Business-Science-Education: a Collaboration for Competitive and Sustainable Growth of the Wine Industry

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Abstract. Optimization of the collaboration “business-science-education” is a prerequisite for the increase of the competitiveness of the enterprises. The article introduces a scientific solution of a practical problem through the creation of a model for informal education of specialists in the wine industry. The presented models are a part of the Virtual Educational Space (VES) as a smart space, context-dependent, based on a script and a controlled infrastructure. The results of the approbation of the model prove its significance for the practical processes and the increase of the competency of the specialists in connection to the implementation of innovation. Particularly to the wine industry, the suggested model for informal education represents a specific innovation, which approbates the known “good practices” in the strategy “Lifelong Learning”.

1. Introduction
The competitiveness is an economic and managerial category, which in conditions of an increasing globalization, appears as a main force for the development of both each individual business units and national economies. The category is examined as a multi-aspect and polyvalent concept, in which evaluation is a leading priority for each management level. The tendency in the contemporary world forces the enterprises to be proactive, future-oriented and striving for foreseeing future changes. This is connected with the search and formation of new means for competitive behaviour so as to position themselves strategically on the market and generate their sustainable development.

To a huge extent the competitiveness is formed by the innovation activity of the business enterprises, and a huge impact on this activity has the national innovation policy. A possible path for its application is by the use of science and knowledge in the practical activity and the creation of innovation economy and national policy that correspond to the requirements of the EU. With the adoption of the Lisbon strategy (year 2000) has been emphasized on the scientific researches and innovation as key competitive advantages to which the member states of the EU have to aim as goals.

In 2010 the strategy is changed into “Europe 2020”, which has “3 mutually fortifying priorities” – for a smart (economy of knowledge), sustainable (competitive economy), and integrated (economy with high levels of employment) development. One of its main goals is the investments in research and development activities (R&D) with a relative amount of 3% of EUs GDP. The latter is also a main goal of the functioning in the boundaries of the EU the Competitiveness Council, which functions in 4 main areas for “increasing of the competitiveness and enhancement of the growth of the EU”, one of which is exactly innovation and scientific researches.
As a result from a preliminary research by a team of experts, regarding the realization of a project in the development of a conceptual model for implementation of innovation and increase the competitiveness of industrial enterprises № KP-06-M25/5/17.12.2018, financed by the National Scientific Researches Fund, 2018-2020, defined the need for increasing research activity so as to ensure opportunities for informal education, which has to be targeted to specialists in the wine industry enterprises. The obtained results show that there is a need of an appropriate form of education for the enhancement of the levels of innovation in SMEs in the wine industry. The managerial staff is not well aware of the opportunities and does not have a clue of those, which can be integrated in their enterprises. The collaboration between the experts in the project and team members of wine enterprises formed prerequisites for the creation of a unified information archive of knowledge or Virtual Educational Space (VES).

The goal of the research is to present the relation between the real-world problems of the business, the expertise of the scholars, directed to the solving of the problems and the opportunities of informal education of the specialists.

2. Triangle of Knowledge “Science-Business-Education”
A main challenge for Bulgaria is to achieve the goals set by the adopted in 2011 national strategy for development of scientific researches 2020 [1], which aim is to “enhance the development of science in Bulgaria so as to convert this experience into a factor for the development of the economy, based on knowledge and innovation activity”[1].

The aim is at encouraging the interaction of the “triangle of knowledge”, which includes an interconnected system “science-business-education”. The latter corresponds to the idea of approbation of the scientific researches and realization of the educational product in the practical activity with intent to form a unified scientific-manufacturing process and a competitive economy. The “triangle of knowledge” is accepted as a “main constructive element, which creates, generates and transforms knowledge from science to the business and its use in the real economy.”[2].

In the current research is presented an example of collaboration between experts from science and representatives of the business sphere. Science attempts to provide a solution to a real-world problem for business, determined by a preliminary empirical study. The developed model for informal education with the help of the formation of smart agents and ontologies will provide guidelines to the representatives of the business and science spheres for the level of acquired education by the specialists.

