

Article

Data Mining in Entrepreneurial Competencies Diagnosis

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Abstract: The aim of the paper is to diagnose the entrepreneurship competency levels among students to identify differences in competencies and their levels regarding gender, material status, and professional situation. In addition, the goal of the analysis is to indicate the competencies that need to be strengthened among individual groups of students. The research was conducted using a questionnaire by The European Entrepreneurship Competence (EntreComp) framework that was sent to students at the Pedagogical University of Cracow and the Rzeszow University. The rule induction method enabled us to discover dependencies that were not obvious among different competencies of respondents and their status. The research revealed that the surveyed women had completely different competencies than men. Good financial status has a positive impact on the self-assessment of competencies and worse-cause difficulties in assessing business ideas. Unemployed students need stimulation to take action, seek funding, share ideas, and protect them. Students running their businesses are able to identify market needs. The results revealed the following implications: It is important to verify the EntreComp methodology to examine how different groups are evaluating their entrepreneurial competencies; the data mining technique enables discover of new knowledge based on regularities hidden in data; and the results can be used to tailor special teaching programs for developing skills that individual subgroups lack.

Keywords: data mining; rule induction; EntreComp; entrepreneurship; entrepreneurial competencies

1. Introduction

Education of entrepreneurship has become a challenge due to the growing complexity in running a business in a modern economy, as well as due to the universality of entrepreneurial competencies. The entrepreneurial competencies are applicable for entrepreneurs in a narrow sense as business owners, and also for so-called intrapreneurs, i.e., employees working at companies. “Enterprising employees” are motivated within corporations to stimulate their creative approaches to problems and emerging opportunities, and to create new, valuable solutions [1]. Research in the corporate entrepreneurship area has revealed the increasing importance of social, human, and intellectual capital in creating competitive advantages and wealth in today’s knowledge economy [2]. According to the research of V. K. Gupta, D. K. Dutta, and X. Chen, the entrepreneurial orientation as a capability of large firms was conditioned by managerial capabilities which had a significant impact on firm’s performance [3]. In turn, G. Dess and G. Lumpkin noted that firms that followed a strategy of corporate entrepreneurship were able to pursue growth through new venture opportunities and strategic renewal. They underlined that firms that were able to effectively follow this strategy, experienced sustainable advantages and yielded above-average returns [4].

The importance of universities' roles in entrepreneurial competency development has been confirmed by studies [5]. M. Z. Solesvik showed that students who participated in university enterprise programs reported higher levels of entrepreneurship-related skills [6]. In turn, being equipped in entrepreneurial competencies influenced the entrepreneurial intentions [7,8].

Research diagnosing entrepreneurial competencies has led to the development of entrepreneurship education programs at various levels of education [9].

More in-depth studies have been related to gender differences in entrepreneurial competencies. Women have been generally associated with lower venture performances, they run smaller businesses, and invest less capital than men do [10]. They are considered to lag behind men in terms of entrepreneurial outcomes, self-efficacy, risk-taking attitude, intentions, and propensity in venturing [11–15].

V. M. J. Nassif, T. Andreassi, M. J. Tonelli, and M. T. L. Fleury devoted more attention to improving competencies among female entrepreneurs in Brazil (however, engaging a small group of respondents) and they identified entrepreneurial competencies that should be developed. These competencies included the following: formal communication, negotiating, proactive behavior, perfecting ideas and relationships, as well as improving the capacity to form partnerships. The surveyed women also considered it to be important to be prepared to deal with unexpected situations in their businesses, and for this reason, enhancement of creativity and confidence regarding being on the right track was a step towards success. Other factors of relevance which were aimed more at entrepreneurial actions, concentrated on learning how to make personnel accountable, make forecasts, earn money, and learn to say “no”. Female entrepreneurs also greatly valued the development of analytical thought and focused on innovation and predisposition to learn with the aim of making decisions. Women interviewed in the authors' research underlined the importance of establishing partnerships, developing relationships by creating a social network, and also a balance between work and personal life [16].

E. Ćatić-Kajtazović, A. Nuhanović, and S. Bilanović, in turn, stated, on the basis of their research among students at three universities in Bosnia and Herzegovina, that there was a need for different teaching approaches in the development of entrepreneurial competencies, given the differences between genders, with a special emphasis on encouraging female students to start their own businesses [17].

There is no research on the measurement of the entrepreneurial competencies which refer to different job positions or material status of interviewees.

This study concentrates on the “individual level” of entrepreneurship context, mainly referred to as entrepreneurial competencies. The aim of the research is to assess the level of entrepreneurial competencies of academic students using the rule induction method in data analysis. The analysis concentrates on identification of differences in competencies and their levels regarding gender, material status, and professional situation of respondents. The goal of the analysis is also to indicate the competencies that need to be strengthened among individual groups of students.

The research was conducted from May 2019 to February 2020.

2. Entrepreneurship and Entrepreneurial Competencies

The complexity and importance of entrepreneurship can be derived from the discussion of R. Thurik and S. Wennekers about the role of entrepreneurship in economic growth based on many researches in the field. They “decomposed” the phenomenon of entrepreneurship and divided it into the following three levels: individual, firm, and macro level (Figure 1). The concepts of entrepreneurship, as a complex phenomenon, should be, according to the authors, the subject of future, multidisciplinary research [18].

