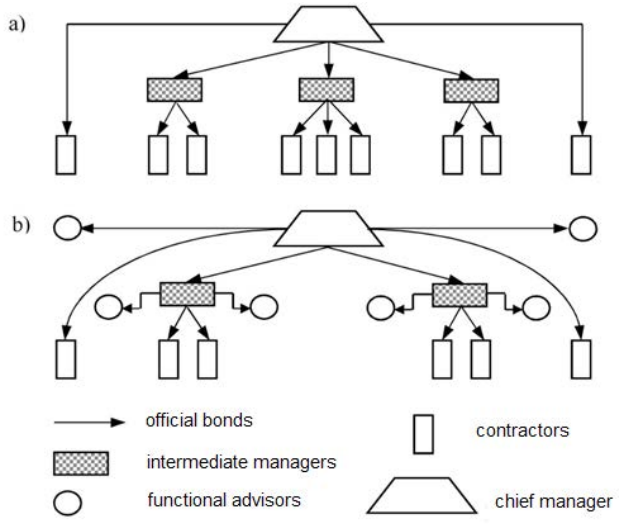


Fig. 7. Example of linear structures a) without functional advisers, b) with functional advisers (Przybyła et al. 1995)

Rys. 7. Przykłady struktur liniowych a) bez doradców funkcjonalnych, b) z doradcami funkcjonalnymi (Przybyła i in. 1995)

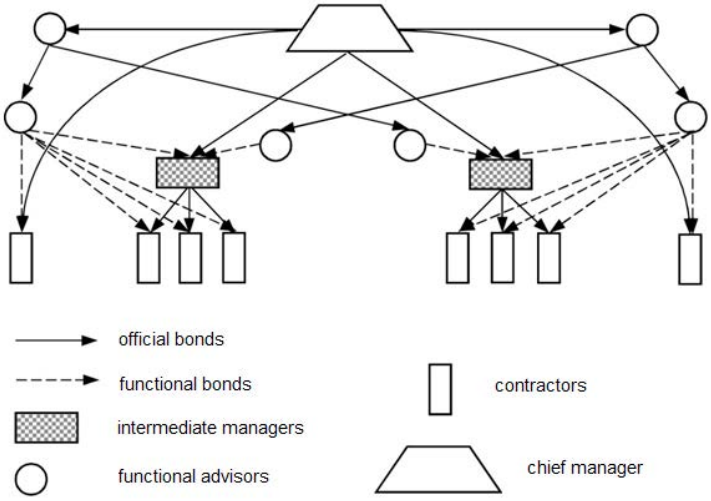


Fig. 8. Functional structure of support type (Przybyła et al. 1995)

Rys. 8. Struktura funkcjonalna typu wspomagania (Przybyła i in. 1995)

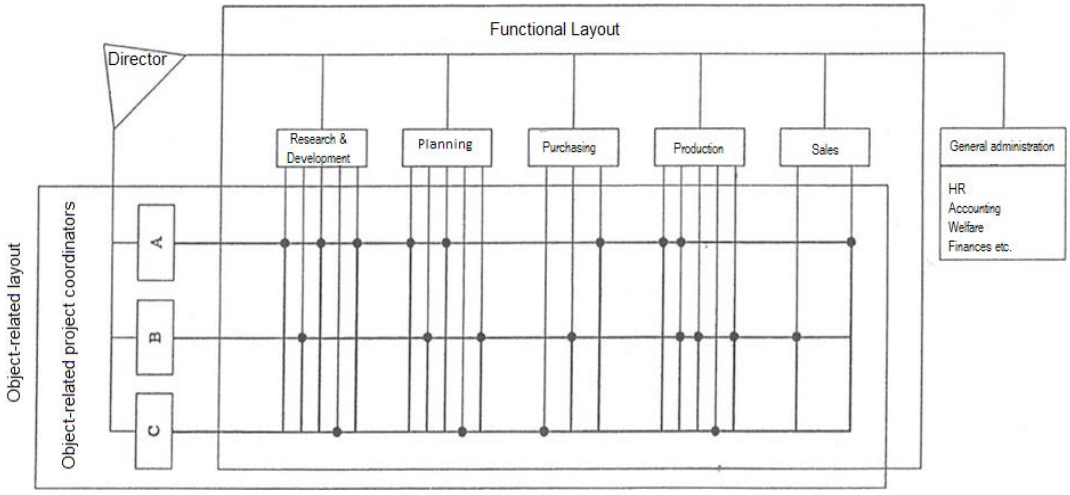


Fig. 9. Matrix organizational structure (Czerwiński and Trzciniecki 1994)

Rys. 9. Struktura macierzowa (Czerwiński i Trzciniecki 1994)

The principle behind the matrix structure is the double subordination of the employee: to the head of a functional cell (e.g. geology, mining, etc.) and to the project manager, if it is of an interdisciplinary nature. Project structures are still more complex, as the employees do not report to the heads of functional cells (no such cells exist), but to project managers, who employ workers possessing certain competences.