2.1. Correlation Science-Business
The correlation between science and business have been evaluated in the annual report for global competitiveness (The Global Competitiveness) of the World Economic Forum. The same is accepted as one of the fullest, most complete and representative sources for evaluation of the competitiveness of nations. The data for economic growth is presented via the Global Index for Competitiveness (The Global Competitiveness Report), which shows the prosperity of each individual country. The report is prepared on the basis of 12 points (columns), divided into 3 groups, which measure the macro- and microeconomic aspects of the competitiveness, encompassing 111 indicators that take into account all specifications of each of the individual countries included in it. From 1999 onwards Bulgaria is included in the Report via the Centre for Economic Growth as a partner of the World Economic Forum.

Pursuant to the data in The Global Competitiveness Report, the positions of Bulgaria in the indicator for cooperation in Research and Development activity for the period 2013-2018 are presented in Table 1.

For the first three years of the examined period unstable positions can be seen for our country regarding the indicator for cooperation in Research and Development activity. According to analysts, the reason roots in the ineffective national administration, corruption practices, difficult access to financing and other.
For the last 3 years, however, a rapid stable growth can be observed, as in 2018 our country reaches 41st place out of 140 countries. The indicated can be considered as a significant progress in the sphere.

Table 1. The position of Bulgaria regarding cooperation in R&D activity, for the period 2013-2018.

| The Global Competitiveness Report | University-industry collaboration in R&D, Rang* |
|----------------------------------|-----------------------------------------------|
| The Global Competitiveness Report 2013–2014 | 117/148                                      |
| The Global Competitiveness Report 2014–2015 | 113/144                                      |
| The Global Competitiveness Report 2015–2016 | 112/140                                      |
| The Global Competitiveness Report 2016–2017 | 74/138                                       |
| The Global Competitiveness Report 2017–2018 | 74/137                                       |
| The Global Competitiveness Report 2018 | 41/140                                       |

2.2. Relationship Business-Education
The aim of this research is to find an appropriate model for informal education of specialists from the wine industry, which would help in the integration of innovation. Similar models have been developed by the authors, as the idea will be adapted and developed to the specific sphere of work. The presented models are part of VES [3] as a smart space, context-dependent, based on a script and a controlled infrastructure.

The online education is getting more and more used in last years. The team of experts, representatives of science, is aimed at the development of a conceptual model for the integration of innovation and increasing of competitiveness of the industrial enterprises by using a VES. The current conceptual example is applied to the formalized representation of opportunities for increasing and integration of innovation in the wine industry.

The conceptual model for informal education of specialists from the wine industry (figure 1) appears as an agent-oriented space [4], which is built in 5 modules:

- **Module 1**: Education. Lifelong Learning;
- **Module 2**: Examination of user’s knowledge level;
- **Module 3**: Generation of knowledge for the wine industry via surveys;
- **Module 4**: Measuring of innovation, as a model for measuring is yet to be done;
- **Module 5**: Consultations and recommendations.

- **BLA** – Basic Learning Agent
- **TA** – Test Agent
- **UKA** – Update Knowledge Agent – responsible for the gathering of knowledge from surveys and filling of ontologies LO and ICO, if new knowledge is present. Archives the results from the conducted surveys.
- **IMA** – Innovative Measurement Agent – responsible for the measuring of the level of the imported innovation and recommendations for the importing of appropriate innovation for a specific user.
Figure 1. A conceptual model for informal learning

The Knowledgebase is built up of two ontologies and one archive: LO – Learning Ontology – for preparing of training and examination of knowledge. ICO – Innovation Criteria Ontology Archive – storage of surveys, documents and other.

3. Approbation of the Science-Business-Education Collaboration through an Informal Learning Model

Opportunities for using innovative products in companies depend on many factors such as company security, crediting, and senior managers’ capabilities to develop and deploy new products and
technologies, and more. With the sustainable growth of the economy, the trend of improving the entrepreneurship and business environment in Bulgaria continues. Specifically for the wine industry, the proposed informal learning model is a specific innovation, which exemplifies the "good practices" set out in the Lifelong Learning Strategy. Observations show that the qualification level of the Bulgarian labor force has a steady trend of decrease, even of degradation. Thus, the increasing human resource quality is a priority strategic problem for our country [8].

