



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

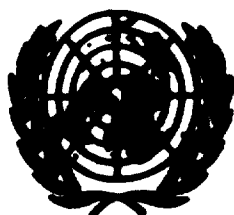
FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org



05686



United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.187/5
19 August 1974

ORIGINAL: ENGLISH

Meeting of Experts/Decision Makers for Promotion
and Development of Machine Tool Industries in
Developing Countries of Asia and the Far East

Tbilisi, Georgia, USSR, 5 - 15 October 1974

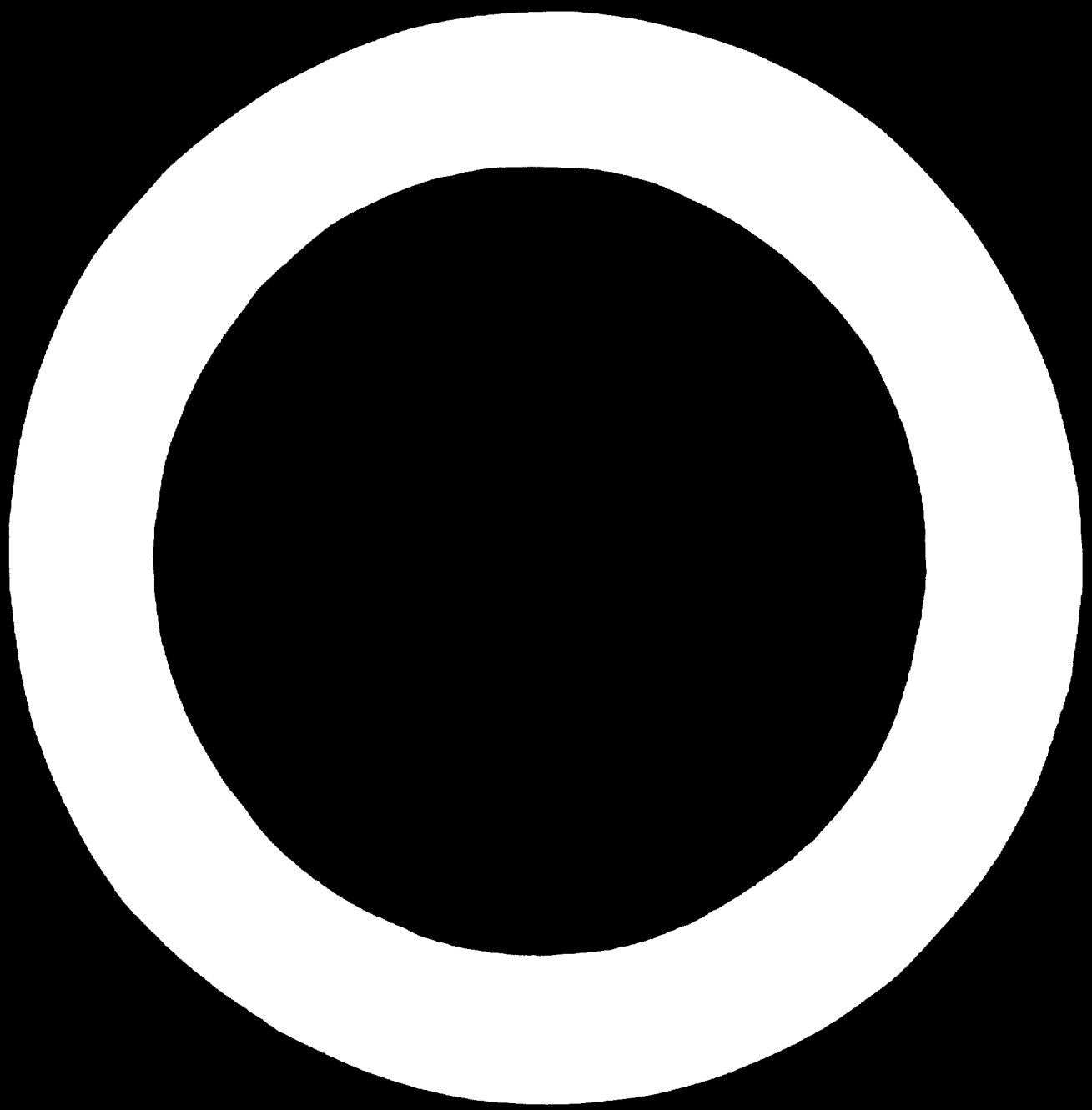
DEVELOPMENT OF THE MACHINE TOOL ✓
INDUSTRY IN GEORGIA

T. N. Loladze *

* Professor, Vice-rector of the Georgian Polytechnic Institute, Corresponding Member of the Georgian Academy of Science, USSR.

