

# Antecedents of University Entrepreneurship: Empirical Evidence from Serbian Public Universities

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## Abstract

*The aim of this paper is to portray the effects of individual entrepreneurial orientation of the faculty (professors, teaching assistants and researchers) on entrepreneurial outcomes and outputs of Serbian higher education institutions. Particular objective of the paper is to examine and explore how research mobilization, unconventionality, industry collaboration and university policies affect entrepreneurial outcomes – joint research agreements, contractual agreements, consulting activities, establishment of spin-offs and patenting. For this purpose, primary data were collected at Serbian public universities. In total, 552 respondents correctly fulfilled the questionnaire specifically designed to meet the purpose of the study. The results indicate that entrepreneurial orientation plays a statistically significant role in entrepreneurial outcomes. However, entrepreneurial orientation is more important in commercial than non-commercial research outcomes.*

**Key words:** *entrepreneurial university; Serbian universities; technology transfer; third mission.*

## Introduction

Globalization and internationalization processes have remarkably changed the role of universities in the last few decades. Universities are required to operate in a more entrepreneurial manner, while at the same time undergoing rapid changes and assuming new roles in society, beyond the traditional roles of education and research. Thusly, the scene was set for business-like expansion and market and knowledge transfer

orientation (Gunasekara, 2006). This evident shift in paradigm is seldom referred to as a transition towards the “entrepreneurial university” (Clark, 1998).

Entrepreneurship of universities is still an amorphous phenomenon, and the term itself lacks solidified definitions. Nonetheless, scholars unequivocally advocate for the similarity of certain characteristics of entrepreneurial universities. Namely, high interdependence with the government and businesses, reliance on different sources of income, emphasizing entrepreneurial activities of all members (students, academics, and non-academic staff), implementing various strategies in order to create new ventures, and continuous appropriation of organizational structures (Guerrero et al., 2006).

A particularly interesting feature of entrepreneurial universities, which sets them apart from the non-entrepreneurial ones, is the way of teaching, conducting research and joint engagement of professors, students, and representatives of the business sector. A broad body of evidence indicates that there is a positive relationship between the educational processes and technological innovation and development (Kruss et al., 2015). Practical strategies implemented by entrepreneurial universities are mostly centred on the collaboration with the private sector, introduction of lectures from practice-wide experts, case study approach, problem solving, and development of business-oriented ideas. Examples of concrete measures used to boost entrepreneurial spirit at higher education institutions include providing facilities to other stakeholders from outside the institution, participating in regional clusters, supporting local cultural and artistic activities, providing opportunities for regional start-ups or already established companies, and taking an active role in determining the strategic direction of local development. University-industry linkages are particularly important in the developing countries (Zavale & Macamo, 2016).

It should be noted that the majority of higher education institutions are to some extent engaged in a myriad of different entrepreneurial activities. From a grand scheme of things, nevertheless, this does not imply that all these universities can be specifically considered as entrepreneurial institutions. The point of differentiation are close ties with the industry. Entrepreneurial universities can undertake different entrepreneurial activities in society, such as creating innovations in the ecosystem (Sam & van der Sijde, 2014), making a shift in education from the individual to the organizational level, tailoring the curriculum to companies’ needs, conducting research for industrial usage, meeting social and economic needs, or establishing business incubators, networked incubators and incubator networks (Etzkowitz, 2001). Close ties of research and industry are an important prerequisite for technology-driven economic development (Shin et al., 2020). On the other hand, universities are becoming more financially independent and at the same time more oriented to “entrepreneurial thinking and acting” (Audretsch, 2014). Additionally, entrepreneurial orientation and outcomes of such orientation might decrease the fiscal pressure on higher education institutions (Jacob & Gokbel, 2018).

Accordingly, this paper narrows down the definition of entrepreneurial university mostly to the links that universities create with the industry and business sector.

Broader definitions include many other faces of entrepreneurial university, particularly emphasizing contributions of universities to society and economic development (Cerver Romero et al., 2021). The goal of higher education institutions with regards to their Third Mission is not only to behave in a business-like, profit seeking manner, but rather to be proactive, innovative, and responsible institutions that participate in economic and social development of their environment, developing and educating entrepreneurial individuals competent to actively participate in society.

The close university-industry collaboration has been extended and recognized in the Triple Helix Model. This model sets the scene for establishment of functional relations and links among industry, university and government (Etzkowitz & Leydesdorff, 2000). Only those universities that implement different activities in order to improve the regional or national economic performance, while providing financial advantages for themselves, can be considered entrepreneurial (Etzkowitz, 2001). From this point of view, academic entrepreneurship is viewed as an approach that enables formal and informal mechanisms to commercialize research (Baldini et al., 2014). The entrepreneurial university has gained prominence as a catalyst of knowledge and innovation (Fayolle & Redford, 2014) of key importance for the competitiveness, stimulation of economic growth and creation of wealth in today's globalized world (Mian, 2011).

## **Methods**

### ***The research aim and problem***

Entrepreneurial university as such might not be a novel topic. A number of studies point out that entrepreneurship agenda is flagged as a paramount factor in number of universities and particular academic disciplines (Ahmad et al., 2016). The drivers of entrepreneurial activities at higher education institutions, on the other side, are still vastly under the research radars.

Following the aforementioned research gap, the general aim of this paper is to provide an overview of entrepreneurial activities of professors, teaching assistants and researchers employed at Serbian public universities in order to recognize and rate the human potentials as a part of the institutional intellectual capital of Serbian public universities, their utilization, strategy and performances.

Compared to other developed countries, research intensity in Serbia is still insufficient. Nonetheless, the number of business-related ideas developed at Serbian universities and intended for the industrial and business sector is not as modest. Serbian universities have the required capacity to transfer knowledge through the development of patents, spin-offs and start-ups, and to contribute to leadership by fostering entrepreneurial thinking, performing entrepreneurial actions and providing entrepreneurial capital to help implement new ideas in the economy, as a form of hybridization of knowledge. The triple helix model has been implemented to some extent at Serbian universities during the last years, as a result of the increasing urge for research and innovations in Serbian economy (Rakicevic et al., 2018).

Entrepreneurial orientation of Serbian universities has been strongly encouraged by the government and state institutions. The year 2016 was proclaimed the Year of Innovation and Entrepreneurship and witnessed the launching and promotion of various governmental programs that supported entrepreneurial activities in all sectors, including higher education. Innovations and entrepreneurship are seen as key drivers for the creation of a more sustainable economy and society. The prominent intention was to ensure a profound financial independence of universities by fostering collaboration between higher education institutions and the business sector.

However, when measuring the quality of entrepreneurial activities at Serbian universities against the financial resources generated from such activities, it can be noticed that not all higher education institutions (particular universities or faculties within universities) are equally successful. Basically, entrepreneurial activity depends on the entrepreneurial knowledge and capacities of employees at higher education institutions, which is the main reason for big discrepancies in revenue generation. Such discrepancies can be found everywhere in the world, and Serbia is no exception (Vesperi & Gagnidze, 2021; Pita et al., 2021). Consequently, the problem analysed in this study is individual entrepreneurial orientation of professors, teaching assistants and research staff at Serbian public universities, and the way it affects the development of entrepreneurial universities. From an entrepreneurial line of reasoning, university professors are expected to 1) act proactively by mobilizing research capacities to address practice-related problems, 2) be original and unconventional, 3) foster collaboration with industry, and 4) exploit favourable university policies related to entrepreneurial activities and processes (Cvijić et al., 2019).

### ***Hypotheses***

The specific aim of this paper is to portray the effects of individual entrepreneurial orientation of the faculty (professors, teaching assistants and researchers) on entrepreneurial outcomes and outputs of Serbian higher education institutions. The individual entrepreneurial orientation was measured through self-evaluation of entrepreneurial activities using a structured instrument adapted from I-ENTRE-U scale, i.e. Individual entrepreneurial orientation scale for universities (Todorovic et al., 2011).

Entrepreneurial output of individuals at higher education institution is defined by joint research agreements (JRA), contractual research agreements (CRA), consulting, establishment of spin-offs and patenting. Accordingly, the hypotheses underlying this research project that are explored in the empirical research are as follows:

H1: Entrepreneurial orientation positively affects joint research agreements (JRA).

H2: Entrepreneurial orientation positively affects contractual research agreements (CRA).

H3: Entrepreneurial orientation positively affects consulting activities.

H4: Entrepreneurial orientation positively affects the establishment of spin-offs.

H5: Entrepreneurial orientation positively affects patenting and similar activities related to intellectual property.

Based on the presented context and literature review, and the development of hypotheses, the graphical display of the hypothesized model is given in Figure 1.

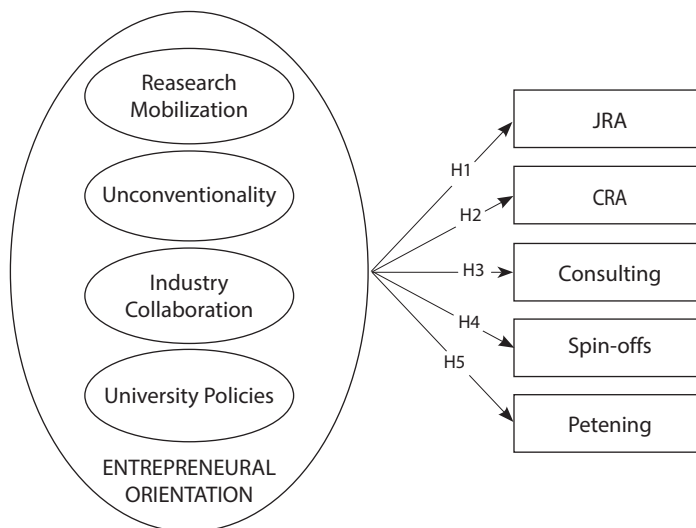


Figure 1. Hypothesized model

### **Instrument**

The study was based on primary data collected with the use of a structured questionnaire as a research tool. The questionnaire was in electronic form, and it was distributed using CAWI (Computer-Assisted Web Interviewing) web tool. The questionnaire was delivered in Serbian language, and it encompassed five sections. The first part considered the respondents' demographics. The following three sections were aimed at collecting the data on independent variables: research mobilization, unconventionality, industry collaboration, and university policy. The last section was reserved for dependent variables – the frequency of respondents' engagement with industry.