Lifelong learning can be defined as any purposeful learning activity that serves to continually improve people's knowledge, abilities and competence. It is necessary to create an interest for both employers and employees to constantly increase their qualifications through legal regulation, rigor and control of the occupation of qualified candidates, which ensures the achievement of the expected results of the Lifelong Learning strategy. In order to successfully implement the strategy in an organization, it is necessary to create opportunities for certification of results of distant, informal and self-dependent learning, of skills acquired in practice and recognition of all learning achievements - knowledge, skills and competences. This will enable employees to combine the performance of their duties with learning. The essence of the model is represented by five modules that create opportunities for increasing the competence of the specialists.

3.1. Module 1 - Education

Module 1 provides informal training for wine industry specialists to learn about innovative techniques. Informal learning is purposeful and organized, but its successful completion does not lead to the acquisition of a level of education (class, stage) or degree of professional qualification (including qualification as part of a profession). The most common forms of informal learning are courses, private lessons, seminars, workshops with training, workplace training, occupational safety briefings, etc. All of these require the employee to be separated from his / her employment position, which is associated with financial loss for the enterprise. Successful completion of non-formal learning optimizes the process of learning, testing, counseling, etc., with no need for absenteeism.

Possible topics and sections of the training are related to innovation management; use of financial instruments; GDPR and security; opportunities for developing wine tourism.

In Module 1 the informal learning is expected to be done using agency-oriented architectures and knowledge-based ontologies. The intelligent agent, the BLA (basic learning agent), provides information on a specific subject to predefined criteria. Preliminary criteria are taken as a limiting condition once a questionnaire is completed to determine the knowledge and interests of the consumer. These conditions in the questionnaire are foreseen in the next version of the informal learning model. The current version provides an agent solution that monitors the provision of structured content by learning ontology (LO). The ontology is divided into two sub-ontologies KLO and TLO. Where KLO (knowledge learning ontology) contains knowledge about all types of innovations, and TLO (test learning ontology) contains user knowledge verification questions and is used by TA (test agent) in Module 2.

In consideration with the examined agent architecture, it is important to note some definitions that will later be considered in the research. There are various definitions of agents in the literature, but only some of them are presented here.

- "An agent is an identity that can perceive the environment by means of sensors and effects that have influence through effectors" [5].
- "Autonomous agents are computing systems that inhabit some complex dynamic environment, perceive and act autonomously in that environment, and acting in this way reach a multitude of goals or actions for which they are created" [6].
- "Intelligent agents continuously perform three functions:
  - Adoption of dynamic conditions in the environment;
  - Action to influence the conditions in the environment;
  - Reflections on interpretation of perceptions, solving problems, making conclusions and determining impacts on the environment" [7].
BLA agent for management the Knowledge Learning Ontology – KLO

- **Beliefs**
  - Data ontology;
  - User responses processed by the agent to determine restrictive conditions.

- **Desires**
  - Reading of ontology;
  - Retrieving data from ontology against restrictive conditions.

**KLO** – It is envisaged to develop a model covering the types of innovation and their aspects. One idea of building the KLO ontology might look like this:
Types of innovation -> sub-type -> definitions -> concepts
Or represented in OWL (Web Ontology Language): Class -> subclass -> annotations -> individuals

![Figure 2. Web Ontology Language](image)

3.2. *Module 2* - Verification of knowledge
Knowledge verification is possible even if *Module 1* is omitted, as shown in Figure 1, only if minimal knowledge is covered. Otherwise, the user is required to return to the initial position of *Module 1*. Analogously to the above models, a test agent model - TA and ontology of exams - TLO are applied.

Agent running an ontology of knowledge issues:

- **Beliefs**
  - Ontology with questions, sequence of questions;
  - List of questions already asked;
  - User responses;
  - List of questions to be asked.

- **Desires**
  - Reading ontology, retrieving question lists and answers from it;
  - Asking a next question;
  - Receiving a response from the user.

A model for ontology of knowledge verification is to be developed. Since the two ontologies are to be linked and form the Learning Ontology (LO), the model will be refined and presented in the next team's work (see Figure 3).