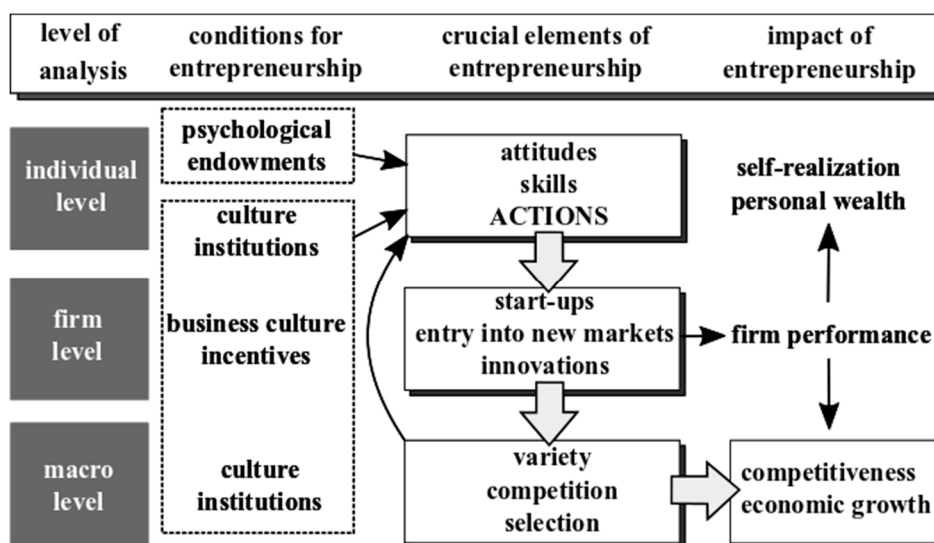


Figure 1. Final framework, linking entrepreneurship to economic growth by R. Thurik and S. Wennekers. Source [18].

Entrepreneurship, as a competence, applies to all spheres of life. It enables citizens to nurture their personal development, to actively contribute to social development, to enter the job market as an employee or as self-employed, and to start-up or scale-up ventures which can have a cultural, social or commercial motive [19]. Regardless of age, entrepreneurship is an essential and even indispensable competency for understanding the world around consciously making decisions in business and professional life and also in everyday life [20,21].

R. Thurik and S. Wennekers perceived entrepreneurship as a behavioral characteristic of persons (regarding the first and second identified level). “This behavior has an input and an output side: where on the one hand entrepreneurial behavior requires entrepreneurial skills and qualities, it also implies the participation in the competitive process on the other” [18].

Identification of entrepreneurial competencies or traits has been sharpened over the last decades. Investigation and analysis have led to the conclusion that entrepreneurs are made not born. The competencies, understood as abilities and skills, makes entrepreneurship a teachable and learnable behavior [22].

According to the United Nations Industrial Development Organization, general, competency is a set of skills, knowledge, and attributes that allow an individual to successfully perform a task or an activity within a specific function or job (Figure 2) [23].

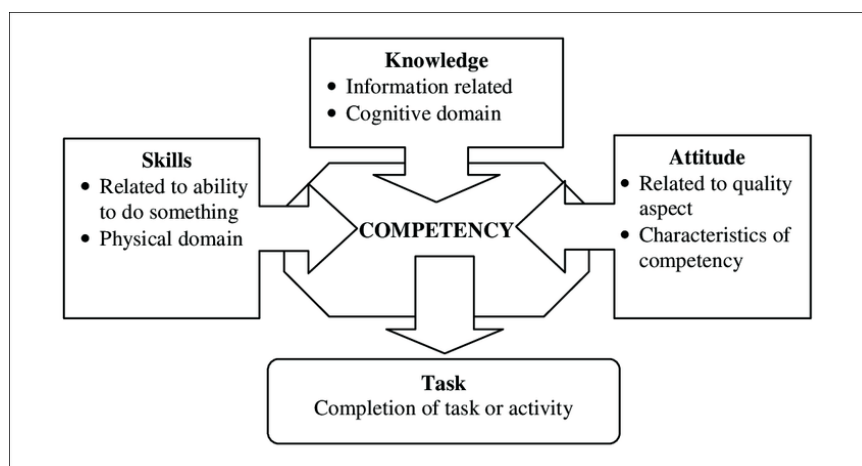


Figure 2. Competency according to UNIDO. Source [23].

According to the Organization for Economic Co-operation and Development, the set of entrepreneurial competencies allows individuals to identify, create, and act upon opportunities in order to create value, by marshalling resources, demonstrating self-efficacy and confidence in the ability to achieve, and persist in the face of obstacles [23–25].

In addition to competencies, the formation of entrepreneurial attitudes is influenced by both personal characteristics and the need to achieve something significant, maintaining control over one's fate, propensity to risk, belief in one's own strength, and possibilities of achieving a specific goal, as well as by sociocultural and demographic conditions, such as: socio-political system, gender, entrepreneurial traditions in the family, material status, network of contacts and social ties, unsatisfactory position in the society, and the situation “at the crossroads” [26].

3. The European Entrepreneurship Competence (EntreComp) as the Framework for Shaping Entrepreneurial Competencies

In January 2015, on behalf of the Directorate General for Employment, Social Affairs and Inclusion (DGEMPL), the European Commission launched a study on entrepreneurship competence, under the name EntreComp. As a result, EntreComp was introduced as a framework that aimed to establish a bridge between the worlds of education and work and to be taken as a reference for fostering entrepreneurial learning [19].

According to the document, entrepreneurship is when one acts upon opportunities and ideas and transforms them into value for others. The value that is created can be financial, cultural, or social [27]. There are three areas of entrepreneurial competencies according to The European Entrepreneurship Competence Framework which directly reflects the definition of entrepreneurship as the ability to turn ideas into action that generate value for someone other than oneself; and the 15 competencies that, together, describe the entrepreneurship as a competence.

The conceptual model of EntreComp shows how the entrepreneurship competence has been broken down into its constituent parts within the framework.

They are arranged in the following three areas: ideas and opportunities, resources, and action.

The list of competencies is presented in the Figure 3.



Figure 3. Entrepreneurial competencies of the The European Entrepreneurship Competence (EntreComp) framework. Source [19].

The 15 competencies are interrelated and interconnected and should be analyzed jointly, and therefore the traditional statistical methods are insufficient to conduct an in-depth analysis and

understanding of the full context of entrepreneurial characteristics. The progression in entrepreneurial learning is based on the following aspects:

1. Developing increasing autonomy and responsibility in acting upon ideas to create value;
2. Developing the capacity to generate value from simple and predictable contexts up to complex, and constantly changing environments.