The measures by which teachers and researchers at higher education institutions mobilize their research capacities (Milosavljevic & Benkovic, 2014) or use their own or institutional capacities for entrepreneurial purposes (Marzocchi et al., 2017) were considered as independent variables. The constructs for these variables were adapted from I-ENTRE (Felgueira & Rodrigues, 2020) related scales. I-ENTRE is an individual transformation of a well-known I-ENTRE-U stream of research (Todorovic et al., 2011). In total, 21 items were structured into four categories:

- 1) Research Mobilization: a) encouraging graduate students to engage in practice-based research [RM1], b) encouraging students to seek practical implications

[RM2], c) emphasizing applied research [RM3], d) making efforts toward contributions required in practice [RM4], e) partnering with non-academic professionals in research [RM5], and f) expecting to make contribution to industry or society [RM5].

- 2) Unconventionality: a) research ideas usually come out of my institution [UC1], b) research ideas usually come from industry [UC2], c) financing my research from non-research grants [UC3], d) individual research is effective and productive [UC4], e) generating off-campus benefits from research [UC5], f) excellence in identifying research problems [UC6], g) supporting colleagues in collaboration with industry [UC7], and h) first-mover towards the unconventional ideas [UC8].
- 3) Industry Collaboration: a) encouraging involvement of industry in research [CI1], b) research is highly regarded by industry [CI2], c) recognition from industry for innovativeness and flexibility [CI3], and d) my students secure high-quality jobs [CI4].
- 4) University Policies: a) institution-wide policies substantially contribute to research [UP1], b) university policies are made “bottom-up” [UP2], c) my institution is responsive to new ideas [UP3], and d) my department has autonomy in selecting performance criteria for appointing faculty members [UP4].

All these items were measured on a Likert-type scale ranging from 1 (completely disagree) to 7 (completely agree).

The frequency of industry engagement item was developed based on D’Este and Perkmann’s work (2010). The items are indeed the outputs of university-industry relationship or the classic mechanisms for technology transfer. These mechanisms encompass joint research agreements (JRA), contractual research agreements (CRA), consulting, establishment of spin-offs and patenting. The last two mechanisms are motivated by commercialization, whilst the other three are dominated by research-related motivation such as learning from industry. The examinees were asked, ‘How frequently were you engaged in the following activity in the last year?’ The answers were coded in the following manner: 1 – not at all, 2 – once or twice, 3 – three to five times, 4 – six to nine times, and 5 – more than 10 times.

The questionnaire was pilot tested by eight experts (all of them faculty staff) to ensure the readability and the precision of inquiries (Cicvaric Kostic et al., 2013). Accordingly, the questionnaire was slightly modified, and most of the adjustments were of linguistic nature. This process resulted in the final questionnaire used to collect the data. The final version of the questionnaire in Serbian language is available upon request to the authors of the paper.

### **Sample**

This research utilized the method of stratified sampling. The aim of the study was to examine only the faculties from public universities in Serbia, excluding arts and

defence universities and colleges (five universities were examined in total: University of Belgrade, University of Novi Sad, University of Nis, University of Kragujevac, and State University of Novi Pazar). The total population is given in Table 1.

Table 1  
The total population of the faculty by university

| University                     | Total  | Title split |            | Gender split |       |
|--------------------------------|--------|-------------|------------|--------------|-------|
|                                |        | Professors  | Assistants | Female       | Male  |
| University of Belgrade         | 4,834  | 3,470       | 1,364      | 2,844        | 1,990 |
| University of Novi Sad         | 3,219  | 2,144       | 1,075      | 1,658        | 1,561 |
| University of Nis              | 1,508  | 1,120       | 388        | 749          | 759   |
| University of Kragujevac       | 1,121  | 743         | 378        | 586          | 535   |
| State University of Novi Pazar | 192    | 140         | 52         | 76           | 116   |
| Total                          | 10,874 | 7,617       | 3,257      | 5,913        | 4,961 |

The questionnaire was distributed to faculties in e-form via email. Data were collected in the period from May to August 2020, in three rounds. In the first call, the emails with the questionnaire attached were sent using the 'snowball' sampling procedure (see Damjanović et al., 2020). The emails with coded questionnaires were sent to university administrators who forwarded them to the faculty members. The process was actively controlled to limit any invasive sub-clustering (see Radonić & Milosavljević, 2019). After the first round, 218 responses were collected.

When the invasive sub-clustering was detected (particularly for the University of Novi Sad), the second round was initiated. The emailing list with 3,184 electronic addresses was compiled for other four universities using publicly available data from the university and/or faculty web sites. The emails with the attached questionnaire were sent accordingly. The follow-up was made two additional times for the second round. In total, 346 additional responses were collected (the response rate for the second round was 9.2 %).

The total number of responses collected in both rounds was 564. Nevertheless, 12 responses were eliminated (eight for having less than 70 % of answers and four for possible survey fatigue). Accordingly, the final sample size was 552, with the confidence interval of 4.06 and the confidence level of 95 %.

### **Procedure**

The data were entered and analysed in the Statistical Package for Social Science (SPSS), version 26.0. The quantitative data were analysed using the measures of descriptive statistics: percentages, means and standard deviations. For multiple comparisons we used the analysis of variance and standard deviation. Interdependence of research mobilization, unconventionality, collaboration with industry, university policy and five dependent entrepreneurial outcomes was determined by the Pearson's product moment two tailed correlation and multiple regression analysis.

## Results

### *Sample features*

The sample was stratified. The majority of respondents were from the University of Belgrade (265 or 48.0 %), followed by the University of Novi Sad (182 or 33.0 %), the University of Nis (54 or 9.8 %), the University of Kragujevac (38 or 6.9 %) and the State University of Novi Pazar (13 or 2.4 %). This distribution corresponds to the strata distribution in the total population (see Table 1).

As for the scientific field, more than a half of all respondents work in technical sciences (294 or 53.3 %). Nearly a quarter of respondents are in the field of social sciences and humanities (130 or 23.6 %), whereas medical, natural sciences and others make up 13.4 % (45), 8.2 % (45) and 1.6 % (9) of the sample, respectively.

With respect to gender, the relative majority of 282 were female respondents (51.1 %) which reflects the gender split in the total population (see Table 1).

When it comes to the title, teaching assistants make up 28.4 % (or 157 respondents), assistant professors 24.3 % (or 134), associate professors 18.3 % (or 101), full professors 23.0 % (127) and others 6 % of the sample. The main preoccupation of the examinees was lecturing (approximately 70 %). Only slightly above a quarter of examinees were 'pure' researchers (144 or 26.6 %), whereas lecturing was predominant occupation for more than two thirds of examinees (69.9 % or 386 examinees).

### *Preliminary analysis*

Prior to testing the hypotheses, we calculated descriptive statistics and conducted reliability tests and correlation analysis. The descriptive statistics for individual items of independent variables are given in Table 2. As displayed in the table, respondents' market research mobilization items are the cornerstone of their entrepreneurial activity. In particular, their efforts to mobilize graduate students were highly graded (RM2 – M 5.59, STD 1.48, and RM1 – M 5.35, STD 1.60). On the other side, university policies are the largest barrier to entrepreneurial activities at Serbian public universities (i.e., UP2 - M 3.53, STD 1.60, and UP1 - M 3.58, STD 1.63).

As for the channels for entrepreneurial activities (for the purpose of this study – dependent variables), the frequencies of responses are shown in Table 3. As expected, the faculties at public universities in Serbia have been scarcely involved in entrepreneurial activities in the previous year. For instance, only around 17 % of respondents have been actively working on patenting or similar activities related to protecting intellectual property, and merely 10 % have been included in the establishment of spin-offs. The situation is somewhat better when it comes to low-performing entrepreneurial outputs such as joint research or contractual research.



