

# DOSTIGNUĆE INDUSTRIJE 5.0 U VISOKOŠKOLSKIM USTANOVAMA NA OSNOVU BALANCED SCORECARD (BSC) – FOKUS NA PERSPEKTIVU INTERNIH POSLOVNIH PROCESA

## ACHIEVEMENT OF INDUSTRY 5.0 IN HEI BASED ON THE BALANCED SCORECARD (BSC) – FOCUS ON INTERNAL BUSINESS PROCESS PERSPECTIVES

Nedeljka Živković<sup>1</sup>, Maja Glogovac<sup>2</sup>, Sanela Arsić<sup>3</sup>,  
Isidora Milošević<sup>3</sup>, Nedeljko Živković<sup>2</sup>

<sup>1</sup>Beogradska akademija poslovnih i umetničkih strukovnih studija, Beograd,

<sup>2</sup>Univerzitet u Beogradu, Fakultet organizacionih nauka, Beograd,

<sup>3</sup>Univerzitet u Beogradu, Tehnički fakultet u Boru, Bor

*Razvoj tehnologija obeležio je Industriju 4.0 dok Industrija 5.0 ide korak napred stvarajući balans između tehnološkog i društvenog aspekta. Poznato je da visokoškolske ustanove imaju ključnu ulogu u razvoju društva i da industrijske revolucije moraju biti podržane u akademskim zajednicama. Visokoškolske ustanove ostvarenje strateških ciljeva mogu postići primenom modela Balanced scorecard. Shodno tome, upotrebljen je Balanced scorecard sa naglaskom na perspektivu internih poslovnih procesa, s obzirom da je ova perspektiva usmerena na operativne aktivnosti organizacije. Fokus ovog istraživanja usmeren je na deskriptivnu strukturu varijabli koje čine perspektivu internih poslovnih procesa. Anketno istraživanje sprovedeno je u visokoškolskim ustanovama u Republici Srbiji na osnovu 374 pravilno popunjenih odgovora. Dobijeni rezultati pokazuju najvišu prosečnu ocenu za pitanja koja uključuju: računarska oprema, online baze podataka, naučni časopisi i dostupni bibliotečki materijali adekvatni za potrebe primene Industrije 5.0 radi poboljšanja kvaliteta istraživačkog procesa u pravcu Industrije 5.0 što dovodi do zadovoljstva studenata nastavnim procesom i ukupnom nastavnom performansom u Industriji 5.0.*

**Ključne reči:** industrija 5.0; visoko obrazovanje; perspektiva internih poslovnih procesa

*Industry 4.0 has been characterized by the development of technologies, whereas Industry 5.0 takes a step forward by creating an equilibrium between the technological and social aspects. It is known that higher education institutions play a key role in societal development, and that industrial revolutions must be supported within academic communities. Higher education institutions can achieve the realization of strategic goals by implementing the Balanced Scorecard model. Accordingly, the Balanced Scorecard was used with a focus on the Internal Business Process Perspective, given that this perspective is directed towards the operational activities of the organization. The focus*

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\* Corresponding author: [nedeljka.zivkovic@bpa.edu.rs](mailto:nedeljka.zivkovic@bpa.edu.rs)  
<https://orcid.org/0000-0001-6663-7467>

Maja Glogovac: <https://orcid.org/0000-0003-3268-8543>

Sanela Arsić: <https://orcid.org/0000-0002-1957-566X>

Isidora Milošević: <https://orcid.org/0000-0001-5539-8253>

Nedeljko Živković: <https://orcid.org/0000-0002-3698-1045>

*of this research is directed towards the descriptive structure of variables that constitute the perspective of internal business processes. A survey was conducted in higher education institutions in the Republic of Serbia based on 374 successfully completed responses. Obtained results show the highest average rating for questions including: computer equipment, online databases, scientific journals, and available library materials suitable for the needs of implementing Industry 5.0 to improve the quality of the research process towards Industry 5.0, which leads to student satisfaction with the teaching process as well as the overall teaching performance in Industry 5.0.*