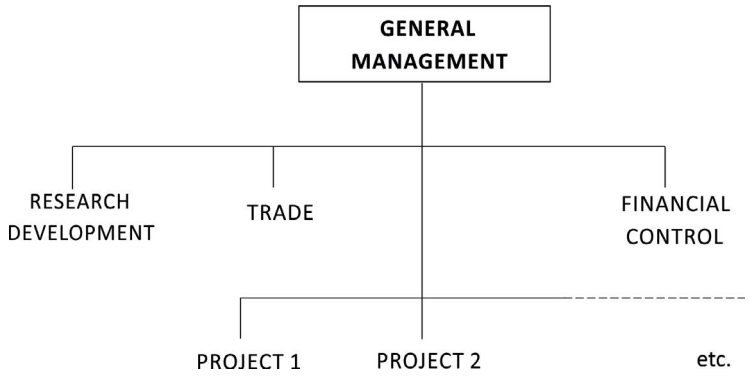


Fig. 10. Clear project structure (Czerwiński and Trzciniecki 1994)

Rys. 10. Czysta struktura projektowa (Czerwiński i Trzciniecki 1994)

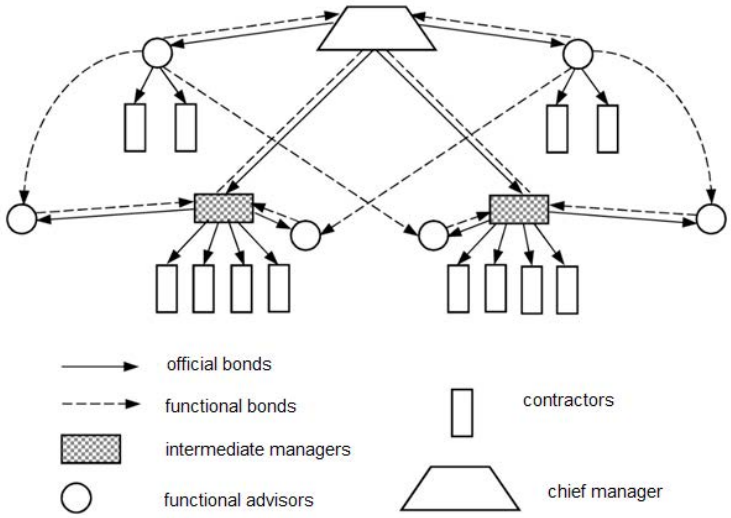


Fig. 11. Linear-staff organizational structure (Przybyła et al. 1995)

Rys. 11. Struktura sztabowo-liniowa (Przybyła i in. 1995)

2.2. Characteristics of structures regarding organizational units classification

The criterion (rule) of organizational units classification includes functional structures, divisional structures, processing structures and their combinations. The principle behind describing those structures is usually the type of cells at the second of third management

level, although other structure levels may have other unit classification rules, e.g. in a functional structure, lower levels may comprise divisions (modules), and at lower management levels in a divisional structure, the units may and sometimes should be classified according to the functionality criterion. Individual structures have characteristic features. In the case of a functional structure, organizational units are grouped in sets according to the functions they perform, i.e. they are grouped according to uniform, usually repeatable tasks. This leads to narrow specialization and technical perfection, but also causes limited flexibility and difficulty in result control.

Functional structures in the extractive industry occur practically in one-unit mining companies, in which two basic parts of the structure are distinguished: the management and the operation (Kudełko 2009). The mining plant operation is supervised by the manager of the mining plant operation accredited by an appropriate Mining Authority. The manager of the mining plant operation and the director (on some occasions the president) of the company may or may not be the same person.

In a divisional structure (company, module, sector), at the second management level, divisions are created on the basis of subject**,** market or territorial criteria. A multi-unit mining company is an example of such a structure (Fig. 12).