Table 2  
Descriptive statistics for individual items

| Research mobilization  |      |      |      |      |      |
|------------------------|------|------|------|------|------|
| Item                   | M    | STD  | Item | M    | STD  |
| RM1                    | 5.35 | 1.60 | RM4  | 5.24 | 1.61 |
| RM2                    | 5.59 | 1.48 | RM5  | 4.68 | 1.88 |
| RM3                    | 5.07 | 1.66 | RM6  | 3.31 | 1.73 |
| Unconventionality      |      |      |      |      |      |
| Item                   | M    | STD  | Item | M    | STD  |
| UC1                    | 5.04 | 1.59 | UC5  | 5.20 | 1.49 |
| UC2                    | 3.68 | 1.81 | UC6  | 4.35 | 1.52 |
| UC3                    | 3.42 | 1.93 | UC7  | 4.34 | 1.77 |
| UC4                    | 4.27 | 1.46 | UC8  | 5.59 | 1.41 |
| Industry collaboration |      |      |      |      |      |
| Item                   | M    | STD  | Item | M    | STD  |
| IC1                    | 3.72 | 1.85 | IC3  | 4.01 | 1.82 |
| IC2                    | 4.08 | 1.81 | IC4  | 5.88 | 1.45 |
| University policies    |      |      |      |      |      |
| Item                   | M    | STD  | Item | M    | STD  |
| UP1                    | 3.58 | 1.63 | UP3  | 4.46 | 1.61 |
| UP2                    | 3.53 | 1.60 | UP4  | 4.23 | 1.91 |

Table 3  
Frequencies for dependent variables

|         | Joint Research |      | Contractual Research |      | Consulting |      | Spin-off Establishment |      | Patenting |      |
|---------|----------------|------|----------------------|------|------------|------|------------------------|------|-----------|------|
|         | N              | %    | N                    | %    | N          | %    | N                      | %    | N         | %    |
| 1       | 222            | 40.2 | 207                  | 37.5 | 278        | 50.4 | 495                    | 89.7 | 459       | 83.2 |
| 2       | 224            | 40.6 | 266                  | 48.2 | 131        | 23.7 | 24                     | 4.3  | 65        | 11.8 |
| 3       | 73             | 13.2 | 57                   | 10.3 | 79         | 14.3 | 7                      | 1.3  | 8         | 1.4  |
| 4       | 12             | 2.2  | 7                    | 1.3  | 25         | 4.5  | 1                      | .2   | 1         | .2   |
| 5       | 12             | 2.2  | 8                    | 1.4  | 28         | 5.1  | 1                      | .2   | -         | .0   |
| Total   | 543            | 98.4 | 545                  | 98.7 | 541        | 98.0 | 528                    | 95.7 | 533       | 96.6 |
| Missing | 9              | 1.6  | 7                    | 1.3  | 11         | 2    | 24                     | 4.3  | 19        | 3.4  |
| Total   | 552            | 100  | 552                  | 100  | 552        | 100  | 552                    | 100  | 552       | 100  |

Individual items for independent variables were combined into multi-item constructs – Research Mobilization, Unconventionality, Industry Collaboration and University Policy. The items were scaled for the purpose of reliability analysis. The results for the reliability test (Cronbach's Alpha) were .83, .70, .85 and .77 for four dependent variables, respectively (see Table 4). All the values were above the threshold of .70 (Taber, 2018). In the context of this particular study, this unidimensional feature of the measurement scale is somewhat expected as all the items have been to the major

extent extracted from the previous body of knowledge. The fact that respondents see market university policies as the main barrier to entrepreneurial activities is interesting to note ( $M = 3.95$ ,  $STD = 1.3$ ).

Table 4  
Descriptive statistics, reliability analysis and the correlation matrix

|                        | M    | STD  | CA  | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     |
|------------------------|------|------|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| Res. Mobilization      | 4.88 | 1.22 | .83 | .60** | .61** | .31** | .24** | .20** | .26** | .05   | .15** |
| Unconventionality      | 4.09 | 0.93 | .70 |       | .69** | .21** | .35** | .30** | .38** | .15** | .19** |
| Industry Collaboration | 4.42 | 1.45 | .85 |       |       | .22** | .41** | .33** | .43** | .14** | .18** |
| University Policy      | 3.95 | 1.30 | .77 |       |       |       | .01   | -.03  | -.01  | -.05  | .11** |
| Joint Research         | 1.84 | 0.90 | -   |       |       |       |       | .48** | .41** | .25** | .24** |
| Contractual Research   | 1.79 | 0.79 | -   |       |       |       |       |       | .31** | .15** | .15** |
| Consulting             | 1.88 | 1.14 | -   |       |       |       |       |       |       | .24** | .17** |
| Spin-Offs              | 1.09 | 0.37 | -   |       |       |       |       |       |       |       | .44** |
| Patenting              | 1.16 | .43  | -   |       |       |       |       |       |       |       |       |

Legend: \* - significant at 0.05; \*\* – significant at 0.00.

We found a number of statistically significant correlations. The majority of independent variables have shown positive correlation with the dependent variables (Table 4). The highest correlation was detected between Industry Collaboration and Consulting ( $b=.43$ ,  $p<.00$ ), and Industry Collaboration and Joint Research ( $b=.41$ ,  $p<.00$ ). No statistically significant correlation was found between University Policies on the one side and Joint Research, Contractual Research, Consulting or Spin-Off Establishment. Nonetheless, we decided to include University Policies into multiple regression analysis.

### Hypotheses testing

In order to estimate the extent to which the selected entrepreneurial orientations (Research Mobilization, Unconventionality, Industry Collaboration and University Policies) affect the entrepreneurial output of Serbian public universities, we used several multivariate linear regression models. We used Joint Research Agreements (JRA), Contractual Research Agreements (CRA), Consulting, Spin-Off Establishment and Patenting as dependent variables in these models. Equation 1 presents linear model specifications for five dependent variables.

$$IR_{1-5} = C + \alpha_1 RM + \alpha_2 UC + \alpha_3 IC + \alpha_4 UP + \epsilon_t$$

Acronyms IR1-5 denote five dependent variables (Joint Research Agreements, Contractual Research Agreements, Consulting, Spin-Off Establishment and Patenting).

As for independent variables, RM is Research Mobilization, UC is Unconventionality, IC is Industry Collaboration, and UP is University Policy. C is the constant, and  $\epsilon_t$  is the error that follows Gaussian distribution.

Since a number of positive correlations have been found among independent variables, we thoroughly examined possible autocorrelation. The values for Durbin-Watson test were between the threshold values (2.07, 2.07, 2.12, 2.01 and 1.99, respectively) for all regression models. The Variation Inflation Factors (VIF) for each variable were relatively low and below the well-known rule of thumb values.

The parameters for the first model (where the dependent variable is Joint Research Agreements) are displayed in Table 5. As shown in the table, the model is statistically significant ( $F=27.23$ ). However, it explained only 18 % of variability ( $R^2=.18$ ). Thus, H1 is confirmed, which means that individual Entrepreneurial Orientation positively affects Joint Research Agreements at Serbian public universities. When explored in detail, the predictors of Joint Research as an entrepreneurial output of a faculty at Serbian public universities were Unconventionality, Industry Collaboration and University Policies ( $p<.05$ ).

Table 5  
The regression model for joint research as a dependent variable

| Model 1<br>(Joint Research) | B    | STE   | $\beta$        | t     | Sig.               | VIF  |
|-----------------------------|------|-------|----------------|-------|--------------------|------|
| (Constant)                  | .71  | .19   |                | 3.80  | .00                |      |
| Research Mobilization       | -.04 | .04   | -.06           | -1.01 | .31                | 1.89 |
| Unconventionality           | .14  | .06   | .14            | 2.39  | .02                | 2.17 |
| Industry Collaboration      | .22  | .04   | .39            | 5.94  | .00                | 2.20 |
| University Policy           | -.06 | .03   | -.08           | -1.96 | .05                | 1.11 |
|                             | R    | .42   | R <sup>2</sup> | .18   | Adj.R <sup>2</sup> | .17  |
|                             | F    | 27.23 | Sig.           | .00   | D-W                | 2.07 |

As for the second model, the parameters are shown in Table 6. The model is statistically significant at  $p<.00$  and explains 13 % of the variability in the dependent variable (Contractual Research Agreements). Accordingly, H2 is confirmed, which means that Entrepreneurial Orientation positively affects Contractual Research Agreements at Serbian public universities. The predictors are the same as in the first case ( $p<.05$ ).

When it comes to Consulting as a dependent variable, the model is statistically significant at  $p<.00$ . The parameters are presented in Table 7. Approximately 22 % of variability of Consulting as an output is explained with individual entrepreneurial orientation ( $R^2=.22$ ). Therefore, H3 is confirmed, meaning that Entrepreneurial Orientation positively affects Consulting Orientation at Serbian public universities. Once again, individual predictors were the same as in the first two models.

Table 6

*The regression model for Contractual Research as a dependent variable*

| Model 2<br>(Contractual Research) | B    | STE   | $\beta$        | t     | Sig.               | VIF  |
|-----------------------------------|------|-------|----------------|-------|--------------------|------|
| (Constant)                        | .94  | .17   |                | 5.51  | .00                |      |
| Research Mobilization             | -.02 | .04   | -.04           | -0.63 | .53                | 1.89 |
| Unconventionality                 | .16  | .05   | .19            | 3.03  | .00                | 2.17 |
| Collaboration with Industry       | .13  | .03   | .24            | 3.94  | .00                | 2.21 |
| University Policy                 | -.07 | .03   | -.12           | -2.65 | .01                | 1.11 |
|                                   | R    | .37   | R <sup>2</sup> | .13   | Adj.R <sup>2</sup> | .13  |
|                                   | F    | 19.27 | Sig.           | .00   | D-W                | 2.07 |

Table 7

*The regression model for Consulting as a dependent variable*

| Model 3<br>(Consulting) | B    | STE   | $\beta$        | t     | Sig.               | VIF  |
|-------------------------|------|-------|----------------|-------|--------------------|------|
| (Constant)              | .33  | .23   |                | 1.41  | .19                |      |
| Research Mobilization   | -.06 | .05   | -.06           | -1.14 | .26                | 1.89 |
| Unconventionality       | .23  | .07   | .19            | 3.21  | .00                | 2.19 |
| Industry Collaboration  | .28  | .05   | .36            | 6.13  | .00                | 2.22 |
| University Policy       | -.09 | .04   | -.12           | -2.53 | .01                | 1.12 |
|                         | R    | .46   | R <sup>2</sup> | .22   | Adj.R <sup>2</sup> | .21  |
|                         | F    | 34.15 | Sig.           | .00   | D-W                | 2.12 |

In a grand scheme of things, the entrepreneurial output that is not necessarily motivated by commercialization (in this case, Joint Research Agreements, Contractual Research Agreements and Consulting) is affected by entrepreneurial orientation. As the results indicate, only Research Motivation is not an empirically proved predictor.

