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ENTREPRENEURIAL EDUCATION FOR ENGINEERS

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Abstract. In a knowledge-based society, higher education institutions become agents that generate the welfare of society and its members. They become identities that create knowledge based on scientific research that, being implemented in society, turn into practical results. This knowledge forms the competences to be formed through university study programs. A modern approach to developing a study program that meets the current needs of the society should be geared to the training of competences that a professional has to possess, that will be assimilated by the dynamic social-economic environment. General requirement: the engineering profession should be taught by combining engineering and managerial competences.

Keywords: *entrepreneurship, entrepreneurship education*

Introduction

The mission of higher education institutions must respond to the needs of students' professional development, so that the young specialist can achieve the opportunity to enter the labor market after completing his/her studies. At the same time, the university has to meet the necessary competences of the country's social-economic environment. It has to be borne in mind that these requirements change over time, they are influenced by accelerated dynamics conditioned by the rapid evolution of technical and managerial paradigms. Thus, the environment in which university graduates will work professionally changes continuously, which requires an effort to adjust and predict university study programs. A modern approach to the development of a study program should be based on occupational standards and the qualifications framework, must be geared to the acquisition of skills that a professional must possess, that will be assimilated by the dynamic social and economic environment.

A young engineer must acquire the theoretical and practical knowledge needed to manage a technological process, but at the same time he/she must have the necessary knowledge to solve a large number of issues related to managerial and marketing area, organizational behavior, communication and efficient negotiation, etc. This emphasizes that today the engineering profession must be trained by combining engineering and managerial competences.

General requirements

In order to achieve the entrepreneurial training goal, it is necessary to rethink all study plans and programs at all levels, it is necessary to explore the socio-economic environment, all members of the entrepreneurial cluster. Thus, any university study plan and program, either for the Bachelor's degree (cycle I) or Master's degree (cycle II), must be elaborated taking into account the following moments:

- Existence of economic and social demand for this specialty;
- Coordination of the study plan and programs with social and economic partners, professionals and professional associations;
- Developing entrepreneurial competences for future specialists is mandatory.

Entrepreneurial education became a subject of training in Moldova in 1994-1995. The first training for entrepreneurs was mainly focused on adults who were made redundant, later oriented

towards those who wanted to set up a business. As a rule, the training was supported financially by international organizations such as TACIS and the World Bank, followed by other international projects supported by USAID, ASDI, GTZ, etc.

The first hours of entrepreneurial education for students in higher education were included only in the years 1995-1998. In some institutions, these subjects were called the Basics of Entrepreneurship, others were geared to developing the business plan. In economic specialties the entrepreneurial education also had the form of studying the subjects of management, marketing, international relations, etc.

At present, almost all specialties provided by higher education institutions in the Republic of Moldova have included in their study plans subjects oriented towards entrepreneurial education. But the questions - What is the optimal course content? What is the best way to teach this subject? - are still current in the academic environment.

Integration of entrepreneurial disciplines with technical disciplines

Entrepreneurial and managerial teaching efforts for master students should take into account a number of basic moments:

- What is the purpose of inclusion in the study plan, is the discipline about entrepreneurship or is it for entrepreneurs or for those who want to start a business?
- hich target group is discipline oriented to?
- What is the most appropriate structure of the discipline (course and practical classes ratio)?
- What kind of pedagogical and didactic model is more appropriate in order to achieve the objective of entrepreneurial education?

Reality shows that most higher education institutions teach entrepreneurship using similar teaching methods as for other academic disciplines. Everyone understands that this subject has to be taught differently, others even try to change the principle and the way of teaching. Teaching this discipline needs to be mixed with elements of active and interdisciplinary training competences. At this level, the objective of the discipline should be oriented towards training for the entrepreneur, along with the objective of making the student learn about entrepreneurship.

Some higher institutions have introduced the “Assistance in Business Start-up” discipline, which has a curriculum similar to the content of a business plan. But practice shows that for a non-economist student, a technician, just teaching the discipline oriented to learning how to draw up a business plan is little. The study plan must also include commercial economic disciplines, disciplines that form business opportunities. Exploring innovative business ideas is the most rational way for technical students. They need to learn to generate different business ideas, see and evaluate business opportunities and plan how to turn them into real business. Also, students need to be trained how to work after starting a business, how to run the business day by day.

Thus, study programs for technical students should be focused on entrepreneurial innovations, which would complement the entrepreneurial training of future specialists and managers. Such studies would make a much greater use of entrepreneurial training than teaching a course in “Basics of Entrepreneurship” or “How to Draw Up a Business Plan”.

