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DEVELOPING CURRICULUM FOR THE ENGINEERING MANAGEMENT STUDY MODULE: CASE STUDY

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Abstract

This paper presents developing of the curriculum for the engineering management study module, in the transition environment. The study module was realized during past six years at the Technical faculty in Bor, which is the part of the University in Belgrade (Serbia) and authors of this text believe that it is the right time to perform a critical evaluation and comparasion with foreign practice of management studies in the USA and EU academic environment. Considering the worlds best practice in this field of education, characteristics of the transition economy surroundings and the available resources of our school, where this program is realized, MSc, BSc and PhD level curriculum can be defined including the courses model based on the graduated students competences.

Keywords: Management, engineering management, curriculum, education

1. INTRODUCTION

All post communistic societies were involved in the transition process during which number of dramatically changes are happening. Serbian society is not different from its surrounding, with exception that those changes are even slower here. Economical changes are especially complicated which leads to slow social development. The process of transition demands restructuring of the industry, managers who possess new knowledge and arts, while for good business there is a need for complex organizations which can successful operate in the global market environment.

Educational programs and institutions consisting Serbian academic education are in the process of national accreditation, which is necessary for comprehension in European educational associations. This process should be completed until the end of 2009.

Academic education in the field of management sciences has the dominant importance in reconstruction of Serbian

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industry. Management studies in Serbia were for the first time organized at the Technical faculty in Bor, during 1992., as the part of EU project called TEMPUS. Several famous European universities took part in realization of this special course on strategic management (Grenoble, Erasmus, London, Berlin, …).

In Serbia, nowadays, management studies are organized at few private universities (with students obtaining diploma in the field of economic science) and few public universities (where students obtain diploma in the field of engineering management), among which the Technical faculty in Bor.

Technical faculty in Bor (TF Bor) is located in the East Serbia, close to Romanian and Bulgarian state border. Bor's region has well developed industry, especially: mining, metallurgy, technology, agriculture and energetic which was the main reason for developing engineering management study program, during the year 2002. After six years experience with this program, there are about 1300 students at the bachelor level, about 200 students at the master level and about ten students at PhD level, which indicates great interest for this study program. Besides, over 200 graduated students are now employed in the Serbian companies, at the positions with high level of responsibility, while over 10% percent of our graduates have left the country and work abroad - mostly in the EU countries and USA.

Similar study programs in the surrounding countries (Hungary, Slovenia, Romania and Bulgaria) were developed, during transition period, with great assistance of the European universities. Good example is industrial management study program developed at the Sofia university, developed with assistance of the University in Nottingham (Ratchev et.al., 2006).

Developing of the curriculum, for the study program presented in this paper is aiming to analyze experiences obtained at technical faculty in Bor in the period from 1992 until today (especially after 2002) and to compare them with the best practice of management studies at EU and USA universities. Main motivation is our tendency that knowledge, which graduate students obtain at TF Bor, have adequacy for the industry in local and global surrounding. Program developed in such a way with an ambition, after national accreditation which will happen during 2008., to be proposed for European accreditation and organized in the form of international studies. This kind of international program should be interesting for the students in surrounding countries, Bulgaria which borderline is only 50 km away form TF Bor and Romania (80 km to its border). Both of the countries are already EU members.

2. DEFINING THE PROBLEM

Experience reveals that most of our students are focused toward general management studies, which has a positive response from the restructured economy in the transition environment where those students are employed after graduating. At the same time, teaching staff is mostly consisted of the professors with the background in technical sciences and more then one MBA specializations. This was solid base for developing curriculum in the field of engineering management (the name was adopted from national nomenclature and in general, it corresponds to the industrial management in USA and EU). Additionally,

local environment, as an industrially developed zone (including near-by regions in the Bulgaria and Romania) having export orientation, lead the authors of this paper and management of TF Bor to develop the curriculums with following subjects and resulting diplomas:

a) at the bachelor level (8 semesters) – management engineer

b) at the master level (two semesters) – graduated engineer of the management – master

- module I: industrial management,
- module II: international business

c) at the PhD level (6 semesters): doctor of technical sciences – engineering management

Each semester is valuated with 30 ECTS points.

