

Leonid Vital'evich Kantorovich: a Man and a Scientist. Vol. 1

Edited by V. Kantorovich, S. Kutateladze, and Ya. Fet. – Novosibirsk: Scientific Publ. Center of RAS, 2002. – 544 pp. + 48 pp. of photos (106 photos). – (In Russian).

This book concerns one of the most striking pages of history of Russian science: the life and creative work of the great mathematician and economist, Nobel Prize Winner Leonid Vital'evich Kantorovich.

L. V. Kantorovich devoted his life to the struggle for recognition of new scientific methods of planning and organizing economy discovered by him. The only purpose he had was to help his country.

This book presents a collection of autobiographical materials, memoirs, selected papers and addresses he could not publish at those times. The book is intended for a general reader interested in the history of science and the lives of outstanding people.

Preface

Leonid Kantorovich is one of those brilliant scientists whose lives are inalienable from the 20th century history of Russia. One might say that Kantorovich lived two different lives in science, as a mathematician and as an economist. Kantorovich-mathematician started his studies at the age of fifteen and soon was acknowledged as a leading scientist. Kantorovich-economist was to wait for almost 20 years till his works were published to finally bring him worldwide fame.

Kantorovich was born on January 19, 1912, in St. Petersburg, in a family of a doctor. He showed his talent very early. He entered the Leningrad University in 1926, being only fourteen. Having graduated in 1930, Kantorovich engaged in teaching activity and active scientific work. In 1932 he was appointed a professor at the Leningrad Institute of Engineers of Industrial Construction and a senior lecturer at the Leningrad University, his *alma mater*, where he took professorship in 1934 and the degree of a Doctor was conferred on him without a thesis defence in 1935. Kantorovich remained associated with the Leningrad University and the Leningrad Department of the Steklov Institute till he moved to Novosibirsk in 1960.

It was in Leningrad that Kantorovich achieved his main scientific results. Having started with challenging abstract problems, he had contributed greatly to theoretical mathematics already in the 1930s. Moreover, his studies of

approximate calculus exerted no lesser, if not greater, influence on mathematics of that time.

Functional analysis plays a special role in Kantorovich's mathematical activity. Being a classic in this area and an author of the theory of ordered vector spaces, Kantorovich made functional analysis a natural language of computational mathematics. His article "Functional analysis and applied mathematics," published in *Uspekhi Matematicheskikh Nauk* in 1948 and awarded a Stalin prize, was a milestone in his work. Its very title sounded then paradoxically, but the ideas soon became classical. Just a few years later computational mathematics seemed as impossible without functional analysis as without computers.

Kantorovich coordinated a number of specific computing projects, including a nuclear studies project and a project on optimization of blanks nesting in the manufacturing industry. He realized the importance of computer technology at its very dawn and believed that this invention "will influence all human activities as greatly as did book-printing, steam engine, electricity, and radio." Fascinated with computers, he designed one of the first systems of automatic programming and a number of new computer configurations, some of which were then put into practice.

In 1957 Kantorovich was invited to the newly created Siberian Branch of the USSR Academy of Sciences and was elected a Corresponding Member of the Academy in economics and statistics. Since then his main works were devoted to economic problems. Among the few exceptions was the world-famous course of functional analysis by Kantorovich and Akilov.

Kantorovich's book *The Best Use of Economic Resources* published in 1959 faced hostile criticism from Soviet economists and caused much debate which lasted as long as until the mid-1960s, attracting keen interest of foreign scientists. It was the time when his first works on linear programming, translated into foreign languages, became famous and brought him priority and recognition in the West. In the mid-1960s recognition came to him in Russia as well: in 1964 he was elected a full member of the USSR Academy of Sciences, Department of Mathematics, and awarded the Lenin prize in 1965. Those were the years when he put forth much effort to implement his new ideas and methods into the economic practice.

Since the end of 1950s he received numerous honorary invitations to international conferences on computational mathematics, operation research, mathematical programming, econometrics, etc. News were coming from foreign academies about awarded honorary titles and membership. Nevertheless, in Russia trips abroad were repeatedly refused to him. He was allowed to go abroad for the first time only in 1975 after being awarded the Nobel prize in economics "for the contribution into the theory of optimal use of resources."

In the early 1970s Kantorovich moved to Moscow where he continued his studies in economic analysis and the attempts to achieve practical implementation of his ideas and their integration into the decision making processes in the national economy.

Leonid Kantorovich passed away on April 7, 1986. He was buried at the Novodevichye cemetery in Moscow.

