





The Analysis of IT Competencies in the Hospitality Related Study Programs in the Republic of Serbia

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Abstract: *Following the trends of modern tourism development and the expansion and adoption of new technologies, the hospitality industry is constantly improving its service, which is most commonly based on information technologies. The stated situation is noticeable in the two main segments of the hospitality industry – the hotel and restaurant industry and in most activities carried out before, during, and after the guest's stay. Depending on the tasks performed, human resources in the hospitality industry must have adequate competencies to use the available IT. Thus, their adequate education is necessary. The subject of this paper is the analysis of IT competencies in the hospitality-related study programs in the Republic of Serbia. The aim is to determine the presence of IT courses (compulsory/elective) in hospitality study programs implemented at institutions of higher education in the Republic of Serbia. The study programs were analyzed according to the type and level of study and ownership type of the institutions that implement them. Study programs accredited during or after 2017, whose name directly refers to the hospitality industry, were included in the analysis.*

Keywords: *education; HEIs; curriculum; hospitality studies; competencies*

1. INTRODUCTION

The constant development of information technology (IT) necessitates a change in the way business is conducted in the hospitality industry. Changes are noticeable in both branches of hospitality:

- Hotel management (primarily focused on providing accommodation services) and
- Restaurant management (primarily focused on providing food and beverage services).

The introduction of new technologies and the necessity of obtaining skills to use them can be identified as future trends in human resource employment in tourism and hospitality. These primarily refer to "new working models, digitization, and robotization," as well as skills such as "management, analytical, digital marketing, and customer behavior analysis" [1]. Technology can have both positive and negative impacts on employment [1].

The existing curricula of hospitality-related higher education programs should be reformed to respond to the increasingly significant role that advanced technologies play in the hospitality industry. The inclination towards big data competence presents an example [2]. In the post-COVID-19 era, one of

the focal points in adjusting the curricula of tourism and hospitality study programs in higher education should be technology. Thus, the focus is primarily on introducing artificial intelligence (AI), virtual reality (VR), and big data (BD) [3]. Modifications of the existing curricula, due to the influence of technological changes on education in hospitality, need to be implemented through mandatory cooperation between education and industry [4].

On the other hand, besides implementing IT into curricula, it's crucial to implement them into the teaching process [5]. Modern information and communication technology (ICT) has changed how students communicate with each other and their teachers [6]. There is undoubtedly a vigorous tendency to use ICT among students. This tendency should be utilized to enhance the teaching process while simultaneously introducing IT and ICT education so that students acquire proper competencies. There are two ways to achieve this:

- by introducing new IT subjects into study programs or
- by introducing IT competencies into existing subjects in study programs.

Serbia is an example of a country continuously striving for IT development through a comprehensive digitalization process. The strategic

focus on technology and artificial intelligence is particularly noticeable [7, 8]. Thus, attention should also be directed towards educating future professionals, both managers and other employees in the field of IT.

In line with the above, the subject of this paper is the analysis of IT competencies in the hospitality-related study programs in the Republic of Serbia. The aim is to determine the presence of IT courses (both compulsory and elective) in hospitality study programs that are implemented at higher education institutions (HEI) in the Republic of Serbia.

2. METHODOLOGY

The analysis was conducted from March 5th to March 7th, 2024, following the example of other similar research studies [9, 10]. Table 1 represents the phases of the analysis.

Table 1. *The phases of the analysis*

Phase	Subphase
1 Identification of the study programs' sample	<ul style="list-style-type: none"> • Compilation of a list of study programs accredited in the Republic of Serbia from 2007 until the beginning of the analysis – March 2024 [11]. • Identification of study programs whose names directly suggest hospitality or one of its main segments – hotel and restaurant management. The potential presence of hospitality in particular modules of study programs not listed in [11] is not further considered. • Identification of study programs accredited in 2017 or later (option for enrollment in the first year of study for the academic year 2023/2024). • Identification of HEI study programs whose curricula are available on their official websites.
2 Analysis of the presence of IT subjects in the previously identified study programs	<ul style="list-style-type: none"> • Coding data about subjects in study programs using Microsoft® Excel® 2019. • Extraction of subjects whose names suggest they belong to the IT field in study programs. • Analysis of the presence of IT subjects in the curricula of selected hospitality study programs according to various criteria and comparison of the obtained results.

3. RESULTS AND DISCUSSION

A total of 14 hospitality study programs were analyzed. These study programs are implemented at two universities, two academies of professional studies, and four independent higher professional schools (see Table 2). We may conclude that the majority of HEIs offering hospitality study programs belong to the category of professional study institutions.

Table 2. *HEIs where hospitality programs are implemented*

University / Academy	Departments of University / Academy or independent HEI
Academy of Applied Studies Belgrade	<ul style="list-style-type: none"> • The College of Hotel Management Belgrade
Academy of Professional Studies Southern Serbia	<ul style="list-style-type: none"> • Department of the Leskovac Business School
„Singidunum“ University	<ul style="list-style-type: none"> • Studies at the University, Belgrade • Higher Education Unit outside the seat of the institution without legal entity, Novi Sad • Higher Education Unit outside the seat of the institution without legal entity, Niš
The University of Kragujevac	<ul style="list-style-type: none"> • Faculty of Hotel Management and Tourism, Vrnjačka Banja
-	<ul style="list-style-type: none"> • Higher Business School of Professional Studies "Prof. dr Radomir Bojković", Kruševac
-	<ul style="list-style-type: none"> • Higher Education Technical School of Professional Studies, Novi Sad
-	<ul style="list-style-type: none"> • Higher Professional School of Organizational Sciences "EDUKA", Belgrade
-	<ul style="list-style-type: none"> • Higher School of Professional Studies for Management and Business Communication, Zemun

The structure of hospitality study programs is presented in Table 3. According to the criterion of the type of study, the majority belongs to the category of professional studies (8 study programs, 57.14%).