**Key words:** *industry 5.0; high education; internal business process perspective*

## 1. Introduction

In the global era, meeting the criteria for ranking higher education institutions, or simply meeting accreditation requirements, does not guarantee the achievement of the strategic goals of a higher education institution, therefore, one way to overcome these barriers is the implementation of the Balanced Scorecard [1]. In recent decades, there have been significant reforms in the field of higher education, with digital education in the digital era of learning and knowledge transfer occupying a significant place [2]. Institutions of higher education, as the foundation of societal development, are expected to adopt innovative mechanisms and embrace Industry 5.0 [3]. Unlike Industry 4.0, which is based on technologies, Industry 5.0 is focused on reconciliation, namely on increased collaboration between humans and machines [4]. While there is still much discussion about the implementation of Industry 4.0 in all geographical areas, Industry 5.0 is moving forward and requires a change in thinking and action [3],[5]. Higher education institutions have the potential to address global challenges in the sphere of learning and knowledge transfer for technological global changes by adopting innovative methodologies and devising new ways to shape society [6].

Educational institutions are facing increasing challenges and higher expectations from students as well as other stakeholders [7]. The field of higher education is essential for the development of any society [8]. Strengthening competitive advantage is achieved by improving the quality and performance in organizations [9],[10]. By using four perspectives: Customer perspective, Internal business process perspective, Learning and Growth perspective, and Financial perspective, the creators of the Balanced Scorecard model, Kaplan and Norton, devised a new model for measuring performance in organizations [11]. The Balanced Scorecard can be successfully used in the field of higher education as a management system in managerial structures [8]. The field of higher education is specific and encompasses very sensitive processes in the public sector [12]. Global competition in higher education has led to increased accountability of higher education institutions and demand for better results however, for higher education institutions to survive in a competitive market, they need to adopt a strategic management framework for education quality, such as the Balanced Scorecard, with successful implementation in higher education [8]. The internal process perspective in higher education relates to internal activities including teaching quality, research outcomes, productivity, human and material resource management [13]. Based on this, a part of the Balanced Scorecard model with a focus on the Internal Business Process Perspective was used to assess the achievements of Industry 5.0 in higher education. After a brief introduction to Industry 5.0 and Industry 5.0 in higher education, quality models, Internal Business Process Perspective, a literature review for these areas with hypothesis formulation follows, then the research methodology, results execution, discussion and conclusions and directions for future research are presented in the final part of the paper.

## 2. Literature review

### 2.1. Theoretical background

Industrial revolutions throughout history have shaped society, making industries more efficient [5]. Essentially, Industry 5.0 entails a strategic framework for enhanced collaboration between humans and machines, based on sustainability and societal well-being [14]. The global COVID-19 pandemic has contributed to the emergence of digital tools and platforms in higher education in the process of learning and knowledge transfer [15]. The role of universities in open innovations, which represent the result of knowledge and work, is essential for creating strategies to adapt to societal needs [4]. The field of higher education is undergoing rapid changes, and while the concept of Industry 4.0 has not yet fully reached higher education in its true form and sense, a new phenomenon called Industry 5.0 is emerging [3]. Universities should take on the role of creating future visions that will be both technical and social [4]. The fifth industrial revolution must be driven by higher education institutions as a change in mindset, adaptability to new challenges, and sustainability are emphasized in a study focusing on engineering education [5]. Considering that Industry 5.0 and Society 5.0 are fully focused on humans, universities are expected to provide new ideas as a developmental path towards sustainable societal development [4]. Rapid technological advancement leads to industries rapidly transforming in a relatively short period, while individuals and societies are expected to adaptability and readiness to face new challenges [5].

