

THE HIERARCHICAL SYSTEM OF PLANNING
IN A SOCIALIST SOCIETY
(The Iron and Steel Industry in CSSR For Example)

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The Central Planning

For better understanding of the actual system of planning namely the vertical functioning of the hierarchical management, it is necessary to explain briefly some characteristics of its evolution.

The planning system in the period of the past twenty years concerning the supplies of iron and steel, changed the form according to the development of methodology, increased production and demand. Characteristics of the period are a strict concentration, concerning production and sale, mainly in the beginning and after nationalizing all steel and iron plants in Czechoslovakia.

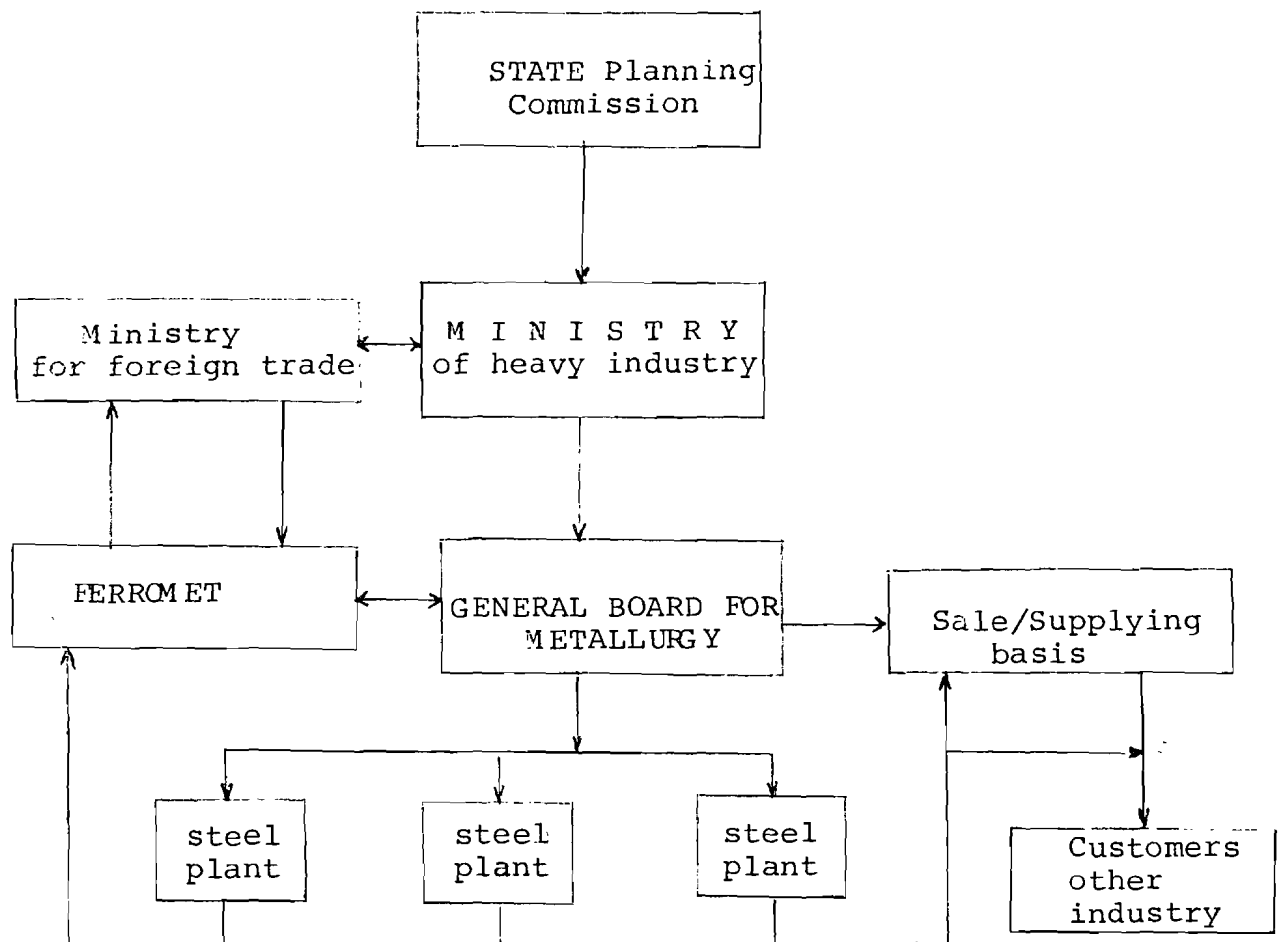
The General Board of management for metallurgy (GBMM) was founded as the central organization for steering the whole production process and representing all plants. The customers of iron and steel products were divided into four basic groups:

