# KAREL KOŘISTKA AND THE PROVINCIAL STATISTICAL SERVICE IN THE CZECH LANDS

## PROKOP ZÁVODSKÝ, ONDŘEJ ŠIMPACH

University of Economics, Prague, Faculty of Informatics and Statistics, Department of Statistics and Probability, W. Churchill Sq. 4, Prague, Czech Republic e-mail: prokop.zavodsky@vse.cz, ondrej.simpach@vse.cz

## Abstract

Karel Kořistka, since the death of whom 110 years have already passed, was a prominent Czech mathematician, surveyor, geographer, reformer of the technical universities in the Habsburg monarchy and, last but not least – the statistician who acquired his technical education at the Academy of Mining and Forestry in Banská Štiavnica (1843 – 1847), where he also shortly worked as an assistant of mathematics and physics to professor Christian Doppler. The aim of our paper is to deal with Kořistka's statistical activities in the period of 1864 – 1905. These activities were mainly the long-term management of the Statistical office of the Central Committee for statistics of agriculture and forestry economy. Together with the reorganization of this institution was in 1897 established the Provincial Statistical Office (the direct predecessor of the Czechoslovak State Statistical Office), which was led by Kořistka until his 80 years. Kořistka is also an author of numerous publications. He divided the whole territory of the Bohemia to 11 "natural landscapes" and also attended at many meetings of the International Statistical Institute (ISI), where he gave a series of proposals, especially on the issue of statistical graphs and other topics.

Key words: Karel Kořistka, Provincial Statistical Office, International Statistical Institute.

## 1. Introduction

As already knew the ancient classics, there is "historia magistra vitae". Even today there is no doubt that the part of every scientific discipline is its history. The development of statistics in our country has been published at different times by several authors, but the historical processing of this discipline is still totally inadequate. Therefore, the authors of this paper would like to contribute to improve this situation by a number of smaller studies about the development of statistics in the XIX. century and in the first half of XX. century (see also papers by Závodský and Šimpach, 2014, 2015; and Kodera et al., 2015).

This year we commemorate the 120th anniversary of the decisive negotiations on the establishment of the Provincial Statistical Office (PSO) in Bohemia, the direct ancestor of today's Czech Statistical Office. In January, 110 years have passed since the death of the builder of PSO and its leader prof. PhDr. Karel Knight Kořistka, dr. h. c. Given to his longstanding and extensive multilateral action he was already dedicated to a number of different posts, often outdated or not engaged in statistical activities by K. Kořistka. Therefore, in our paper we decided to deal mainly with the merits of statistical service in Bohemia and the development and popularization of statistical methodology.

## 2. Life and Work

Karel František Edvard Kořistka was born on February 7, 1825 at Březová nad Svitavou during the family migration to the new seat of his father in the Křižanov at Velké Meziříčí. Talented young man received a quality education. After gymnasium studies in Jihlava and Brno he studied at the Philosophical (still instructional) Faculty of Vienna University, he also attended lectures at the local Polytechnic. In the years 1843 – 1847 he studied Mining and Forestry Academy in Banská Štiavnica, which was excellent at that time. In 1849, he acquired here an assistant position of the famous mathematician and physicist prof. Christian Doppler and wrote here his first scientific work.

Figure 1: Karel Kořistka (photo from 1886)



Source: personal archive of P. Závodský.

When prof. Doppler was called to Vienna, Kořistka took his place at the academy as a substitute. In Banská Štiavnica and surroundings took place in 1849 bloody battles with the Hungarian rebels and in one street fight Kořistka only with lucky coincidence escaped from death (Stěhule, 1925, pp. 3). Under these circumstances Kořistka left Banská Štiavnica and at the end of the year he was appointed as a professor at the newly established Polytechnic in Brno. Soon he volunteered to audition for the vacant chair of professor of elementary mathematics and practical geometry at the Polytechnic in Prague. As the youngest of the candidates (26 years) won, and then he lectured there from academic year 1851 / 1852 until his retirement in 1893. His lectures very soon extended about the practical applications of geodesy (surveying of railways, tunnels, etc.).