Analyzing the articles published in the distinguished journals on management education: The Academy of Management Learning and Education, The Journal of Management Education and Management Learning, Korphailo et.al. (2007) has defined following four questions during formation of the management education concept:

a) Who is obtaining the education?

b) How the education is obtained?

c) What is to be achieved with the obtained education?

d) What is justifying tendency to reach certain goals and to apply specific set of educational means?

In this paper question (a) was reformulated as: Who is obtaining the education and from whom? Searching for the answer on the question (a) authors of this paper have focused on type of the students and teachers who would participate in this special form of education, having in mind that in the UK and USA management studies are regarded as elitistic regardless the certain criticism (Locke 1996; Mintzberg 2004). Cranier and Dearlove (1999) stated that business schools simply facilitate mechanisms for selected elite: “people do not attend top class business schools to study, they tend to become members of elitistic clubs, which do little or noting on improving their management skills”. Lorange (2002) points out that main challenge for business schools is achieving possibilities for leaders’ positions which are most attractive to future students. Those facts are in particularly important for future students in the countries with transition economy, where aspiration toward management studies is even higher because of the opportunity for worldwide career development – especially in the USA and EU. This way, main factor when choosing education is prestige. Institutions having high reputation institutions, which Management department on TF Bor tends to become, are attractive if their future students recognize the opportunity offered to them concerning chances to further build their career after graduating. As a result, Faculty will have better position when recruiting new students which consequently increase its ability to produce new members of future business elite which is jet to be developed in the transition countries. Through management studies most of the students obtain certain type of education which is already at the higher social level, since those who employ people prioritize candidates which posses’ knowledge similar to their own (Engval, 2007). Besides, on this way, specific kind of net is created which is the other feature of management education through social interaction among the students and chances for long-term friendship and professional contacts. Thus,

management education, have an important role in creating elitistic network as well as social mobility (Hugstad, 1983).

To accomplish scholar goals which should be realized in proposed curriculum, the model of business education, based on competences as a higher level compared to knowledge, is the main object of educational activities (Koriaho et.al. 2007). Competence demand skills and not the knowledge (Brewis, 1996). Practice reveals that most wanted graduated students are those which, besides the knowledge of business disciplines, are able to demonstrate effective managerial skills on specific and measurable way (Brownell and Chung, 2001).

The key competences, at the end of the education process, through curriculum of engineering management should be: active recognition and understanding of the company's organizational system and management methods which will lead to super ordinary results as the outcome of the processes of planning, organizing, human resources selection, motivation and control. Comprehension of the organizational harmonization and its adaptation toward global environment is one of the graduated students key competence which should distinguish them from others. Top level comprehension of quantitative methods, accompanied by utilization of modern informational technologies, is special attribute of each curse in the curriculum discussed in this paper. The program is conducted through progressive forms of socially recognized theories. Study process is upgraded in moral aspect with addition of one important component, which is practice resulting from experience. This way, students realize that they are performing in the real time context, applying relevant knowledge and skills. Art of knowledge creation during study program, in its essence, is dedication to educate future managers toward individual validation of performances in their work and achieving relevant goals in real life situation (Bigelow, et al., 1999).

Student, who fits in this model, after graduation, becomes concurrent, inductive and capable for further developing of his/hers business capabilities. Students have predispositions to become useful and further developed. This should be taken in consideration, even during selection of the candidates for further advanced management programs, as suggested by McEvoy et al. (2005). Selection of the candidates for those advanced programs, including engineering management program, should accommodate segregation of those whose potential for competences developing is higher comparing to pure scholar knowledge.

Professors' role is to identify and categorize relevant competences of his students and to define how they could be further developed. Professor isn't just ordinary OB teacher. He must possess experience in professional fields. Besides, he must take responsibilities for human development of his students to limited level. Since everyone try to presents the best of his talent, management studies serve society best if revealing the most appreciated competences and selecting who will attain them at the end. To develop this concept the practice must be incorporated in educational process, since management couldn't be learned in special lectures separated from the experience. It's not enough just to bring practical experiences to classroom in the form of narration and case studies, to visit practitioners on their workplace or to present empirical data during presentations. Most effective way for students to learn is from other managers and during engagement in

solving real time problems which occur in their surroundings (Realin 1997).