The learning outcomes in the framework for the individual competencies are measured on the eight levels of proficiency, divided into four levels, i.e., basic, intermediate, advanced, and expert.

In this research, an eight-level scale of entrepreneurial competencies measures was applied (Table 1) according to the approach developed under the EntreComp model.

Table 1. EntreComp progression model.

Foundation Level		Intermediate Level		Advanced Level		Expert Level	
A	B	C	D	E	F	G	H
Relying on support from others		Building independence		Taking responsibility		Driving transformation, innovation, and growth	

In the literature, there are more competency models described that are similar to the EntreComp framework [28,29]. The comparison of three models was conducted by G. Ganesini et al. who contrasted EntreComp with Bartram's the great eight model and the 13 entrepreneurial competencies model elaborated by Morris et al. [30–32].

The researchers concluded that the approach of EntreComp was better than the other two models with respect to balancing the number and type of competencies for each area. It better captured the unique characteristics of entrepreneurship competencies in regard to stimulation entrepreneurship, incentives, and barriers for launching new ventures and sustainable development of a business [30].

The scholars indicated that no comprehensive set of entrepreneurial competencies had emerged and no or little empirical evidence has been provided to validate these categorizations [32].

In addition, the authors of the EntreComp framework indicated its limitations, i.e., that the framework had not yet been tested in the phase of its elaboration. Therefore, this research seems to be the first attempt to verify the framework developed [19].

4. Methodology of the Research

In the research, one of the most important techniques of machine learning, i.e., rule induction, was used [33,34]. According to this tool, regularities hidden in data are expressed in the rule conditions.

The detailed analysis of the received sets of rules was aimed at identifying the relationships among entrepreneurial competence and the metric questions, i.e., gender, material status, and professional situation.

4.1. Rule Induction

Rule induction has the ability to infer new knowledge based on regularities hidden in data. Data from which the rules were induced, were expressed in the form of a decision table. Rows of the decision table represent cases (respondents' answers), while columns represent variables creating a set of entrepreneurial competencies (attributes). As a decision, we used gender, material status, and professional situation, respectively. The set of all cases was denoted by U. The set of all cases labeled by the same decision value was called a concept.

A simple example of the decision table is presented in Table 2, in which the attributes are the following: government expenditure on education, total (% of GDP); taxes on goods and services (% value added of industry and services); and ease of doing business score (0 = lowest performance to

100 = best performance). Values of these attributes describe the entrepreneurship level represented by the indicator for new business density, denoted as a decision. In Table 2, decision has two values, positive or negative. A set of cases having the same value of decision is called a concept. In Table 2, there are two concepts, i.e., {1,6} and {2,3,4,5}.

Table 2. Example of a decision table. Source, own elaboration.

Case	Conditions for Entrepreneurship Development			Entrepreneurship Level
	Government expenditure on education, Total (% of GDP)	Taxes on goods and services (% value added of industry and services)	Ease of doing business score (0 = lowest performance to 100 = best performance)	New business density (new registrations per 1000 people ages 15–64)
1	high	high	high	positive
2	high	low	low	negative
3	high	high	low	negative
4	low	low	low	negative
5	low	high	high	negative
6	low	low	high	positive

Usually, the rules are expressions of the following form:

(attribute_1, value_1) and (attribute_2, value_2) and ... and (attribute_n, value_n) → (decision, value)

If the conditions of the rule are satisfied, then, the cases belong to the class given in the conclusion.

The induction method based on rough sets was chosen because it has excellent accuracy, in particular, the LEM2 algorithm [35–39]. This algorithm explores the space of attribute-value pairs (a, v) and produces a local covering of each decision concept. Let B be a nonempty decision concept and t be the set of all cases from U, such that the attributes, a, have the value, v. A nonempty collection of nonempty sets of attribute-value pairs, T, is a local covering of B if and only if the following criteria are satisfied:

1. Each member T of T is a minimal complex of B, i.e., B depends on $T \cap [T] = [T] \cap [t] \subseteq B$ and no proper subset T' of T exists such that B depends on T';
2. $\bigcup_{t \in T} [T] = B$ and;
3. T is minimal, i.e., T has the smallest possible number of members.

To induce a rule for concept {2,3,4,5}, the first step of the algorithm LEM2 is to compute all attribute-value pair blocks. For Table 2, these blocks are:

(Government expenditure on education, high) = {1,2,3};

- (Government expenditure on education, low) = {4,5,6};
- (Taxes on goods and services, high) = {1,3,5};
- (Taxes on goods and services, low) = {2,4,6};
- (Ease of doing business score, high) = {1,5,6};
- (Ease of doing business score, low) = {2,3,4}.

It can be assumed that B = G = {2,3,4,5}. In the next step, the attribute-value pairs (a, v) were identified with the largest $|(a, v) \cap G|$. The cardinality of the set $|(a, v) \cap G|$ is equal to three for one attribute-value pair [(Ease of doing business score, low)]; and $[(Ease of doing business score, low)] \subseteq B$, therefore $[(Ease of doing business score, low)]$ is the first minimal complex of G.

The new set G is equal to $B - [(Ease of doing business score, low)] = \{2,3,4\}$. The cardinality of the set $|(a, v) \cap G|$ is equal to one for three attribute-value pairs [(Government expenditure on education, low)], [(Taxes on goods and services, high)], and [(Ease of doing business score, high)]. The next criterion is the size

of the attribute-value pair block. For these three blocks, this criterion is again the same and equal to three. If all criteria are equal, the first pair [(Government expenditure on education, low)] is selected. However, [(Government expenditure on education, low)] = {1,5,6} $\not\subseteq$ B, therefore, an additional iteration of the internal loop is needed. The next candidates are [(Taxes on goods and services, high)] and [(Ease of doing business score, high)]. Both criteria (cardinality and size) of this attribute-value pairs are the same as selected in the paper [(Taxes on goods and services, high)]. And [(Government expenditure on education, low)] \cap [(Taxes on goods and services, high)] = {4,5,6} \cap {1,3,5} = {5} \subseteq B, so the candidate for a minimal complex is the set [(Government expenditure on education, low)] \cap [(Taxes on goods and services, high)]. Then, it is checked whether the candidate for a minimal complex is really the minimal complex. For all attribute-value pairs of the candidate for a minimal complex, it is checked whether deleting any of them causes that the reduced candidate \subseteq B. If so, such a pair should be removed from the candidate.