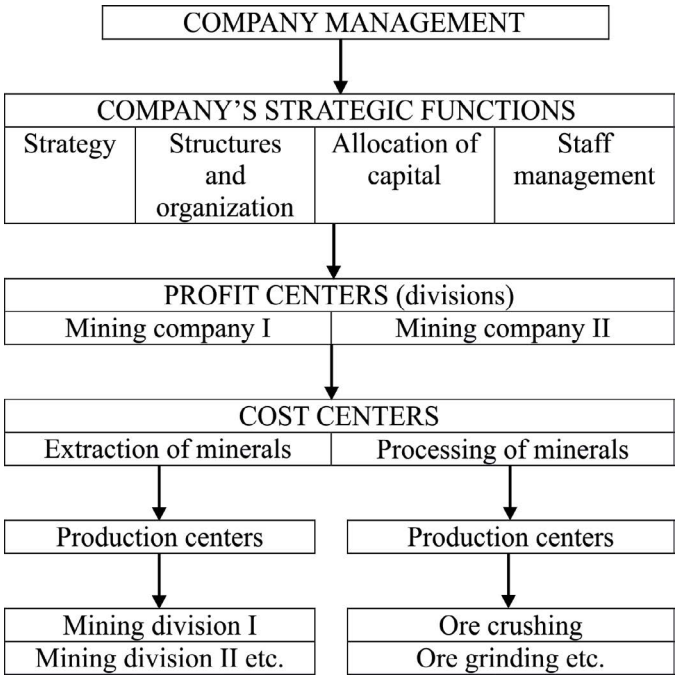


Fig. 12. Example of the divisional structure of the multi-unit mining company (own source)

Rys. 12. Przykład struktury dywizjonalnej przedsiębiorstwa górniczego wielozakładowego (opracowanie własne)

Divisions, in this case plants, may have different degrees of independence that result from the powers delegated by the management board. In this sense, the plants are considered management centers, which are:

- production centers, responsible for the production volume, or
- cost centers, responsible for production and cost level, or
- profit centers responsible for achieving an established goal, or
- investment centers responsible for profit level and having investment powers.

Divisions of high powers include strategic business units (SBU) having the following features (Janowski et al. 1996; Łobos 2003; Butra et al. 2010):

- Buyers of SBU's services should be from outside of the company.
- SBU should have specifically named competition.
- SBU's manager should have extensive independence to decide on own strategy.
- Each SBU which is a profit center should prepare financial reports.

Process structures are structures in which a company is viewed as a set of processes. They are derived from the so-called *reengineering*, which features a radical (breakthrough) change of structures, especially of functional structures, and stresses the market version of process structures that corresponds to current structures in the operation of mining plants. The market version as understood in *reengineering* features the following elements (Grajewski 2007; Borowiecki 2008):

1. A set of processes constitutes the entire activity of a company.
2. A process is defined as a stream of activities aimed at processing the input resources (raw materials, half-finished products, information) from the suppliers into production for internal and external clients.
3. Each process has an owner.
4. Decisions are ceded to the location where the process is carried out.
5. Process are carried out by universal teams, i.e. teams of many competences.

The market version of process structures is senseless in mining plants (mines), especially due to:

- lack of possibility to sell its own half-products and services to external clients (such a possibility exists, but when carried out by other teams),
- lack of possibility to carry out the purchase/sell transaction between the owners of the processes within the company,
- regulations related to industrial safety law,
- the carrying out of metaprocesses (e.g. extraction and processing of minerals) using inter-company balances,
- the nature of deposit exploitation that consists in the carrying out of processes through mining plant operation (dynamic structure),
- process efficiency, which may be increased using methods employed in work and labor organization, e.g. motivating through labor standards.

The described structures usually occur in mixed form, rather than in clear form. For example, a functional structure may be represented as a functional-processing one (Fig. 13).

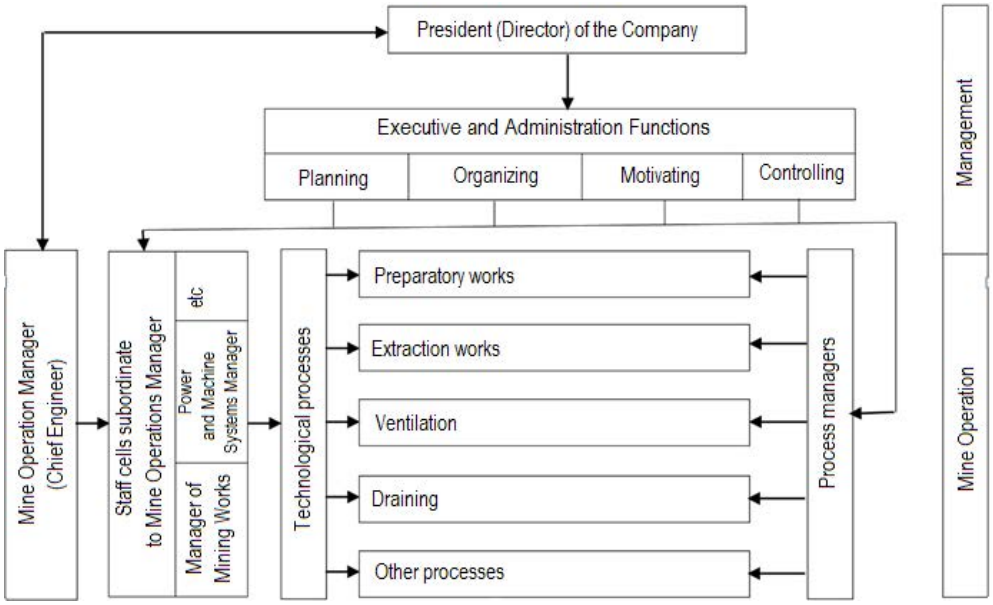


Fig. 13. Schematic diagram of the functional-processing structure (own source)