Professor Kořistka was one of the most important representatives of our science in the second half of the XIX. century, his specialization was very broad. In the 50s and 60s he passed (with support of Vienna and Provincial Offices - in Bohemia) several study trips across the most developed European countries, where he visited mainly the leading technical universities (in the German states, England, Belgium, France, Switzerland, etc.). In the relations for the Ministry

of Religious Affairs and Education in Vienna and for the Regional Committee in Prague and also in the published essays, Kořistka proposed on the basis of foreign experience a significant reorganization of the techniques in the monarchy.

Prague Polytechnic (as well as others in Austria) did not have a full university character – the study (4 years) was not specialized, the individual disciplines were lectured only encyclopaedically, each by one professor, the head of the Polytechnic was permanent director, appointed by the Government. The language of instruction was German.

After several meetings with the active participation of Kořistka there was managed to enforce the Polytechnic reorganization. By accepting the so-called Organic statute (the late 1863) became the Prague Polytechnic bilingual university with effect from study year 1864 – 1865. The first rector was unanimously elected prof. Kořistka (then again at the year from 1866 to 1867), who could then complete the proposed reforms. Each of the main courses was now taught in both languages. By his lectures on Czech geodesy prof. Kořistka contributed to the emergence of Czech geodetic terminology.

Kořistka as a renowned expert in the field of organization of higher technical education also participated in the reorganization of the Technical University in Vienna, was called into various commissions and asked for expertise, even for foreign countries. Relentless Kořistka all these tasks successfully take over, but convenient locations that had been offered in Vienna and Germany, did not accept.

Polytechnic in Prague remained bilingual just five years. Already in 1869, the Polytechnic split into two independent institutes - German and Czech. Kořistka decided for to Czech Polytechnic, but coincidentally there was no place for him. Thus remained (until his retirement) at the German Polytechnic, where he was held in high regard and also twice elected as rector (the election did not accepted). Both of two Polytechnic were by the Provincial institutes (funded by Provincial funds) taken over by the state since the beginning of 1875. Since the study year of 1879 - 1880 they also received new names: E. k. Czech / German Technical University. Each of the Technique was already organized into sections, which had slightly less autonomy than the faculties at the university. Kořistka actively participated in negotiations on organization changes at the Techniques, e.g. on the establishment of the common department, on which was founded the study of actuaries, the predecessor of study of statistically-insurance engineering<sup>1</sup>.

The greatest scientific merit of prof. Kořistka belong to the development of geodesy, cartography and geography. Since the 50s he mostly organized and personally conducted an extensive, especially hypsometric measurements in the Alps, Moravia, Bohemia and elsewhere, and for this purpose he also developed his own instruments. The result is dozens of Kořistka's maps, scientific articles and other publications that go beyond the thematic scope of our contribution. We cite only Kořistka's brochure "Die Hohe Tatra in den Central-Karpaten: eine geographische Skizze verfasst auf Grundlage einer Bereisung" (Gotha, 1864, 40 pp.), which includes also the statistical characteristics of the local climate, the amount of own and cited altimetry and the author's coloured natural map and custom artwork.

Kořistka's scientific and organizational activities were at home and abroad highly appreciated. Kořistka worked in important positions in the Royal Czech Society of Sciences and in the Czech Academy of Sciences and Arts, he was a member of several international scientific societies. In 1879 was knighted by the Emperor. In his coat of arms was a golden

<sup>&</sup>lt;sup>1</sup>At the Czech Technique from 1904, at the German two years later. See more in Závodský (2013, pp. 368).

Surveying tower (accompanied by five golden stars) on a blue field with the slogan "Perseverantia omnis mons vincitur" (Each mountain is conquered with perseverance) as is stated in the bulletin published in his honour, Karel Kořistka and his home village Březová nad Svitavou (1976, pp. 25). University of Vienna and Prague German Technique awarded prof. Kořistka by honorary doctorate, he was also awarded by important Austrian, French and Russian awards etc.

Figure 2: Coat of arms of Karel Knight Kořistka (inner part)



Source: personal archive of P. Závodský.