As a result, the second minimal complex is identified as follows:

{(Government expenditure on education, low), (Taxes on goods and services, high)}.

Therefore, $G = \{2,3,4\} \cup \{5\} = \{2,3,4,5\}$, $B - G = \emptyset$ and the complete rule set, induced by LEM2 for concept negative, is the following:

(Ease of doing business score, low) \rightarrow (New business density, negative);

(Government expenditure on education, low) and (taxes on goods and services, high) \rightarrow (new business density, negative).

For cases where new business density is positive {1,6}, the rules are as follows:

(Government expenditure on education, high) and (taxes on goods and services, high) and (ease of doing business score, high) \rightarrow (new business density, positive);

(Government expenditure on education, low) and (taxes on goods and services, low) and (ease of doing business score, high) \rightarrow (new business density, positive).

In research, the importance of the rules was evaluated by the following two parameters: (1) support, the sum of all cases correctly classified by rule during training; and (2) the Laplace estimate of the rule's confidence [40]. The most important rules were identified. The identified rules characterized the competence profiles of the respondents in the abovementioned metric criteria. Contrary to the traditional correlation, the use of the rule induction method has allowed a comprehensive characterization of individual groups of respondents, including the distinguishing features of a given group.

4.2. Data

In the research, there were 290 respondents, i.e., students representing the Pedagogical University of Cracow (75%) located in Lesser Poland and the Rzeszow University (25%) in the Podkarpackie Region. Among the respondents, 88% of the students were women, 61% were first-degree students, 38% were second-degree students, and 1% were uniform master's students. Regarding the form of studies, 69% of the respondents studied in stationary form and the remaining respondents studied in non-stationary form; 75% of respondents studied administration as the field of study and 25% of the respondents studied economics. Regarding where the respondents lived, 58% of the students lived in a village, 9% in cities up to 20,000 inhabitants, 8% in cities 21,000–50,000 inhabitants, and 18% in cities over 100,000 inhabitants.

The questionnaire precisely reflected the survey form of The European Entrepreneurship Competence Framework "EntreComp". It was sent to the lecture groups, and thus the gender structure of the respondents was random.

According to the methodology, the competencies were measured at the following four levels: foundation, intermediate, advanced, and expert. Each level was measured (in most cases) by two sublevels that were marked in the database with letter as follows: A, B, C, D, E, F, G, and H, respectively (Table 1).

A general overview of the results obtained presents (in Figures 4–6) the frequency distribution of the respondents' answers. For each variable (competence), the distribution of the answers given is presented. Competencies from the three areas are coded as follows: “ideas and opportunities” as x1–x18, “resources” as y1–y21, and “into action” as z1–z21.

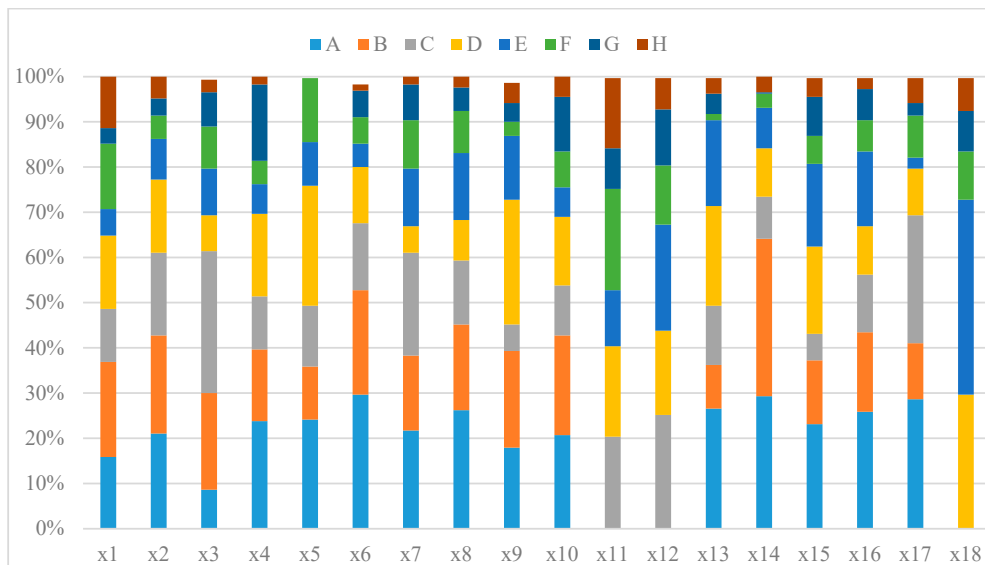


Figure 4. Distribution of response frequencies regarding competencies evaluation in the “ideas and opportunities” area. Source, own elaboration on the base of the research. Legend: x1, identify, create and seize opportunities; x2, focus on challenges; x3, uncover needs; x4, analyze the context; x5, be curious and open; x6, develop ideas; x7, define problems; x8, design value; x9, be innovative; x10, imagine; x11, think strategically; x12, guide action; x13, recognize the value of ideas; x14, share and protect ideas; x15, behave ethically; x16, think sustainably; x17, assess impact; x18, be accountable.