Unfortunately, today this approach is rarely encountered, a discipline or at most two that remain is regarded as a standard, for these students interdisciplinary courses are also held very rarely.

Specific content for different students

International practice shows that some interdisciplinary disciplines of entrepreneurial training can be held jointly for students from humanitarian and technical profiles with those from the economic profile. This practice motivates learning from one another. Students understand better the specifics of competences when they are exposed to these mixed series of students, get acquainted with the logic of thinking of different study profiles. A progressive experience for

interdisciplinary courses is the involvement of managers of innovative enterprises in the conduct of entrepreneurial training.

The professional skills and competences specific to the engineering profession should be oriented towards the following:

- Professional skills and competences, materialized in core knowledge related to the field of activity, which induce the understanding of the interdisciplinary knowledge necessary for a manager engineer;
- Communication skills of your own ideas, perceptions;
- Knowledge about business and organizational culture.

Thus, for students of technical profile special disciplines should be offered focusing on specific entrepreneurial needs:

- commercialization of technical ideas;
- patenting and protecting technical ideas;
- financing innovative technical ideas;
- internationalization of high-tech ideas;
- commercialization of spin-in and spin-off processes.

While the following modules are relevant for students humanitarian profile:

- social entrepreneurship;
- conceptualizing ideas for new business;
- methods to stimulate innovation;
- business languages;
- communication.

Discussions with contemporary managers show that it is very important for the manager to be universally developed. They greatly appreciate programs that develop teamwork and effective communication skills, analytical and decision-making skills and knowledge, problem solving in a wide range of managerial activities, proper management and administration of the business situation, studies should focus on a variety of managerial careers.

The content of disciplines for different levels of study has to be structured on the same elements at different levels, but naturally the theoretical and practical components are advancing with the advancement from the Ist cycle (Bachelor's degree studies) to the IInd cycle (Master's degree studies).

Synthesis of the methods and techniques used in the teaching of entrepreneurial training subjects

Methodologies and teaching techniques specific to non-economic studies

Learning methods for this study profile do not differ from other profiles. The teaching of these disciplines must still be activated and energized by modern approaches, teaching from the teacher to the student should be also avoided. From discussions with professors who practice entrepreneurial teaching, we can conclude that there are still differences between teaching a technical and economical course. Being exposed to business situations and challenges, students need to be stimulated to find solutions to problems that can arise in business practice. As several variants will appear, students should be encouraged to discuss and evaluate these variants. In this case, the teacher has to change the role he/she traditionally has, from the role of transferring knowledge to the role of facilitator of discussion, so the benefit of the course is to facilitate the transfer of lector-student and student - student knowledge.

Methodology and didactic techniques for teaching entrepreneurial disciplines should not be different for the first cycle and the second cycle, but the complexity of the analyzed and discussed issues should advance from cycle I to cycle II.

Teacher's knowledge and experience

Unfortunately, few teachers teaching entrepreneurship courses have a business set up and

management practice. It is understandable, as it is very difficult to attract managers who manage a business into the didactic activity. It is therefore very important to stimulate by various methods the involvement of experienced businessmen/businesswomen in the entrepreneurial training of students.

It is easier to attract people who have recently started their business, because in this case a gaining process is taking place on both sides. The young entrepreneur can discuss a concrete case study focused on the problems he/she faces, thus learning from the teacher and the students. This ambiance can also continue if some of the students then have a practice internship at this enterprise.

Cooperation between universities and businesses

Effective co-operation requires a win-win approach from both sides: teachers and students contribute with the transfer of theoretical knowledge to entrepreneurs, and they in turn - with the transfer of practical knowledge. For a more positive effect, collaboration is good to be a long-lasting one, involving entrepreneurs and business leaders as internship supervisors and individual work papers. Their experience can be used to develop case studies, company data - to develop themes and practical problems. It is very welcome when study programs are formed and discussed with experienced entrepreneurs. The enterprise can benefit from collaboration by involving students in innovative research and activities, market research, marketing activities, etc. Taking into account these basic reasons, close collaborations can be created between SMEs active in different fields of activity.

Mobility of teachers and researchers

The mobility of teachers and researchers from higher education institutions and businesses is still poor. Practically very few entrepreneurs agree to teach courses at the university, where the remuneration is too low compared to the efforts they have to make. On the other hand, not too many teachers manage to start a successful business.

A good way is to attract entrepreneurs and managers to teach part-time. Another case would be to attract teachers with appropriate knowledge and skills into the practical work of enterprises either to practice or as an instructor and consultant. The realization of these collaborations is very important for the scientific and teaching activity of both entrepreneurial and technical disciplines.

