

INSTITUTIONALIZATION AND PROFESSIONALIZATION OF LOGIC IN SLOVAKIA AFTER 1918*

Jozef VICENÍK

Institute of Philosophy, Slovak Academy of Sciences,
Klemensova 19, 813 64 Bratislava, Slovakia

In his article, the author gives an analysis of the first stage of institutionalization and professionalization of logic in Slovakia in the period of 1918–1948. He writes about difficulties of this process. According to his work the basic transformation from traditional logic to modern formal logic was performed in the content of published studies at the end of the thirties and beginning of the fourties. This process occurred at Colleges and Grammar schools gradually until the year 1949 and was more intensive only in the sixties.

The subject of special analysis in this study will be a complex process of institutionalization and partially also of professionalization of logic, or, more precisely, of modern formal logic, which, in terms of various traditions and in different geographical zones, appears as “formal”, “symbolic”, or “mathematical” logic. The process of institutionalization and professionalization of logic will also include the process of the establishment of modern logic as a subject to be studied particularly at universities and secondary schools. In the schools of Austria-Hungary, where logic was taught, it was the so-called traditional logic that reigned there; that logic covered many issues of Aristotelian logic but it was not identical with it. Within traditional logic, “the interest in rhetoric, psychological, epistemological and methodological questions pushes the issue of logic in to the background” ([4], 77). Aristotelian logic and the so-called traditional logic underwent some changes during their development. The preparation of the principal paradigmatic change in the character and the subject of logic had taken a relatively long time and the change took place towards the end of the nineteenth and at the beginning of the twentieth centuries chiefly under the influence of the logical works of G. Frege and later also other philosophers and mathematicians who specialized in the research of logic (G. Peano, B. Russell, A.N. Whitehead, D. Hilbert, etc.).

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A new paradigmatic phase in the development of logic was represented by the classical propositional and predicate logic. The classical logic was not the result of a sort of mechanical transformation of the traditional logic. The new classical logic had qualitatively overcome the teaching of traditional logic in many directions: 1. by an abundance and exactness of its own means of expression as an important device of logical analysis; 2. by the extent of the subject of logical analysis (it started to study the rules of correct inference, logical systems (calculi) of propositional and predicate logic and their different properties which had not been the subject of traditional logic); 3. by the preciseness and wealth of the methods used and, ultimately, 4. by the impact of possible applications. Modern classical logic assimilated many problems from the content of traditional logic into its own system and expressed it more exactly by means of predicate logic. The twentieth century witnessed a rapid growth in modern formal logic. At the beginning of the twentieth century nonclassical logics were formed. They breached the principles of classical logic. Both types of logic became part of modern formal logic. The formation of metamathematics and/or metalogic (i.e. the theory of logical and mathematical deductive systems and their properties) was of great importance to the development of modern formal logic. Three basic systems were formulated within metamathematics: Hilbert's Programme of the **formalization of mathematics, logicism, and intuitionism**, which represented various philosophical attitudes developed within mathematics. Metalogical (and/or metamathematical) investigations were originally reduced to syntactic analysis of logical and mathematical theories. Awareness of the importance of the concept of meaning for the logical analysis of language and theory meant that semantic and later also pragmatic (logical pragmatics) analyses started to be important.

The issues of the exploration of correct (deductive) reasoning, analysis of a series of deductive systems (syntactically formulated or semantically interpreted) and their properties became the core of modern formal logic. The above mentioned paradigmatic changes in the area of logic were reflected in some countries towards the end of the nineteenth and at the beginning of the twentieth century and they were also gradually reflected in the changes of the content of the instruction in logic as well as in the character of logical issues. The process of reflection and assimilation of modern classical logic and later also nonclassical logic accompanied by the pushing of the issue to the periphery of interests took place at first at the universities in Germany and England, a little later in Austria but it was also very intensive in Poland. After the disintegration of Austria-Hungary and the establishment of the Czechoslovak Republic in 1918, this process had not even begun.

Science as a social system with a special focus on the acquisition of knowledge, modern knowledge in particular, underwent some changes during its historical development, including the separation from philosophy of particular sciences as part of the European tradition and their shaping as independent scientific disciplines as well as a complex process of *institutionalization* and *professionalization*. B. Tu-

chańska stresses that it is the creation of different organizational forms of science with the corresponding scientific institutions where research and teaching were carried out, that is important for the institutionalization of science. Scientific activities in those institutions were controlled by the rules determining the mode of the functioning of science (scientific discipline). Those rules were components of the culture of science of that period.