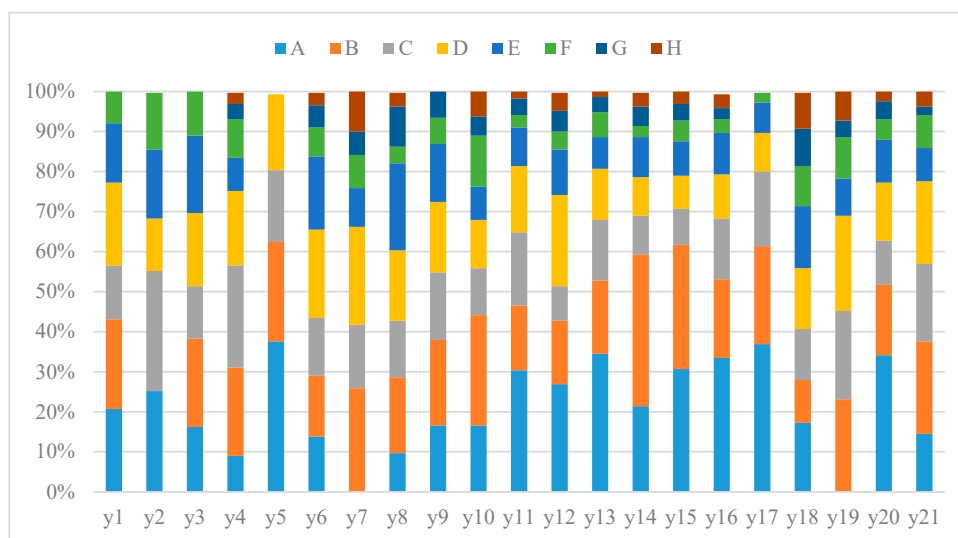


Figure 5. Distribution of response frequencies regarding competencies evaluation in the “resources” area. Source, own elaboration on the base of the research. Legend: y1, follow your aspirations; y2, identify your strengths and weaknesses; y3, believe in your ability; y4, shape your future; y5, stay driven; y6, be determined; y7, focus on what keeps you motivated; y8, be resilient; y9, don’t give up; y10, manage resources; y11, use resources responsibly; y12, make the most of your time; y13, get support; y14, understand economic and financial concepts; y15, budget; y16, find funding; y17, understand taxation; y18, inspire and get inspired; y19, persuade; y20, communicate effectively; y21, use media effectively.

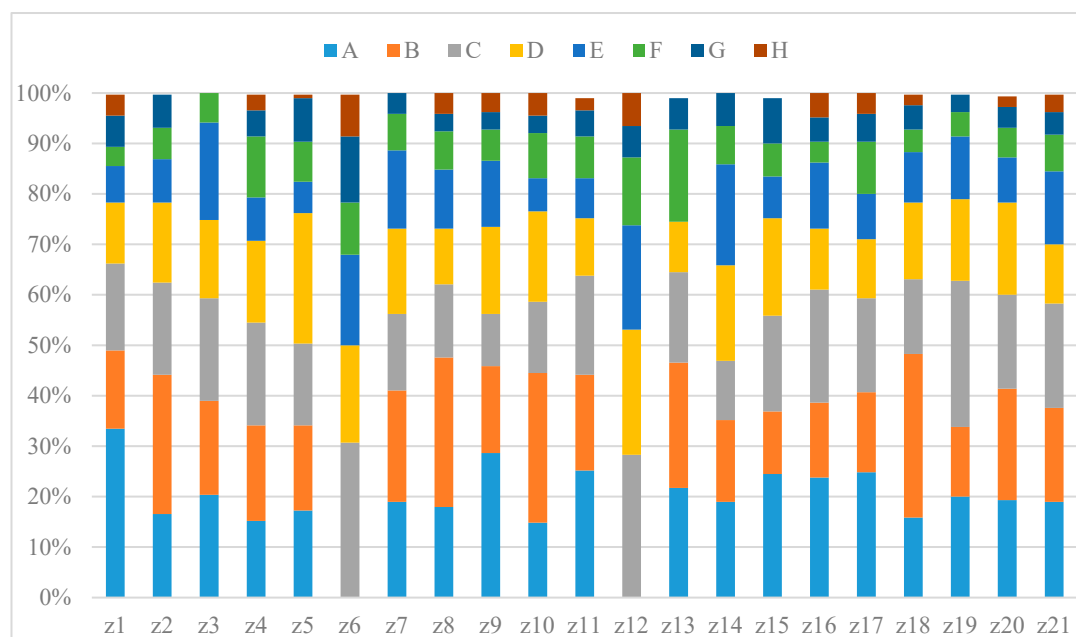


Figure 6. Distribution of response frequencies regarding competencies evaluation in the area “into action”. Source, own elaboration on the base of the research. Legend: z1, take responsibility; z2, work independently; z3, take action; z4, define goals; z5, plan and organize; z6, develop sustainable business plans; z7, define priorities; z8, monitor your progress; z9, be flexible and adapt to changes; z10, cope with uncertainty, ambiguity; z11, calculate risk; z12, manage risk; z13, accept diversity; z14, develop emotional intelligence; z15, listen actively; z16, team up; z17, work together; z18, expand your network; z19, reflect; z20, learn to learn; z21, learn from experience.

Analyzing the frequency of the responses, in the first area “ideas and opportunities”, on the one hand, it should be noted that (on the scale of A–H) 70% of respondents assessed their competencies at most at an intermediate level (Figure 4) and, in the “resources” area, approximately 80% of respondents declared competence at the most intermediate level (Figure 5). On the other hand, in the “into action” area, approximately 75% of respondents had a level no higher than intermediate (Figure 6). Very few respondents rated their competencies at an expert level in all three areas. Each area also had competencies rated at the most advanced level.

5. Experiments and Results

Three datasets (decision tables) were created for gender, material status, and professional situation, separately. Each set was created by combining the respondents’ answers regarding the evaluation of individual entrepreneurial competencies with the mentioned demographic data.

Rules were induced for each of the sets as follows: 49 rules for gender, 79 rules regarding material status, and 86 rules in terms of professional situation.

5.1. Gender Analysis

Among the total students, 88% of the students were women. Out of 49 rules for gender, there were 34 rules generated for women. From among 48 attributes constituting all rules for respondents in terms of gender, in 10 attributes, 16 advanced or expert level of competency assessments can be seen. Competencies rated the highest by women were the following: strategic thinking, ethical behavior, being accountable, curious and open, innovative, determined, guiding action, identifying one’s strengths and weaknesses, managing resources, and self-reflection. At an intermediate level of competence, women were represented in following their aspirations and building teams.