Professors should take responsibilities for group study and with time to transfer the responsibilities to their students. This question isn't placed in the focus, nevertheless this question creates environment in which everyone is free to upgrade and to develop himself. This approach is defined in so-called Bologna process in which more then 50 European countries are involved at this time.

3. CURRICULUM STRUCTURE

3.1. The purpose of the study program

The production scope, although dominant in most of the transitional economies, is more and more transferred toward service sector. According to the strategy of South East Europe development until 2010., in the conditions of global integrations, which include Serbia, structural development will be orientated toward service sector. This rise demands for high specialist knowledge including management science. Accordingly, the purpose of engineering management study module at BSC and MSC level can be realized through following activities:

- study of the organizations as the whole, means of organizational management and perspectives of organizational environment changes;
- preparation for the future career development in management and international business through developing of the professional skills and, in the same time, abilities necessary for research in related fields of science;
- developing abilities for applying obtained knowledge and understanding complex domains of industrial management and international business, from systematic as well as creative point of view, aiming to improve management and business practice;
- stimulation of long-term processes of learning and professional development of the future managers enabling them for independent and original work and further contribution to development of management practice in their social environment;
- advanced education should be available at the PhD level for advanced students who wishes to continue their careers in academic, scientific and production research institutions. A doctoral studies course includes rigorous research methodology which, besides being intellectually simulative, gives challenges for best students. Combination of properly chosen subjects offers rear possibility for students to have interdisciplinary approach in research, methodology and skills of the empirical and analytical management disciplines. It consists of advanced methods and subjective orientated seminars. Additionally, this program demands progressive investigations and completion of doctoral thesis after publishing of at least one scientific paper in a journal from SCI list.

3.2. Study program goals

The theory and practice of management is related to planning, organizing, personnel selection, leadership and control – main management functions – under different contexts of all type of the organizations, regardless their ownership status, size and age. Ultimate managerial task consists in introduction right goals, as well as optimal planning and utilization of human, financial and physical resources of the company.

Accordingly, management study is

orientated toward successful operation of all types of organizations. This means that, main purpose of this program is to introduce students with width spectra of theoretical and practical principles in management. Students will become able to realize crucial management functions, and have opportunities to apply basic managerial skills such are problem solving, team work, communication, decision making under uncertainty etc. Study program include behaviorist approach, which apostrophizes qualitative management aspects.

3.3. Competences of graduated students

Competences of graduated students on this study program must reach highest level concerning disciplines included in the curriculum. Common competences are consisting understanding and overall ability to analyze, synthesize and predict solutions and consequences, accompanied with critical and self-critical process of thinking. Graduated students, are mostly wanted if they possess not only business related knowledge, yet have abilities to demonstrate effective managerial and practical solutions at specific and measurable manner (Brownell and Chung, 2001).

With adequate students at MSc, and specially PhD level, there is ability to develop adequate business policy and strategy which fulfils stakeholders' needs in the frame of dynamic market environment. Developed skills for critical thinking, analyzes and synthesis, argument drawn theorems, identification of implicit values and adequate generalization, becomes the part of their competences. Developed skills of qualitative problem solving and decision making, accompanied with creation, evaluation and adequate option selection are also on the list of their competences. Also, those courses should develop abilities for further learning and necessity for reflective, adaptive and collaborative learning of graduated students.

3.4. Program structure

Program structure – curriculum – was constructed according to the preset goals, concerning engineering management in general, through several group courses: academically – educational, theoretically – methodological, scientifically and vocationally applicational which enables achieving of the programs goals and competences of graduate students.

The base of study program lean on properly selected students, after rigorous selection of the candidates, for the advanced program of engineering management which demands choosing those who's potential for competences development is higher then for development of pure scholar knowledge.