By the side of the rules directing scientific activities from the outside, particularly the rules determining which cognitive activities are recognized as scientific and as preferred from the external perspective, there were also methodological rules accepted by a community within particular institutions, which directing the scientific activities from the inside. Serious conflicts might have arisen between the rules controlling scientific activities from the outside and those regulating them from the inside ([37], 303–309). The institutionalization of science was accompanied with a complex institutionalization of the edition of scientific works, i.e. the system of publications which enabled dissemination of the knowledge and made it accessible to the wider public. The concept of the institutionalization of science is sometimes distinguished from the concept of the professionalization of science. The process of the latter could have been launched when the external need (i.e. the need outside the scientific community) and the interest in scientific achievements emerged. This led to a change from the status of the scientist-amateur to that of the scientist whose scientific activities were conducted on a professional basis. It was the beginning of the shaping of scientific careers, formation of scientific teams of teachers and pupils, preparation of scientific workers, growth of specialization, formation of new scientific institutions, growing needs to raise funds for the implementation of scientific activities, etc. ([1], 99–104).

1. Logic in Slovakia between 1918 and 1945. The years after the disintegration of Austria-Hungary in 1918 and the establishment of the Czechoslovak republic, witnessed a more dynamic growth in the national education system in Slovakia. This required some time because of the lack of Slovak teachers. The first national university (although not the first in our territory), Comenius University, was established in 1919. One of its faculties was the Faculty of Philosophy (1921). By that time the disciplinary structure of sciences and the system of scientific and educational institutions with their own inner organizational structures were almost completed in Europe. The Faculty of Philosophy accepted the traditional structure known particularly from the universities in Austria-Hungary and Germany. The Faculty was divided into Chairs where several seminars worked. The Chair of Philosophy was constituted at the very beginning, with psychological and sociological seminars but also with a philosophical seminar. The instruction itself and the research in the field of logic were implemented within the Chair of Philosophy and the constituted philosophical seminar. The beginnings of the instruction in logic were complicated. Philosophy started to be taught in 1922 and the instruction in

logic began as late as in the summer term of 1925, when Dr. Josef Král (Associate Professor and later Professor and Dean of the Faculty in 1930–31) introduced lectures on **elementary logic** (part of traditional logic). His primary focus was on philosophy but his interests also intervened in the fields of sociology, psychology, and education, which was not unusual at that time. It was the same with other University teachers lecturing on logic between 1925 and 1945. The lectures on logic were not regular. It depended on teachers whether they offered courses of lectures on logic for particular terms. The irregularity in logic teaching at the Chair of Philosophy lasted till 1948. Logic was rarely the subject of philosophical seminars, where lectures were delivered, essays and compositions were prepared from the history of philosophy, systematic philosophy and in part also from traditional logic, the history of logic, and methodology.

Lectures on logic (including lectures within philosophical seminar) between 1925 and 1945 were successively delivered by Professors Josef Král, Josef Tvrđý, N. O. Losskii and Doc. Dr. S. Štúr (later Professor of philosophy). The content of lectures did not in principle go beyond the content and structure canonized by textbooks of traditional logic. Although the curricula of these subjects have not been preserved, it can be guessed from the titles of the subject in the list of lectures for particular terms; they expressed the traditional division of logic into elementary and abstract parts, which was further divided into elementary part, methodology, etc. This opinion is confirmed by the content and structure of Tvrđý's 'Logic' (1937) which might be assumed to be the core of his lectures. As for the logic lectures by N. O. Losskii and partly also by S. Štúr, they could possibly contain parts on logic with regard to their professional activities and with S. Štúr with respect to his dissertation thesis, but it would be difficult to place them into the content and the structure of traditional logic not to mention modern formal logic.

The authors, who, went beyond traditional logic in their studies (we shall specify them later), did not teach at the Faculty at that time. What is certain is that by 1945, the basic change in orientation and transition from traditional to modern formal logic did not take place at the Faculty of Philosophy but outside it. The activities of Professors J. Král and J. Tvrđý influenced many Faculty graduates – the authors of the works on formal logic.