Competencies rated the lowest among the surveyed women were in the following fields: taxation, defining priorities, strategic thinking, assuming responsibility, obtaining financing, using the media, inspiring themselves and others, ethical behavior, and evaluation of project's impact (level A). There were rules identified among women declaring a B level of competence in the field of budgeting, understanding economic and financial concepts, sharing and protecting ideas, believing in one's own ability, focusing on challenges, and strategic thinking.

The strongest rules were the following:

1. If understanding economic and financial concept is B and thinking sustainably is A, then the gender is woman (supportSize = 31 and laplace = 0.9697);
2. If understanding taxation is A and defining priorities is A, then the gender is woman (supportSize = 31 and laplace = 0.9697);
3. If understanding taxation is A and taking responsibility is A and finding funding is A, then the gender is woman (supportSize = 27 and laplace = 0.9655);
4. If using media effectively is A and finding funding is A, then the gender is woman (supportSize = 21 and laplace = 0.9565);
5. If inspiring and getting inspired is A and behaving ethically is A, then the gender is woman (supportSize = 20 and laplace = 0.9545);
6. If budgeting is B and managing resources (material and nonmaterial) is B and developing ideas is A, then the gender is woman (supportSize = 19 and laplace = 0.9524);
7. If managing resources (material and nonmaterial) is H, then the gender is woman (supportSize = 18 and laplace = 0.95);
8. If assessing impact is A and communicating effectively is A and developing ideas is A, then the gender is woman (supportSize = 18 and laplace = 0.95);
9. If being innovative is D and coping with uncertainty and ambiguity is D, then the gender is woman (supportSize = 17 and laplace = 0.9474);
10. If sharing and protecting ideas is B and finding funding is A and being accountable is D, then the gender is woman (supportSize = 16 and laplace = 0.9444);
11. If believe in one's ability is B and thinking strategically is H, then the gender is woman (supportSize = 14 and laplace = 0.9375);
12. If following one's aspiration is D and guiding actions is G, then the gender is woman (supportSize = 13 and laplace = 0.9333);
13. If team up is C and focusing on challenges is B, then the gender is woman (supportSize = 13 and laplace = 0.9333);
14. If behaving ethically is B and thinking strategically is B, then the gender is woman (supportSize = 13 and laplace = 0.9333);
15. If being accountable is E and sharing and protecting ideas is A and shaping one's future is C, then the gender is woman (supportSize = 13 and laplace = 0.9333).

In conclusion, it can be seen that the surveyed women often feel the need to increase their knowledge in economics, taxes, intellectual property rights, whereas they seem to already have sufficient competencies and features important for running their own business such as team cooperation, management, strategic thinking, guiding action, being curious, open, and innovative.

As men constituted only 12% of the respondents, there were only 15 rules concerning this group. They were not as strong as those concerning women. The strongest rules for men were the following:

1. If staying driven is A and being accountable is D and being flexible and adapting to changes is A and persuading is C and managing risk IS C and managing resources (material and nonmaterial) is B, then the gender is man (supportSize = 4 and laplace = 0.8333);
2. If following one's aspirations is B and calculating risk is C and focusing on what keeps one motivated is C, then the gender is man (supportSize = 4 and laplace = 0.8333);

3. If focusing on what keeps one motivated is C, then the gender is C (supportSize = 4 and laplace = 0.8333);
4. If staying driven is A and being accountable is D and being flexible and adapting to changes is A and persuading is C and managing risk is C and managing resources (material and nonmaterial) is B, then the gender is man (supportSize = 4 and laplace = 0.8333);
5. If budgeting is B and designing value is A and staying driven is A and defining problems is C and being curious and open is A, then the gender is man (supportSize = 3 and laplace = 0.8);
6. If sharing and protecting ideas is B and being determined is D and working independently is B and budgeting is A, then the gender is man (supportSize = 3 and laplace = 0.8);
7. If being accountable is E and team up is A and calculating risk is A and focusing on what keeps one motivated is A, then the gender is man (supportSize = 3 and laplace = 0.8);
8. If focusing on what keeps one motivated is H and using media efficiency is D and make the most of one's time is B, then the gender is man (supportSize = 3 and laplace = 0.8);
9. If expanding one's network is B and reflect is C and coping with uncertainty and ambiguity is B and thinking sustainably is B, then the gender is man (supportSize = 3 and laplace = 0.8);
10. If reflect is D and focusing on what keeps one's motivated is D and defining priorities is E, then the gender is man (supportSize = 3 and laplace = 0.8);
11. If shaping one's future is D and working independently is B and persuading is D and using media effectively is C, then the gender is man (supportSize = 3 and laplace = 0.8);
12. If developing emotional intelligence is E and recognizing the value of ideas is E and identifying one's strengths and weaknesses is F, then the gender is man (supportSize = 3 and laplace = 0.8).

In the identified rules, men did not indicate any competencies at the expert level. The surveyed men demonstrated the advanced level in regard to emotional intelligence development and recognizing the value of ideas. According to the rules, the intermediate level of men's competencies referred to calculating and managing risk, accountability, persuasion, defining problems, efficient use of media, reflecting, focusing on what keeps them motivated, and shaping their future. In turn, basic levels of competencies were in the following fields: staying driven, being flexible and adaptability to changes, managing resources, following their aspirations, budgeting, and designing value.

The surveyed men seem to be short of competencies that women have, i.e., in the field of resource management and following their aspirations, but they also need to broaden their economic and financial knowledge.

5.2. Material Status Analysis

In terms of material status, the largest group of respondents assessed their situation as good (60%), and in turn, 27% as average, 9% of students evaluated their situation as very good, and only 4% as unsatisfactory.