✓ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.



Introduction

Georgia, one of the ancient countries with a highly developed culture reached its flourishing after the Great October Socialist Revolution, which created favourable conditions for rapid development of the agriculture, industry, national culture and art.

At present time the industrial enterprises of Georgia supplied with modern equipment and by highly skilled specialists produce ferrous and non-ferrous metals, ferroalloys and complicated machineries and equipment, among them: powerful locomotives, nautical vessels with submarine wings, lorries, aircrafts, different kinds of instruments and apparatus and a great number of various wares of light and food industries.

Machine tool production keeps a leading position in Georgia. Now under serial production are: screw-cutting lathes (heavy duty engine lathes), external grinding machines and a number of special machine tools for pipe industry. Besides, a number of cutting tools and hand tools are under mass production. Georgia supplies enterprises of USSR with several thousand machine tools and special machine tool lines.

Development of Machine Tool Production

History of the machine tool industry of the Georgian Republic numbers nearly four decades.

Early in 1930, in Georgia only several weak work-shops producing not-complicated equipment for agriculture were under operation. In 1929, creation of the Tbilisi large new mechanical plant was started, now this plant is well-known in the Soviet Union and abroad as the Machine tool Kirov plant. At the very beginning the plant was manufacturing special machines for oil industry and in 1936 started to manufacture special screw-cutting lathes, model "507", supplied with tangential thread die head for machining threads up to diameter 1,5 inch. Since 1937 the Kirov plant began to produce special pipe-manufacturing machines mainly for oil industry. Since that time modification of pipe-manufacturing machines produced at the Kirov plant was continuously widened. By producing the pipe-cutting machines, model "9161" and pipe-threading machines, model "9A151" the plant step by step gains a leading position in our country on manufacturing a range of machine tools and machine tool lines for pipe industry. At the same time the serial production of the universal screw-cutting lathe was started. Initially, screw-cutting lathe, model "DIP-300", afterwards, model "163" were produced. Since 1972 screw-cutting lathe, model "163" was improved and manufacturing of screw-cutting lathe, model "1M63" was put into production. So, characteristics of screw-cutting lathes were continuously improved and widened by engineers of the plant. Screw-cutting lathe, model "1M63" by its performance figure, rigidity of system machine -

work-piece - tool, machining accuracy and production efficiency comes to the level of the best standards of the similar machines manufactured by the well-known companies.

For example, comparisons of the main performance characteristics of the screw-cutting lathes "1M53", "Morando R-30" (Italy) and "DLE 630E" (DDR) are given in table I.

T A B L E I

Name of a lathe	"1M53"	"Morando R-30" (Italy)	"DLE630E" (DDR)
The biggest diameter of the machined work-piece (mm)	630	640	630
The maximum diameter of the rolling passing through the spindle hole (mm)	65	82	72
Number of spindle speeds	22	24	18
Range of variations of spindle rotations (rev/min)	10-1250	12-1500	28-1400
Range of variations of longitudinal feed limits (mm/rev)	0,064-1,025 with the possibilities of 4-multiple increasing	0,04-9,14	0,035-10
Main motor capacity	13	15	10/13

Using high quality cast-iron, unit-cast bed, quenched main slides of a lathe, high rigidity and accuracy of a machine are reached. Tool life of the lathe is high enough and the

duration between capital repairs is raised up to 9 years.

From the days of manufacturing up to present days the plant has been producing more than 5000 machines "1M63". Several hundreds of them are sold abroad.

For the purpose of the farther improvement of performance characteristics of the machine tool and providing it with special devices, the plant designers are working on realization the problem. In the nearest future the plant is going to produce new modifications of universal screw-cutting lathe, model "16K30" which should have the production efficiency by 15-20% higher as compared with model "1M63"; accuracy and the guarantee period of operation will be increased by 20-25%. On the basis of the lathe model "16K30", NC lathes are under progress and will be produced in future.

At present time the plant is producing: pipe-cutting machines: 91A11, 91A15, 91A25, 91A28, 91A53; pipe-threading 9M14; pipe facing 9139, 9149; sleeve-threading 9L179, etc. Besides, special machine tool lines are under production too.