The contacts with modern formal logic lagged behind other countries and its impact on the change of the teaching programme of secondary schools (grammar schools) and of universities in particular, started to increase around 1960. There were several reasons for this. It was not only the shortage of teachers, who would have specialized in the field of logic, studied and pursued the discipline systematically and adopted the ideas of modern formal logic and would have transferred them systematically into the curricula of logic and then into teaching or would have tried to work in the field independently. There were also other developmental difficulties that had to be coped with by the emerging schools. At the Comenius University it was chiefly the lack of foreign contacts, and difficulties with the acquisition

of the professional literature for newly established libraries at particular faculties, primarily for seminar libraries.

The assimilation of the results from modern logic was also complicated by other circumstances. In the neighbouring countries, it was professional mathematicians who took a significant part in the development and dissemination of formal logic; and where the spread of modern logic was the merit of philosophers and the barrier between philosophers and mathematicians was successfully overcome, it was markedly conducive to the development of formal logic and the process of its institutionalization and professionalization. Poland can serve as a classical example of this type of collaboration between philosophers and mathematicians ([41], 20–21). We do not argue that that was the decisive reason for a slow acceptance of the ideas of formal logic in our country. It could have hardly been assumed that the transition to modern formal logic would take place at secondary schools. The traditional stereotype of instruction in logic according to the approved curricula survived at the level of secondary schools where logic was taught between 1918 and 1945. The curricula were difficult to innovate substantially, not to mention insufficient preparedness of many teachers for the instruction in traditional logic. The best conditions for changes in the content of logic were at the University. Undeniably, as we shall see later, university graduates and post-graduates, were able to accept the outcomes of formal logic and set out to work in the field.

After 1918, the activities of Matica slovenská (MS) were renewed. MS was a national institution with a significant cultural and educational mission. Several scientific departments, inclusive a philosophical one, were set up within MS. With regard to the aims of MS and its staff, it was hardly possible to anticipate that philosophy would become an institution within which the research in the field of modern formal logic would start to develop.

The institutionalization of a particular scientific discipline, in our case of formal logic, can also be realized in other institutions, where several scientific disciplines or components of particular scientific fields operate autonomously side by side. Logic can then fulfill its basic functions in these institutions, chiefly to provide teaching, prepare specialists, conduct scientific research, publish papers, establish relations with related scientific institutions. The status of independent scientific discipline and independent organizational unit would be reached gradually and would take a longer time. This was the case of Slovakia where the institutionalization proceeded from 1962 at the Faculty of Philosophy of Comenius University. Those interested in logic gained the space, conditions and an increasingly higher degree of autonomy for the implementation of their interests in the field of teaching and research and they succeeded in extending the space within the Department of Philosophy as well as outside it.

The institutionalization of publishing (journals, collections of works, monographs, etc.) within particular scientific institutions aimed at presenting the results of scientific work is also an important component in the process of institutionaliza-

tion of logic and, actually, of all scientific branches. It is a prerequisite of the professionalization and promotion of the status of the scientific discipline as such. Professors of the Faculty of Philosophy sensed the necessity to publish a collection of scientific papers as early as in 1921. Professor Miloš Weingart initiated publication of such a collection and the professorial staff agreed on its publication on November 17, 1921. The scientific body of the Faculty started to be published under the title *Sborník filosofickej fakulty* (Collection of works of the Faculty of Philosophy) and covered the works from 1922–1923. The publication of similar collections of works was a common practice in the world. In our country it was novel. There was no such a collection published in Prague or Brno at that time ([28], 31–32). The studies from logic were actually not published in particular study years. By 1925, other journals and collections of works were established also offering possibilities to publish works on logic. This occurred particularly in the case of the journal *Bratislava* published by the learned society ‘Učená spoločnosť Šafárikova’. The first volume was issued in 1927 but works on logic did not appear in the first eight volumes (1927– 1934).