Referring to the classification of respondents, according to the evaluation of their material status, 79 rules were induced. In the group assessing their financial situation as very good, 10 rules were identified. The most frequent attributes constituting the rules are on two levels. On the basic level there were belief in one's ability, staying driven and coping with uncertainty, and ambiguity, whereas on the intermediate level there was the effective use of media. The strongest rules describing this group were the following:

1. If use media efficiently is C and budgeting is A and coping with uncertainty and ambiguity is B and team up is A, then material status is very good (supportSize = 6 and laplace = 0.6364);
2. If being accountable is E and believing in one's ability is E and inspiring and get inspired is G, then material status is very good (supportSize = 4 and laplace = 0.5556).

The largest group of rules (as many as 38) was distinguished among the respondents who assessed their material status well. The statistics of the most frequently appearing attributes in the rules show

that respondents in this group show the highest level of their competence in the following areas: guiding action, being accountable, making the most of one's time. However, in the areas working together, following one's aspirations, shaping one's future, persuasion, and coping with uncertainty and ambiguity, respondents' competencies are rated at the intermediate or basic level.

The most important rules were as follows:

1. If guide action is C and understand taxation is A and focus on what keeps you motivated is D, then material status is good (supportSize = 10 and laplace = 0.7333);
2. If be accountable is E and monitor your progress is B and expand your network is B and cope with uncertainty and ambiguity is B and manage resources is B, then material status is good (supportSize = 12 and laplace = 0.7647);
3. If find funding is A and understand economic and financial concepts is B and cope with uncertainty and ambiguity is B and shape your future is B, then material status is good (supportSize = 9 and laplace = 0.7143);
4. If share and protect ideas is B and assess impact is C and think strategically is C, then material status is good (supportSize = 11 and laplace = 0.75);
5. If guide action is C and think strategically is C and focus on challenges is A, then material status is good (supportSize = 11 and laplace = 0.75);
6. If be determined is B and team up is A, then material status is good (supportSize = 9 and laplace = 0.7143);
7. If use resources responsibly is D and plan and organize is C, then material status is good (supportSize = 10 and laplace = 0.7333).

The next group of rules (as many as 25) was induced for students assessing their material status as average. Only three of all attributes were noticeably more often found in the rules in this group, i.e., at an advanced level, being accountable; at an intermediate level, staying driven; and at a basic level, understanding economic and financial concepts. Other attributes occurred rarely. There were three stronger rules in this group as follows:

1. If be accountable is E and be innovative is D and team up is C and guide action is E, then material status is average (supportSize = 5 and laplace = 0.6);
2. If identify your strengths and weaknesses is C and understand economic and financial concepts is B and calculate risk is C and make the most of your time is B, then material status is average (supportSize = 5 and laplace = 0.6);
3. If inspire and get inspired is A and recognize the value of ideas is A and learn to learn is B, then material status is average (supportSize = 5 and laplace = 0.6).

In the group assessing their material status as unsatisfactory (six rules), the most frequently appearing competencies, i.e., analyzing the context, thinking strategically, and shaping one's future, were at the highest intermediate level.

The analysis of the strongest rules describing the respondents according to the material status assessment characterized the students' differentiating competencies.

It can be deduced that students having a very good financial situation were not forced to budget their expenses, hence, they did not have high competencies in this area, but they believed in their capabilities, which were partly due to the good financial situation enabling a "better start", also in business.

The respondents assessing their material status as good were quite strongly focused on motivation and taking actions in pursuit of the set goal, but they needed to improve their knowledge of tax systems. They were also highly responsible, but slightly less competent in monitoring progress of an enterprise or project, expanding networks of cooperation, coping with uncertainty and volatility, as well as in resources management, shaping their own future, and understanding financial issues. They used

resources responsibly and were able to plan and organize activities quite well, but they were poorly focused on challenges and problems.

Students who assessed their status as average had a high level of being accountable and guiding action. The assessment in terms of being innovative, teamwork, and identifying strengths and weaknesses, as well as calculating risk were not as good. This group needed support in economic and financial education, time management, and learning, as well as inspiration and evaluation of ideas.

Among the people assessing their material status as unsatisfactory, a rule was found that there were people who were able to calculate risk quite well and discover market needs, but they needed support in designing new solutions. They could determine their strengths and weaknesses very well and analyzed the context of the venture, they could monitor relevant trends and saw how they caused threats and new opportunities to create value, and they could also listen actively.

5.3. Professional Situation Analysis

In terms of the current professional situation, the largest group of respondents were nonworking students, i.e., 47% and part-time working students, i.e., 37%. Additionally, 10% of the respondents worked in a private company, 3% in administration, less than 2% ran their own business, while 1% of the respondents worked in their parents' companies. Considering the criterion of professional situation, 86 rules were generated.

In the group of unemployed students (36 rules), the attributes most often found in the rules represented the following basic level of competencies: sharing and protecting ideas, staying driven, managing resources, understanding economic and financial concepts, budgeting, finding funding, communicating effectively, coping with uncertainty, ambiguity, and working together. In addition, we found the following intermediate level of competencies: uncovering needs, assessing impact, developing sustainable business plans, and learning to learn. There were only two attributes that were rated the highest, i.e., managing resources, developing sustainable business plans.

In this group the strongest rules were as follows:

1. If manage resources is B and monitor your progress is B and understand economic and financial concepts is B and learn to learn is B, then current professional situation is unemployed (supportSize = 10 and laplace = 0.6471);
2. If cope with uncertainty and ambiguity is B and be flexible and adapt to changes is A and develop ideas is A and be curious and open is D, then current professional situation is unemployed (supportSize = 8 and laplace = 0.6);
3. If cope with uncertainty and ambiguity is B and define priorities is B and work independently is B and find funding is A, then current professional situation is unemployed (supportSize = 8 and laplace = 0.6);
4. If stay driven is B and develop sustainable business plans is E and make the most of your time is B, then current professional situation is unemployed (supportSize = 7 and laplace = 0.5714).