Kořistka does not avoid political activity. In 1866 he was elected to the Czech Provincial Council. Following year he was delegated to the Imperial Council in Vienna. Since 1869 he left this political activity, but for three decades (1861–1891), he worked in the Prague City Council.

## 3. Activity in Statistics

Official statistics of Hapsburg monarchy was until year 1918 in critical rate concentrated in Vienna (after year 1867 only Cisleithanian part of the empire). Attempts to establish specialized centres for the systematic management of marginal statistics can be observed in Bohemia around the middle of XIX. century by the Industrial Unity, business and trade chambers and especially E. k. patriotic-economic society (PES), dealing with versatile support for the development of agriculture. Since the management of agriculture was essentially under the responsibility of the provincial authorities, precisely in the context of PES was the germ of the later Provincial Statistical Office.

After lengthy negotiations, the PES set up a Central Committee for Statistics of agriculture and forestry of Czech Kingdom, which started its activities in year 1856. Early in 1858, also began the operation of the executive body – the statistical office. Organization and program or the activities of the statistical office was the work of Eberhard A. Jonák, the professor of statistics and political economy at the Prague's university who also became its first head. The office had only a few workers throughout its existence.

The statistical office soon gained the recognition (also international), especially by its publishing activities. Besides German and Czech versions of periodic reports on the activities there were 13-volumes resource work summarizing the data especially on soil conditions in the Czech Lands – "Tafeln zur Statistik der Land - und Forstwirtschaft des Königreiches Böhmen". Total of 12 volumes were dedicated to particular regions, published 1861–1872, last in year 1881 (Krejčí, 1925, pp. 26). During issuing this publication a consideration was given to introduce the individual volumes by geographic characteristic of the particular region. The Central Committee turned to a leading expert in our country, professor Kořistka.

consequences of this step were the unexpected - although all volumes eventually for some reason appeared without planned geographic introductions, Kořistka was drawn into a statistical work, to whose organization he have been then devoted over four decades with diligent and abilities which were natural to him.

In 1864 Kořistka became a member of the Central Committee and at the beginning of 1868 after the resignation of E. Jonák he accepted under the insistence of the entire committee the demanding function of the head of the statistical office. The office, despite the modest staffing and finance, under Kořistka's leadership performed the agile activity that was not restricted only ever on the issue of agriculture and forestry. Besides Kořistka, there was also a qualified person – a secretary of statistical office, which was for a long-term JUDr. Josef Bernat (1834 – 1907).

Since year 1867, a Central Committee and its statistical office annually published report on its activities in German and Czech<sup>2</sup>, including an overview of the activities in the previous year and tabular reports and factual analysis of the examined factors. Starting from the third report (for year 1868) there are the results of the harvest and agricultural production in general annually published in well-arranged tables, surveyed by the financial support of the Viennese Ministry of Plowing (Agriculture). The amount of the harvest of each crop was assessed (estimated) based on the data on sown areas of crops and crop yields from Austrian morgen<sup>3</sup>. Since the report for the year 1870 the tables with average prices of cereals, meat and bread, accompanied by averages for the whole country and for a number of recent years were added.

The tables are precede by text part which describes meteorological relation in observed years, especially the deviation from normal, and which also explains the methodology of survey and processing of the data in submitted report. Also the information about the agricultural statistics in foreign countries are not missing, as same as the reflections (with quotes from foreign literature) about the dependence of food prices (also the number of inhabitants and crime) on the amount of crop harvest (resp. poor harvests). Also a textual part is accompanied by tables, comparative actual results from Bohemia with other countries of the monarchy and with foreign countries, with results from previous years etc. especially since the report for the year 1870. Publishing of available time series is also common.

Unlike the vast majority of other statisticians of XIX. century and the first decades of the next century (in Bohemia), Kořistka was not lawyer by education, but a mathematician and geodet. Kořistka's exact thinking was reflected in all its activities – in the exact definition of measured indicators, compiling well-arranged tables, calculating the averages, comparative figures, calculating the percentages (instead of the previously common fractions with different denominators) etc. To this the extraordinary international outlook of Kořistka can be added. We can not ignore Kořistka's significant contribution to creation of Czech statistical terminology.