2. Transition from traditional logic to modern formal logic between 1918 and 1948. The process did not take place in the vacuum of ideas. Gradual institutionalization of logic proceeded within philosophical institutions in the environment which could either be conducive to or could impede this process. Between 1918 and 1945 there was a broad spectrum and plurality of a variety of philosophical currents and orientations in Slovakia. Many Czech Professors lectured at the Faculty of Philosophy of Comenius University from the establishment of the Chair of Philosophy in 1922 up to 1938. Their activities significantly contributed to the development of philosophical thought in Slovakia and the preparation of the new generation of professional philosophers. They ensured the continuity in the teaching of logic at the Faculty of Philosophy. They recruited those who wrote seminar works but also dissertations chiefly from traditional logic. They also provided the latest information on the events in the field of modern formal logic. The thought of the Czech philosophers “was characterized by positivist-realistic orientation” and “consciously referred to T. G. Masaryk” ([3], 16). However, the source of their views was not positivism in the third phase of its development, called neopositivism or logical empiricism but positivism inspired by A. Comte. We also agree with the fact that they preserved a critical attitude to traditional positivism as well.

Those were the years when the ideas of Marxist philosophy penetrated and were spread. Christian philosophy was developing. Neothomism was spread in Slovakia by Catholic philosophers. Philosophy was also developed by Lutheran philosophers. At the beginning of the forties critical or intuitive realism appeared and found its place in our territory.

From the perspective of the cultivation of logic in the 1920s and 1930s, the dominant position of positivism at the Faculty of Philosophy and later penetration

of the ideas of neopositivism into our milieu was undoubtedly important. They provided space for its instruction and further development. The attitude of religious philosophers to logic was, in our opinion, ambivalent. They considered it, in its traditional canonized form, rather as an instrument for philosophizing. Philosophers orientated irrationalistically did not actually deal with the issues of logic.

Now we shall pay attention to various changes, chiefly researches in the area of logic presented in both published and unpublished works as well as instruction in logic in order to be able to identify the *border* (although not sharp) of the transition to a new research paradigm – to *modern formal logic*. We have mentioned that the instruction in logic at the Faculty of Philosophy was launched by J. Král as late as in the summer term of 1925. However, the textbook on *Logic I-II* [26] was published by J. Koreň, Professor of the then Prešov Evangelical college and the well-known author of different textbooks, as early as in 1923.

Logic is a science exploring the “laws which should be obeyed for factual thought to be correct”. Simultaneously, it is **normative** science, that is it does not speak about “what thought is like, but what it should be like”. Psychology “is the preparation for logic”. Correct thought is both deductive and inductive, induction being one of the stages of deduction ([26], 4–6). The account of logic clearly includes psychologism. The interpretation of logic itself must not contrast, according to Koreň, with the laws of psychology. He does not, however specify the laws.

The significance of this logic textbook primarily consists in the fact that 1. it is the first textbook written in the Slovak language and 2. it represents the first attempt to codify the Slovak terminology of logic. With its content and structure it is very similar to the textbook on traditional logic by F. Krejčí which was published before 1918 in several editions [27]. We failed to find whether its influence on the teaching of logic was of more than local character in Slovakia. It is true, however, that the later authors on logic and the history of philosophy, J. Tvrďá, S. Š. Osuský, H. Höffding or J. Král do not mention it in their works ([38]; [43]; [20]). A study of Hugo Szántó [42] was published in the same year (1923). The core of the study deals with the philosophical issue of the relation between logic and reality. Against the background of this problem, Szántó tries to find a correct solution in the selection between the attitudes of philosophers arguing that only that which is logical can exist (Spinoza, Herbart); philosophers, who recognize the inalienability of the principles of traditional logic but, at the same time, they prefer the existence to the logical (Losskii), and philosophers, according to whom reality violates the principles of logic, mainly the principles of contradiction and of the excluded middle. There is something else that is interesting. Szántó uses results from mathematical logic, particularly attempts of logicism to reduce logic to mathematics for formulating his own standpoint, Russell's efforts to resolve mathematical antinomies but also problems with the relation of Euclidian and non-Euclidian geometries, etc. in order to justify the need for a *new logic*. H. Szántó rejected the reduction of mathematics to logic using the arguments of H. Poincaré. He emphasized that traditional

logic is not able to solve the problem of antinomies and therefore it should be critically revised. His contemplations result in metaphysical conclusions. One of them avers that “if metaphysics is possible as a comprehensive picture of the universe, it is merely possible if it (with respect to its objects) leaves the field of traditional logic and admits the existence of real matters which contradict one another, that is they are syntheses of logical contradictions. The strife of Hegelians and Herbartists mentioned in the introduction to this paper has been decided in favour of the Hegelians for ever” ([42], 77). It is his knowledge of the issues of modern formal logic (more precisely) metamathematics, mathematics and natural sciences that is interesting, although he prefers new logic based on Hegelian dialectics.