In today's digital era environment, companies are required to deliver products/services that meet customer expectations and to keep up with technological advancements [16]. In a competitive market, the economy requires graduates with sophisticated knowledge and skills who can meet new challenges in the face of global changes [5]. Higher education institutions, as drivers of societal development, are expected to be open to change in learning and knowledge transfer [3,16]. Based on a literature review, it can be concluded that there are different models for organizational and process quality improvement through model implementation [17]. According to research by [9], conducted in Portugal, small and medium-sized enterprises in the private sector have insufficient significant interest in the application of the EFQM (European Foundation for Quality Management) maturity model due to inadequate promotion of the model within national frameworks conversely, there is more interest in meeting the requirements of the ISO 9001 standard, and generally, there are no initiatives for further progress towards excellence [9]. The assessment of quality management system maturity is achieved by applying the internationally accepted ISO 9004:2018 standard [18]. Sustainable development can be achieved through the application of the ISO 9004 standard [17]. In accordance with the requirements of objectivity, the maturity assessment of organizational performance can be carried out through the application of the EFQM model or through self-assessment using ISO 9004 (maturity model) [19]. Reduction in budget funding and the establishment of an increasing number of private colleges result in heightened expectations from students and other stakeholders, leading to greater challenges for higher education institutions [8]. The BSC can be utilized as a tool for managers in managing higher education institutions [20].

The Balanced Scorecard is a strategic performance measurement framework that encompasses both financial and non-financial metrics across four perspectives: customer perspective, internal business processes perspective, learning and growth perspective, and financial perspective [11]. The application of the Balanced Scorecard is evenly represented in both profit and non-profit organizations [20]. Given the specificity of higher education services, the implementation of the Balanced Scorecard requires modification of the model (for instance, replacing the customer perspective with the stakeholder perspective, positioning the customer perspective at the top while placing the financial

perspective at the bottom of the hierarchy), this is done in light of the particular characteristics of higher education institution operations, primarily reliant on budgetary funding, alongside other constraining factors [21]. Stakeholders often require information on non-financial performance indicators in organizations [22]. [8] states that the Internal Process Perspective, as part of the Balanced Scorecard, relates to the processes of a higher education institution (both academic and non-academic) aimed at improvement implementation. Managerial structures must emphasize meeting customer expectations, which are measured through process quality [23]. The internal business process perspective in the hospitality sector was identified as the most significant perspective in research for the application of the Balanced Scorecard model [21].

### **3. Internal Process Perspective in Higher Education Institutions – Part of the Balanced Scorecard**

To meet customer expectations, authors [20] and [23] suggest that top management must largely focus on internal business processes as they are directly related to product/service delivery and quality levels. It is confirmed that internal business processes are crucial for meeting customer requirements and consist of three vital factors: development of facilities and infrastructure, improved processes, and development of information and communication technologies as IT support [24]. Business processes are closely linked to customer satisfaction with factors such as quality, price, and employee productivity, along with the capability of top management to devise techniques to synchronize the organization's overall goals with individual participation and competencies of each employee to fulfill the organization's mission objectives [23]. The Internal Business Process Perspective involves improving institutional efficiency to achieve vision goals, fulfill mission objectives, not only through enhancing internal processes but also by devising new innovative processes to support existing ones [8]. Addressing the quality concept in higher education is achieved by establishing mechanisms for process management systems, reducing variations, using improvement tools, and enhancing education processes as key resources for the future, considering that higher education institutions are the foundation of societal development and progress [25]. There has been an increase in awareness of fulfilling customer satisfaction within internal business processes [26]. The focus on internal business processes encompasses productivity, delivery time, accuracy, efficiency in the utilization of all resources. Additionally, in higher education, internal business processes involve the quality of education, the learning process, knowledge transfer as the primary processes of higher education [25].

### **4. Data and methodology**

The balanced scorecard is a strategic management tool that helps higher education organizations define, monitor, and achieve their goals. It consists of a Financial perspective, a Customer Perspective, an Internal Business Perspective, and an Innovation and Learning Perspective. The perspective that focuses on improving the organization's operational activities is related to internal business processes. Therefore, the focus of this research is on the demographic structure of the variables that make up the Perspective of Internal Business Processes.