Rys. 13. Schemat ideowy struktury funkcjonalno-procesowej (opracowanie własne)

3. Features of organizational structures

The analysis of organizational structures allowed specifying some quite commonly accepted features used to characterize each structure. These features include (Przybyła et al. 1995; Janowski et al. 1996):

- specialization,
- hierarchization,
- centralization,
- formalization.

The features listed above are presented rather qualitatively (descriptively) than quantitatively using various measures.

Specialization may be represented at the following levels:

- strategic in relation to products and services and to markets (clients),
- operational at lower management levels in relation to the possessed competences.

Specialization at operational level refers to the technology and organization of both work and labor.

Hierarchization is defined as the arrangement of organizational units in a company, according to the principle of subordination and superiority and to the delegation of powers and duties. It can be described in two dimensions:

- slenderness of the structure described through the number of organizational levels in the structure,
- span of control, the number of subordinates to one manager.

Although the flattening of structures is desired, consideration should be also paid to the optimal number of workers directly supervised by one manager. The rule for the description of the functions carried out by an organization unit in relation to the whole structure must be absolutely observed. Fictitious cells and their managers should not be appointed, as crossing a certain employment barrier does not result in any added value.

Centralization is a feature of organizational structure defined by:

- decision-making space,
- division of decision-making powers.

The decision-making space is generally created by the management board and the mining plant operations management. The management board has some flexibility in the division of decision-making powers. In the mining plant operations, the decision-making space is clearly defined and decision-making powers are related to the required competences and, in the case of the mining plant operation managers, to the approval of Mining Authorities. Due to the centralized nature of the structurization of mining companies, the following rules should be observed:

1. Strategic decisions regarding planning, organizing, motivating and controlling, should be taken at top management levels.
2. Operational decisions should be taken at operational levels in accordance to the scope of tasks carried out at those levels.
3. The scope of decision-making powers should be adjusted to both dynamic and static structures. The decision-making powers of the managers of organizational units should be compatible with their duties.
4. Top level managers of organizational units should not interfere in the scope of decision-making powers of lower level managers when those managers carry out their tasks, except in cases justified by the results of control.
5. Resource allocation in relation to the organizational structure must be adjusted to the tasks performed by the organizational units.
6. The goal should be to flatten the structures and take decisions at locations in which problems arise regarding the tasks performed and the powers held.

Formalization is defined as formal and legal, technological and economic rules for the functioning of companies, as well as the standards for the behavior of their employees, recorded in the statutes, procedures, instructions and other documents. Two groups of documents may be distinguished, while the documents may relate to either:

- strategic level, or
- operational level of the company's functioning.

In relation to the strategic level, the following types of documents may be distinguished:

- documents that describe the formal and legal situation of the company,

- documents that result from legal regulations implemented by national and local bodies in the area of company functioning (e.g. license),
- deposit development plan,
- documents related to the company's strategy, including:
  - definition of the main focus of operations,
  - outlets for production,
  - goals of the company,
  - competitive advantage,
  - functional activity programs,
  - quality management system.

In relation to the operational level, the following groups of documents may be distinguished:

- mining plant operation plan,
- organization charts,
- processes and process descriptions,
- duty register,
- procedure description,
- instruction description.

Procedures describe the sequence of a activities being part of the performed processes and include the description of:

- the goal, object and scope of procedure,
- the data that define the procedure,
- schedules for the implementation of the procedure,
- results of the implemented procedure.

Instructions precisely define the activities described in the procedures for particular positions and/or particular situations.

From the point of view of managing documents, formalization should be tightly related to the Integrated Management Systems based on ISO standards and on computer technology.

4. Case study

As a concept, a company's organizational structure project results from the following three business processes (Botin 2009):

- a segmentation process, which allows the decision authority and responsibility organ to be divided into several operating units,
- an integration process, focusing on the implementation of certain integration mechanisms, ensuring that the operating units resulting from segmentation operate in alignment with the corporate strategy,
- an empowerment process, through which the decision rights – executive and controlling – and responsibilities of each operating unit and each management level are defined.

The main characteristic of the company's organizational structure is the criteria used for segmentation at the top management level (senior officers, vice-presidents), which are individual for different types of organization. Typically mining companies may be segmented by functions (production, engineering, marketing), by divisions or business units (energy coal, base metals, gold) or through some combinations of both descriptors.