During his stay at the Faculty of Philosophy in Bratislava, Josef Král published the work *České logiky humanistické* (1926), which, however, does not bring anything new in view of the matter of our concern. Philosophical life was developed during the Philosophical seminar led by J. Král between 1925 and 1931. J. Tvrđý participated in the activities within the Philosophical seminar from the school year 1926–1927. In 1931 he took over the Seminar after J. Král. We have already mentioned that lectures and papers were read there, discussions were held and students prepared written compositions on different topics: *Aristotle: Organon* (1925), *F. Bacon: New Organon* (1925), *R. Descartes: Discourse on the Method, Meditations on First Philosophy* (1926), *G. W. Leibniz: Monadology* (1927), *Logic, Reading and Interpretation of Goblot's Traité de logique* (1928–1929), etc. They mostly concerned topics from the history of philosophy, which in some aspects dealt with the issues of methodology of sciences, that is that which can be, in terms of H. Scholz, included into the theory of science or that used to be called methodology, but not the basic questions of logic ([33]; [34]).

Within the framework of the Chair of Philosophy of the Faculty of Philosophy of Comenius University, national theses and doctoral dissertations were prepared under the supervision of professors in the years 1922 – 1948 as well as in the following years. We shall mention at least those, which are partially connected with the issues of logic. The selection of topics and their preparation was by 1938 influenced particularly by Professor J. Tvrđý's personality. It mainly concerns the following works: *J. Červenka: Zásluhy stoiků o logiku* (1929); *J. Janovják: Vývoj teorie soudu v řecké filosofii*; *S. Štúr: K logickým problémom súčasnej filozofie*. From among other works: *V. Illenčík: Genéza rozumu* (1942) and *V. Filkorn's Mnohohodnotové logiky* (1948). The reader can find a more detailed list of works in ([10]; [19]).

A number of different international philosophical congresses were held between 1922 and 1948. The journal Bratislava published a review by J. Král on *Osmý mezinárodní kongres filosofie v dnech 2.–7. září 1934* (Eighth International Congress on Philosophy, September 2–7, 1934). J. Král also spoke there about the work of the section of logic ([5], VIII, 571).

In 1936 the dissertation thesis of S. Štúr, the pupil of J. Tvrđý, was published as a monograph [36]. Although according to the title of the work, it should deal with

logical issues of contemporary philosophy, the term “logic” has many meanings there and it is not the issues of traditional logic or modern formal logic that are the content of the work. The most adequate meaning of his term of “logic” is the “logic of philosophy”, the term having been used by H. Scholz. S. Štúr’s attitude to modern formal logic (logistics) and its role in relation to philosophy is critical and rejecting. Hypertrophying of the formal-logical approach to the analysis of philosophical problems can certainly be criticized but it is difficult to agree with the opinion that “logistics not respecting the integrity of the subject studied and its reality are distorting, not only worthless for but even harmful to philosophy with its formal schematization” ([36], 21). S. Štúr’s point is expressed by the question whether “one cannot find common foundations and a higher unity of thought, which is the exclusive mission of the real philosophical logic, in that variety and multiformity ([36], 31). The monograph is of epistemological character, it is not a work on logic. After the establishment of the Slovak State on March 14, 1939, S. Štúr and his supporters were not allowed to teach philosophy at the Faculty of Philosophy of Comenius University. He started to work within the Philosophical seminar in 1946 and lectured on logic in the school year 1945/46. The contents of his lectures were the issues encompassed main in his work [36].

In 1937, J. Tvrđý published *Logika* [38], where “he presented our first greater textbook on this discipline from the perspective of relational logic” ([38], 331). He understands relations as the last logical elements and “all logical concepts are dependent and they are the manifestation of the two basic relations of identity and non-identity”. Logic is “science of universal forms of the consciously justified thought, that is the thought which consciously leads to the truth” ([38], 3); however, not to the material truth but to the logical truth. It should be said that J. Tvrđý speaks about traditional logic, as the content and the structure of his work show. He considers induction to be the basis of all logical thought ([38], 96) but his concept of rational induction is unclear.