Network of dissemination of the methodology and teaching practices

The idea of building such networks is not new, but there are very few cases of practices implemented in Moldova. We can only give examples of conferences organized by some higher education institutions. Here, it would be a good practice to organize conferences, workshops under the aegis of the Organization for the Development of Small and Medium Sized Enterprises (ODSMSE). Creating and delivering inter-university projects is a valuable experience in improving teaching methods and techniques, changing opinions, finding and applying best international practices. Such an international TEMPUS project supported financially by the EU is currently implemented by the Technical University of Moldova, where 5 other universities in the country are also involved: SUM, CCUM, AESM, SUAM and SU from Comrat.

Success factors and good practices

The evaluation criterion of a success is the significant involvement of students of both university cycles in the complex training of future entrepreneurs and managers. This training would be fruitful through the setting up of new businesses, particularly of innovational ones; by acquiring business management skills; by contributing to technical and managerial innovation processes in existing companies and organizations. Upon graduation from higher education institutions graduates must be able to enter the entrepreneurial environment in order to manage their own company or become a good manager in a business management. They must realize these moments by being trained through the accumulation of theoretical knowledge and practical

entrepreneurial and managerial skills. In other words, they must be prepared for a future creative, innovative technical and managerial work. Naturally, this statement is relevant for both private and public sector activities. The society needs managers with creative, innovative approach and for all public posts.

The number of courses with entrepreneurial-managerial orientation is important, but the quality of the courses, the quality of the final product, the theoretical and practical knowledge the student accumulates is very essential. An important success factor is essentially to what extent traditional learning has been replaced by a well-balanced pedagogy through the predominance of creativity, which is characteristic of a new managerial culture. Attempts are made, but there is much to do in this direction. Of course there are many barriers: bureaucracy, organizational inertia, conflicts between didactic and research activity, low wages, etc. But here too are positive changes. More and more young graduates with new modern visions are convinced that theory and practice are no longer on different banks, they go together, combine into a modern ambience that leads to success. Several managers are convinced that they have good management school needs, they come to get their Master's degree a few years after completing their Bachelor's degree. Many of them with technical studies background come to do their master's degree in economics and management.

Requirements to increase the number and quality of economic and management disciplines come increasingly from the business world, which is very good. Studying just to get a diploma is a little expensive. The quality of the future national economy depends on the quality of master studies. We need to learn from other countries that are doing better in this area.

Criteria for evaluating good practice in teaching management courses

There are some situations that need to be resolved:

- The amount of hours with economic and managerial orientation in the total hours of teaching;
- The extent to which didactic activities would have greater effect compared to traditional teaching?
- How to attract experienced companies and experienced specialists with benefit for both sides, businesses and students?
- Which teacher, of technical or economic discipline, should teach courses in entrepreneurial and managerial education?
- How to train pedagogical and entrepreneurial / managerial competences in teachers?
- How to rationally combine technical and managerial competences in the training of students?
- How to find the optimal combination between the accumulation of theoretical and practical knowledge?

There are also other directions for discussion:

- What is the teaching strategy in this area?
- Understanding the need for cultural change, switching from bureaucratic management to managerial management mode;
- The need for social responsibility in both public and private organizations and institutions;
- Developing an action program with multiple tasks of optimal combination of traditional teaching with practical combination, teaching of technical subjects with the involvement of the acquisition of entrepreneurial skills, acquisition of traditional technical abilities and new innovative and creative elements;
- Involvement of owners, entrepreneurs, managers in the development of study plans and study programs;
- Attracting owners, entrepreneurs, managers to contributions of practical knowledge, experience and financial resources compensating with contracts with students, teachers and researchers.

Conclusions

To increase the efficiency of managerial training, study programs should be geared towards training the competences needed for a manager engineer. In order to promote university studies, it is necessary to have such a structure of disciplines that students are convinced that they acquire the skills and competences necessary to hold the profession they want, to be able to tend to the managerial level which they dreamed of when coming to studies.

For the training of entrepreneurial and managerial competences, the following are proposed:

- For the purpose of employing and starting up their own business for all specialties of the first cycle, Bachelor's degree, disciplines related to the foundations of entrepreneurship must be introduced;
- Interdisciplinary courses that would generate innovative business ideas, stimulate the use of new business opportunities must be introduced in the second cycle, master's degree;
- Interdisciplinary disciplines for master students should stimulate learning to develop the business;
- The approach of knowing what to do should be complemented by a practical approach to doing;
- Teaching technical subjects should be action-oriented and train creative competences;
- Traditional "passive" teaching of managerial education disciplines needs to be changed into active training.

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