Logical superpose to this base are carefully selected professors which, besides undoubtedly possessing theoretical knowledge, carry practical knowledge from good companies in which most of them spent 5 to 10 years on top level managerial positions. Some of them have long-term consulting experience in world known companies which gives them direct connection to real time management problems. Moreover, part of educational staff have teaching experience of more then twenty years in the field of production and engineering with remarkable CVs on international level. Combination of properly selected students and carefully chosen professors require demanding teaching plan and program based on best practice from business schools in UK and USA (Oxford,

Nottingham, MIT, Clemson, …). Logical outcome of study program, defined in this way, are quality and competences of graduated students which are accepted in all companies in near, as well as, in wider environment. Attaining of such goal is possible only through educational process which offers high level knowledge and skills in the field of following disciplines at BSc level:

- Mathematics and statistics,
- Informational technologies,
- Social sciences and languages,
- Economy and business,
- Management,
- Quantitative methods,
- Law, as pillars for the knowledge and skills content which is most important competence of graduated students at first BSc level. Pillars for the MSc level are:
- Management,
- Production,
- Technology,
- Business.

Basic disciplines at PhD level, as highest educational level, demands professors with international scientific reputation and advanced students with higher level of knowledge, intelligence and desire for success which enables outlet quality that can be integrated in international scientific elite. Main scientific disciplines required for attaining these goals are:

- Scientific and research methodology,
- Quantitative methods,
- Strategic planning,
- Economy,
- Production.

Schedule of the individual disciplines, during realization of study program, through

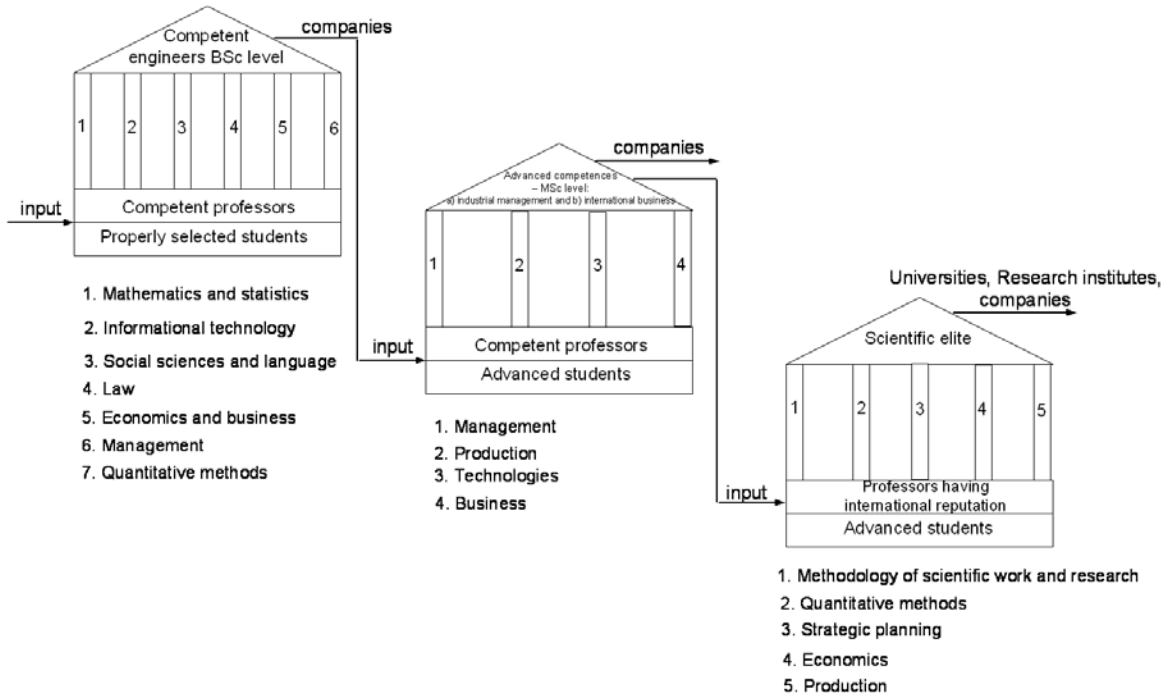

Figure 1. Structure of engineering management study program at BSc, MSc and PhD level

academic semesters until completion of study at PhD level, presents thematic design of engineering management study program which is schematically represented in Figure 2. Content of study program is composed on "cascade principle", where knowledge obtained at one course "overflows" to another.