Small mining companies

The functional structure is a standard in small-scale mining companies which carry out their business in one or two mines located on small geographic area. In this structure, functional managers' report to the company's managerial staff (chief executive officer CEO, chief operational officer – COO, vice-president). The exemplary structure of a company shown in the flowchart in Fig. 14 comprises five functional areas (mining production, human resources, environmental health and safety, technical services, and finance and administration).

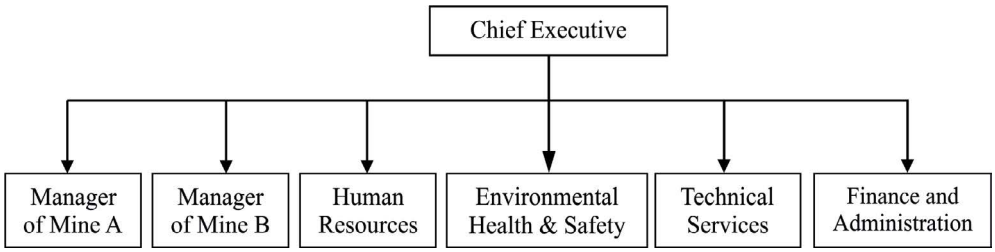


Fig. 14. Typical flowchart of a functional structure (Botin 2009)

Rys. 14. Typowy schemat struktury funkcjonalnej (Botin 2009)

In the case of medium-sized mining companies and large corporations, functional structure is also an industrial standard. A good example of the use of such structure is Podolsky Plc. mining company, which operates in Sudbury (Ontario province, Canada) and which is organized at the first management level in six functional areas shown in the figure below (Fig. 15):

- the chief engineer, accountable for planning and engineering,
- the deputy director of the mine, accountable for production,
- the chief geologist, responsible for ore reserves management,
- the accounting officer, accountable for cost control and cost reporting,
- the health and safety (H&S) coordinator, accountable for the coordination and control of working conditions,
- the environmental coordinator, accountable for the coordination of environmental plans and works.

As may be seen in the flowchart above, unit mine operations also use functional segmentation to organize the second and third organizational levels.

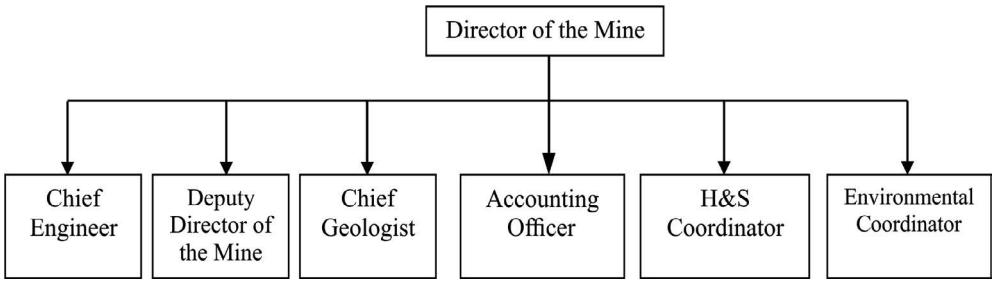


Fig. 15. Organizational flowchart of Podolsky mine (Botin 2009)

Rys. 15. Schemat struktury organizacyjnej kopalni Podolsky (Botin 2009)

Medium-sized mining companies

Organizational standards used in medium-sized and large mining companies are related to divisional structure, where the segmentation criterion may be the product (coal, copper, gold), the region (Europe, Asia, North and South America), the business unit, or a combination of these criteria (Kudełko 2006; Botin 2009). The Inmet Mining Corporation with a chief executive officer (CEO) at the head may by an example of this type of company. This is a Canadian mining company (copper, zinc, gold), which produced 84 thousand Mg of copper and 45.7 thousand Mg of zinc in 2012 (Inmet MC 2012). The company became global with its operations in Canada, Spain, Finland and Turkey. Its operational structure consists of four operating divisions, as shown in Fig. 16.