In spite of this way of understanding of logic, it should be said that Tvrđý followed changes taking place in the field of logic from the beginning of the century; he had a certain grasp of them and tried to introduce some results into his Logic. It was most marked in the chapter devoted to the history of logic where he provided factual information on the new **formal logic**, **mathematical logic**, **logistics**, etc. and its development from Leibniz up to the 1920s. He also tried to use some outcomes in his account of logic ([38], 37–46, 120–123, 126). Tvrđý’s Logic was the subject of discussion in 1939 in the ‘Spolok pre vedeckú syntézu’ (Association for scientific synthesis), his understanding of rational induction, in particular ([3], 54–56).

Here we should mention the establishment of the Spolok pre vedeckú syntézu (Association for scientific synthesis) on July 23, 1937. The Association brought together philosophers, literary people, and scientists from a number of other fields as well as artists. The programme of the Association contained remarkable efforts to open up the space for the latest theoretical-methodological achievements, achieve-

ments of global science and modern philosophy in the interest of the development of Slovak science. The Association played an important role in the integration of the progressive Slovak intelligentsia, in the dissemination of the rational approach to problem solving and in the building of a barrier against the penetration of irrationalistic, mystical conceptions and opinions. No special attention was, however, devoted to the issues of logic. The problems associated with the theory of science (methodology of sciences) were more dominant at that time and they were presented in the works of I. Hrušovský ([21]). The influence of logical empiricism was evident in his work *Theory of science*. The significance of this work consists mainly in the fact that achievements in modern formal logic, particularly the problems of syntactic and semantic analysis of the language of science and axiomatic construction of scientific systems, were offered to public attention against the background of the issues of methodology. This was of indisputable importance to the shaping of formal logic and to finding a space for it in our conditions. I. Hrušovský had not restricted himself to passive acceptance of logical empiricism but he preserved his critical attitude with respect to it. In the following years he orientated himself towards gradual construction of his own original philosophical conception.

Towards the end of the thirties, *fundamental changes in the field of scientific research into logic, gradual and strong withdrawal from the issues of traditional logic and the growth in the dominance of the questions concerning modern formal logic were observable*. Several studies appeared between 1940 and 1948, which are, from the point of view of the content, structure, and methods used, works dealing with modern formal logic.

An extensive study on the logic of the Stoics written by J. Červenka appeared in 1940 [9]. J. Červenka was Professor at the Slovak Evangelical college in Prešov in 1939–1940. It is probably the *first modern study on the history of logic* published in Slovakia. It highly appreciates the achievements of the Stoics in the field of logic. In accord with modern appraisals and account it states that the “logical system of the Stoics is quite modern in certain ways, it approaches the opinions professed in contemporary logic and the Stoics can actually be considered to be direct predecessors of contemporary modern algebraic logic” ([9], 187). The author presented different objections to Stoic logic occurring from ancient times to the modern age and to the incapability to understand its advantages, mainly the fact that in contrast to Aristotle’s logic of concepts it is “an entirely different type of logic, it is the logic of propositions” ([9], 188). J. Červenka analyses the position of logic in the system of Stoic philosophy and its noetic prerequisites. His focus is on the account of their own logic. Modern analyses of the theory of meaning (semantics) in the Stoics’ understanding, their understanding of propositions (lekta) are interesting. It appears that the Stoics distinguished between simple propositions and compound propositions obtained by “combining simple propositions” ([9], 221). By contrast with Aristotle, who preferred categorical propositions, the Stoics laid emphasis on hypothetical propositions. He showed that the Stoics understood implications as they are

understood in contemporary logic. An important place in his analyses is occupied by the Stoic teaching about arguments, schemata of arguments and rules of reasoning and about the possibilities of their transformation into logical theses. He emphasized that by recognizing the “modus ponendo ponens as the basic form of syllogism, the Stoics also indicated that their logic as a whole is of literally deductive character” ([9], 239). In conclusion, J. Červenka clearly showed the difference between Aristotelian and Stoic logic. He had indicated a series of advantages of Stoic logic and alerted to significant anticipations, which were later worked out in modern formal logic.