3.3. *Module 3* - Generation of Knowledge
It is planned to build a survey to generate knowledge about innovative and useful practices in micro and small wine enterprises.

The Update Knowledge Agent (UKA) is responsible for gathering knowledge, by querying and completing LO and ICO ontologies if new knowledge is available. Retains polls as an archive in the repository. At first glance, the task of solving is simple in collecting certain data in the form of a poll and storing them in the repository (database) as an archive. This is an easily solved and fully automated task.

On the other hand, the system's ability to detect new knowledge and to update ontologies with it would be most valuable. The latter is a serious challenge and requires significant efforts, but the authors are determined to offer a solution.
The goal is to develop a model for detecting new system intelligence by the intelligent agent UKA, then outputting a message to an expert to validate the data and assess whether or not where to revise the ontologies LO and ICO.

![Diagram of the verification process]

Figure 3. A Module for Knowledge Verification

3.4. Module 4 – Innovativeness Measurement

Measuring the innovativeness of a micro- or small enterprise in the wine industry is the biggest challenge for the authors. First, on the basis of a study, a definition of the term "innovation" is going to be applied. Secondly, in consideration with the accepted concept follows a presentation in a formal
model. The aim of the upcoming research is to find the exact criteria that can assess the innovativeness in the specific field. In parallel, a questionnaire is developed through the Innovative Measurement Agent (IMA) responsible for measuring the level of innovations introduced and recommendations for introducing appropriate innovations for a particular user in Module 5. The investigation is also focused in creating an appropriate Innovation Criterion Ontology (ICO).

3.5. Module 5 – Consulting and Recommendations

In the last module (stage) is foreseen that the system had already generated the necessary information about the knowledge level of the particular specialist and the lack of other appropriate knowledge, with the possibility to offer recommendations to the user. The goal is to show the level of innovation in Module 4 and to highlight the weaknesses and the possibility of introducing innovations into Module 5 that other enterprises have successfully introduced and used.

Conclusion

The fundamental objective of the research is to collaborate on the three-way science-business-education relationship by developing and adapting a model for informal learning of wine industry specialists. The models presented are part of the Virtual Education Space as an intelligent space, context-sensitive, script-based, and controlled infrastructure. The results of the preliminary study confirm the lack of such a model and the possibility of forcing research efforts. The results of the methodology's testing prove its significance for the practice and potential for transforming human resources into human capital for organizations.

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References

[1] Dimitrova G and Dakova M 2016 Cooperation between business, science and education - a factor for sustainable development and competitiveness, Int. business Conf. “Science and business for intelligent future”, University of Varna, (available in Bulgarian)

[2] Valkanov V, Stoyanov S, Valkanova V 2015 Building a virtual education space, WMSCI 2015 - 19th World Multi-Conf. on Systemics, Cybernetics and Informatics, Proc., 1, pp. 322-326

[3] Georgiev P, Valkanov V, Sandaliski M, Stoyanov S 2016 Intelligent environment for manager’s training, Proc. Int. Scientific Conf. "High Technologies. Business. Society 2016", ISSN: 1310-3946 (available in Bulgarian)

[4] Stoyanov S, Popchev I, Ganchev I and O'Droma M 2005 From CBT to e-Learning, Information Technologies and Control, vol. 4, pp. 2-10, ISSN 1312-2622.

[5] Stoyanov S, Ganchev I, Popchev I, O'Droma M and Sgurev V 2010 An Approach for the Development of a Context-Aware and Adaptive eLearning Middleware, J. Intelligent Systems: From Theory to Practice, vol. SCI 299, Berlin, ISBN: 978-3-642-13428-9, pp. 519-535.

[6] Stoyanov S, Ganchev I, Popchev I, O'Droma M 2008 An Approach for the Development of InfoStation-Based eLearning Architecture, Compt. Rend. Acad. Bulg. Sci., vol. 62, no. 9, pp. 1189-1198

[7] Mihova T, Angelov K, Ferdov A 2018 Specificity of the Training of The Employees in High-Technological Enterprises, IX Nat. Conf. with Int. Participation (ELECTRONICA), Sofia, IEEE Catalog Number: CFP18P58-POD, ISBN:978-1-5386-5802-4