Special new-type machine tools have a number of advantages as compared with the initially produced, namely, increased rigidity of machine tool system prevents brittle failure of the cutting tool and allows using of carbide tip tools. As a result, production efficiency and accuracy of machining are significantly increased, besides, there is a possibility of machining pipes after heat treatment and machining pipes from high-temperature alloys. Guarantee period of operation between the repairs will

be increased up to 9,5 years. Approximately, the total economic effectiveness from the introduced new models of pipe-machining tools into pipe production industry of the USSR, exceeds 3 million rubles per year.

The Tbilisi Kirov machine tool plant with its design office is an advanced organization of the Soviet Union on designing and manufacturing special machine tools and machine tool-lines for pipe-production industry.

Serial production of screw-cutting lathes and a great number of customers makes it advisable to use at the Kirov plant many special automatic, semi-automatic and special gear-cutting machine tools, aggregate and NC machine tools for manufacturing processes.

The plant having high-capacity work-shops to manufacture special cutting tools, devices and accessories required for own needs, is able to introduce any new achievement of production engineering science.

Usage of aggregate machine tools for manufacturing the gear box, feed box, tailstock frame and other complicated machine-parts considerably increases production efficiency and reduces production cost. Namely, applying NC machine tools to manufacture gears, different kinds of shafts and other machine-parts gives the same results. Fourteen special production tool-lines are designed and introduced at the plant for the purpose of increasing the production efficiency and accuracy of machining.

Recently, special painting shop was built at the plant for introducing the new method of electrophorus, for improving the painting quality of the machine-parts.

Simultaneously with increasing of the production issue, labour productivity and the quality of the production the plant is continuously growing and widening.

The existing work-shops are broadened and the new ones are under construction.

In 1941, the Tbilisi plant of precision cylindrical machines was created. It keeps the second place by its importance in machine tool industry of Georgia. It produces cylindrical grinding machines, model "3A110"; "3B110"; superprecision, model "3B110"; drill-resharpening, model "3B659" and some others.

In 1934 nearby Tbilisi in Avtchala place a cast-iron and steel foundry plant "Taentrolit" was put under operation.

The reason to create high-capacity foundry plant, evidently, is to fulfil needs of the machine-building factories and other enterprises using modern technology. The plant is equipped with modern high-capacity cupola, air and electrical furnaces for steel casting. Special casting methods, casting in metallic and non-metallic mould, precision or investment casting, shell moulding etc. are utilized at the plant too.

In 1955 construction of a new special Tbilisi cutting tools plant was completed and now lathe tools with soldered and clamped carbide tip cutting tools, milling cutters from high-speed steel in the range of the diameter 30-45 mm; metrical system taps M3, M6, M8 and M16 are produced at the plant. Mass production of cutting tools enables to use special equipment and high level automation of manufacturing processes.

The Georgian machine tool industry production is exported to many countries: BDR, France, DDR, Poland, Bulgaria, Cz.SSR, Romania, Hungary, the Lebanon, Libya, Bangladesh, Iran, Jordan, the

Jemen, Mongolia, Turkey, Cuba, India, Indonesia, Pakistan, Iraq, Siria, etc.

Education, Research and Science in the
Field of Production Engineering

Development of the machine-building and machine tool industries in Georgia required training highly skilled engineering personnel. For this purpose a new mechanical engineering department with "Production Engineering" speciality was organized in Georgian Polytechnic Institute, in 1936.

Famous georgian scientists, corresponding member of Georgian Academy, professor G.K.Gedevanishvili, professor G.D.Gotsiridze, professor M.V.Kasjan and V.A.Didobulidze were the pioneers in organizing the mechanical engineering department. Simultaneously, some experienced engineers were invited from industry as lecturers to mechanical engineering department and staff members of department was strengthened. A hardful work had been done by them to compose technical terminology, curriculum, different text-books and instruction in georgian language, that made it possible to deliver lectures in mother tongue.

In 1938, the first group of graduating students, production engineering speciality, was sent to enterprises of machine-building industry.

Professorial staff of the mechanical engineering department at the initial period of activities took part in reconstruction

of the existing machine-building plants and in designing the new ones in Georgia. By the same time, scientific and research works were started in the field of metal working processes. Research in the field of forming and joining processes (forging, rolling, welding) were conducted under the guidance of professor G.K.Gedevanishvili, professor M.V.Kasjan worked in the field of theory of metal cutting and professor G.D.Gotsiridze - on problems of machine tool design. At that period the separate chairs of machine-building technology and machine tool design under professor G.K.Gedevanishvili and professor G.D.Gotsiridze guidance were organized.