The establishment of spin-offs is also affected by individual entrepreneurial orientation (Table 8). Therefore, H4 is confirmed at  $p < .00$  and explained with 20 % of variability ( $R^2 = .20$ ). Accordingly, Entrepreneurial Orientation positively affects the establishment of Spin-Offs at Serbian public universities. Model 4, however, is predicted only by Research Mobilization and Collaboration with Industry as independent variables.

Table 8

*The regression model for Establishment of Spin-offs as a dependent variable*

| Model 4<br>(Spin-offs) | B    | STE  | $\beta$        | t     | Sig.               | VIF  |
|------------------------|------|------|----------------|-------|--------------------|------|
| (Constant)             | .88  | .09  |                | 10.10 | .00                |      |
| Research Mobilization  | -.04 | .02  | -.12           | -1.97 | .05                | 1.89 |
| Unconventionality      | .05  | .03  | .11            | 1.73  | .08                | 2.19 |
| Industry Collaboration | .03  | .02  | .13            | 1.92  | .05                | 2.24 |
| University Policy      | .01  | .01  | .05            | 1.05  | .30                | 1.12 |
|                        | R    | .18  | R <sup>2</sup> | .20   | Adj.R <sup>2</sup> | .02  |
|                        | F    | 4.08 | Sig.           | .00   | D-W                | 2.01 |

Finally, H5 is confirmed ( $p < .00$ ), which means that Entrepreneurial Orientation positively affects activities related to patenting and other similar means of protection of intellectual rights. Nonetheless, only about 5 % of variability in Patenting is explained with individual entrepreneurial orientation. As displayed in Table 9, Unconventionality is the sole statistically significant predictor of Patenting.

Table 9  
The regression model for Patenting as a dependent variable

| Model 5<br>(Patenting) | B    | STE  | $\beta$        | t    | Sig.               | VIF  |
|------------------------|------|------|----------------|------|--------------------|------|
| (Constant)             | .72  | .10  |                | 7.16 | .00                |      |
| Research Mobilization  | -.00 | .02  | -.01           | -.15 | .88                | 1.90 |
| Unconventionality      | .06  | .03  | .13            | 1.99 | .05                | 2.16 |
| Industry Collaboration | .03  | .02  | .09            | 1.34 | .18                | 2.20 |
| University Policy      | .02  | .02  | .07            | 1.48 | .14                | 1.11 |
|                        | R    | .22  | R <sup>2</sup> | .05  | Adj.R <sup>2</sup> | .04  |
|                        | F    | 6.25 | Sig.           | .00  | D-W                | 1.99 |

A relatively small portion of variability of commercial-based entrepreneurial outputs at Serbian public universities is explained by the individual entrepreneurial orientation of the faculty and research staff. Also, particular independent variables are not always good predictors of the Establishment of Spin-offs or the creation of new patents and other industrial or intellectual intangibles. Surprisingly, University Policy does not play a pivotal role for these high-performing entrepreneurial outputs.

## Discussion

### *Key findings and contribution*

The aim of this paper was to examine and explore how entrepreneurial orientation of academics engaged at Serbian public universities affects entrepreneurial outcomes – joint research, contractual research, consulting, spin-off establishment and patenting. For this purpose, we collected evidence from 552 faculties. The results indicate that individual entrepreneurial orientation plays an important role in entrepreneurial outcomes. The graphical representation of the key findings is given in Figure 2.

However, not all elements of entrepreneurial orientation are equally important for the university entrepreneurial output. In general, research mobilization is important for commercial-related activities, which is a finding in line with ones from similar studies. In an adverse and unfriendly entrepreneurial environment such as the Serbian one (Seguí-Mas et al., 2017), public universities play the key role in fostering social and economic development through academic entrepreneurship. The faculty and researchers with higher power to mobilize research capacities in this case have higher chances of commercializing the effects of their entrepreneurial activities. Unconventionality has a powerful impact on four out of five entrepreneurial outcomes examined in the study.

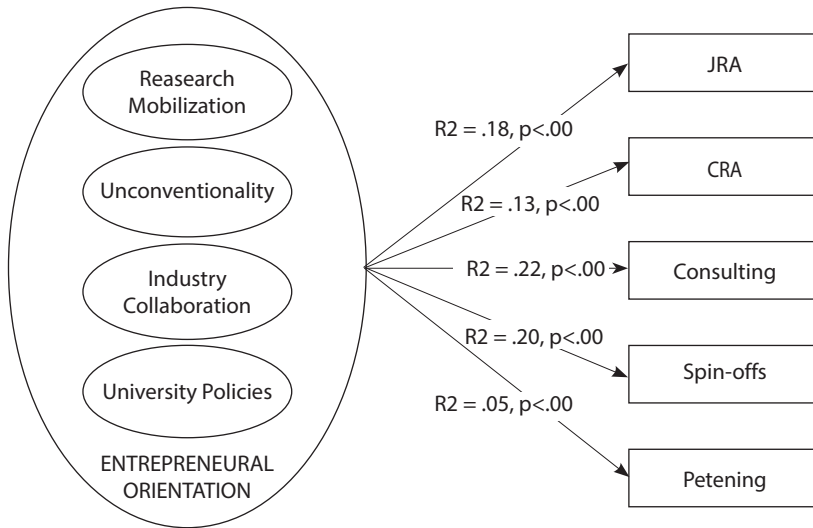


Figure 2. Validated model

This is in line with previous Serbian studies on the way unorthodox approaches to the creation of any service in the public sector improve the output quality (Milanović et al., 2019). Also, the collaboration with industry fairly affects high-performing entrepreneurial outputs. This university dynamics underlying the relationship of the faculty and research staff has not been thoroughly explored in the existing body of research, but only some findings can be found which confirm its importance for both industry and university (Steinmo & Rasmussen, 2018). Interestingly enough, university policy is a fair predictor of low-performing entrepreneurial outputs such as joint or contractual research agreements. Still, it seems that Serbian universities lack consistent and comprehensive policies to stimulate and incentivize collaborative innovations (see Song et al., 2020). It also seems that Serbian university policies and particularly the lack of stimulus for research might be the paramount factor in hindering entrepreneurial outcomes.

Current policies are solely based on publishing as the output of research, i.e. the emphasis on publishing in turn causes the neglect of entrepreneurial outcome. It can be speculated that the change in university policies towards commercially-based research will improve. As already pointed out in recent research, some public universities in Serbia strive to become more entrepreneurial, although higher education itself lacks the entrepreneurial tradition (Stanković, 2006; Vekić et al., 2019).

### Implications

The study has twofold implications – for researchers and practitioners. The main implication for the research is yet another confirmation of the validity of I-ENTRE scale (Felgueira & Rodrigues, 2020). The measurement of entrepreneurial orientation of the

faculty and research staff at higher education institutions has been high on the agenda of contemporary research (Covin et al., 2020). Additionally, this study confirmed that entrepreneurial orientation has its effects and impact on the entrepreneurial output. Although this might be a low-tension research question in industry-related research, higher education institutions have hitherto been out of the research radars (Bell, 2019).

The implications are more fruitful for practitioners, and they are aimed at both the faculty and researchers as well as policy-holders and decision makers in higher education institutions. On the other hand, policy holders need to actively explore and exploit abundant information to support their decision making (Desouza & Lin, 2013). This study provides ample evidence on the interplay between the entrepreneurial orientation and entrepreneurial outcomes at public universities. Although the findings are geographically and contextually related to a single case, they could be generalized to serve policyholders in other similar countries and universities.

### ***Limitations and further recommendations***

As in the case of other quantitative empirical explorations, this study has a number of flaws. The first and foremost downside of the paper is related to the number of variables used to examine and explore the nature of entrepreneurial outputs at Serbian public universities. As the results indicate, only up to approximately one fifth of variability of entrepreneurial outputs is explained by entrepreneurial orientation as an antecedent. This creates an avenue for further research in terms of including other variables in order to generate more comprehensive findings. For instance, a possible niche for further research could be the exploration of how government-based acts affect the innovative outcomes of university-focused technology transfer policies (see Cunningham et al., 2019). Also, financing as a predictor of entrepreneurial activities at Serbian universities might bring additional variability to dependent variables pool.

An important strength of this study is the size of the sample. However, the analysis is purely quantitative so future research efforts should focus on thorough qualitative examination of the relationship between different individual features, attitudes and behaviours (those entrepreneurially predictive ones in particular) and entrepreneurial outcomes.

### **Conclusions**

Entrepreneurship is a synonym for innovation, a source of new ideas, goods, services, and businesses/or procedures. Entrepreneurs play a pivotal role in any economy, using the skills and initiative necessary to anticipate the needs of the market and bring good new ideas to it. The role of university lecturers and professors is changing as well. They are expected to act more entrepreneurially by promoting the entrepreneurial mindset and spirit, fostering entrepreneurship as a matter of culture. Entrepreneurial activities at Serbian universities are still at their infancy, but this study has confirmed their elements among Serbian academics.