- (i) iron and steel plants (own consumption)
- (ii) export
- (iii) sale and supplying basis (stores)
- (iv) other customers

ad (i) - After discussion with plant management the GBMM confirms the volume of deliveries for their own consumption for a year period, broken down in quarters. The directivity of planning concern also determines the volume and product types allocated to each production unit.

ad (ii) - For the other group - i.e. export the GBMM estimates, for all plants, as a rigid part of the plan, the

BASIC HIERARCHICAL STRUCTURE FOR METALURGICAL PRODUCTION PLANNING



proportion of their production capacity to be allocated to exports. These estimates cover costs, time periods (year, quarters) and quantities for each product type. All contracts for export deliveries are prepared by another specialized organization for exporting - Ferromet - which renders preliminary delivery orders to the management of the plants.

ad (iii) - The same system of planning and ordering concerns the third group e.i. for so called "sale and supplying basis". The planning of all metallurgical production which is delivered to all the industry or free market in CSSR passes in year and fixed quarter periods.

ad (iv) - The rest is represented by small customers, with unperiodical consumption of steel and iron products. The planning system is here not so rigid and the steel plants are authorized for contracting directly with customers in the range of a global volume.

For illustration - the volume of all delivery items per year:

- direct deliveries from steel plants - 270,000 items
- delivery from supplying basis or stores - 1,300,000 items.

Lower level planning

The plant, as an object of a hierarchical management system, is considered to be like a subsystem of a macro-system, in this case, representing the metallurgical activity. The degree of liaison between two levels in the structure can vary.

In a system, where the plant is connected with the consumers by a market, then the goals are determined by the market research and forecasting the demand.

In socialist countries the planning system connects the plants with the environment. The plan specifies the objectives and criteria for functioning and is fixed by the General board of management, or directly by the Ministry of heavy industry.

Although the environment is normally predictable some disturbances can happen in practice which upsets the expected pattern of a stochastic character. These disturbances have a form: missing the planned terms of production or delivery of materials, change of the quality, change of previous schedule etc. For a plant these interferences are an undesirable swing from a balanced state and make the control of the production and process itself very difficult.

Also inside of the plan exist unpredictable outstanding situations, which are caused by changes of characteristics of the equipment or by stopping the production flow owing to some kind of breakdown etc.

The Enterprise Plan

The economic operational plan is specified by the GBMM for its organizations in a way to be as to the proportion, subject and time coordinated among the individual organizations and to secure a profound linking between the economic plan and the state plan. Each enterprise is obliged to incorporate specified tasks (binding tasks, binding limits) and orientation indices of the economic plan and the state plan in its own economic plans.

The binding tasks are incorporated in the plan in a way that ensures that the range specified by the GBMM is considered as a minimum, in the binding limits case

the range specified by the GBMM is considered as a maximum.

The orientation indices are incorporated in the plan in accordance with concrete conditions but in a way that secures the fulfillment of the state plan and the economic plan.

The production plans are elaborated quarterly in a range of the "Uniform Methodical Advices" fixed by the State planning commission.

The specification of the economic operational plan contains in its production part a survey of indices with differentiated grades of the bindingness:

- (i) - binding task of the state plan - BTSP
- (ii) - orientation index of the state plan - OISP
- (iii) - binding task of the economic plan - TEP
- (iv) - orientation index of the economic plan - OIEP

