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Integrated development of the iron and steel industry and the capital goods industries

Case study - Czechoslovakia

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Introduction

The iron and steel industry, being a key producer of metals, is characterized by numerous interlinkages with many other sectors of national economy. Its principal backward linkage is the linkage with the mining and power industry (iron and other ores, coal, fuels, electric energy, refractory materials e.g. magnesite, dolomite, kaolin etc.). Its principal and most important forward linkage is the linkage with the capital goods industry. As a matter of fact, the iron and steel industry and the capital goods industry both belong to the metal- working or metal-transforming sector, i.e. that sector of the economy which transforms and manufactures metal.

Industries of the metal-working sector are of special importance to the economy as they are key producers of capital goods and, thus, a strategic agent for growth. Investment in all other sectors has to rely predominantly upon the output of the metal-working sector. Moreover, in the course of the process of industrialization of all developed countries, the sector has traditionally been a centre of innovation and focus of technological and cultural change stemming from the upgrading of skills and organizational abilities at all levels.

There are, of course, many other important forward linkages between the iron and steel industry and other sectors of the economy, e.g. construction, transport, power engineering and distribution, agriculture. We shall deal with these linkages in due course.

The main objective of this paper is to provide a survey of the interrelations between the Czechoslovak iron and steel industry and other sectors of the economy, particularly the capital goods. The paper begins with a discussion of entries into the iron and steel sector and continues with a brief historical review of interrelations between the above mentioned industries. This brief discussion sets the stage for the

subsequent examination of the iron and steel relations with other sectors including foreign trade in the more recent period with some comparison to other countries. An analysis is undertaken of the latest statistical data including those on production, trade and some specific ratios relevant to the studied sectors with a rather limited projection up to 1990.

The second part of the study provides some insight into policies and strategies for increased integration between both sectors and specific technological alternatives for achieving more independent and self-reliant development of developing countries. It will be seen that the experience accumulated in this respect in Czechoslovakia from the earliest period of interaction between the two industries up to the present days represents a case for an integrated development. It is believed that useful lessons may be drawn on the basis of this experience and, adjusted to specific conditions, may be used to shape the strategies and modalities of development of the iron and steel industry and capital goods industry in developing countries.

I. Iron and steel and capital goods industry in Czechoslovakia - historical review

The territory of today's Czechoslovakia has for many centuries been an important cross-road of both commercial and intellectual traffic. Ore deposits have been exploited since medieval times and metals were first processed more than 700 years ago.

First iron workshops were mostly part of feudal estates and their task was to supply necessary tools to support the estate's agricultural production. By the end of the 18th century, the output of 13,000 tons of iron per year put Czech lands to the 4th place among European countries; in iron production, Czech lands surpassed at that time even the then Prussia. Extremely rapid development of iron making was registered in the 19th century. In 1836, for instance, some

10,000 people were already engaged in iron production. As local ores were more suitable for casting than fining, foundries were the core of the iron industry. Long before independent mechanical engineering workshops emerged, these foundries used to manufacture simple machines in addition to various castings.

First large-scale iron works were built in the 1830's in Vítkovice. The Vítkovice Iron Works started to produce iron in coke ovens. The demand generated by the rapid development in the 1840's of railroads and the mining industry led the Vítkovice Iron Works to expand its mechanical workshop whose original purpose was to finish the castings produced by the Works. The expanded workshop started to manufacture turntables, turnouts, gear sets and axles for locomotives and wagons. Later on, the workshop entered the manufacture of steam engines, boilers and railway wagons.

In the 1850's , the Prague Iron Works Co. built another modern iron works in Kladno extended in the 1860's to include a large rolling mill.

Thanks to the supply of metal, specialized mechanical engineering shops and plants came soon to existence. In 1857, for example, there existed already 35 engineering plants engaged in the manufacture of steam engines, mining equipment, textile machinery, railroad equipment, equipment for sugar factories, distilleries, flour mills, breweries, tanneries and glass factories. Apart from that, 287 small workshops used to manufacture simple machines and tools.