This study examined various factors that affect the entrepreneurial success of public universities in Serbia. One of its important findings is that institutional capacity tends to be the most substantial driver of the entrepreneurial success of Serbian public universities. Thus, higher education policy makers should put more effort into a more rational use of tangible, intangible and financial assets with the aim of maximizing the entrepreneurial output.

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# Prethodnice sveučilišnoga poduzetništva: empirijski dokazi sa srpskih državnih sveučilišta

## Sažetak

*Cilj je ovoga rada prikazati utjecaj individualne poduzetničke orijentacije akademika (profesora, asistenata i istraživača) na poduzetničke ishode srpskih institucija visokoga obrazovanja. Posebna zadaća ovoga rada bila je ispitati i istražiti kako pokretanje istraživanja, nekonvencionalnost, suradnja s industrijom i sveučilišna politika djeluju na rezultate u poduzetništvu – zajedničke istraživačke sporazume, ugovorna istraživanja, aktivnosti savjetovanja, osnivanje tvrtki kćeri (spin-off) i patentiranje. Za tu svrhu sakupljeni su primarni podatci na srpskim državnim sveučilištima. Ukupno je 552 ispitanika točno ispunilo upitnike osmišljene za potrebe ovoga istraživanja. Rezultati pokazuju da poduzetnička orijentacija ima statistički značajnu ulogu u poduzetničkim ishodima te da je poduzetnička orijentacija važnija u komercijalnim nego u nekomercijalnim istraživačkim ishodima.*

**Ključne riječi:** *poduzetničko sveučilište; prijenos tehnologije; srpska sveučilišta; treća misija.*

## Uvod

Globalizacija i međunarodni procesi značajno su promijenili ulogu sveučilišta u posljednjih nekoliko desetljeća. Sveučilišta su suočena s potrebom prilagođavanja svojega djelovanja poduzetničkoj orijentaciji, dok u isto vrijeme prolaze kroz brze promjene i zauzimaju nove uloge u društvu, izvan granica tradicionalnih uloga obrazovanja i istraživanja. Stoga, postavljen je temelj za ekspanziju nalik na biznis i tržišnu orijentaciju prijenosa znanja (Gunasekara, 2006). Ova očita promjena paradigme rijetko se naziva prijelazom na „poduzetničko sveučilište” (Clark, 1998).

Poduzetništvo sveučilišta još uvijek je amorfna pojava i sam termin nije čvrsto definiran. Unatoč tome, znanstvenici nedvosmisleno tvrde da postoje sličnosti određenih karakteristika poduzetničkih sveučilišta. Naime, postoji izražena međuovisnost poduzetničkih sveučilišta, vlade i tvrtki, ona se oslanjaju na raznolike izvore prihoda, naglašavaju poduzetničke aktivnosti svih članova (studenta, akademskoga i neakademskoga osoblja), primjenjuju razne strategije za realizaciju novih poduhvata i kontinuirano prilagođavaju svoju organizacijsku strukturu (Guerrero i sur., 2006).

Posebno zanimljiva odlika poduzetničkih sveučilišta, koja ih razlikuje od nepoduzetničkih, jest način poučavanja, izvođenja istraživanja i zajednički angažman profesora, studenata i predstavnika sektora gospodarstva. Veliki broj dokaza ukazuje na pozitivan odnos između obrazovnih procesa i tehnoloških inovacija i razvoja (Kruss i sur., 2015). Praktične strategije koje primjenjuju poduzetnička sveučilišta većinom su usredotočene na suradnju s privatnim sektorom, uvođenje predavanja raznih stručnjaka iz prakse, pristup studije slučaja, rješavanje problema i razvoj zamisli orijentiranih na gospodarstvo. Primjeri konkretnih mjera korištenih za poticanje poduzetničkoga duha na institucijama visokoga obrazovanja uključuju davanje prostora drugim dioničarima izvan same institucije, sudjelovanje u regionalnim klasterima, podržavanje lokalnih kulturnih i umjetničkih aktivnosti, osiguravanje prilika za regionalna mlada poduzeća ili osnivanje kompanija i preuzimanje aktivne uloge u utvrđivanju strateškoga smjera lokalnoga razvoja. Veze između sveučilišta i industrije posebno su važne u razvijenim zemljama (Zavale i Macamo, 2016).

Treba napomenuti kako je većina institucija visokoga obrazovanja do neke mjere angažirana u široku lepezu raznolikih poduzetničkih aktivnosti. U širem kontekstu ovo ipak ne podrazumijeva da ta sveučilišta možemo smatrati specifično poduzetničkim institucijama. Točka razlikovanja je bliska veza s industrijom. Poduzetničko sveučilište može se baviti raznolikim poduzetničkim aktivnostima u društvu, povezanima s inovacijama u ekosustavu (Sam i van der Sijde, 2014), ili mijenjati poučavanje s individualne na organizacijsku razinu te oblikovati kurikulum prema potrebama kompanija, provoditi istraživanja za upotrebu u industriji, zadovoljavati društvene i ekonomske potrebe, ili uspostavljati poslovne inkubatore, poduzetničke inkubatore i mreže inkubatora (Etzkowitz, 2001). Bliske veze istraživanja i industrije važan su preduvjet ekonomskoga razvoja zasnovanoga na tehnologiji (Shin i sur., 2020). S druge strane, sveučilišta postaju financijski sve neovisnija i u isto vrijeme sve više orijentirana na „poduzetničko razmišljanje i djelovanje” (Audretsch, 2014). Osim toga, poduzetnička orijentacija i ishodi takve orijentacije mogu smanjiti fiskalni pritisak na institucije visokoga obrazovanja (Jacob i Gokbel, 2018).

Prema tome, ovaj rad sužava definiciju poduzetničkoga sveučilišta većinom na veze koje sveučilišta stvaraju sa sektorom industrije i gospodarstva. Šire definicije uključuju mnoge druge aspekte poduzetničkoga sveučilišta, posebno naglašavajući doprinose sveučilišta društvu i ekonomskom razvoju (Cerver Romero i sur., 2021). Cilj institucija visokoga obrazovanja s obzirom na njihovu treću misiju nije samo poslovno djelovanje usmjereno na profit, već i aktivno, inovativno i odgovorno djelovanje institucija koje sudjeluju u ekonomskom i socijalnom razvoju okoline, razvijajući i obrazujući poduzetne pojedince, tj. kompetentne i aktivne članove društva.

Bliska suradnja između sveučilišta i industrije proširena je i prepoznata u modelu trostruke uzvojnice. Ovaj model daje osnovu za uspostavljanje funkcionalnih odnosa i veza između industrije, sveučilišta i vlade (Etzkowitz i Leydesdorff, 2000). Samo ona sveučilišta koja poduzimaju različite aktivnosti kako bi poboljšala regionalnu i

nacionalnu ekonomsku izvedbu, dok u isto vrijeme sebi osiguravaju financijsku korist, mogu se nazvati poduzetničkim sveučilištima (Etzkowitz, 2001). Iz ovoga gledišta, akademsko je poduzetništvo pristup koji omogućuje formalne i neformalne mehanizme komercijalizacije istraživanja (Baldini i sur., 2014). Poduzetničko sveučilište dobilo je na važnosti kao akter znanja i inovacije (Fayolle i Redford, 2014) od ključne važnosti za kompetitivnost, stimulaciju i ekonomski rast te bogato stvaranje u današnjem globaliziranom svijetu (Mian, 2011).

## Metode

### *Cilj i problem*

Poduzetničko sveučilište kao takvo možda nije nova tema. Brojne studije ukazuju na to da je poduzetnički program rada označen kao najvažniji čimbenik na brojnim sveučilištima i u posebnim akademskim disciplinama (Ahmad i sur., 2016). Pokretači poduzetničkih aktivnosti na institucijama visokoga obrazovanja su, s druge strane, još uvijek nedovoljno istraženi.

Na osnovi prethodno spomenute praznine u istraživanju, opći je cilj ovoga rada dati pregled poduzetničkih aktivnosti profesora, asistenata i istraživača zaposlenih na srpskim državnim sveučilištima kako bi prepoznali i ocijenili ljudske potencijale kao dijela institucionalnoga intelektualnog kapitala srpskih državnih sveučilišta, njihovu upotrebu, strategiju i izvedbu.

U usporedbi s drugim razvijenim zemljama, intenzitet istraživanja u Srbiji još je uvijek nedostatan. Ipak, broj poslovnih ideja razvijenih na srpskim sveučilištima i namijenjenih sektoru industrije i gospodarstva nije zanemariv. Srpska sveučilišta imaju potreban kapacitet za transfer znanja kroz razvijanje patenata, kompanija kćeri i doprinosa vodstvu kroz poticanje poduzetničkoga razmišljanja, izvođenje poduzetničkih radnji i osiguravanje poduzetničkoga kapitala za primjenu novih ideja u ekonomiji, kao oblika hibridnoga znanja. Model trostruke uzvojnice do neke je mjere primijenjen na srpskim sveučilištima posljednjih godina kao rezultat sve veće potrebe za istraživanjem i inovacijama u srpskoj ekonomiji (Rakicević i sur., 2018).

Institucije vlade i države uvelike potiču poduzetničku orijentaciju srpskih sveučilišta. Godina 2016. proglašena je *Godinom inovacije i poduzetništva* te su se tijekom te godine pokrenuli i promovirali razni vladini programi koji su podržavali poduzetničke aktivnosti u svim sektorima, uključujući visoko obrazovanje. Inovacije i poduzetništvo promatraju se kao ključni pokretači stvaranja održivije ekonomije i društva. Istaknuta namjera bila je osiguravanje potpune financijske neovisnosti sveučilišta razvijanjem suradnje između institucija visokoga obrazovanja i poslovnoga sektora.