The survey method was applied to collect primary data. A random sample survey was conducted in the second half of 2023 in higher education institutions in the Republic of Serbia, and the opinions of 374 respondents were collected. The questionnaire was distributed via email. The analyzed variables were graded using a 5-point Likert scale.

## 5. Results

Within the demographic data of the sample, the respondents' gender, age, years of work experience in higher education institutions, and positions of employees were analyzed.

Out of the total number of respondents, 7.8% are younger than 30, 25.1% are between 31 and 40 years old, 33.2% are between 41 and 50 years old, 23.5% are between 51 and 60 years old, and 10.4% have more than 61 years old. 47.1% of male and 52.9% of female respondents participated in the research. Analyzing the sample structure, according to the years of working experience in higher education institutions, 1.9% of total respondents have less than one year of experience, 27.5% of total respondents have between 1 and 10 years of experience, 38.2% of total respondents have between 11 and 20 years of experience and, more than 20 years of experience have 32.4% of the respondents who took part in this research. When it comes to job positions, all respondents were divided into the following categories: 16.8% of respondents are employed as administrative staff at higher education institutions and the same percentage of respondents work as teaching assistants or assistants, while the largest numbers of respondents, 66.3%, are professors.

For further data analysis, SPSS v. 22 was used to conduct exploratory factor analysis and extract factors representing the Internal Business Perspective. In this research, Principal Component Analysis (PCA) is used to simplify data by reducing the number of variables [27]. Varimax rotation is chosen as a rotation method, which implies minimizing the number of variables with high absolute values of factor weights [28]. Additionally, in this case, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) is 0.972, which is higher than the threshold value of 0.50. At the same time, Bartlett's Test of Sphericity is statistically significant ( $p < 0.001$ ) [29]. The analysis factor, Internal Business Perspective, consists of 16 items with a Cronbach's Alpha of 0.973. It represents 71.6% of the total variance of the original variables, which is acceptable for factor analysis, according to [30].

Table 1 shows the results of descriptive statistics of the sample for all analyzed issues within the Internal Business Perspective. Descriptive statistics summarize and describe the basic characteristics of a data set. This type of statistical analysis provides insight into the structure, distribution, and underlying properties of the data, enabling researchers to understand their data better. The mean value, standard deviation, median, mode, and range were analyzed as part of the research.

In Table 1, all mean values range from 2.74 to 3.45 and indicate no large oscillations, that is, a difference in the respondents' thinking in relation to the analyzed claims within the Internal Business Perspective. This is supported by the fact that all obtained values of standard deviation range from 1.048 to 1.184, which does not indicate a significant deviation from the arithmetic mean. All the calculated values of Mode and Median are 3 and 4, while the calculated range value in all issues is 4.

Analyzing the obtained results in Table 1, it can be seen that the respondents agree to the least extent with the statement PIP\_14 (2.74), that is, that the commitment to the equality of salaries and wages in the EU is in the context of Industry 5.0. It is a fact that salaries in higher education institutions in the Republic of Serbia are lower than in the EU. Also, a lower grade average (3.02) was recorded for the statement PIP\_8, which refers to the number of domestic and international recognitions for teaching excellence in the context of Industry 5.0.

On the other hand, the highest average marks were recorded for questions IBP\_3 (3.48), IBP\_9 (3.45), and IBP\_7 (3.44). The respondents mostly agreed that computer equipment, online databases, scientific journals, and available library materials are appropriate for the needs of the Industry 5.0 application to improve the quality of the research process in the direction of Industry 5.0. This leads to student satisfaction with the teaching process and overall teaching performance in Industry 5.0, as evidenced by the high average score on this issue.