Induced by the process of industrialization, the demand for machinery and equipment continued to grow. It is quite interesting to follow the history of one of the present largest concern in Czechoslovakia, SKODA concern, in its early days. In 1869, Mr. Emil Skoda bought a small engineering shop in Pilsen, re-built and expanded it to manufacture equipment for agro-based industries. In the course of years, it was found necessary to support the manufacture of capital goods by building a large foundry in 1872 and a modern

steel mill to produce cast steel in 1885. With that support, the SKODA Works expanded the manufacturing programme to include steel castings for railroad construction, shipbuilding, propellers and rudders which soon became important export articles.

The end of the 19th century witnessed the invention of electric motors and diesel engines which brought a new orientation to the capital goods industry. In 1895, Messrs. Laurin & Klement founded a bicycle factory in Mladá Boleslav to enter later on into the manufacture of motorcycles and passenger cars. Mr. Emil Kolben built in 1896 an electrical engineering plant in Prague and engaged in the manufacture of direct-current generators and electric motors. The former was later incorporated into the SKODA concern while the latter into another large concern, the CKD (Czech-Moravian Kolben Daněk) group.

In summing up the experience of the early years of the process of industrialization of Czechoslovakia, it can be concluded that of main importance for the initial development of the capital goods industry were foundries and iron and steel works. The development of agro-based industries, especially of sugar factories, mechanization of transport and rapid development of coal mining provided the emerging capital goods industry with growing outlets supplemented by exports.

Science, education and vocational training have also made a significant contribution to the development of both the iron and steel and capital goods industries. The world's first mining and metallurgical school was founded in Jachymov, a Czech silver mining centre, in 1716. Founded in 1348 and 1717 respectively, Prague's Charles University and Czech Technical University are the oldest institutions of higher learning in Central and Eastern Europe. Mechanical engineering - as an independent line of study - was introduced at the Czech Technical University as early as in

1863. An extensive system of professional high schools and vocational training institutions provided the iron and steel industry and capital goods industry with trained technicians and qualified workers.

Two modalities were seen in the interaction between the iron and steel industry and capital goods industry, leading to their close integration: Demand-pushed down stream integration to engineering industries in the Vítkovice Iron Works which started with iron and steel production and expanded into capital goods manufacture and, demand-pulled integration towards the establishment of iron and steel industry in the SKODA concern which started with capital goods manufacture and decided to support the latter by their own iron and steel production.

II. Further development of the iron and steel industry

In 1913, 1,229 th. tons of steel were produced on the territory of today's Czechoslovakia. That figure almost doubled to reach the peak of the period between the two world wars in 1937 - 2,291 th. tons. The most rapid development of the iron and steel industry, however, was registered in the post-war period, rising to 15 mil. tons produced in 1983. The production of basic metallurgical products in the period of 1911 - 1983 is illustrated in Appendix 1 (pig iron, crude steel, rolled stock and steel tubes).

The industry's raw material base is rather incomplete. While cokable coal, magnesite, dolomite and limestone are relatively abundant in Czechoslovakia, iron ore, oil and natural gas deposits are rather meager. Iron ore, for instance, is 90 per cent imported, mostly from the Soviet Union. The iron industry belogs to highly energy-intensive sectors of the Czechoslovak economy. Its consumption of fuels and energy represents some 14 per cent of total consumption in Czechoslovakia. The introduction of energy-

saving measures, however, brought specific energy consumption from 37 GJ/1 ton of steel in 1965 to the present 26.6 GJ/1 ton which is the combined result of energy-saving measures in pig iron production and of the gradual transition to the production of steel in oxygen convertors and tandem furnaces from open-hearth furnaces.

The iron and steel industry belongs to the group of highly capital-intensive industries due mostly to the equipment used in the production of iron and steel. As far as pig iron production is concerned, 14 blast furnaces are in operation in Czechoslovakia with an average useful volume of 1,269 cu.m. Crude steel is produced in 41 open-hearth furnaces, 7 tandem furnaces, 6 oxygen convertors and 30 electrical furnaces with total capacity over 15 million tons. Because of the high energy-intensity of the process, the production of steel in open-hearth furnaces will be terminated in Czechoslovakia by the year of 2000. More than 50 per cent of steel to be produced in 2000 will be made by the progressive continuous casting process.