Kantorovich possessed numerous honorary titles and awards in Russia and abroad. Many names are evaluated according to their regalia, but Kantorovich's name itself imparts special importance to the regalia. His scientific heritage is enormous. Professor Valery Makarov, one of the nearest Kantorovich's pupils wrote: "He is the author of first-class results in functional analysis, in the theory of functions, in computational mathematics. He has a number of great works on the theory of sets, the theory of computer programming, etc. He published a dozen of reputable monographs on mathematics. It seems clear that Leonid Kantorovich is a mathematician to the core. <...> In reality, this is not the whole truth. The uniqueness of Kantorovich is precisely in that he is at the same time an outstanding economist, a scientist who changed fundamentally the understanding of economic events, the whole economic thinking, and became the founder of an original economic school."

Kantorovich is the author of more than 300 scientific works, which encompass an impressively broad range of fields, but are united by his personality as well as by the inherent integrity and mutual association of ideas.

The same inner integrity of attitudes guided the life of Kantorovich as a person and a citizen. Honest and daring in science, he also was that way in life. "It is the scientist's duty and right to tell the truth," said Kantorovich in his last interview. These words are not just a declaration, but a moral attitude confirmed by his whole life. As a scientist, Kantorovich did not discriminate among problems as being fundamental or applied, as related to mathematics or to humanities, as prestigious or not. He engaged in any challenging problem with unflinching interest and devotion and proved by all his activity that a real scientist can find the depths in any minor problem which bring it to the highest level of science. As a citizen he defended the truth irrespective of the opinions imposed from above and fearlessly upheld his ideas for the nation's sake.

These attitudes of Kantorovich showed up most clearly in the case of the "plywood trust" (1938) where his work on a specific problem grew into the theory that made him famous. In the classical article *Mathematical Methods in the Organisation and Planning of Production* (1939) published as an outcome of that work, he first formulated the principles of optimization (linear programming). The article was followed by years of silence, as the usually profuse flow of his publications suddenly stopped. That silence coincided with the war period and an engagement in the problems of economy and optimization. It was during those years that he wrote the cited *The Best Use of Economic Resources* which was not published until 17 years later. Some other works written at that time could not be published and remained unknown.

In this book we tried to give special attention to that hard period of Kantorovich's life. We publish here some of his works and documents that

evidence the unsuccessful efforts to convince the authorities how much benefit his discovery would bring through efficient organization of economy during the hard times of war.

What prompted Kantorovich to move into economics? A clue possibly comes from his reminiscences that “the world was under the terrible threat of the brown plague, the German fascism,” “I had a clear feeling, it was the state of decision making in the economy that restricted our industrial and military power,” “I felt myself responsible, realizing that outstanding people must do something about it.” He was motivated by a feeling of civil duty rather than a scientific interest, and only that can explain the repeated attempts to put his ideas into practice and a persistency sometimes close to recklessness.

Taking into account what economics was like in Stalin’s time, the very decision to work in that field seems dreadfully courageous. Economics was emasculated just after the October revolution, Marxism was proclaimed the culmination of human knowledge, and all “reactionary professors” were deported out of the country. The economic science was cut down to the level of Smith and Ricardo in Marx’s interpretation, and the scientific methodology was replaced by medieval scholasticism of “explication of the classics.” Any fresh thought was proclaimed heretical; theories of “bourgeois economists” could only be treated as “reactionary” or “apologetic.” Nobel prizes in economics did not exist; instead, “special Stalin prizes” were widely distributed to scientists: first prize – execution, second prize – prison camp, and third prize – exile. Economics was one of the most dangerous professions, so that few serious scientists managed to avoid those “awards.” (Many older scientists at the Central Economico-Mathematical Institute, which gathered best economists of Moscow in its early days, were “winners” of these “special Stalin prizes.”)

Kantorovich’s move from mathematics to economics seems especially reckless, taking into account the role mathematics played at that time. Russian mathematics at that time occupied a leading position in the world in many aspects; on the other hand, it was free from ideology as mathematicians firmly stated that their science could not be bourgeois or proletarian, idealistic or materialistic. It was relatively safe to work in mathematics, but Kantorovich, who was recognized as a classic of mathematics in his lifetime, devoted most of his activity to economics with the only aim of helping his country.

The existing literature shows very little of Kantorovich’s life, or the history of his discoveries and their significance for science and the society, his struggle against ignorance and indifference, his victories and failures. The materials of this book reveal the personality of the scientist, the scope of his interests and the scale of his achievements, as well as the complex and uncompromising relations with the academic and social environment.