Since 1939, a post-graduate study was started at the mechanical engineering department and capable young engineers had been selected for farther teaching and scientific works.

At that period, mining and metallurgic institutes were organized at the National Academy of Science of Georgia and close cooperation between Georgian Polytechnic Institute and Georgian Academy of Science in scientific research affairs was developed. So, step by step scientific and research works in the field of production engineering were broadened.

Since 1950 up today fundamental investigations of the chip-formation process of metal cutting, contact and heat phenomena, stress-state condition of working part of the tool and study of physics of friction and wear of cutting tool were conducted by members of the machine-building technology chair.

As a result of the obtained experimental data theory of brittle and plastic failure of the cutting tool, theory of adhesive, chemico-abrasive and diffusive types of wear were developed.

Results of scientific research works conducted for the above-mentioned period were summarized in some monographs: "Chip-formation during Cutting of Plastic Metals", 1952; "Tool-Wear", 1958; "Wear of Diamond and Diamond Wheels", 1967; "Development of Science of Metal Cutting in USSR for the 50 years" the jubilee volume, 1967, are widely adopted in scientific-research laboratories of USSR and abroad and are translated into German, English languages. Simultaneously, since 1960 study of various modern engineering methods, hot-machining of metals, plasma arc-machining, laser-machining etc. is started.

At present time problems of accuracy, contact rigidity and surface finish are also under progress. Results of these research works are reflected in publications of USSR, USA, West Germany, France, India and other countries.

Development of theory of metal cutting and fundamentals of machine-building technology in general, have become significant contribution for creation of a number of high-efficiency manufacturing methods successfully introduced in industries.

As a result of the scientific-research work, high-frequency diamond superfinishing method was originated, which considerably increased obtained surface smoothness and production efficiency. This method was widely introduced at a number of industrial enterprises of USSR and the total economical effect exceeds 200

thousand rubles per year. Tool wear investigation was a basis for construction of centerless lathe TT-140 and TT-141, used for stripping of high-temperature alloys bars which were under operation at "Elektrostal" and "Verkhnya Salta" plants.

Investigations of hot-milling process of the stainless steel and nickel-based high-temperature alloys give helpful data for designing of special thermo-peeling machine GF-1730 which at present is under production at the Gorki plant of milling machines.

As it is not economically possible to obtain stainless steel and high-temperature alloys ingots which after being stripped, are free from all superficial defects, connected with ingots mould casting. These defects are in the main cracks, cold drops, inclusions and other impurities. The ingots, therefore, require special treatment for the elimination of these defects. Designed thermo-pilling machine GF-1730 with its performance should overcome "Innocenti" hot-ingot pilling machine due to its capacity to provide pilling of high-temperature alloys using special carbide tip milling cutters.

In 1974-75 years a special automatic line for cutting-of pipe ends in hot condition after rolling mills is planned to be introduced at Rustavi metallurgic plant. This modern pipe-production technology will be transferred into other pipe-manufacturing enterprises of USSR. Formulation of metal cutting tool requirements made it possible to create a new composition of carbides without usage of tungsten and cobalt bond media.

In 1956, Tbilisi scientific-research technology institute of machine-building (PTNIIME) was founded. The main activity of the institute is working out the new technological and automatic processes for hand tool and file mass production. Special machine tools and machine tool lines were introduced for this purpose.

During the passed period new alloys for explosion proof hand tools, special steels for file production, some buffing and stripping machines for hand tool production etc. were also created.

Some departments of the institute (PPNIIME) design new plants and deal with reconstruction of the existing ones.