Ipak, prilikom mjerenja kvalitete poduzetničkih aktivnosti srpskih sveučilišta prema generiranim financijskim sredstvima od tih aktivnosti, zamjetno je da sve institucije visokoga obrazovanja (određena sveučilišta ili fakulteti unutar sveučilišta) nisu jednako uspješni. Poduzetnička aktivnost u osnovi ovisi o poduzetničkom znanju i kapacitetima zaposlenika na institucijama visokoga obrazovanja, što je glavni razlog velikih razlika

u stvaranju dohotka. Takve nepodudarnosti prisutne su svuda u svijetu, pa tako i u Srbiji (Vesperer i Gagnidze, 2021; Pita i sur., 2021). Posljedično, problem analiziran u ovom istraživanju je individualna poduzetnička orijentacija profesora, asistenata i istraživačkoga osoblja na srpskim državnim sveučilištima i način na koji ono utječe na razvoj poduzetničkih sveučilišta. S poduzetničkoga stajališta od profesora se očekuje 1) aktivno djelovanje putem mobiliziranja istraživačkih kapaciteta kako bi se riješilo probleme u praksi, 2) originalnost i nekonvencionalnost, 3) promicanje suradnje s industrijom i 4) iskorištavanje povoljnih sveučilišnih politika vezanih za poduzetničke aktivnosti i procese (Cvijić i sur., 2019).

### **Hipoteze**

Poseban cilj ovoga rada bio je prikazati učinke individualne poduzetničke orijentacije fakultetskoga osoblja (profesora, asistenata i istraživača) na poduzetničke ishode i krajnje proizvode srpskih institucija visokoga obrazovanja. Individualna poduzetnička orijentacija mjerila se samoprocjenom poduzetničkih aktivnosti upotrebom strukturiranoga instrumenta osmišljenoga na osnovi Skale individualne poduzetničke orijentacije (I-ENTRE-U) (Todorovic i sur., 2011).

Poduzetnički rezultati pojedinaca na institucijama visokoga obrazovanja definirani su dogovorima zajedničkoga istraživanja (DZI), ugovornim istraživačkim dogovorima (UID), savjetovanjem, osnivanjem tvrtki kćeri i patentiranjem. Prema tome su formilirane hipoteze ovoga istraživačkog projekta koje su se ispitivale u empirijskom istraživanju:

H1: Poduzetnička orijentacija pozitivno utječe na dogovore zajedničkoga istraživanja (DRI).

H2: Poduzetnička orijentacija pozitivno utječe na ugovorne istraživačke dogovore (UID).

H3: Poduzetnička orijentacija pozitivno utječe na aktivnosti savjetovanja.

H4: Poduzetnička orijentacija pozitivno utječe na osnivanje tvrtki kćeri.

H5: Poduzetnička orijentacija pozitivno utječe na patentiranje i slične aktivnosti povezane s intelektualnim vlasništvom.

Na osnovi predstavljenoga konteksta i pregleda literature te razvoja hipoteza, na Slici 1 prikazan je hipotetski model.

Slika 1.

### **Instrument**

Istraživanje je zasnovano na primarnim podacima dobivenim upotrebom strukturiranoga upitnika. Upitnik je bio u elektroničkom obliku, a distribuiran je putem mrežnoga alata CAWI (Računalno potpomognuti mrežni intervju). Upitnik je bio na srpskom jeziku i obuhvaćao je pet dijelova. Prvi dio odnosio se na demografske podatke ispitanika. Sljedeća tri dijela namijenjena su prikupljanju podataka o nezavisnim varijablama: korištenju istraživanja, nekonvencionalnosti, suradnji s industrijom i sveučilišnom politikom. Posljednji dio rezerviran je za zavisne varijable – učestalost angažmana ispitanika u industriji.

Nezavisne varijable bile su mjere prema kojima profesori i istraživači na institucijama visokoga obrazovanja koriste svoje istraživačke kapacitete (Milosavljević i Benković, 2014) ili koriste svoje vlastite ili kapacitete institucije za poduzetničke svrhe (Marzocchi i sur., 2017). Konstrukti za nezavisne varijable usvojeni su iz I-ENTRE (Felgueira i Rodrigues, 2020) skala. I-ENTRE skala predstavlja individualnu transformaciju dobro poznate I-ENTRE-U skale (Todorović i sur., 2011). Instrument obuhvaća ukupno 21 česticu koje su grupirane u četiri kategorije:

- 1) Pokretanje istraživanja: a) poticanje dodiplomskih studenata na angažman u istraživanjima zasnovanima na praksi [PI1], b) poticanje studenata na traženje praktičnih implikacija [PI2], c) naglašavanje primijenjenoga istraživanja [PI3], d) ispunjavanje potreba prakse [PI4], e) partnerstvo u istraživanju sa stručnjacima izvan akademskoga područja [IS5] i f) očekivanje doprinosa industriji ili društvu [RM5].
- 2) Nekonvencionalnost: a) istraživačke zamisli obično dolaze iz moje institucije [NK1], b) istraživačke zamisli obično dolaze iz područja industrije [NK2], c) financiranje mogega istraživanja iz donacija koje nisu namijenjene istraživanjima [NK3], d) pojedinačno je istraživanje učinkovito i produktivno [NK4], e) korist istraživanja izvan kampusa [NK5], f) izvrsnost u utvrđivanju istraživačkih problema [NK6], g) podržavanje kolega u suradnji s industrijom [NK7] i h) prvi korak prema nekonvencionalnim idejama [NK8].
- 3) Suradnja s industrijom: a) poticanje uključivanja industrije u istraživanje [SI1], b) veliki zahtjev za istraživanjem od strane industrije [SI2], c) priznavanje inovativnosti i fleksibilnosti od strane industrije [SI3] i d) moji studenti dobivaju visokokvalitetne poslove [SI4].
- 4) Sveučilišna politika: a) politika širom sveučilišta značajno doprinosi istraživanju [SP1], b) sveučilišna politika donosi se odozdo prema gore [SP2], c) institucija reagira na nove ideje [SP3] i d) odsjek ima autonomiju u biranju kriterija za odabir zaposlenika [SP4].

Sve navedene čestice mjerene su Likertovom skalom u rasponu od 1 (potpuno neslaganje) do 7 (potpuno slaganje).

Čestica uključenosti industrije razvijena je na osnovi istraživanja D'Este i Perkmann (2010). Navedene su čestice svakako produkti odnosa sveučilišta i industrije ili klasičnih mehanizama za transfer tehnologije. Ti mehanizmi uključuju: dogovor o zajedničkom istraživanju (DZI), ugovorni sporazum o istraživanju (USI), konzultiranje, osnivanje kompanija kćeri i patentiranje. Posljednja dva mehanizma motivirana su komercijalizacijom, dok s preostala tri dominira motivacija vezana uz istraživanje, poput učenja od industrije. Ispitanicima je postavljeno pitanje: „Koliko ste često sudjelovali u navedenim aktivnostima u prošloj godini?” Odgovori su kodirani na sljedeći način: 1 – uopće ne, 2 – jednom ili dvaput, 3 – tri do pet puta, 4 – šest do devet puta i 5 – više od deset puta.



Upitnik je prošao pokusnu fazu testiranja koju su proveli osam stručnjaka (svi su članovi fakultetskoga osoblja) kako bi se osigurala čitljivost i preciznost upita (Cicvaric Kostic i sur., 2013). Prema toj su fazi učinjene blage, većinom jezične promjene. Ovaj proces rezultirao je završnim oblikom upitnika koji se koristio u prikupljanju podataka. Spomenuta verzija upitnika na srpskom jeziku dostupna je na zahtjev autoru rada.

### **Uzorak**

Postupak uzorkovanja donio je stratificirani uzorak. Cilj istraživanja bio je ispitati samo fakultete državnih sveučilišta u Srbiji, isključujući umjetnička sveučilišta, sveučilišta i fakultete obrane (ukupno je uključeno pet sveučilišta: Sveučilište u Beogradu, Sveučilište u Novom Sadu, Sveučilište u Nišu, Sveučilište u Kragujevcu i Državno sveučilište u Novom Pazaru). Ukupna populacija prikazana je u Tablici 1.

#### Tablica 1.

Upitnik je distribuiran po fakultetima putem elektroničke pošte. Podatci su sakupljeni u periodu od svibnja do kolovoza 2020. godine u tri navrata. U prvome navratu poslane su poruke elektroničke pošte s privitkom koji je sadržavao upitnik, upotrebom postupka uzorkovanja „snježne grude“ (Damjanovic i sur., 2020). Poruke s kodiranim upitnicima poslane su e-poštom administratorima na sveučilištima, koji su ih prosljedili fakultetskom osoblju. Proces je bio aktivno kontroliran kako bi se ograničila bilo kakva vrsta invazivnoga pregrupiranja (Radonić i Milosavljević, 2019). Nakon prvoga kruga sakupljeno je 218 odgovora.

Kada je otkriveno invazivno pregrupiranje (posebno na sveučilištu u Novom Sadu), započet je drugi krug. Sastavljen je popis od 3184 elektroničke adrese za ostala četiri sveučilišta koja koriste javno dostupne podatke sveučilišnih i/ili fakultetskih mrežnih stranica. Na adrese s popisa poslane su elektroničke poruke s upitnicima. Dodatna kontrola za drugi krug provedena je dva puta. Ukupno je dobiveno 346 dodatnih odgovora (stopa odgovora za drugi krug bila je 9,2 %).