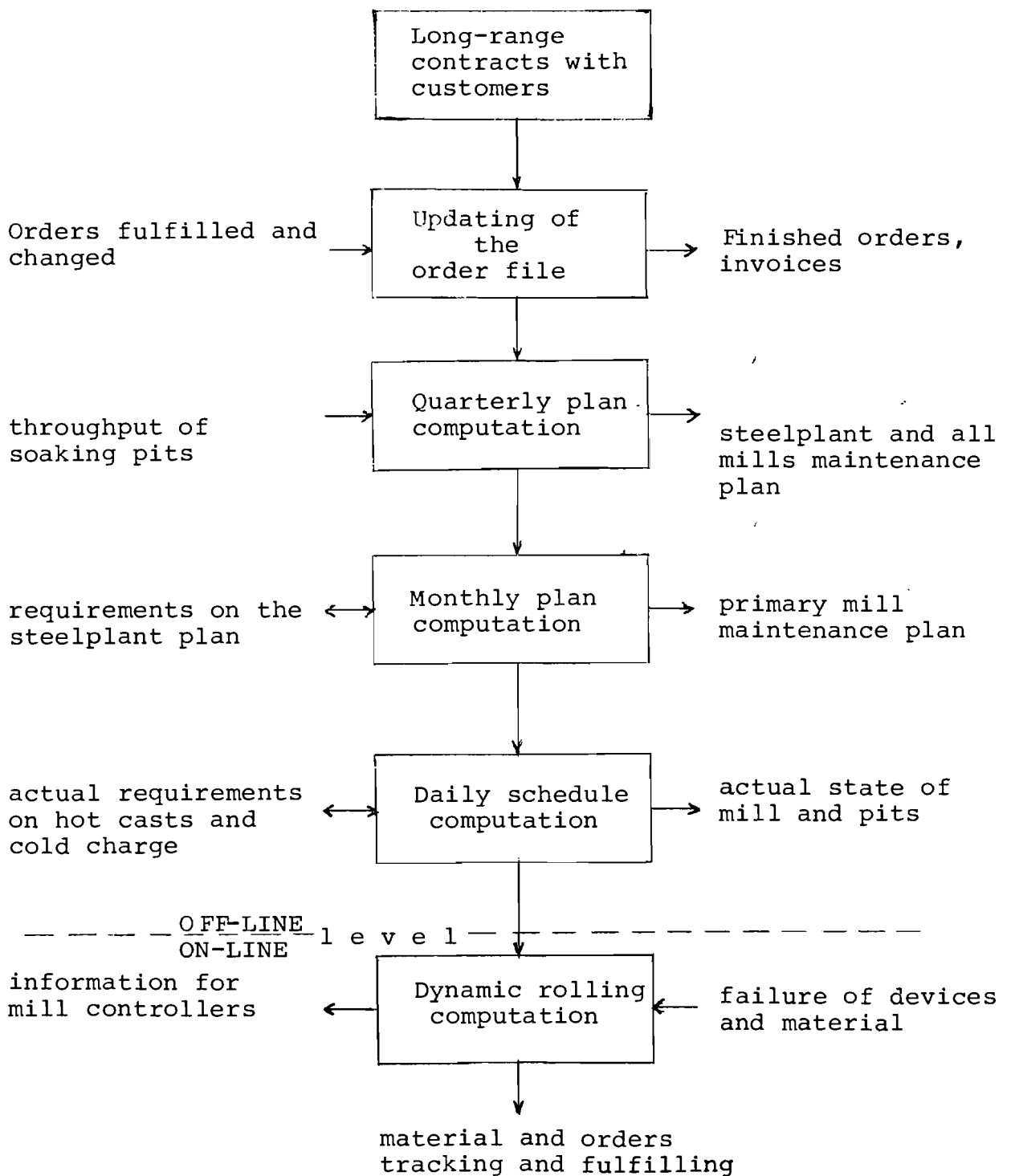
For a typical steel work in CSSR there are specified e.g. following indices;

<u>Index</u>	<u>Bindingness</u>
I Commodity production in current prices	OISP
Gross production in comparative prices	OISP
II Wet coke	BTSP
Dry coke	OIEP
Nitrogen fertilizers	OISP
III Pig iron - total	OISP
Steelmaking pig iron	OISP
Foundary pig iron	OISP
Steel - total	OISP
IV Rolled material	OISP
Semifinished products	OISP
Small sections	OISP
Rolled wire	OIEP
Concrete reinforcement steel	OIEP