Some 11 mil. tons of rolled stock and 1.5 mil. tons of steel tubes are now produced in Czechoslovakia per year. Old rolling trains have been gradually modernized and new large-scale trains built. A new integrated works to produce rolled sections and pipes was built in 1960 in Kunčice and another large-scale works to produce sheet metal was put into operation in 1965 in Košice, Slovakia. The structure of rolled stock produced has undergone significant changes - the share of steel sheet and strips increased to 44 per cent while that of rough and medium sections dropped to 15.8 per cent. Thin-walled sections shared by 17.3 per cent and rolled wire by 8.5 per cent. As far as steel tubes are concerned, there has been a substantial growth of the share of welded tubes in total output, their share increased to represent as much as 38 per cent. (All data on the structure of output refer to 1982).

III. Features of the iron and steel industry

Czechoslovakia has this industry well diversified and developed but with limited local raw material base and therefore important quantities of iron and steel inputs incl. energy are continuously imported. In spite of this, there is comparatively high level of consumption of metals which pull the production of iron and steel as it is well shown in the table below: (1980)

Indicator	Czecho-slovakia	GDR	Austria	FRG	Japan
GDP in bill. US $	89,26	120,94	76,38	819,12	1039,98
Consumption of steel in mil. t.	11,15	9,75	2,66	33,78	73,44
Consumption of steel (in t.) for 1 mil. US $ of GDP	125	81	35	41	71
Relation to Czecho-slovakia in per-centages	100	65	28	33	57
Production of steel per capita (in kg)	974	437	616	696	954
Consumption of steel per capita (in kg)	729	583	354	549	629

Sources: Czechoslovak Statistics - 1982
UN publications (GDP) - 1981

Though some of the data (particularly GDP) are not fully comparable due to differences in the methodology of their calculation in centrally planned economy and market economy countries, the relative data demonstrate extremely high consumption and, in this connection, production of

steel in Czechoslovakia. As far as consumption of steel per 1 million of US $ of GDP (in tons) is concerned, the ECE has estimated that the member countries of CMEA have more than 3 times higher relative metal consumption in comparison with the member countries of the Common Market.

IV. Iron and steel relations with other sectors

The declining share of iron and steel in the gross industrial production is a characteristic feature of this industry for the majority of socialist countries incl. Czechoslovakia, with the exception of Bulgaria where there is a slight increase. It is expected that this tendency is going to continue till 1990 in all analysed countries as it is demonstrated below.

(in percentages)

Country:	1960	1970	1978	1961-1965 (cumulative averages)	1974-1978 (cumulative averages)	1986-1990 (cumulative averages)
Czecho-slovakia	14.2	13.6	12.2	14.0	12.6	10.7
Bulgaria	6.0	7.0	8.6	6.6	7.7	6.1
Hungary	13.8	11.9	9.7	12.9	10.5	7.4
GDR	10.1	8.7	9.2	10.5	9.5	7.8
Poland	11.0	9.5	7.9	10.7	8.0	4.6
Rumania	8.6	7.7	6.7	8.3	6.7	3.7
USSR	9.2	8.7	7.7	9.5	7.9	6.4

Remarks: all data in constant prices (1960)
CMEA classification of industries incl. mining

Czechoslovakia is seen with constantly the highest share of this industry in the total gross industrial production. This reality has extremely important influence on the structural profile of Czechoslovak industry in comparison with other socialist countries. The mentioned

high share of iron and steel industry has its reflection also in the relations between this sector and the production of machinery and equipment, particularly if this feature is compared with other socialist countries. It is seen from the following table:

Ratio of iron and steel to machinery and equipment production

	1961-1965	1974-1978	1986-1990
Czechoslovakia	0.55	0.38	0.27
Bulgaria	0.42	0.26	0.16
Hungary	0.47	0.32	0.20
GDR	0.35	0.26	0.18
Poland	0.45	0.22	0.09
Rumania	0.31	0.17	0.08
USSR	0.46	0.25	0.17

As a result of higher efficiency in iron and steel utilization in the whole engineering sector, it is seen how the ratio has been changed with the continuation in decreasing trend towards 1990. Though the decrease of the ratio has been observed in all analysed countries demonstrating the same structural tendency, the size of ratio with respect to Czechoslovakia is much higher than in all other socialist countries analysed here. At the same time this indicator proves that in Czechoslovakia there is much higher consumption of iron and steel in the whole reproduction process than in all other analysed countries.