It is a modern study. It is a critical and non-dogmatic account of Stoic logic, respecting the outcomes of the latest research and interpretations of the history of logic and also other works of modern logic. In his work, J. Červenka referred to his writing on “the problems of the truth about many values” (about many-valued logic) several times ([9], 231, note 107, 244). This term was also used by J. Tvrđík in his evaluation of the work of J. Lukasiewicz ([38], 43). Although the work about many-valued logic [8] was published as late as in 1945, it was the outcome of Červenka’s work by 1940. From this point of view, it is probably the first work devoted to the issues of *non-classical* logics in Slovakia. In this study, Červenka analyses logics violating some principles of classical formal logic (mainly the two-valued principle and extensionality but also other principles). He showed that deviations from these principles have been known from ancient times. The core of his analysis in this writing are Lukasiewicz’s many-valued logics and brief descriptions of the system of many-valued logic of E. L. Post, intuitionist logic and other systems. J. Červenka formulates a series of his own critical remarks on many-valued logics which are primarily motivated by the defence of the principle of many values and the principle of the excluded middle. He sees the greatest mistake of the creators of many-valued logics in the facts that 1. they tried to transfer mathematical theorems into logic; 2. by building formal systems their contact with reality is cancelled, and, ultimately, 3. the mathematical and logical theorems cannot be identified ([8], 111). These comments do not change the fact that it is a work on modern formal logic. In his further work, J. Červenka partially dealt with the analysis of the seventeenth-century logic as it was taught and cultivated in schools of that time by many Evangelical teachers ([7], 217– 224).

A series of studies dealing with modern formal logic were published between 1940 and 1941. S. Felber published an article on the issues, which, as he underscores, got *modern mathematical researches* moving [15]. He provides factual information on axiomatic construction of Euclidian geometry, on the formation of non-Euclidian geometries, on formalistic, intuitionistic, and logistic streams in mathematics and on their basic characteristics. Further studies by S. Felber deal with the *symbolic logic* (formal logic) and the possible applications of formal logic in science. The first of the studies [11] explores the logical structure of definitions used for the definition and specification of the meaning of the physical terms (ab-

stract concepts and ideal concepts) and seeks for such schemes of the definitions used which are most suitable for the definition of the physical concepts ([11], 115–118). He uses the latest achievements in the research of logic in his analyses (R. Carnap, L.E.J. Brouwer, W. Dubislav, C.J. Lewis, H. Reichenbach, B. Russell, J. Lukasiewicz, etc.).

The other two studies are devoted to the subject of symbolic logic represented by logistics (the name of formal logic in the 1920s and 1930s). In his first study [14] he analyses the language of propositional logic, mainly the syntactic analysis of language. He gives a systematic account of the propositional functions (one-argument and two-argument propositional connectives) by means of a truth table and shows the examples of table verification of the formulas of the propositional logic. He extends the analysis to predicate-logical functions (predicate-logical forms) that is expressions containing individual-name variables, predicate variables and operators (universal and existential quantifier). In his second study [13], he focuses on the account of the axiomatic system of propositional logic (calculus) (Frege's implication-negation system and Russell's and Whitehead's implication-alternative system). He briefly indicated the possibilities of the use of the language of predicate logic for expressing the logical structure of syllogisms, construction of the calculus of classes and relations. He pointed to the importance of Russell's theory of types for the elimination of the paradoxes of the theory of sets.

Similar issues were examined by K. Kattoš [25] in his study published in instalments. In some parts he refers to the work of J. Tvrđý, particularly by stressing the significance of the logical principles formulated by traditional logic (principle of identity, principle of contradiction, principle of the excluded middle and principle of sufficient reason for human thought. He pays attention to the development of these axioms (as he calls them) within traditional logic. He refuses aprioristic understanding of axioms and his attitude that axioms are obtained by induction and unless they are verified they are hypotheses is identical with J. Tvrđý's view. He characterizes the structure of the axiomatic system in modern logic and its basic properties (consistency, independence of axioms and completeness). The conclusion of the study is devoted to the issues of the relation between mathematics and logic. He correctly alerts to the difficulties associated with the reduction of mathematics to logic with respect to the fact that during axiomatic construction of mathematics by logical means there is an axiom of infinity, an axiom of choice, an axiom of reducibility are used, which are not logical but mathematical in character. K. Kattoš's attitude is that of non-reducibility of mathematics to logic. He critically analyses the understanding of apriority and of the evidence of axioms and maintains that "we cannot dispense with the principle of sufficient reason in any logic" ([25], 234). This principle leads us to the inductive beginning of thought. There is a variety of outlooks on the origin of axioms following from different philosophical attitudes. The view that axioms are the outcome of the use of the method of induction is unsustainable. In the study of K. Kattoš methodological and philosophical

problems related to modern formal logic are clearly dominant. This is decisive from the perspective of the goal of this study.