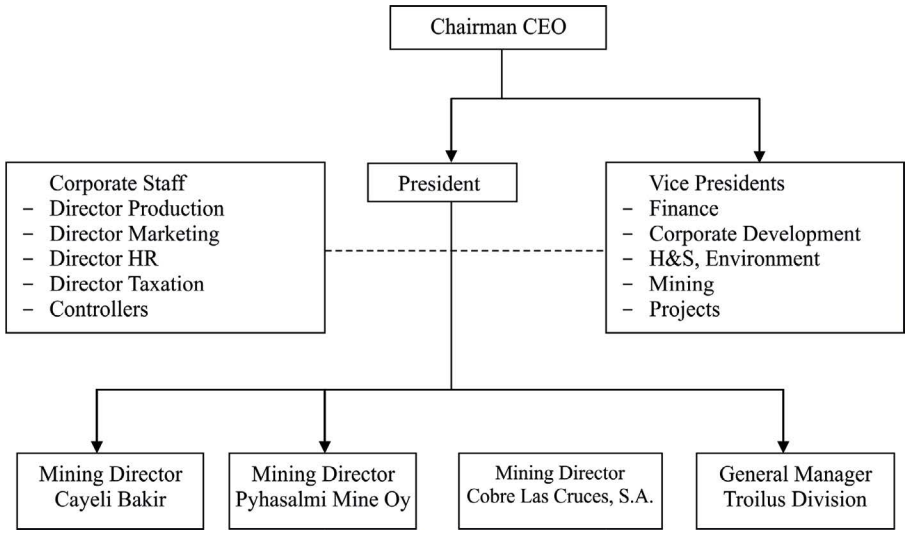


Fig. 16. Divisional organization flowchart of Inmet Mining Company (Inmet MC 2012)

Rys. 16. Schemat struktury dywizjonalnej Inmet Mining Company (Inmet MC 2012)

A typical divisional organization decentralizes operational responsibility down to the division level, but keeps the most strategically important functions at the top management level in order to prevent the excessive redundancy of some services. Typically, centralized functions are financial strategy (vice president of finance), corporate development, health, safety and environment protection, mining. Furthermore, the decentralization of decision making requires the implementation of appropriate IT systems and acceptance at the respective management levels in the organization. In any case, an adequate balance between division autonomy, corporate strategy, and cost-efficiency should be preserved.

Global mining companies

The organizational standards for the global mining operators, although formally divisional, go one step further, allowing for strategic diversity at some management levels. In the conventional divisional organization, the strategy is centralized at the corporate level, while large mining corporations are business conglomerates operating is several business sectors of the mineral industry (base metals, petroleum, coal). Each sector of this industry requires an adequate, specific strategy. However, the top management level retains the decision making rights required to maintain a common business mission (Botin 2009).

An example in this group of companies is Xstrata plc, the organizational structure of which consists of six business units (Fig. 17). The business units operate as independent businesses with their own management board, and are strategic business units in a specific industry sector aligned with the business mission of the entire holding (alloys, zinc, copper, nickel, coal and technical services). The company's production in 2012 reached 1180.0 thousand Mg of alloys, 747.0 thousand Mg of copper, 106.8 thousand Mg of nickel, 734.4 thousand Mg of zinc, 90.4 million Mg of coal, and are based on mining projects located in Canada, Australia, Argentina, Chile and Peru (Xstrata plc 2012). At the corporate level, Xstrata retains executive, controlling and finance functions.

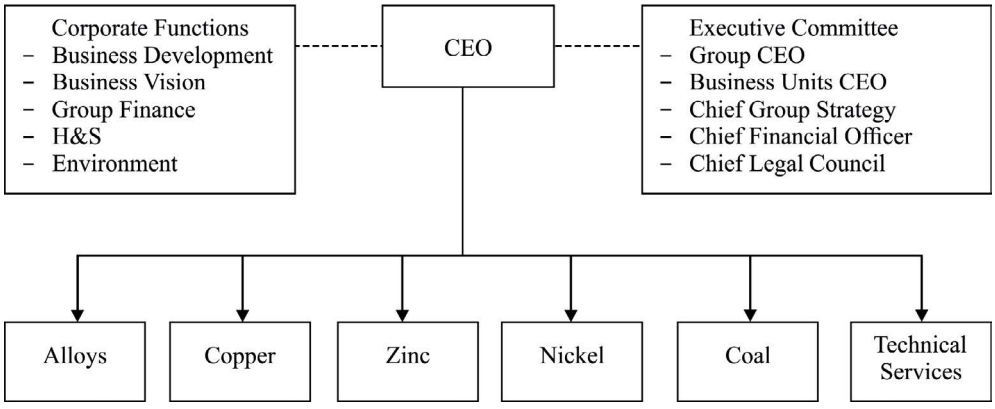


Fig. 17. Organization flowchart of Xstrata plc (Xstrata plc 2012)

Rys. 17. Schemat struktury organizacyjnej Xstrata plc (Xstrata 2012)

Another example of a divisional structure is BHP Billiton Plc. The company's segmentation is based on ten business units, horizontally integrated, referred to as "*customer sector groups*", due to its business being focused on particular customers receiving the company's products and services (Kudełko et al. 2015). In this case, the segmentation criterion is based on final products, i.e. aluminum, base metals, diamonds, energy coal, iron ore, metallurgical coal, manganese, petroleum, steel and technologies (Fig. 18). The company's production in 2015 involved 762.0 thousand Mg of copper, 1023.8 thousand Mg of copper concentrate, 6.0 thousand ounces of silver, 118.2 million Mg of iron ore, 21.0 million Mg of metallurgical coal, 19.0 million Mg of energy coal, 37.0 thousand Mg of zinc, 37.3 thousand Mg of nickel, 3.1 Mg of uranium concentrate, produced from projects carried out in Canada, the US, Australia, Chile, Peru, Pakistan, RSA, Brazil, Columbia, Singapore, and Algeria (BHP Billiton 2015). Each group operates as an independent unit with its own direction, strategy, finances and legal services.