Being the raw material for capital goods, building construction and other sectors and branches of national economy, this industry has a key role in the economic development. At the same time this sector is an export industry as well. The most important users of iron and steel products are mechanical, electrical and electronics bran-

ches of industry. These branches have consumed approx. two thirds (between 64 and 68 per cent) of the total home supplies as an average in the past 10 years. The level of metal utilization in all these industries has reached approx. 80 per cent which could be well compared with the GDR and USSR. In the developed market economy countries it is estimated according to the ECE Report that the corresponding figure is 85 per cent.

The second biggest consumer is the building construction sector. The consumption of iron and steel has oscillated between 17 and 21 per cent of the total home consumption. As far as the transport is concerned, the major part of it, i.e. transport means and equipment, are included in the engineering industries and the rest (e.g. railway rails) has been estimated at the level of 1 to 1.5 per cent.

V. Foreign trade and the iron and steel sector

Czechoslovak metallurgical industry has been developed principally to serve internal needs, not as an export industry although, due to many reasons, particularly foreign exchange availability and cash problems in the balance of payments, this industry has turned into export one. While in 1960 the share of exports in total output reached about 16 per cent, ten years later it was more than 28 per cent and now the share of exports in the iron and steel output is estimated to be approx. one third. As far as the structure of exports is concerned, there are mainly sheets, strips, wire and sections, imports are composed predominantly of sheets and sections.

It is of interest that while exports have been increasing, imports have been decreasing in the same period. The share of imports in the total home consumption has gone from 12 per cent in the year of 1960 to about 8 per cent in 1970 and at present it is around 6 per cent. Czechoslovakia has

thus become one of the biggest exporters and at the same time one of the smallest importers in the world, contrary to the majority of countries with developed iron and steel industry.

As a result of various analyses it could be said that exports of iron and steel have reached in the past 20 years quite high level in relation to production and have stabilized at it while imports since the end of the 1960's have constantly fallen. Constant decline of external resources (imports) and increased outflow from the iron and steel sector have been characteristic features of the creation of home supply for further manufacture. New production capacities being built in that period have therefore been converted into import substitution and/or export promotion. Contrary to this, majority of industrially developed countries have at the same time taken advantage of the transformation functions of foreign trade, particularly increasing share of imports in the incremental growth of iron and steel internal supply. In other words, it is an expression of a specialization process taking place among developed countries. It is not expected, taking into consideration efficiency criteria, that the above mentioned features of Czechoslovak development be reproduced and continue in the future.

VI. Policies for achieving integration between the iron and steel and the capital goods industries - experience and recommendations

The experience of Czechoslovakia has shown that the iron and steel industry and capital goods industry were of primary importance for the establishment of the country's technological and infrastructure base. During the post-war period, continuous integrated development of the two industries has been ensured at the national and sectoral planning levels. It may be noted in this connection that as far as top management at the national level is concerned, both industries come under the guidance of a single ministry - Federal Ministry of Metallurgy and Heavy Engineering. Policy decisions, structural framework, investment priorities as well as guidelines for

research and development are thus co-ordinated from one centre.

The need for an integrated development of the iron and steel industry and capital goods industry in developing countries is rather self-evident. Its strategies and policies will however depend on a number of factors, e.g. the country's natural resources, economic structure, size of the market, demand structure and its development, availability of infrastructure as well as of trained and qualified manpower. Possibilities open for sub-regional or regional co-operation should also be taken into account. There is hardly any need to stress that such strategies should be connected with the objectives and targets of economic and social development of the country concerned. These objectives and targets differ at various stages of development and in individual developing countries.

The following principles appear, however, to be of general validity during various stages of development:

- Utilization of local raw materials for iron and steel production (many developing countries possess iron ore, fuels and other required raw materials);

- Satisfaction, in the first place, of fundamental local needs (housing, construction, agriculture, agro-based industries);

- Selectivity and phase-by-phase approach (selectivity in terms of both products and manufacturing techniques, from simple towards more complex and R&D intensive products and technology);

- Active role of the State (depending on the socio-economic system, the role of the State may vary from the establishment of favourable economic and social environment up to direct participation; however, non-substitutable is the role of the State in development planning and in the

field of education and manpower training).

Useful lessons might be drawn by developing countries while preparing to enter the field of iron and steel and capital goods industries in an integrated way from the early experience of Czechoslovakia as described in section I.