Merchant sections	OIEP
Merchant sections except strips, I-beams, channel iron, mine rails	OIEP
Hot-rolled strips	OIEP
I-beam and channel iron up to 160mm	OIEP
Mine rails	OIEP
Heavy sections	OIEP
Heavy plates	OIEP
Thin sheets	OIEP
V Steel tubes - total	OISP
Seamless tubes up to 133 mm	OIEP
Seamless tubes over 133mm	OIEP
Welded tubes over 219mm	OIEP
Welded structures	OIEP
Threaded tubes	OIEP
Precise welded tubes inclusively cold rolled steel sections	OIEP
Precise welded tubes	OIEP
Hollow sections	OIEP
Seamless oil-field tubes	OIEP
Cold rolled steel sections	OISP
VI Grey cast iron castings	TEP
Steel castings	TEP
Steel forging and press pieces	TEP
VII Limestone	OIEP
Steel scrap	OIEP
Cast iron scrap	OIEP
VIII Rolling devices	OISP
Metal structures	OISP
Tube products	OIEP
Disc wheels	OIEP
Rolls for rolling mills	OIEP

Production planning system

Functions of the planning system in the metallurgical plant is roughly represented by the scheme:



The basic specification of the production plan is completed by a specification of the blast furnace charge, inter-factory delivery of iron, steel semifinished products and by a production specification and delivery obligations of selected products of the engineering metallurgy.

Blast furnace charge materials are specified in accordance with the production of pig iron. The consumption of ore imported from different states form a binding index of the economic plan. The consumption of the other charging components is an orientation index, but all the changes are to be discussed with the GEMM. The balance of sources and steel requirements and duplicated semifinished produces is provided by the GEMM.

The specification of the inter-plant delivery is a binding task of the economic plan and for the enterprise it is composed of the following components:

- Supplies into the plant according to suppliers and assortment composition.
- Supplies into the enterprises within the GEMM according to individual enterprises and in a gross assortment composition (blooms, slabs, billets, coils of sheets).
- Production and delivery obligations of castings of grey cast iron and cast steel form a binding index of the economic plan in the engineering metallurgy area.

The production plan tasks must be specified by the enterprise without any rest for it's individual plants with the respect that all the binding tasks are to be secured in a specified range (as a minimum) and all the limits

are to be kept. In a case of an acceptance of higher production tasks with a direct connection with the binding limits of the material consumption it is necessary to discuss the realization of the production with corresponding units of the GBMM.

The production plan of the enterprise is detailed in the so called production articles (containing basic technical-economic indices of the production, utilized production capacity, consumption balance etc..) differentiated according to the kind of production. For the quality guarantee of products there are specified Quality parametres for the individual plants (e.g. for the supply of metallurgical coke for the blast furnaces there are used parametres M40 and M10, average sulphur contents in pig iron, average sulphur contents in steel etc. in accordance with a monetary need). The production assortment is given by the allotment of orders.

In the frame of the production plan there are also specified the gross sales for the individual plants. This index is used for several plants as a basic index of the wage regulation. The gross sales form a money expression of the substantial production volume. They are valued in current wholesale prices and the calculation method is one part of the specification of the production plan for the individual plants.

The quarterly planning

of primary mill production is in fact a balance of the mill throughput on the one side, and requirements on billets, on the other. The total throughput is determined by the quarterly throughput of the soaking pits area, as this area is the bottleneck for the billet production.

The quarterly quantity of required billets is known from the long-range contracts with customers. The main criterion for planning calculation is an equitable fulfillment of billets from different final rolling devices which suits quarterly maintenance plan of the steel-plant and mills.

The monthly planning

of primary mill production is a recommendation how to process customer orders in accordance with the given delivery terms, and at the same time respecting constraints imposed by the facilities of the mill (throughputs of production devices, maintenance plan etc.).

The monthly plan consists of the following parts:

- (i) sorted list of orders allocated for the current month
- (ii) monthly balance sheet of production (similar to quarterly plan)
- (iii) table of production requirements divided to 2-3 days interval
- (iv) detailed list of optimum production strategies for each 2-3 days interval
- (v) balance sheet of cuttings.