Kořistka had enrolled to our history of the statistics also as a pioneer of modern graphical representation in statistics<sup>4</sup>. Already in the Activity Report for the year 1868 there are in six colour cartograms (choropleth maps) printed, whose author is professor Kořistka (see also Fig. 3). Similar maps Kořistka created for some other volumes of Activity Reports. They express not only the yields of various crops, but also the distribution of damages caused by natural disasters,

<sup>&</sup>lt;sup>2</sup>A detailed bibliography is provided by Podzimek (1974).

<sup>&</sup>lt;sup>3</sup>Approximately 0.5 hectares. Direct measurement of the harvest of each crop was not possible due to concerns of respondents that the survey results will be used for tax purposes. Statement of distrust and fear of statistical surveys in the population is also a regular part of annual reports.

<sup>&</sup>lt;sup>4</sup>Overview of the development of graphic representation in statistics is given e.g. by Beniger and Robyn (1978), Marwan (2008) or Pindozzi et al. (2016).

intensity of forestation individual districts, ratio of the number of cattle per 100 inhabitants, etc.

Figure 3: Cartogram (choropleth map) of potato yields in Bohemia in the year 1868

Čísl. 5. Výnos zemčat z jitra v roce 1868.



Source: Activity report of Central Committee for statistics of agriculture and forestry in Czech Kingdom for year 1868 (Prague, 1869) – coloured original, zoomed.

Starting with Report for year 1872 there are published linked graphs in some years which illustrate long-term time series, mostly the development of prices of various agricultural products. This is the first usage of those graphs in our statistical literature. Here Kořistka explains in detail the possibilities of different scales on the vertical axis. In the case of the graph expressing the development of the price of one commodity, it is possible to use normal uniform scale. But to illustrate the development of prices of several commodities in one graph, the normal scale does not allow proper capturing of relatively faster growth of cheaper product (e.g. potatoes) against relatively slower growth in prices of more expensive commodities (e.g. wheat). Therefore, Kořistka had been using logarithmic scale on the vertical axis in some graphs, which he justifies in detail in the text (see Fig. 4). Due to the operational and financial sophistication of the manufacturing and printing these graphs, it was necessary to drop them in some years; otherwise the graphs were usually made with bilingual labels for publication in Czech and German versions of the Report on activities.

We return to the issue of agricultural statistics. Let us remind that despite some exceptions (where agricultural statistic did not belong), there was not enacted reporting obligation in Hapsburg monarchy. Necessary data on agriculture were collected by a system of delegates,

who were unpaid correspondents in the districts. They were recruited between economic officials, landowners, foresters, priests etc. and their enthusiasm for official statistics was not usually high. A renowned organizer, whom was Kořistka, managed to improve the situation even here. Often, however, it was necessary to personally visit the delegates in various parts of Czech lands, which at that time was difficult due to transport possibilities and Kořistka advanced age.

Figure 4: Justification of using of log. scale for graphical presentation of time series (part)

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Šlo-li by pouze o nástin jediné z těchto plodin na př. ovsa, musela by se dle methody prvější zcela správně za cenu r. 1846 vzíti pořadnice s něco více než jednou tak velká a tím naznačiti, že se cena o něco více než zdvojnásobila.

Chtěli-li bychom ale na témž listu znázorniti, v jakém k sobě poměru ceny veškerých těchto čtyř plodin vystoupily, vystoupila by při této methodě na př. cena pšenice skoro pateronásob proti ceně bramborů 2.57:0.59, kdežto v skutečnosti, vzhledem totiž k oběma základním hodnotám 2.15 a 0.36, cena bramborů poměrně značně více vystoupila než cena pšenice.