It has been shown that small and medium-sized foundries together with their mechanical shops played a dynamic role in that they responded to the demand generated by the process of industrialization, agriculture mechanization and transport development (especially rail-road). Integrated iron and engineering works of the subsequent period represented second stage of development. Under the conditions of relative scarcity of metallurgical products, these works had the advantage of being able to adapt the structure of output of their metallurgy "divisions" to the needs of engineering "divisions" (in terms of steel quality, shapes etc.) and to cater, at the same time, to the needs of the construction sector. Large-scale iron and steel works established still later on used to supply the then relatively well-developed capital goods industry with the necessary metallurgical inputs. Given the magnitude of demand, it became possible for them to introduce a certain degree of specialization (e.g. production of sheets, tubes etc.). That notwithstanding, nearly all bigger engineering plants used to have their own foundries and forging shops to ensure smooth supply of semi-products for mechanical engineering production. In the post-war period, given the expanding industrial structure, the former type of integration between the iron and steel and the capital goods industries was transformed into integration based on national and sectoral planning.

Developing countries wishing to establish the iron and steel and capital goods industry might, therefore, find it useful to make use of the experience described above to start with integrated steel and engineering works which have

the benefit of lower combined capital-intensity, easier production and supply, management and planning and improved opportunities of manpower training. Under the conditions of underdeveloped infrastructure and shortage of qualified manpower, national and sectoral planning is a necessary prerequisite.

VII. Alternative technological development

Various technological alternatives, adequate to the specific conditions of a developing country will lead to success only if more independent economic and social development is reached. Having taken into consideration the experiences and at the same time the differences among developing countries, there cannot be a single model for the development of both capital goods and steel industry that is automatically applicable to all of the countries. There are many differences coming from the size, natural resources endowment, level and sophistication of development including human skills and indeed technological absorption and innovative ability vary from one country to another. There is, however, an important feature to be taken into consideration: the iron and steel sector will need to be related to the rest of the economy, to the needs of dominant sectors and branches of the economy. It is as usual building construction sector, but many countries have emerged in the mechanical and electrical engineering industries or at least they have plans to do so in the near future.These interrelations should be studied and results of this taken into serious consideration when planning the development of the metallurgical sector.

There are two critical areas where the consistent and optimal policies and technology planning are extremely important. Since technology is embodied both in iron and steel products and human skills, particular importance should be attached to the introduction and/or enlargement of the domestic ability to produce the needed metallurgical products and

skilled manpower. Both these areas require rather long gestation periods, well beyond the time horizon of one medium term plan. Strategic decisions for their development have therefore to be taken in advance of the time when their actual output will be available to supply the required needs. The tasks described above are much greater, the long-term strategy of expanding productive capacities and of enhancing technological autonomy should aim at creating within the country not only the ability to reproduce the received technology but also to develop design capabilities to adapt and improve existing technologies, including local ones and to generate new ones suited to the country's requirements.

At the beginning of this decade about one third of developing countries and particularly the most underdeveloped in Africa had no iron and steel industry. Besides, some 10 developing countries have been producing raw steel and rolled goods in small factories for resmelting of scrap in electric arc furnaces and with mini-mills. There is also a group of countries manufacturing rolled products from imported billets. In those countries which have necessary mineral resources available for iron and steel production, integrated iron and steel works have been built.

In order to work out a strategy for the development of the iron and steel industry, the technological complexity of metal products should be taken into consideration. Demand for these products is diversified and based mainly on engineering industries for which this industry provides inputs. At the same time, metal products are the base for the development of the building construction industry and transport in developing countries. Thus, the evaluation of an iron and steel development strategy must be based on requirements first of all coming from the internal economy while the character of its development should be determined by the technological complexity of metal products required for the economy of a developing country.

Technological complexity of metal products could be expressed through its costs; a higher complexity level means in principle increased costs of metal products. This means that the establishment of more complex production of metal products in developing countries requires at the same time higher socially oriented expenditure. To conceive the amount of this expenditure, it is essential to analyze factors which determine the degree of metal products complexity. In the UNIDO study on technological complexity of iron and steel industry products, prepared by a group of Soviet experts, the factors are classified as follows:

(1) complexity of chemical composition of steel for metal products manufacturing,

(2) complexity of metal products configurations which are determined by their shape and produced by means of different rolling facilities, and

(3) metal products quality level of which is provided by steel refining, heat treatment and finishing.