By cuttings we understand a case when an ingot is allocated to more than 1 order. In the balance sheet of cuttings we are looking for the equilibrium of principal and subsidiary orders.

The daily schedule

of primary mill production contains -

- list of hot casts with preliminary allocated orders
- planned cold charge with preliminary allocated orders
- planned sequence of mill resettings and planned maintenance.

The daily plan respects recommendations given by the monthly plan according to the state of the fulfillment of orders, to the actual state of the primary-mill devices, and to the state of the preceding area (steelplant) and the subsequent areas (finishing mills).

The dynamic scheduling

The task which was solved with success, was to determine such sequence of material units to be rolled, that the sum of re-setting times was minimized (by material unit there is understood a set of same grade ingots heated in one pit and allocated to common order).

The optimum sequence of units to be rolled is computed by means of a heuristic algorithm, which tries to group into batches units prepared in the pits (a batch consists of units using the same production route), and then decide according to priorities given in the daily plan the sequence of rolling the batches.

Scheduling and Management systems

The rolling mill departments are split into sections. All records except for the operations and technical records relating to the production process and output are centralized at the plant or top-management level. The records at departmental level serve only for direct operations control and for checking the outputs per shift any per day of the individual sections. The primary source records are kept at the various workplaces.

At the rolling mill departments the operational and technical records are compiled by computers, using a mixed on-line and off-line data acquisition system employing telex links.

Operations Planning and Control System

The internal control in a metallurgical enterprise is realized in an internal co-operation system. Therefore the management is obliged to specify directive tasks for its lower units thus insuring a harmonized work of the enterprise and fulfillment of all the state plan tasks. Range and form of the binding and orientation plan indices in the internal control are determined by an organization system of the enterprise, by a position of the internal units and by their authority and responsibility.

Individual plants or significant operating units forming a closed technology whole with a close accounting that enables to value economic results, elaborate on the basis of directive and orientation plan specifications independently or relatively these parts of the plan:

- (i) production plan
- (ii) total costs and profit creation plan,
- (iii) labour-power and wage plan,
- (iv) resulting parts of the plan (according to the production character).

(i) The specifications of the production plan and on their basis elaborated detail production plans of the individual plant go out of directive and orientation plan indices fixed for the enterprise by the superior unit. The elaborated plans form a subject of a directive specification for the internal units. Only in exceptional cases a certain degree of an independence is left to the plants (or operating units) in the decision making area as to own production volume and assortment; this is concerning only a production of a marginal importance that has no link to other plants and is not

limited by material or other restrictions.

An inevitable basis for the creation of the production plan is formed by technical-economic standards of consumption of materials and energy, that are created before the plan creation and that form necessary assumptions for the guarantee of the planned tasks.

The enterprise units determine, as a rule, only the basic most important standards; plants or production units specify the standards to the detailed standards as they are necessary for planning and production control. The production plan is detailed in the so called plant parts comprising technical-economic production indices, production capacity utilization consumption balances differentiated according to the kind of production.

The co-operative relations within the enterprise directly specified in amount, time and assortment in the production plan of the individual plant serve as a basis for the operation planning. The production plan for lower internal units than a plant is always determined as a binding limit. The material interest of the units is connected with the fulfillment of chosen indices of their work.

The production plan of the internal units is created not only in amount and assortment but also in a money expression. The gross sales are used for the valuation of the production volume. From the plant work productivity point of view it is irrelevant if a product is a semi-finished product for the next processing in the same enterprise or a finished product assigned for the sale outside the enterprise.

The production plan indices, especially the of the whole volume ones, form basic indices for the wage regula-

tion as far as it is tied to the production volume. For the internal regulation it is not possible to use the same method as for the enterprise area of control, where can be applied either realised outputs or commodity production or other similar index. For the internal wage regulation it is necessary to choose differentiated indices according to plant characteristics that can form the best expression of the relation to the live work. The net production is a suitable index for an excluding of co-operation and used material value.

(ii) The plan of total costs and profit creation is the second most important plan of the plant following the production plan. It's elaboration consists as a rule of a directive specification of the profit volume for the plant; on the basis of the specification the individual plants elaborate planned calculations of a detailed assortment and a money expression of the production plan. In that way it is created a basis of the plan for profit creation and planned rentability of individual products. The main item of this part of the plan is formed by the total costs that go out of the technical-economic standard system and of the internal prices.