Ukupan broj odgovora sakupljenih u oba kruga bio je 564. Međutim, 12 odgovora je eliminirano (osam zbog toga što su sadržavali manje od 70 % odgovora i četiri zbog mogućega zamora procesom anketiranja). Prema tome, konačna veličina uzorka je 552, s intervalom pouzdanosti 4,06 i razinom pouzdanosti od 95 %.

### **Postupak**

Podatci su upisani u i analizirani upotrebom Statističkoga paketa za društvene znanosti (SPSS), verzija 26.0. Kvantitativni podatci analizirani su izračunom mjera deskriptivne statistike: postotci, aritmetičke sredine i standardne devijacije. Za višestruke usporedbe koristili smo analizu varijance i standardnu devijaciju. Međuovisnost pokretanja istraživanja, nekonvencionalnosti, suradnje s industrijom, sveučilišne politike i pet zavisnih poduzetničkih ishoda utvrđena je korelacijskom analizom (Pearsonov koeficijent korelacije) i multiplom regresijom.

## Rezultati

### Osobine uzorka

Istraživanje je provedeno na stratificiranom uzorku. Većina ispitanika bila je sa Sveučilišta u Beogradu (265 ili 48,0 %), nakon čega slijedi Sveučilište u Novom Sadu (182 ili 33,0 %), Sveučilište u Nišu (54 ili 9,8 %), Sveučilište u Kragujevcu (38 ili 6,9 %) i Državno sveučilište u Novom Pazaru (13 ili 2,4 %). Ova distribucija odgovara raspodjeli slojeva u ukupnoj populaciji (Tablica 1).

S obzirom na znanstveno polje – više od polovine ispitanika radi u području tehničkih znanosti (294 ili 53,3 %). Gotovo četvrtina ispitanika iz područja su društvenih i humanističkih znanosti (130 ili 23,6 %), dok područja medicine, prirodnih znanosti i ostala čine 13,4 % (45), 8,2 % (45) i 1,6 % (9), tim redom.

U odnosu na spol, relativna većina od 282 ispitanika su žene (51,1 %), što odgovara podjeli spola u ukupnoj populaciji (Tablica 1).

Podjela uzorka prema tituli je sljedeća: udio asistenata je 28,4 % (ili 157 ispitanika), docenti 24,3 % (ili 134), izvanredni profesori 18,3 % (ili 101), redovni profesori 23,0 % (127) i ostali 6 %. Glavno zanimanje ispitanika bilo je predavačko (približno 70 %). Samo nešto iznad četvrtine ispitanike bili su „čisti” istraživači (144 ili 26,6 %), dok je predavački posao dominirao, tj. zastupljen je u više od dvije trećine ispitanika (69,9 % ili 386 ispitanika).

### Preliminarna analiza

Prije testiranja hipoteza primijenili smo deskriptivnu statistiku, testove pouzdanosti i korelacijsku analizu. Podatci deskriptivne statistike za nezavisne varijable predstavljeni su u Tablici 2. Kako je prikazano, čestice pokretanja istraživanja temelj su poduzetničke aktivnosti ispitanika. Njihova nastojanja u angažiranju dodiplomskih studenata u istraživanjima posebno su visoko ocijenjena (PI2 – A 5,59, STD 1,48 i PI1 – A 5,35, STD 1,60). S druge strane, sveučilišna politika najveća je zapreka poduzetničkim aktivnostima na srpskim državnim sveučilištima (tj. SP2 - A 3,53, STD 1,60 i SP1 - A 3,58, STD 1,63).

Tablica 2.

Što se tiče vidova poduzetničkih aktivnosti (za svrhe ove studije – zavisne varijable), frekvencije odgovora prikazane su u Tablici 3. Kako je i očekivano, fakulteti državnih sveučilišta u Srbiji rijetko su bili uključeni u poduzetničke aktivnosti u prethodnoj godini. Na primjer, samo je oko 17 % ispitanika aktivno radilo na patentiranju ili sličnim aktivnostima povezanim sa zaštitom intelektualnoga vlasništva, a samo 10 % njih bilo je uključeno u pokretanje mladih poduzeća, tj. tvrtki kćeri. Situacija je nešto bolja kada je riječ o vidovima poduzetništva niske izvedbe poput zajedničkoga istraživanja ili ugovornoga istraživanja.

Tablica 3.

Pojedinačne čestice za nezavisne varijable kombinirane su u konstrukte višestrukih čestica – pokretanje istraživanja, nekonvencionalnost, suradnja s industrijom i sveučilišna politika. Česticama je promijenjena veličina zbog analize pouzdanosti. Rezultati testa pouzdanosti (Cronbachov alpha) bili su .83, .70, .85 i .77 za četiri zavisne varijable (Tablica 4), tim redom. Sve su vrijednosti bile iznad praga ,70 (Taber, 2018). U kontekstu ovoga istraživanja utvrđena je jednodimenzionalnost osobina mjerne skale pomalo je očekivana jer su sve čestice u velikoj mjeri ekstrahirane iz već postojećih saznanja. Zanimljivo je napomenuti činjenicu da ispitanici vide sveučilišnu tržišnu politiku kao glavnu prepreku poduzetničkim aktivnostima ( $A = 3,95$ ,  $STD = 1,3$ ).

Tablica 4.

Ustanovili smo postojanje određenoga broja statistički značajnih korelacija. Većina nezavisnih varijabli pokazala je pozitivnu povezanost sa zavisnim varijablama (Tablica 4). Najviša korelacija utvrđena je između suradnje s industrijom i savjetovanja ( $b=,43$ ,  $p<,00$ ), i suradnje s industrijom i zajedničkoga istraživanja ( $b=,41$ ,  $p < ,00$ ). Statistički značajna korelacija nije ustanovljena između sveučilišne politike s jedne i zajedničkoga istraživanja, ugovornoga istraživanja, savjetovanja i osnivanja tvrtki kćeri, s druge strane. Ipak odlučili smo uključiti sveučilišnu politiku u multiplu regresijsku analizu.

### **Testiranje hipoteza**

Kako bismo utvrdili opseg u kojemu su odabrane poduzetničke orijentacije (pokretanje istraživanja, nekonvencionalnost, suradnja s industrijom i sveučilišna politika) utjecale na vidove poduzetništva na srpskim javnim sveučilištima, koristili smo nekoliko multivarijantnih linearnih modela regresije. U tim modelima zavisne varijable bile su zajednički istraživački dogovori (ZID), ugovorni istraživački dogovori (UID), savjetovanje, osnivanje tvrtki kćeri i patentiranje. Jednadžba 1 prikazuje specifikacije linearnoga modela za pet nezavisnih varijabli:

$$IR_{1-5} = C + \alpha_1 RM + \alpha_2 UC + \alpha_3 IC + \alpha_4 UP + \epsilon_i \quad (1)$$

U prikazanoj jednadžbi akronim NV označava pet zavisnih varijabli (zajednička istraživanja, ugovorna istraživanja, savjetovanje, osnivanje tvrtki kćeri i patentiranje). S obzirom na nezavisne varijable, PI je pokretanje istraživanja, NK je nekonvencionalnosti, SI je suradnja s industrijom i SP je sveučilišna politika. C je konstanta, a greška koja prati Gaussian distribuciju.

Budući da je ustanovljen određen broj pozitivnih korelacija između nezavisnih varijabli, temeljito smo ispitali moguće autokorelacije. Vrijednosti Durbin-Watson testa bile su između praga (2.07, 2.07, 2.12, 2.01 i 1.99, spomenutim redoslijedom) za sve modele regresije. Faktor varijacije inflacije (VIF) za svaku varijablu bio je relativno nizak i ispod općepoznatoga pravila palca.

Parametri za prvi model (u kojemu je zavisna varijabla zajednička istraživanja) prikazani su u Tablici 5. Kako je prikazano, model je statistički značajan ( $F = 27,23$ ).

Međutim, model objašnjava samo 18 % varijabilnosti ( $R^2 = ,18$ ). Stoga možemo potvrditi hipotezu H1 kojom se tvrdi da individualna poduzetnička orijentacija pozitivno djeluje na zajednička istraživanja na srpskim sveučilištima. Kada se istraži detaljnije, prediktori zajedničkoga istraživanja kao poduzetničkoga ishoda fakulteta srpskih državnih sveučilišta bili su nekonvencionalnost, suradnja s politikom i sveučilišna politika ( $p < ,05$ ).

#### Tablica 5.

Parametri za drugi model prikazani su u Tablici 6. Model je statistički značajan na razini  $p < ,00$  i objašnjava 13 % varijabilnosti zavisne varijable (Ugovorna istraživanja). Tim rezultatima potvrđena je hipoteza H2 kojom se tvrdi da poduzetnička orijentacija pozitivno utječe na ugovorna istraživanja na srpskim državnim sveučilištima. Prediktori su isti kao u prvom slučaju ( $p < ,05$ ).

#### Tablica 6.

Kada promotrimo savjetovanje kao zavisnu varijablu, uočavamo statističku značajnost modela  $p < ,00$ . Parametri su predstavljeni u Tablici 7. Približno 22 % varijabilnosti savjetovanja kao ishoda objašnjeno je individualnom poduzetničkom orijentacijom ( $R^2 = ,22$ ). Stoga, H3 je potvrđena i možemo tvrditi da poduzetnička orijentacija pozitivno utječe na savjetodavnu orijentaciju na srpskim državnim sveučilištima. I u ovom slučaju individualni su prediktori isti kao u prethodna dva modela.