The distinguishing feature of the Study is the determination of complex labour, energy and capital expenditure required for the production of various types of metal products with due regard and recommendations on the most typical technological routes in the modern iron and steel industry.

Conclusions and recommendations

The iron and steel and the capital goods industries are potentially very important contributors to the dynamic process of economic growth and integrated, independent development of a country. There are many complex issues that will have to be resolved in developing both the iron and steel and the capital goods industries in an integrated manner. In adressing these problems, the following policy questions arise, particularly with respect to countries with little or medium industrial development, and newcomers to these industries which

have been discussed in the previous chapters. What are the possibilities and how to promote more integrated development of the iron and steel especially with the capital goods industries including agricultural machinery? What are the technological alternatives and how to overcome various constraints in order to secure more independent development? A further set of policy questions relates to the appropriate role for the state in promoting the integration.

It has been already said that the iron and steel sector will need to be related to the rest of the economy, to the needs of the national economy sectors and branches, i.e. from the capital goods industries, building construction, transport, etc. to the iron and steel. This so called "demand-pulled" integration, i.e. towards the establishment of the iron and steel capabilities to cater to various needs, has been experienced in many developed countries including Czechoslovakia. Such an approach has usually been accompanied by another where integration starts from the iron and steel down the stream to various mechanical engineering industries. First iron workshops in Czechoslovakia supplied the agricultural estates with all necessary tools. This approach has been applied also with respect to medium and large-scale plants as well.

The scope and extent of development of the iron and steel industry depend upon many potentials including raw materials. Some developing countries, however, have in recent years built national steel industry under the conditions of serious imbalances in the domestic raw materials availability. The analyses above have demonstrated that Czechoslovakia too has built this industry with coal, refractory materials and limited quantity of iron ore only. The other raw materials like oil, gas, to a large extent iron and other ores have been imported. It should be said that an extensive system of technical education and as a result of this the availability of well trained manpower have enabled entries and

an integrated development of this sector with the rest of the national economy.

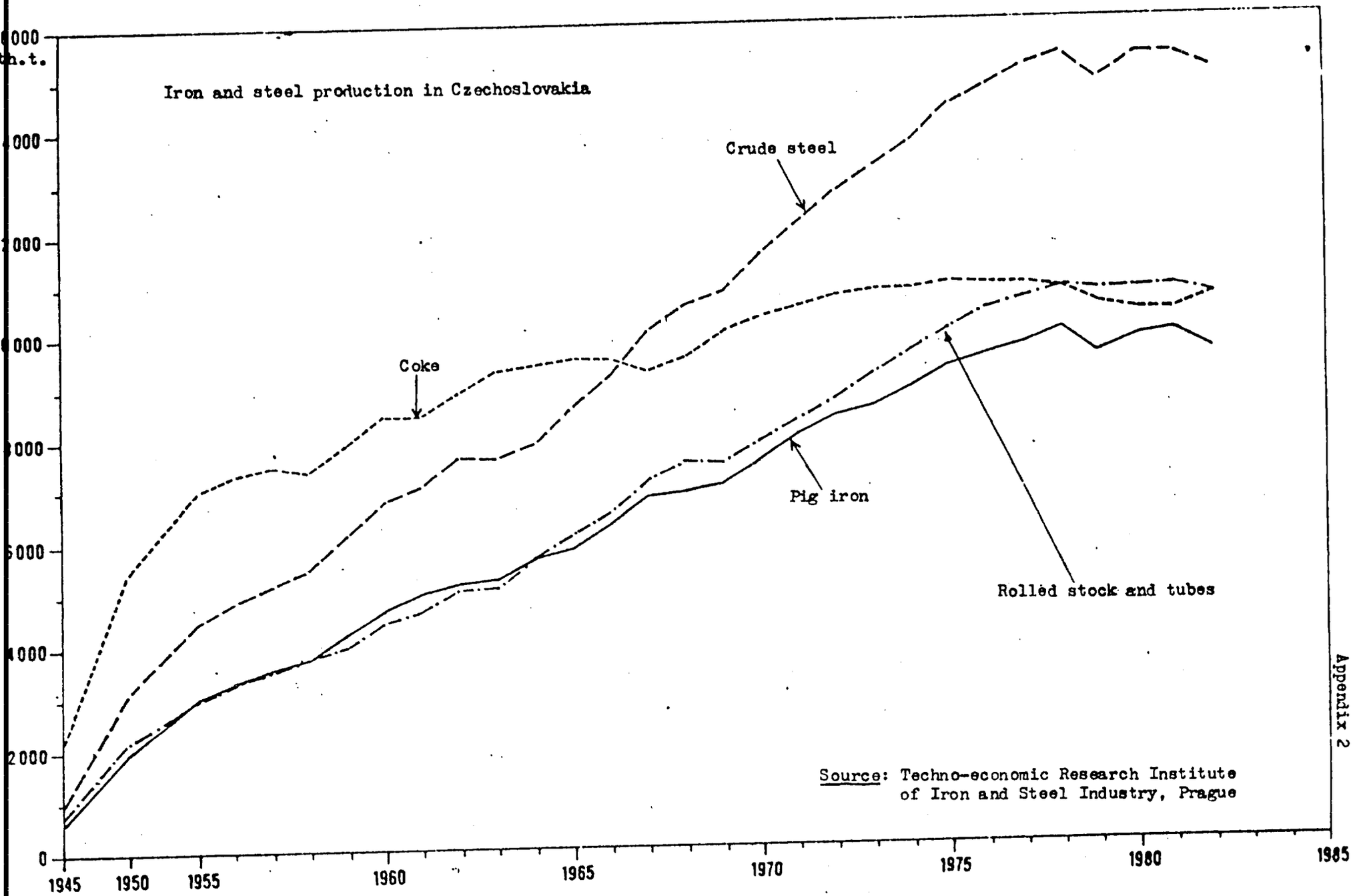
Depending on the socio-economic system the role of state may be seen in assisting the industry through social and economic infrastructure, securing favourable conditions for development up to direct involvement in industrial activities. An efficient planning both sectoral and national is of extreme importance in this connection. There are many shortcomings and problems hindering the establishment and development of the iron and steel industry and particularly interrelations of this sector with the capital goods industries. A proper planning will therefore be needed to overcome the present difficulties and secure well balanced, integrated and more independent development.