In turn, in the part-time working group (31 rules), the most frequent competencies represented the basic level (sharing and protect ideas, understanding economic and financial concepts, budgeting, understanding taxation, and using media effectively) and intermediate level (uncovering needs, being accountable, identifying one's strengths and weaknesses, making the most of one's time, and understanding taxation). There were only two competencies (being accountable and identifying one's strengths and weaknesses) that were assessed at the advanced level. The strongest rules in this group were as follows:

1. If share and protect ideas is B and develop ideas is A and budget is A and share and protect ideas is B, then current professional situation is part-time working (supportSize = 7 and laplace = 0.5714);
2. If listen actively is A and define priorities is A and uncover needs is C, then current professional situation is part-time working (supportSize = 6 and laplace = 0.5385).

There were only two rules induced in the group of students running their own business as follows:

1. If analyze the context is D and persuade is B and develop ideas is B, then current professional situation is self-employed (supportSize = 3 and laplace = 0.4);
2. If develop ideas is E and uncover needs is E and take action is E, then current professional situation is self-employed (supportSize = 2 and laplace = 0.3333).

In the group of people working in private companies (11 rules), the most common attributes were declared at the intermediate level, i.e., being curious and open, expanding one's network, reflecting, learning to learn and basic: believing in one's ability, staying driven, expanding one's network, learning to learn. The strongest rules were the following:

1. If stay driven is B and be curious and open is C and reflect is D, then current professional situation is working in a private company (supportSize = 5 and laplace = 0.5);
2. If recognize the value of ideas is E and manage risk is E and imagine is G, then current professional situation is working in a private company (supportSize = 5 and laplace = 0.5).

There were only two rules induced in the group employed in family businesses, as follows:

1. If be curious and open is D and manage resources is B and learn to learn is D, then current professional situation is working in a family business (supportSize = 1 and laplace = 0.25);
2. If be resilient is D and be accountable is D and assess impact is A, then current professional situation is working in a family business (supportSize = 2 and laplace = 0.3333).

Similarly, a small number of rules (four rules) were generated for students working in the public administration, and the strongest rules were the following:

1. If take responsibility is A and understand taxation is A and manage resources is B and develop emotional intelligence is E, then current professional situation is working in public administration (supportSize = 3 and laplace = 0.4);
2. If focus on what keeps you motivated is H and accept diversity is G and be curious and open is F, then current professional situation is working in public administration (supportSize = 3 and laplace = 0.4).

Analyzing the strongest rules for the current professional situation of the respondents, one can notice a rule among the unemployed students, that is, in the basic scope they can share ideas and protect them, look for sources of financing and take action. A little higher they assess their skills to convince others. They declare basic level of competencies in understanding economic and financial issues, managing resources, monitoring the progress of project implementation and ability to learn, as well as in staying driven and good use of time; but relatively high skills in creating business plans.

Part-time working students declare basic level of competencies in dealing with uncertainty and variability, flexibility in adapting to changes, and developing ideas; and average level of competencies in curiosity and openness. At the basic level they are able to define priorities and show independence in the implementation of tasks and search for funding.

Students running their own businesses can analyze the context well and also identify market needs, which enables them to adjust the offer to the clients' expectations in the conducted business.

People working in private companies can effectively recognize the value of business ideas, manage risk, as well as have developed imagination.

Students hired in family businesses assess their inquisitiveness and openness, as well as resilience and responsibility well.

Students working in public administration in the basic scope take responsibility and are familiar with taxation and management of various resources, but highly rated the development of emotional intelligence. They focus very much on motivation and accept diversity among people, as well as have high competencies of curiosity and openness.

6. Summary

The research presented in the paper was aimed at finding regularities in order to identify entrepreneurial competencies and evaluate their level as follows:

- To identify the differences in competencies and their levels for students regarding gender, material status, and professional situation;
- To identify the sets of competencies that need to be strengthened, and those that can be jointly developed.

The results obtained support the latest approach which is popular amongst scholars that the entrepreneurial competencies are very broad and create a universal set.

The research revealed that the surveyed women had completely different competencies than men. Good financial status has a positive impact on the level of self-assessment of competencies, but it does not help in solving difficult problems or facing challenges. In turn, respondents who are in a worse financial situation need support in economic and financial education, time management, learning, as well as in inspiration and evaluation of ideas.

Unemployed students, despite the mastered skills in developing business plans, need stimulation in regard to taking action, seeking funding, sharing ideas, and protecting ideas. In turn, working students who show openness and curiosity are able to set priorities and demonstrate independence in solving tasks and seeking funding, whereas students running their own businesses can effectively analyze the context and also identify market needs, which enables them to adjust the offer to the clients' expectations in the conducted businesses.

The competencies in each of the analyzed groups that require improvement were listed. A limitation of the research is its anonymity. For practical use of the results, the survey can identify the respondents, and therefore an academic teacher or a trainer would be able to tailor special programs and tasks that allow individual subgroups to develop the necessary and lacking skills. The other limitations of the study are time-related constraints, that is, this was the first time the research was conducted, hence it was not possible to compare the results over time on the same group of respondents. This type of research should be carried out, for example, before and after entrepreneurship courses, which would make it possible to deepen the analysis and evaluate the teaching methods used. This study is a pioneering application of the EntreComp framework, hence it is not possible to compare the results with those obtained by other researchers.

In order to improve the competencies of young people towards stimulating entrepreneurial attitudes, one should understand their complexity and interconnectedness. We plan to continue the research and search for new possibilities to analyze the complex set of EntreComp, as well as to expand the research by a qualitative approach and geographic area. This would enable cross-country comparisons regarding educational approaches efficiency and would also verify if the levels of entrepreneurial competencies increase with subsequent levels of education. We assume that obtaining a larger database would identify more rules important for the process of developing entrepreneurial competencies. We also plan to attempt to use other methods of analysis to explore the collected data in order to increase the efficiency of data processing used in development of entrepreneurial competencies, and therefore lead to a greater scope of influence on entrepreneurial attitudes among young people.

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