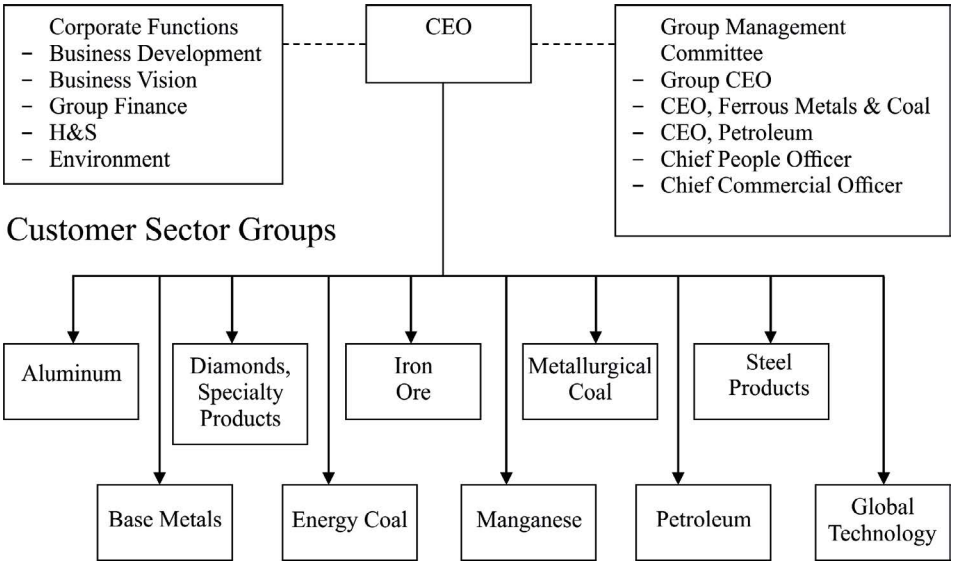


Fig. 18. Organization flowchart of BHP Billiton (BHP Billiton 2015)

Rys. 18. Schemat struktury organizacyjnej BHP Billiton (BHP Billiton 2015)

At the corporate level, the Group Management Committee retains the executive and controlling functions on finance, commercial human resources and ethics functions.

Conclusions

Organizational structures are defined by the unification of organizational units (cells and processes) with hierarchical, technical, organizational, financial and information bounds. Structure is a management tool, as it contains decision-making centers, according to the empowerment and responsibility of decision-makers involved in the hierarchization of the structure.

The basis for the functioning of a mining company is the carrying out of technological processes, which should result in the extracted, and potentially processed, minerals. Technological processes are defined by their structure, i.e. by the operations and actions as well as by the organization of work and labor, and also by the labor system. Technological processes are described through technological stages, work schedules, labor schedules, staffing diagrams and people movement diagrams, production, energy and material streams. Technological processes form the company's dynamic structure, which comprises three types of activities:

- supplying ore exploitation systems with production factors,
- proper exploitation of the deposit,
- selling of the products.

Technological processes require technological and organizational integration as well as process infrastructure, and therefore hierarchical organizational units are created (sections, departments, offices etc.) which are integrated within the static structure. The idea for the company to function as a set of processes with their owners cannot be implemented due to the inefficiency of such a disintegrated structure.

Static structures are of great diversity. Two criteria may be assumed for the classification of the structures:

- hierarchical subordination,
- organizational units classification.

Three basic structures may be distinguished in relation to hierarchical subordination: linear, functional and matrix. In a linear structure each cell and employee is subordinate to one supervisor. In a functional structure each cell and employee is subordinate to a number of functional managers. In a matrix structure employees are subordinate to the manager of the functional unit and to the project manager. Practically, the above listed structures do not occur in a clear form, but in mining take the linear-staff form instead.

In relation to organizational units classification, functional, divisional, and process structures may be distinguished, as well as their combinations. In a divisional structure, the company's units are classified according to management centers (sectors, modules, divisions) of various independence. In a process structure, mining business is viewed as a set of processes. In mining companies, a clear structure in its market form is not used. However, if considered that in the dynamic sense, a mining company naturally is of a process nature, while base (infrastructure) is of a functional nature, the structure of such companies may be classified as process-functional.