Appendix 1

Czechoslovak production of principal metallurgical products 1911-1983

Year	Pig iron	Crude steel	Rolled stock	Steel tubes
1911	1 024	891	569	69
1915	953	935	614	78
1920	737	973	491	47
1925	1 116	1 475	956	117
1930	1 437	1 817	1 136	124
1935	811	1 178	749	94
1940	1 622	2 358	1 548	217
1945	584	959	685	85
1946	959	1 568	1 154	140
1947	1 422	2 286	1 498	184
1948	1 645	2 621	1 776	230
1949	1 865	2 806	1 891	241
1950	1 946	3 122	2 144	285
1951	2 046	3 455	2 261	343
1952	2 311	3 754	2 429	383
1953	2 780	4 366	2 733	400
1954	2 790	4 270	2 751	377
1955	2 982	4 474	2 985	391
1956	3 282	4 882	3 278	463
1957	3 563	5 166	3 494	491
1958	3 774	5 510	3 757	517
1959	4 244	6 136	4 014	552
1960	4 696	6 768	4 481	631
1961	4 971	7 043	4 672	747
1962	5 177	7 639	5 066	770
1963	5 254	7 598	5 106	738
1964	5 716	8 377	5 663	802
1965	5 868	8 599	6 094	906
1966	6 269	9 124	6 518	976
1967	6 822	10 002	7 115	1 012
1968	6 920	10 555	7 511	1 047
1969	7 009	10 802	7 479	1 086
1970	7 548	11 480	7 934	1 133
1971	7 961	12 064	8 307	1 208
1972	8 360	12 727	8 703	1 259
1973	8 534	13 158	9 167	1 336
1974	8 905	13 640	9 572	1 382
1975	9 281	14 323	10 025	1 433
1976	9 475	14 693	10 390	1 461
1977	9 715	15 064	10 586	1 483
1978	9 944	15 294	10 785	1 510
1979	9 529	14 817	10 779	1 536
1980	9 819	15 225	10 758	1 542
1981	9 902	15 270	10 794	1 528
1982	9 525	14 992	10 654	1 528
1983	9 466	15 024	10 730	1 521

Source: Hutnická ročenka 1985 (Metallurgical Yearbook 1985), Techno-economic Research Institute of Iron and Steel Industry, Prague