These course structures were developed according to the regulation of the National accreditation body of Republic of Serbia and experience obtained during University practice of such a program realization. Course structure is modulated on 120 ECTS points for one academic year and at least 600 hours of active tuition (lectures and practice) per year, followed by students' independent work. Bachelor level is completed after four academic years, master level after one and PhD level with three more academic years. Independent, practical, students work is largely accepted in the program structure, especially at the MSc and PhD level. In the thematic modules, courses are defined according to the best international practice and benchmarking partner was the Nottingham business school from England.

Main subjects which are scheduled to be studied during program realization could be concluded from the structure of the study program. What is more important is the essence of educational model which could be portended mostly from the journals, covering educational problems, published in the US educational region. Korphiano et al (2007) discovered several models of management education in Anglo-American literature: traditional; education based on competences; education based on actions and critical education, which doesn't mean that there aren't few other alternatives. In transitional economies, US educational models are mostly popular; on the other hand, National accreditation body in Serbia prefers EU practice.

It is appropriate to ask: "Which model is better"? Moreover, which tactics to adopt for the realization of management education in proposed study program? Not less of the problem is necessity for professors and students overcoming obstacles in the environment created by others, which lies in historical laminar reality of the education and with the practice hard to be changed.

3.5. Educational model

In the transitional economy, such is Serbian, it is easier to accept practice obtained from Anglo American educational region then models developed as the result of own experience. This is a paradigm on which even National accreditation body insists. Besides, models copied in this manner often gives poor results caused with different environmental conditions (Parriton, 2007).

Numerous investigations conducted from Critical Management Studies (CMS) aspect, in England, were based on debates of utilitarian compared to liberal education in the field of management which was described in the book: Critical Management Studies (Alvesson and Willmot, 1992). This book is accepted as beginning of CMS project in the UK. Regardless to criticism toward educational models in the USA and UK, it is not expected that some dramatically changes will happen in the near future (Perriton, 2007). Innovations that could be expected in management education are possible combination of theory and practice (Bailey, 2004). This general proposition, which have equal position in management practice for determining pedagogical approach, is also obvious in the works of other investigators (Smith, 2003).