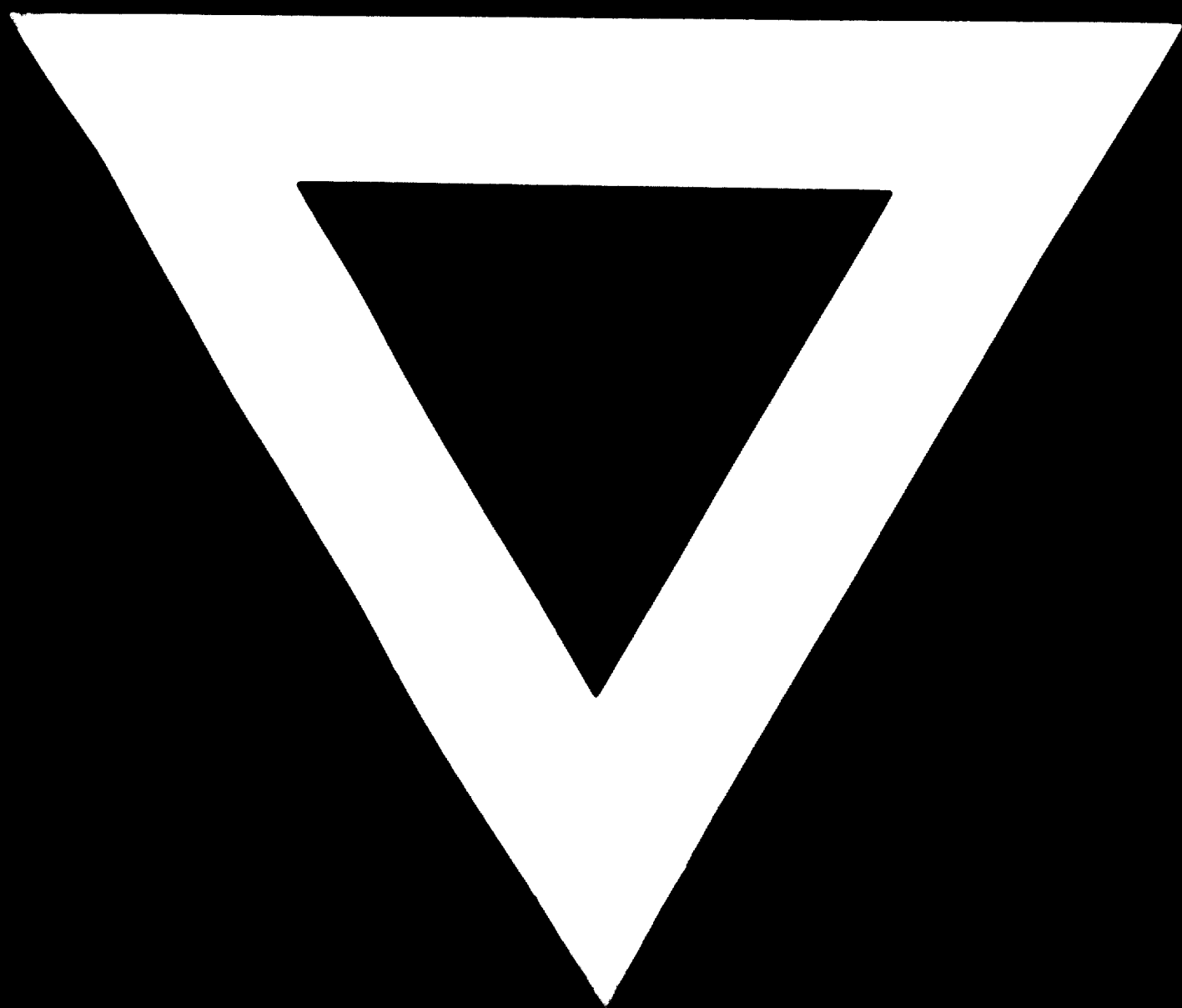
Many examples can be brought down to show how results of scientific-research works of georgian scientists are used in practice.

Some professors of mechanical engineering department of Georgian Polytechnic Institute, professor T.N. Loladze, professor V.V. Tsotskhadze and professor G.I. Razmadze for some period had been joining UNESCO and were working as UNESCO experts. Professor T.N. Loladze was head of UNESCO mission in Indian Institute of Technology in Bombay, than chief technical adviser of UNESCO for creation Mansura Polytechnic Institute in Egypt. Professor G.I. Razmadze worked as UNESCO expert in Tiruchirapalli Engineering college in India in the field of production engineering, professor V.V. Tsotskhadze worked as an expert of the Indian Institute of Technology in Bombay than had been promoted, now he works as UNESCO chief technical adviser and project manager in Delhi.

International seminar of UNESCO "New Trends in Curricula Design and Engineering Education" was held in Tbilisi in 1972. Professorial staff of Georgian Polytechnic Institute and some representatives from industry took an active part in that seminar.

Such, seems, briefly a history of the development of machine tool industry and production engineering research in Soviet Georgia.





74. 10. 14