Kdo i jen s počátky mathematiky jest obeznámen, i hned nahlédne, že v tomto případě nikoliv prosté ceny, nýbrž jich logarithmy na pořadnice vnésti se musí. Nebo je-li cena některého zboží a, jiného v témž čase b; po uplynutí jisté doby ale promění-li se cena a v a' = ma a cena b v b' = nb, jde při grafickém nástinu o znázornění poměru m: n, a sice dle povahy věci spůsobem sčetným neb odčetným. Vezmeme-li z obou poměrů a: b a a': b' logarithmy, můžeme je napsati takto:

 $\log \frac{a}{b} = \underbrace{\log a - \log b}_{D} a \log \frac{a'}{b'} = \log a' - \log b' = \underbrace{\log a - \log b}_{D} + \underbrace{\log m - \log n}_{D'}.$ 

Vyznačíme-li tedy na pořadnicích místo prostých cen jich logarithmy, jest poměrné klesání či stoupání všech druhů zboží (vzhledem k jich průměrné ceně) znázorněno.

Přiložená tabulka jest v ten spůsob zařízena, že jsem 1 zl. = 100 krejcarům položil, za log 10 kr. = 1 libovolnou jednotku přijal a nyní na první čáře (ose) pořadnic dle tohoto měřitka logarithmy cen od 10 k 10 krejcarům naznačil. Dle toho jest tedy

při 60 kr. log 60 = 1.7782při 80 kr. log 80 = 1.9031při 1 zl. log 100 = 2.0000při 2 zl. log 200 = 2.3010 a t. d.

Týkajíc pak se příkladu shora položeného, nejsou za léta 1825 a 1846 pro výše uvedené ceny pšenice, žita, ovsa a bramborů tato čísla sama nýbrž jich logarithmy na pořadnici vnešeny, totiž

		pšenice	žito	oves	brambory
1825		2.3324	2.1238	1.8451	1.5563
1846.		2.6739	2.5717	2.1732	1.9777
rozdíly.	•	0.3412	0.4479	0.3281	0·4214 . B)

Porovnáme-li tyto obdržené a na grafické tabulce znázorněné rozdíly B) s hořejšími A), shledáme, že poslednější (B) podávají úplně správný obraz o poměru vystoupení cen plodin zároveň znázorněných, obraz to tak přehledný, jakéhož z předcházejících tabulek nikterak nelze nabýti. Upozorňuji jen, jak na tabulce poměrně menší kolísání v cenách pšenice proti ostatním plodinám žitu, ječmenu a ovsu vyniká, jak nestejný chod v stoupání cen hovězího masa a chleba, pak ovsa a sena jest patrný, jak dále v čtyrletém průměru měsíčných cen cena ovsa dokonce jinak postupuje, než ceny ostatních druhů obilí a t. d.

Source: Activity report of Office for statistics of agriculture and forestry in Czech Kingdom for year 1872, sheet II (Prague 1873, p. LXIII.).





Source: Activity report of Office for statistics of agriculture and forestry in Czech Kingdom for year 1872, sheet II (Prague 1873, pp. LXIII.). Coloured original, zoomed.



Figure 6: Graph of the development of crop prices in Bohemia in years 1800 – 1890 using normal scale

Source: Report of statistical office of agricultural council for Czech Kingdom for years 1891–1892 (Prague, 1893). Coloured original, zoomed.

In the absence of reporting obligation, was the basic method for survey in agricultural statistics at that times the estimate, mainly of the yields of individual crops, estimates of sowing areas could be based on altogether accurate data from cadastral data. These estimates were then confronted with the results of other municipalities and districts. In order to set solid foundation to this check, Kořistka performed the division of the whole territory of Bohemia on 11 so-called natural landscapes, involving always judical districts with similar conditions for agriculture (elevation and shape of the terrain, soil conditions, climate and usual crops). Consequently this division of Bohemia, among others, allowed deducing from known data for one or two districts on the results of all the districts of the same "landscape". Division of Bohemia, which Kořistka described in the Reports for the year 1871, became a model for similar division in other countries of the monarchy. It had been used for more than half a century in Bohemia and was revised on the basis of changed circumstances in year 1923 (Závodský, 1997, pp. 101-102).

When in the 50s of the XIX. century began the progressive development of international cooperation of statisticians based on the initiative of the famous Belgian statistician Adolphe Quètelet, Karel Kořistka soon started on its participation. At the 3rd International Congress of Vienna (1857) he worked in the section for graphical representation in statistics and he attracted the attention with its proposal on unification plans of the large cities. As the head of the statistical office Kořistka already attended the Congressional hearings on a regular basis - in The Hague (1869) – he reported the agricultural statistics in Bohemia), St. Petersburg (1872) and Budapest (1876) - here successfully presented the forestry statistics in Bohemia and its own methodology of statistical graphs). Achievements of the Czech Provincial statistics he presented as a member of the International Statistical Institute (from 1889), and especially in sessions in Christiania (now Oslo – 1899) and Budapest (1901).