Iron and steel production in Czechoslovakia
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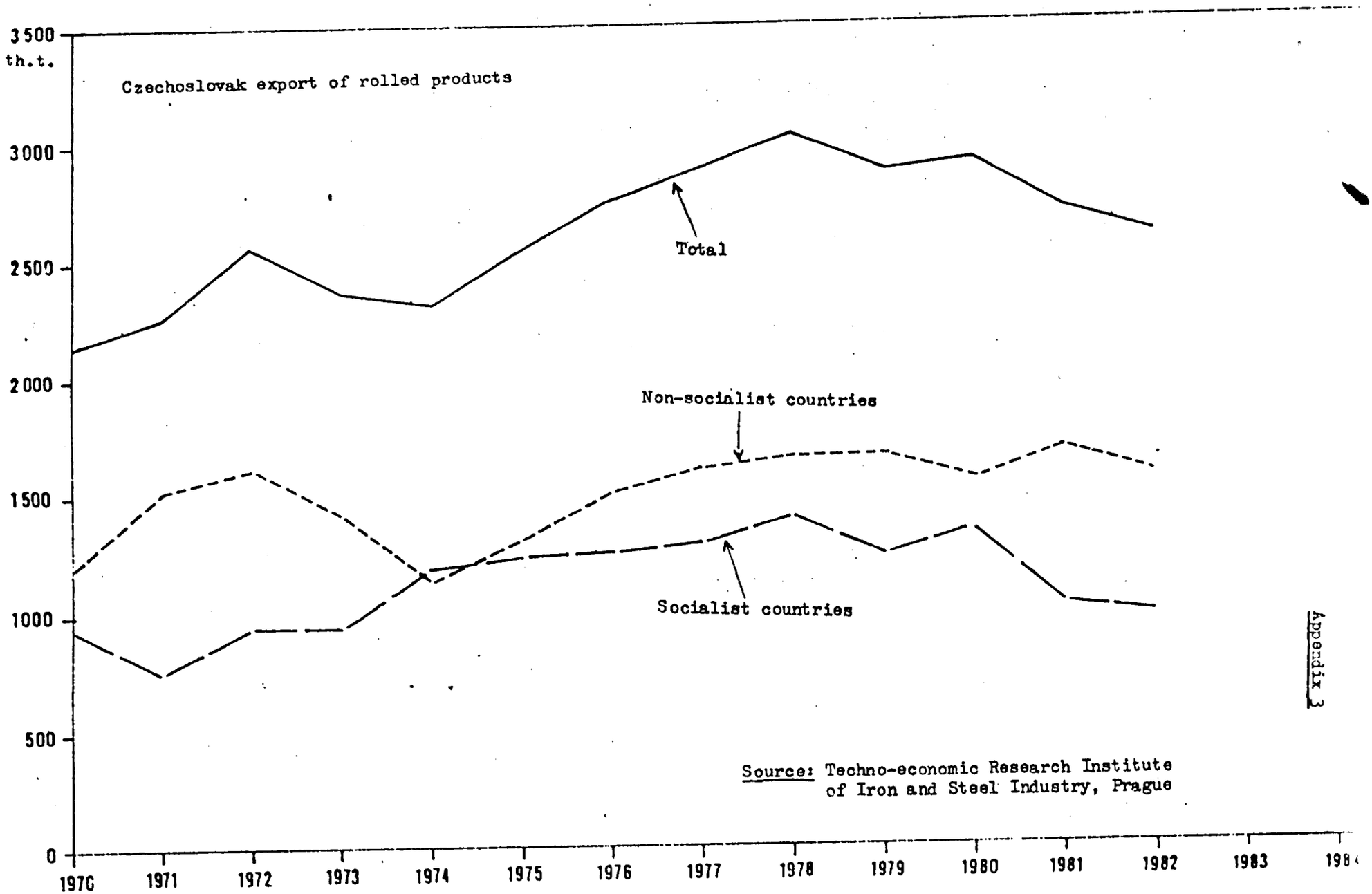
1945
1950
1955
1960
1965
1970
1975
1980
1985
Crude steel
Coke
Pig iron
Rolled stock and tubes
Source: Techno-economic Research Institute
of Iron and Steel Industry, Prague

Appendix 2



Source: Techno-economic Research Institute of Iron and Steel Industry, Prague

Appendix 3