Each structure can be described by the following four features: specialization, hierarchization, centralization and formalization. Specialization is the general directions of the company's businesses and their competences. Hierarchization is the slenderness of the structure (the number of management levels) and the span of control. Centralization is the decision -making space depending on the structure's level. Formalization is defined as the general documentation standards which determine the company's formal and legal situation as well as plans, procedures and instructions describing the exploitation programs, and also the behavior of employees in certain situations.

An analysis of organizational structures of selected mining companies allows for a statement that functional structures are suitable for single mine companies or small mining companies which operate two or three mines with small production levels, located on a small area. This applies mostly to small surface mining companies. Functional managers, who are specialists in their areas, report directly to top level management (chief executive officer, vice president), ensuring the maintenance of simple, effective structure. However, these highly qualified specialists frequently do not possess a global business vision. In light of the above considerations, the best solution is the centralization of decision making at the top management level. However, in a dynamically growing company, most of the decisions are taken slowly, and they evidently lack effectiveness. Considering the above, limitations and the growth of mining companies, which become global operators of numerous mines/ /projects by focusing their activity in several geographical regions or countries, the organizational structure of those companies should be changed from functional toward divisional.

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STRUKTURYZACJA PRZEDSIĘBIORSTW GÓRNICZYCH

Słowa kluczowe

górnictwo, struktury przedsiębiorstw, organizacja

Streszczenie

Strukturą określamy połączenie jednostek organizacyjnych i procesów przedsiębiorstwa poprzez więzi technologiczne, organizacyjne, hierarchiczne i inne. Jest ona jednym z narzędzi zarządzania. Przedsiębiorstwa górnicze charakteryzują się strukturą dynamiczną i statyczną. Struktura dynamiczna obejmuje procesy technologiczne, które zdefiniowane są przez technologię eksploatacji złoża, organizację robót i pracy oraz system pracy. Struktura statyczna stanowi natomiast infrastrukturę procesów technologicznych i obejmuje zespół jednostek organizacyjnych powiązanych określonymi standardami i procesami ich działania.

Typ struktury – w szczególności w części statycznej – określamy zazwyczaj ze względu na hierarchię (struktury liniowe, funkcjonalne, sztabowo-liniowe i macierzowe) i grupowanie (struktury funkcjonalne, dywizjonalne, procesowe i mieszane) jednostek organizacyjnych. Każdą strukturę można scharakteryzować cechami, które mają znaczący wpływ na funkcjonowanie przedsiębiorstwa górniczego, to jest specjalizacja, hierarchizacja, centralizacja i formalizacja.

W artykule scharakteryzowano strukturę dynamiczną przedsiębiorstwa górniczego, wyróżniając podstawowe i pomocnicze procesy technologiczne. W przypadku struktur statycznych szczególną uwagę zwrócono na struktury funkcjonalne związane z jednozakładowym przedsiębiorstwem górniczym oraz na struktury dywizjonalne wielozakładowego przedsiębiorstwa górniczego. Z analizowanych struktur organizacyjnych wybranych kompanii górniczych wynika, iż struktury funkcjonalne są odpowiednie dla pojedynczych kopalń lub małych zakładów górniczych prowadzących działalność

w dwóch lub trzech kopalniach o ograniczonej produkcji surowca, zlokalizowanych na niewielkim obszarze. Natomiast w przypadku dużych przedsiębiorstw górniczych, które poprzez dynamiczny rozwój stają się globalnymi operatorami wielu kopalń/projektów, zlokalizowanych w wielu regionach geograficznych lub krajach, ich struktura organizacyjna powinna ulec zmianie z funkcjonalnej na dywizjonalną.

STRUCTURIZATION OF MINING COMPANIES

Keywords

mining, companies' structures, organization

Abstract

A structure is defined as a combination of organizational units and business processes by technological, organizational, hierarchical and other bonds. It is one of the management tools. Mining companies are characterized by a dynamic and static structure. A dynamic structure includes technological processes, which are determined by mining technology, the organization of mining works and a work system. The static structure consists of technological processes infrastructure and includes a group of organizational units connected by the specific standards and processes of their operation.

The type of the structure, particularly in its static part, is defined considering the hierarchy and organizational units classification. Taking the hierarchy into account, we distinguish: linear, functional, linear-staff and matrix structures. Considering organizational units classification, we distinguish: functional, divisional, processing and mixed structures. Each structure can be described by the following features: specialization, hierarchization, centralization and formalization. The features mentioned above have a significant impact on the mining company activity.

The dynamic structure of a mining company, considering basic and support technological processes, is described in the paper. Concerning static structures, special attention was paid to functional structures in the one-unit mining company, as well as on divisional structures of the multi-unit mining enterprise. Analyses of organizational structures of selected mining companies indicate that functional structures are suitable for small or one-unit mines. In the case of large mining companies, which through the dynamic development become the global operators of several mines/projects localized in different geographical regions or countries, their organizational structure should change from functional toward divisional.