Of the cities in the Austro-Hungarian Empire a specialized authority for statistics was firstly established in Prague. After several years of preparation, which could not even miss prof. Kořistka, was in 1870 established the Statistical Commission of the Royal Capital City of Prague as the body control and the statistical office as an executive authority. The first chairman of the committee (1870 – 1876 and again in 1879 – 1881) was elected Karel Kořistka. He belonged among the honourable and agile members of the Conference for the provincial statistics.

Patriotic-economic Society was cancelled for political reasons in the spring of 1872. Of all its parts only statistical office continued its work - temporarily as an independent institute. The following year, the government established the agriculture council and the statistical office became part of it<sup>5</sup>. Since the 60's the proposals to transform the statistical office to the Provincial Statistical Office often appeared in Bohemia. In the 90's the situation for this step already undoubtedly matured. In several countries of the monarchy, where, if needed, the statistics was dealt by non-specialized officers, there were established provincial statistical offices whose activities are coordinated since 1894 by the Conference for the provincial statistics (Konferenz für Landesstatistik)<sup>6</sup>. After lengthy negotiations finally the Czech Provincial Council on 6 March 1897 approved the establishing of the Provincial Statistical Office of the Czech Kingdom (with effect from 1 January 1898) and also its statute was approved, drawn largely by Kořistka.

<sup>&</sup>lt;sup>5</sup>During the division of agricultural council on Czech and German department in 1891, the statistical office stayed to be a common workplace for both departments.

<sup>&</sup>lt;sup>6</sup>More in Závodský (2004, pp. 292-293).

The Office consisted of Provincial Statistical Commission as advisory body (to the Provincial Committee) and decision-making body (to the Statistical Office), and the Provincial Statistical Office as the executive authority. The Statistical Office was founded by taking over of the personnel and equipment of the Statistical Offices of the Agricultural Council and continued its work in the house no. 799 / II on Wenceslas Sq. (opposite of the current hotel Jalta), where it was housed for four decades. The head of the office was appointed 72-years-old E. k. court advisor knight Kořistka and as concipient was appointed young lawyer Dobroslav Krejčí, who within a few years became the soul of the Statistical Office and then also its boss and builder. In the first year the office employed in addition to the head also eight workers and their number as same as the scope of work has been widening only slowly depending on provided finances.

Main fields of official statistics remained centralized at Vienna offices. The competence of the Provincial Statistical Office (PSO) were, besides agricultural and forestry statistics, particularly statistics of healthcare, educational, cultural and other matters that fell within the jurisdiction of the provincial government. PSO had been publishing from year 1899 in Czech and German version "Reports of the Provincial Statistical Office of the Czech Kingdom".

Prof. Kořistka started to gradually leaving his initiative at office to young employees headed by Krejčí. In October 1905 at the age of 80 years he gave up the management of Statistical Offices and died on 19 January 1906 in Prague. Kořistka's grave can be found at IVth Olšany Cemetery, 6th department. His great credit is often commemorated at the anniversaries of Czech Technical University in Prague (ČVUT) as well as by the geographers, cartographers, geodesists and statisticians. Surprisingly, no street or other public space was named after him in Prague.

## 4. Conclusion

Our paper summarizes forty years of activities of Karel Kořistka in the field of statistics. These are usually the work of organizational leadership in the statistical office, and later in the Provincial Statistical Office, partly by improving agricultural statistics by the division of land into the natural landscape. Significant contribution of Kořistka for the statistical methodology was the introducing of modern graphs, which had also a wide international acclaim. When we examine the history of statistics in our country we need to pay more attention to the contribution of authors of the mathematical and technical education, as it was except Kořistka e.g. a native of Prunéřov Josef Hain (1809 – 1852) in the history of our statistics practically unknown.

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