The book is a result of a thorough investigation of voluminous archive materials, mostly from Kantorovich’s personal archive. The book also contains reminiscences of friends and colleagues, written especially for the occasion, and oral interviews we transcribed and verified.

We wish to express our deep gratitude to many people without whom this work would have been impossible.

Book 1 (this volume) comprises several parts: Kantorovich's autobiographical materials, memoirs of friends and colleagues, and a number of his unpublished and little known articles and oral presentations. It should be noted that the papers and presentations published here can only give a general idea of his activity, since we could not include the mathematical and economic articles intended for specialists rather than for a broad range of readers. Neither can these materials give a true idea of his personal style, as they are mostly draft versions that were not perfected for publishing by their author. In a special section we present Kantorovich's Nobel lecture delivered in Stockholm on December 11, 1975 and some materials related to this event. Book 2 includes the most interesting documents from the scientist's archive as well as his vast correspondence.

We hope this book will help readers to learn a lot about Leonid Kantorovich, a wonderful person, a brave citizen, and an outstanding scientist who founded new fields in mathematics, who has won the battle against ignorance and banality of the official Soviet economic science which he raised to a high level, and who was an example of selfless work for the sake of science.

V. Kantorovich, S. Kutateladze, and Ya. Fet, Editors

Contents

Preface (Russian)	3
Preface (English).....	8
I. L. V. KANTOROVICH ABOUT HIMSELF	15
My path in science (1938).....	15
On the history of linear programming (answers to the questions of Sonja Brentjes)	18
My path in science (Supposed report to the Moscow mathematical society)	22
To look at the truth with open eyes.....	76
Autobiography of Leonid Vital'evich Kantorovich (1944)	83
Autobiography of Leonid Vital'evich Kantorovich (1967)	86
Biographical card.....	94
II. REMINISCENCES ABOUT L. V. KANTOROVICH	97
Special session of the Leningrad mathematical society, dedicated to the 75th anniversary of L. V. Kantorovich.....	97
<i>A. G. Aganbegyan</i> . Teacher, scientist, man.....	115
<i>G. P. Akilov</i> . He aimed at invisible targets	126
<i>A. M. Vershik</i> . L. V. Kantorovich and the linear programming	130

Computations for the atomic project (interview with V. S. Vladimirov and V. N. Kublanovskaya)	153
<i>I. M. Gelfand.</i> Leonid Kantorovich and the synthesis of two cultures	161
<i>V. A. Zalgaller.</i> His key idea.....	164
<i>I. N. Kantorovich.</i> Uncle Lyonya.....	172
<i>S. S. Kutateladze.</i> Kantorovich's spaces	177
<i>V. V. Leontiev.</i> Kantorovich: In memoriam	182
<i>V. N. Livshits.</i> Reminiscences about Leonid Vital'evich Kantorovich	184
<i>S. G. Mikhlin.</i> Reminiscences	191
<i>G. I. Natanson.</i> Some episodes concerning Leonid Vital'evich.....	199
<i>S. P. Novikov.</i> Speech at the Novodevichie cemetery on April 10, 1986.....	203
<i>T. T. Orlova.</i> LV	205
<i>N. Ya. Petrakov.</i> Creator who could be a fighter.....	213
<i>V. M. Tikhomirov.</i> About Leonid Vital'evich Kantorovich	216
<i>D. K. Faddeev.</i> From the student's years	221
<i>S. V. Chesnokov.</i> Leonid Vital'evich Kantorovich: features of the portrait	226
III. UNPUBLISHED AND LITTLE KNOWN PAPERS AND REPORTS (1937–1957)	233
Introduction and Preface to the work “Functional Analysis Based on the Theory of Partially Ordered Spaces”	233

On the distribution of printed production.....	237
On some mathematical problems of economics in industry, agriculture, and transport (Summary)	250
Give new means for struggle against the hateful enemy	271
On numerical methods of solving problems related to planning for best use of resources in a given area of socialist society.....	273
Lecture at the Naval Technical College	302
Foreword to “Economic Calculation of Best Utilization of Resources”	306
On interrelations between some notions with those introduced by subjective schools	317
The indices of work of enterprises need to be revised	375
On the plan of applying to national economy the scientific works of Leningrad division of Steklov Mathematical Institute of the USSR Academy of Sciences.....	399
Documents presented by the Leningrad University to the USSR Council of Ministers in 1957	414
Analysis of economical planning should be raised to the proper level	463
Application of mathematical methods in calculations of economical planning	470
IV. NOBEL PRIZE	499
Mathematics in Economics: Achievements, Obstacles, Perspectives	499