#### Tablica 7.

Gledajući veliku sliku, poduzetnički ishod koji nije nužno motiviran komercijalnim razlozima (u ovom slučaju, zajedničko istraživanje, ugovorno istraživanje i savjetovanje) pod utjecajem je poduzetničke orijentacije. Kako pokazuju rezultati, samo motivacija za istraživanje nije empirijski dokazan prediktor.

Osnivanje tvrtki kćeri također je pod utjecajem individualne poduzetničke orijentacije (Tablica 8). Stoga, H4 je potvrđena na razini  $p < ,00$  i objašnjena s 20 % varijabilnost ( $R^2 = ,20$ ). Prema tome, poduzetnička orijentacija pozitivno utječe na osnivanje tvrtki kćeri na srpskim državnim sveučilištima. Model 4 je pak predviđen samo nezavisnim varijablama pokretanja istraživanja i suradnje s industrijom.

#### Tablica 8.

Naposljetku, potvrđena je hipoteza H5 ( $p < ,00$ ) kojom se tvrdi da poduzetnička orijentacija pozitivno utječe na aktivnosti koje se odnose na patentiranje i druga slična sredstva zaštite intelektualnih prava. Ipak, samo je oko 5 % varijance varijable patentiranje objašnjeno individualnom poduzetničkom orijentacijom. Kako je prikazano u Tablici 9, nekonvencionalnost je jedini statistički značajan prediktor patentiranja.

#### Tablica 9.

Relativno mali dio varijabilnosti tržišno zasnovanih poduzetničkih ishoda na srpskim državnim sveučilištima objašnjen je individualnom poduzetničkom orijentacijom fakultetskoga i istraživačkoga osoblja. Također, posebno nezavisne varijable nisu uvijek dobri prediktori pokretanja tvrtki kćeri ili izuma novih патената i druge industrijske ili intelektualne nematerijalne imovine. Iznenadujuće je da sveučilišna politika ne igra ključnu ulogu za ove visokokvalitetne poduzetničke ishode.

## Rasprava

### ***Ključni rezultati i doprinos***

Cilj ovoga rada bio je ispitati i istražiti kako poduzetnička orijentacija akademika zaposlenih na srpskim državnim sveučilištima utječe na poduzetničke ishode – zajedničko istraživanje, ugovorno istraživanje, savjetovanje, osnivanje tvrtki kćeri i patentiranje. S tim ciljem sakupili smo podatke na 552 fakulteta. Rezultati pokazuju da poduzetnička orijentacija igra važnu ulogu u ishodima, tj. vidovima poduzetništva. Grafički prikaz ključnih rezultata prikazan je na Slici 2.

Slika 2.

Međutim, nisu svi elementi poduzetničke orijentacije jednako važni za ishode sveučilišnoga poduzetništva. Pokretanje istraživanja općenito je važno za tržišno orijentirane aktivnosti. Navedeno je u suglasju sa sličnim studijama. U teškoj okolini poput srpske, koja ne podržava poduzetništvo (Seguí-Mas i sur., 2017), državna sveučilišta imaju ključnu ulogu u poticanju društvenoga i ekonomskoga razvoja kroz akademsko poduzetništvo u takvim okruženjima. Nastavničko osoblje na fakultetima i istraživači s većom mogućnosti pokretanja istraživačkih kapaciteta u ovome slučaju imaju veće šanse za komercijaliziranje učinaka vlastitih poduzetničkih aktivnosti. Nekonvencionalnost ima snažan utjecaj na četiri od pet poduzetničkih ishoda koje se ispitivalo u ovom istraživanju.

Prije navedeno, u suglasju je s dosadašnjim istraživanjima u Srbiji koja su ispitivala kako neortodoksni pristupi stvaranju bilo kakvih uslužnih djelatnosti u javnome sektoru poboljšavaju kvalitetu rezultata (Milanović i sur., 2019). Također, suradnja s industrijom prilično utječe na visokovrijedne ishode poduzetništva. Ova sveučilišta dinamika u pozadini odnosa fakultetskoga i istraživačkoga osoblja još nije temeljito ispitana, pa tako ne postoji ekstenzivna baza istraživanja, ali neki rezultati potvrđuju važnost oboje - industrije i fakultetskoga osoblja (Steinmo i Rasmussen, 2018). Zanimljivo je da sveučilišna politika predstavlja istinski prediktivni faktor niskokvalitetnih vidova poduzetništva poput zajedničkoga ili ugovornoga istraživanja. Ipak, čini se da srpskim sveučilištima još uvijek nedostaje dosljedna i sveobuhvatna politika koja bi poticala i motivirala suradničke inovacije (Song i sur., 2020). Također izgleda da su politika srpskih sveučilišta i posebno nedostatak poticaja za istraživanje ključni čimbenici ometanja poduzetničkih ishoda.

Trenutačna sveučilišna politika temelji se isključivo na izdavaštvu kao ispostavi istraživanja, dok su ishodi poduzetništva zanemareni. Moglo bi se pretpostaviti da će

se dogoditi promjena sveučilišne politike prema tržišno orijentiranome istraživanju. Kako je već istaknuto u prethodnim istraživanjima, neka državna sveučilišta u Srbiji nastoje postati više poduzetnička, ali samo visoko obrazovanje ima nedostatnu poduzetničku tradiciju (Stanković, 2006; Vekić i sur., 2019).

### **Implikacije**

Ovo istraživanje ima dvostruke implikacije – za istraživače i praktičare. Glavna je implikacija istraživanja još jedna potvrda valjanosti I-ENTRE skale (Felgueira i Rodrigues, 2020). Mjera poduzetničke orijentacije fakulteta i istraživačkoga osoblja na institucijama visokoga obrazovanja bila je visoko pozicionirana na rasporedu suvremenih istraživanja (Covin i sur., 2020). Osim toga, ova je studija potvrdila da poduzetnička orijentacija ima utjecaj na poduzetničke rezultate. Iako je to možda pitanje male važnosti u istraživanjima vezanim za industriju, institucije visokoga obrazovanja su do sada bile izvan dosega istraživačkoga radara (Bell, 2019).

Posljedice su plodonosnije za praktičare i namijenjene kako fakultetskom osoblju i istraživačima, tako i tvorcima politika i odluka u institucijama visokoga obrazovanja. S druge strane, tvorcima politika trebaju aktivno istražiti i ispitati postojeće izdane informacije na kojima bi zasnivali svoje odluke (Desouza i Lin, 2013). Ovo istraživanje pruža obilne dokaze o međugri poduzetničke orijentacije i poduzetničkih ishoda na državnim sveučilištima. Iako su rezultati geografski i kontekstualno vezani za jedan slučaj, mogu se generalizirati kako bi poslužili tvorcima politika u drugim sličnim zemljama i sveučilištima.

### **Ograničenja i dalje preporuke**

Kao u slučaju drugih kvantitativnih empirijskih istraživanja, ova studija ima određene nedostatke. Prvi i najistaknutiji nedostatak ovoga rada povezan je s brojem varijabli korištenih za ispitivanje i istraživanje prirode poduzetničkih ishoda na srpskim državnim sveučilištima. Kao što pokazuju rezultati, samo je do približno jedne petine varijabilnosti poduzetničkih rezultata objašnjeno poduzetničkom orijentacijom kao pretečom. Navedeno otvara prostor za dalja istraživanja u smislu uključivanja drugih varijabli, kako bi se došlo do sveobuhvatnijih rezultata. Na primjer, može se istražiti kako vladini akti utječu na inovativne ishode politike sveučilišta o prijenosu tehnologije (Cunningham i sur., 2019). Osim toga, financiranje kao prediktor poduzetničkih aktivnosti na srpskim sveučilištima također bi moglo biti zavisna varijabla.

Važna je prednost ovoga istraživanja veličina uzorka. Ipak, analiza je čisto kvantitativna. Dalja istraživačka nastojanja trebala bi se usredotočiti na temeljito kvalitativno ispitivanje odnosa između različitih individualnih osobina, stavova i ponašanja (posebno onih poduzetnički predvidivih) i poduzetničkih ishoda.

### **Zaključci**

Poduzetništvo je sinonim za inovaciju, izvor novih ideja, dobara, usluga i poslova/ili postupaka. Poduzetništvo igra istaknutu ulogu u bilo kojoj ekonomiji, koristeći vještine i inicijativu potrebne za predviđanje potreba i plasiranje dobrih novih ideja

na tržište. Uloga predavača i profesora na sveučilištima je promjena stanja uma i duha, poticanje poduzetništva kao kulture. Poduzetničke aktivnosti na srpskim sveučilištima još su u povoju, ali ova je studija potvrdila elemente poduzetničkih aktivnosti srpskih akademika.

Istraživanje je ispitivalo raznolike čimbenike koji utječu na postizanje poduzetničkoga uspjeha državnih sveučilišta u Srbiji. Važan rezultat ovoga istraživanja jest činjenica da je institucionalni kapacitet najznačajniji pokretač poduzetničkoga uspjeha srpskih državnih sveučilišta. Stoga bi tvorcima politike visokoga obrazovanja trebali uložiti veća nastojanja za racionalnije korištenje opipljivih, neopipljivih i financijskih sredstava s ciljem maksimalnoga povećanja poduzetničkoga dobitka.