The financial plan in a form as it is known from the enterprise level is not elaborated by the internal units. Therefore the profit division is not a subject of the plant plan only the profit sharing is used for the remuneration fund. By elaboration and evaluation of the total costs plan and profit creation plan there are no items for the internal units that cannot be influenced by the units. E.g. for the internal units there are guaranteed composition and price of charge materials, average assortment, average price of sold

products of a given assortment.

It is done by the fact that the basic task of a plant is to produce a planned amount of production in a needed assortment and quality, to comply with planned total costs, eventually to fulfill other tasks and limits. Material supply and sale belong to the enterprise functional units that are obliged to create conditions for the fulfillment of the planned indices of the internal units. In this way the responsibility for the fulfillment of planned indices is divided amongst plant and functional units that are responsible for relations outside the enterprise. The same remains in force for the other activities that are controlled by the enterprise units, e.g. investment, overhauls and repairs, technical development or different services.

There were tested several kinds of basic indices in a consequence with costs plan and profit creation plan. As the most advantageous one was proved the interest in the production rentability, it means the profit percentage that is calculated according to the real production amount per real assortment. The interest in the rentability forms more intensive pressure on a reduction of the total costs than is that one in the profit.

The interest in the total costs, that eliminates the yield side of the economy, is suitable only on such a place where there is no danger of a creation of a negative interest in quality and furthermore it requires detailed calculations of the assortment expressing the production quality. With an advantage it is used in a mass production, that has an assortment with a low quality division.

(iii) The specification of the labour-power plan involves staff, total volume of wage means, overtime work limits and conditions for exhausting of the wage fund. The labour-power plan is elaborated by a plant on a basis of the directive staff limit specification that is specified for the internal units in accordance with the superior management. Subsequently there are indices for the wage regulation and an applied index for the calculation of the wage volume that are determined for a plant. The last index that the plants can determine their wage volume and at the same time to determine the average earning increase in a boundary of the wage regulation index. So the plant has a possibility to lower it's planned staff under the determined limit and in this way to increase the average earnings.

Staff division and increase division come only relatively under a cognizance of the enterprise units because they must respect conditions of the collective agreement and the enterprise wage policy. Wage division in individual wage parts realized with keeping of the effective tariffs and directives is completely under the cognizance of the plant.

Wage means are divided into two parts:

- so called cost wages (basic wage, premiums, bonuses, personal expenses);
- wages created by the sharing on the enterprise profit (supplementary wages from the profit sharing of the previous year, advances for the profit sharing of the current year and bonuses of the socialist emulation).

Drawing of the so called cost wages is blocked by a fulfillment of a determined basic index. If the basic

index is fulfilled by 100% and on a condition of the fulfillment of a supplemental index there exists a permission to draw the wages in a specified rate. For the drawing of the wages there is applied for a plant a coefficient that regulates the wage drawing according to the percentage of fulfillment or non-fulfillment of the basic index. In a case of the overfulfillment of the basic index and non-fulfillment of the supplemental index there is the wage drawing rested on the specified rate, that means 100%.

The payment of some element of the wages, which is a proportion of the enterprise profit, is conditional upon the fulfillment of the planned profit of the plant. These resources are freed for the plant on a base of a complex valuation of the plant economy.

(iv) The plan of the enterprise and internal control is continually confronted with a real run of the enterprise and internal processes. As far as the system analysis is relatively a laborious affair, there is used a computer technique for the purpose that enables an automatic processing of a comparative result report for the analysis of yield costs and economic result being an analytic report with a money expression of the past processes.

Conclusion

The discussion of planning system in the iron and steel industry in socialistic countries like Czechoslovakia will show only one part of the problem. According to the limits of the volume of this paper the development of computer application in this industry and the level now reached could not be specified in details. Many of

the problems connected with development of computer oriented systems of planning, data banks and control systems have been solved or are being under development. As of this time, of course, the steel industry in CSSR, like all the others in the world is just in the middle of the way to building a full integrated information system. However, the planning functions and control described above have been implemented with good results and influences on increasing production.