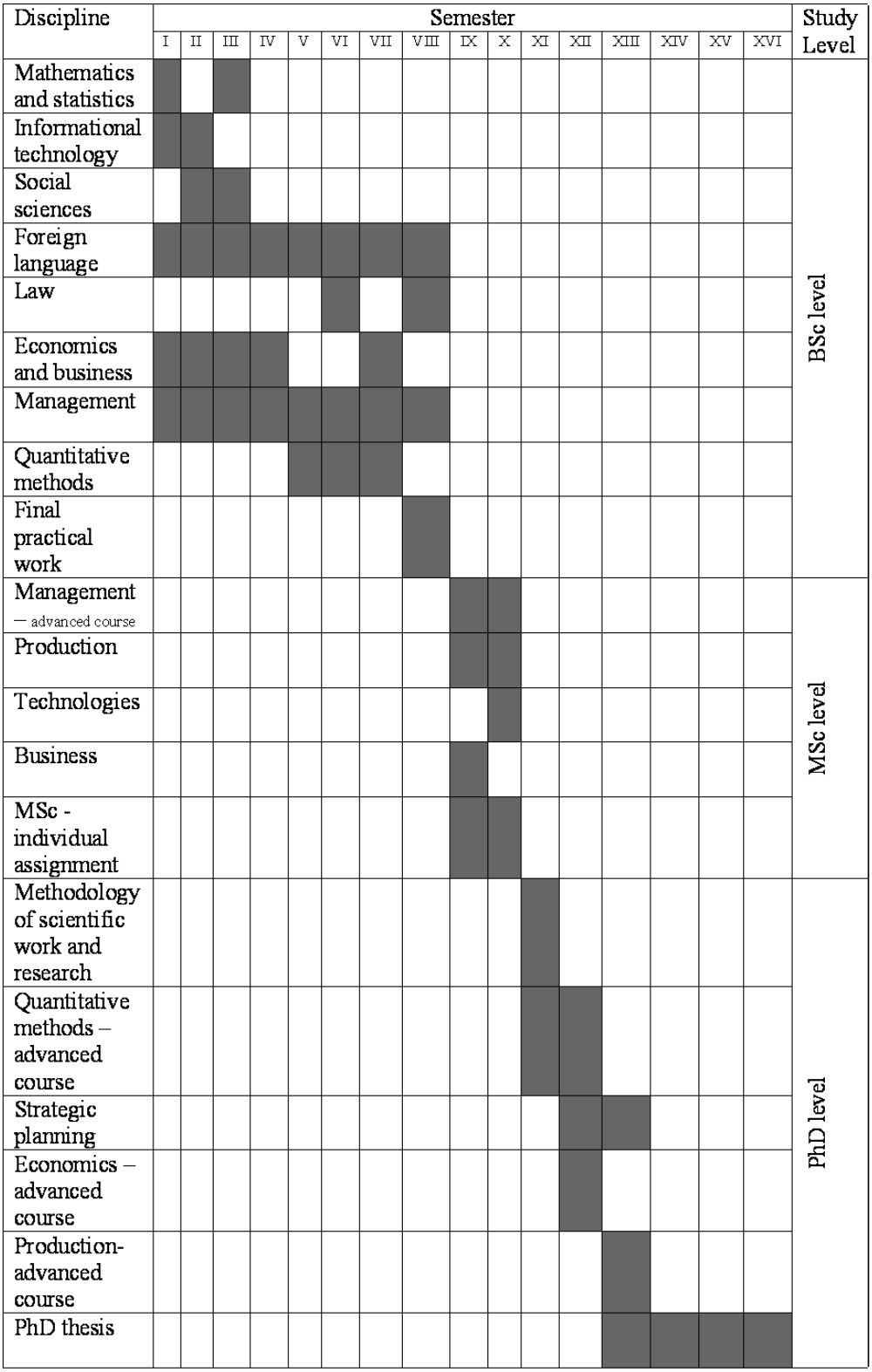

Figure 2. Thematic design of engineering management study program

Applied educational model should, above all, attract students regardless severe selection process which follows. This is necessary for schools to survive at decreasing market of intellectual services such is in Serbia and nearby countries. Idea of engineering management tuition, as professional education and expansion of the US model prototype, could be important when attracting students, resulting from international diffusion of organizational practice.

Competences in recognition and solving the practical problems in the companies, as an outcome of management education in transitional economy, gives best chances to graduate students to create net of intellectual elite at the periphery, as well as with educated world elite which comes from Anglo American educational process. Accordingly, educational model based on competences is imposed as logical for the transitional conditions, which demands great efforts from professors and students during process of competences building using best practice during study program realization.

4. CONCLUSION

Presented curriculum for the study program of engineering management is created according to the best practice at the universities in the USA (University of California, MIT, Clemson University) and in the EU (University of Nottingham, University of Sheffield, Oxford and KTH Stockholm). It was created as an answer to the needs of the students in the Serbian transitional environment, during six years educational experience according to the curriculum discussed.

Students' interest for this curriculum is evident, because they recognize that offered knowledge is necessary for developing successful careers after graduating. Best recommendation for future students are first 230 graduated engineers of management that find their employment easily, and when evaluating their competences after one year work experience, their employers rated them very high (averagely above 4 in the scale from 1 to 5).

Proposed model of curriculum realization is based on competences, which imply that during realization, special care is given on utilization of theoretical knowledge when solving the problems of real time management, which creates recognizable competences of our students. This outcome of the educational process should be initial nuclei for future growing of the national intellectual elite that have potential to be included in the international elite net which already exists.

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