At the end of this part we make a stop at the studies by V. Filkorn, dealing with different methods of the building up of logic and the issues of many-valued logics. Filkorn's approach to logic as a sort of "approximative scheme" in relation to reality and thus to a discipline relative to some extent will be discussed in another study. In his work *Logika a jej metódy* (Logic and its methods) [16], V. Filkorn concentrated on the matrix (table) method of the construction of the two-valued and three-valued logic, also studying the concept of deduction. He formulated an open, disputable problem of the relation between **deduction** and **induction**. However, this issue remains open. In conclusion, he analysed models of two-valued logic, three- and many-valued logics and raised the question of the reduction of functions in many-valued logics.

Like the preceding study concerning the methods and the models of logic, the study dealing with the issues of formation rules in n-valued logic is of metalogical character. In his study [17], V. Filkorn focuses on the issue of partial and total (complete) reduction of truth functions in n-valued logics. He investigates some philosophical problems of these logics and points to the possibility of defining all functors of n-valued logic (where n is the natural number and $n \geq 2$) by one functor denoting the function called by the author many-valued incompatibility (analogon of function denoted by Scheffer functor) ([6], 14).

The problems that attracted the attention of the authors of the studies in 1940–1942 and 1945–1948 confirm the fact that a decisive step was taken from traditional logic towards modern formal logic. The unambiguously dominant questions were: 1. the issues of classical propositional and predicate logic and the methods of the construction of different logical calculi; 2. the issues of non-classical logics, particularly many-valued; 3. metalogical questions concerning the character and the properties of different systems of classical and non-classical logics; 4. philosophical questions of modern formal logic; 5. the history of logic. These are the key problems dominating in that period. From that period onwards, the issues of traditional logic fell from prominence and were not the subject of special interest in the years to come.

The situation was more complicated at secondary schools. Traditional logic was still taught according to the codified and approved syllabuses. It is important that logic has not disappeared from the secondary schools' curriculum. There was still a shortage of teachers able and prepared to provide instruction even in traditional logic. There is a good survey of the teaching of logic from 1918 to 1948, of the number of lectures and continuity of the instruction ensured within "philosophical propedeutics" or "philosophy" ([39]; [35], 176–189, enclosures No. 5–18; [28], 201; [2], 620–623).

After J. Tvrđý had been forced to leave the Faculty of Philosophy of Comenius University and to go to Bohemia as a consequence of the decision of the then re-

gime (he was killed in the concentration camp at Mauthausen in 1942), Professor N. O. Losskii started to teach logic in the school year 1942–1943 and Professor S. Štúr in 1946–1947. Both were professional philosophers. In 1948 V. Filkorn started to work at the Faculty of Philosophy within the Philosophical seminar. He was the first teacher to be engaged in teaching of and research into formal logic on a professional basis. His activities strongly influenced the process of institutionalization and professionalization of logic and the methodology of sciences in Slovakia in the following period. Workers who had a significant hold on the transition from research into traditional logic to modern formal logic between 1940 and 1948 began to orientate themselves towards the issues of philosophy or other disciplines under a variety of influences and mostly stopped publishing writings on logic.

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In this study, we have analysed the first stage of the process of institutionalization and professionalization of logic in Slovakia. The stages and periods of the process can be outlined on the basis of our analysis in this study as well as in another work [6]. The stages of institutionalization and professionalization of logic and methodology of sciences are as follows:

- I. The process of institutionalization and professionalization of logic and methodology of sciences between 1918 and 1948;
- II. The process of institutionalization and professionalization of logic and the methodology of sciences between 1949 and 1962;
- III. The process of institutionalization and professionalization of logic and the methodology of sciences between 1962 and the present.

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