Table 1. Descriptive statistics

| Measurement  | Item   | Mean | Std. Deviation | Median | Mode | Range |
|--|--------|------|----------------|--------|------|-------|
| How do you evaluate the results of scientific research that are important for Industry 5.0?  | IBP_1  | 3.33 | 1.114          | 3      | 3    | 4     |
| How do you assess the compliance of curriculums and programs with the needs of the labor market in the context of Industry 5.0?  | IBP_2  | 3.31 | 1.123          | 3      | 4    | 4     |
| How do you evaluate computer equipment for the needs of Industry 5.0 application?  | IBP_3  | 3.48 | 1.169          | 4      | 4    | 4     |
| How do you evaluate innovations in teaching in the context of Industry 5.0?  | IBP_4  | 3.37 | 1.115          | 3      | 3    | 4     |
| How do you evaluate the integrated use of technologies significant for Industry 5.0?   | IBP_5  | 3.32 | 1.114          | 3      | 4    | 4     |
| How do you assess the increase in the number of teachers competent in applying Industry 5.0?   | IBP_6  | 3.12 | 1.176          | 3      | 3    | 4     |
| How do you assess student satisfaction with the teaching process and overall teaching performance in Industry 5.0?   | IBP_7  | 3.44 | 1.051          | 4      | 4    | 4     |
| How do you evaluate the number of domestic and international recognitions for teaching excellence in the context of Industry 5.0?  | IBP_8  | 3.02 | 1.184          | 3      | 3    | 4     |
| How do you evaluate online databases, scientific journals and available library materials to improve the quality of the research process in the direction of Industry 5.0? | IBP_9  | 3.45 | 1.109          | 4      | 4    | 4     |
| How do you assess operational efficiency in the direction of Industry 5.0?   | IBP_10 | 3.30 | 1.074          | 3      | 4    | 4     |
| How do you evaluate continuous system improvement from the aspect of Industry 5.0 based on the evaluation of results?  | IBP_11 | 3.24 | 1.116          | 3      | 4    | 4     |
| How do you evaluate the efficiency of using all resources that are important for Industry 5.0?   | IBP_12 | 3.22 | 1.122          | 3      | 3    | 4     |
| How do you assess dual education in the direction of Industry 5.0?   | IBP_13 | 3.20 | 1.174          | 3      | 3    | 4     |
| How do you assess the attendance towards equality of salaries/earnings in EU countries in the direction of Industry 5.0?   | IBP_14 | 2.74 | 1.282          | 3      | 3    | 4     |
| How do you evaluate the organization of student support activities that are important for Industry 5.0?  | IBP_15 | 3.29 | 1.110          | 3      | 3    | 4     |
| How do you evaluate education outcomes in the direction of Industry 5.0?   | IBP_16 | 3.37 | 1.048          | 3      | 4    | 4     |

## 6. Conclusion

The results of applying the Balanced Scorecard provide significant information to all stakeholders and society as a whole and can be used as a strategic framework for improving organizational performance [8], [21], [23]. [26] state that student satisfaction is linked to the sustainable development of higher education institutions, which is consistent with the claims of this study, considering that the Balanced Scorecard perspectives can be used as a strategic framework for achieving the goals of a university's mission, vision, and strategy. The results of the conducted research demonstrate validity, with a Cronbach's Alpha of 0.973, indicating the adequacy of the chosen variables. The results also indicate the adequacy of sampling, as confirmed by a Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of 0.972. According to [1], classroom materials are one of the significant indices within the internal business processes in higher education, which is consistent with our findings. This is supported by the high average ratings for online databases, scientific journals, and available library materials that are suitable for the application needs of Industry 5.0, aiming to enhance process quality towards Industry 5.0, leading to student satisfaction. Slightly lower values were recorded for questions related to pay equality compared to EU countries which may be attributed to the fact that the Republic of Serbia is a developing country.

Future research directions should encompass studies at the level of each higher education institution, as well as the involvement of other stakeholders of higher education institutions to obtain a comprehensive understanding.

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