Table 3. *Structure of hospitality study programs*

Criteria	Categories	Number	Percentage
Level of study	Undergraduate	10	71.43
	Master	3	21.43
	PhD	1	7.14
Type of study	Professional	8	57.14
	Academic	6	42.86
Type of HEI ownership	State	8	57.14
	Private	6	42.86

The average hospitality study program in the Republic of Serbia is regarded as undergraduate professional studies implemented at a state HEI.

3.1. Level of study

Table 4 contains basic descriptive statistical data about the number of IT subjects present at different levels of study.

IT subjects are present in all study programs at all levels of study considered. The highest maximum number of IT subjects in a study program is recorded in the undergraduate study program, while the highest minimum number and mode are in the PhD study program. The average number of

IT subjects is the lowest in the master's study program.

Table 4. Level of study – the number of IT subjects

		U	M	D
All	Max	5	2	2
	Min	1	1	2
	Avg	2.00	1.33	2.00
	Mod	1	1	2
Compulsory	Max	2	0	0
	Min	1	0	0
	Avg	1.20	0.00	0.00
	Mod	1	0	0
Elective	Max	5	2	2
	Min	1	1	2
	Avg	0.80	1.33	2.00
	Mod	1	1	2

Notes: U – undergraduate study programs; M – master study programs; D – PhD study programs.

Compulsory IT subjects are only present at the undergraduate level, specifically in all undergraduate study programs. There are no compulsory IT subjects at master's or PhD levels.

Elective IT subjects are present at all three study levels: a) all master and PhD study programs and b) three undergraduate study programs (33.33%). The highest average number, highest minimum number, and mode of elective IT subjects are at PhD level. The highest maximum number of elective IT subjects is at the undergraduate level.

The average number of compulsory subjects is higher than the average number of elective subjects in undergraduate studies. However, the maximum number of elective subjects in undergraduate studies is higher when compared to compulsory subjects – other indicators are identical.

Table 5 contains data on the percentage participation of compulsory and elective IT subjects in the total number of IT subjects at different levels of study.

Table 5. Level of study - percentage participation of compulsory and elective IT subjects

		U	M	D
Compulsory	Max	100.00	0.00	0.00
	Min	20.00	0.00	0.00
	Avg	80.33	0.00	0.00
	Mod	100.00	0.00	0.00
Elective	Max	80.00	100.00	100.00
	Min	0.00	100.00	100.00
	Avg	19.67	100.00	100.00
	Mod	0.00	100.00	100.00

Notes: U – undergraduate study programs; M – master study programs; D – PhD study programs

Given that only elective IT subjects are offered, the average participation of elective subjects and other indicators (maximum, minimum, and mode) at

master's and PhD levels is higher when compared to undergraduate studies, amounting to 100.00%. At the undergraduate level, indicators of the percentage participation of compulsory subjects are higher than those of the elective subjects.

3.2. Type of study

Table 6 contains data on the number of IT subjects in different types of study.

Table 6. Type of study – the number of IT subjects

		Professional	Academic
All	Max	4	5
	Min	1	1
	Avg	1.50	2.33
	Mod	1	1; 2
Compulsory	Max	2	1
	Min	0	0
	Avg	1.13	0.50
	Mod	1	0; 1
Elective	Max	2	4
	Min	0	0
	Avg	0.38	1.83
	Mod	0	2

IT subjects are present in all types of study programs considered. When comparing professional and academic studies, we conclude that the indicators mentioned in the previous table, except for the minimum (identical in both types of studies), are higher in academic studies.

Compulsory IT subjects are present in both types of studies, especially in the majority of professional study programs (7 study programs, i.e., 87.50%) and half of the academic study programs (3 study programs). Professional studies have higher maximums and averages, while the other indicators are consistent.

Elective IT subjects are present in both types of studies, namely: a) one-fifth of professional study programs (2 study programs); b) 83.33% of academic study programs (5 study programs). Academic studies have a higher average, maximum, and mode when compared to professional studies. The minimum is identical.

In professional studies, the average number and mode of compulsory subjects are higher when compared to elective subjects, while other indicators are identical. In academic studies, the average number, maximum number, and mode of elective subjects are higher when compared to compulsory subjects, while the minimum is the same.

Table 7 contains data on the percentage participation of compulsory and elective IT subjects in the total number of IT subjects in different types of study.

The average percentage of participation and mode of compulsory subjects are higher when compared

to elective subjects in professional studies. The same indicators for the elective subjects' participation are higher than in compulsory subjects in the case of academic studies. Other indicators (maximum and minimum) are identical.

Table 7. Types of study – percentage participation of compulsory and elective IT subjects

		Professional	Academic
Compulsory	Max	100.00	100.00
	Min	0.00	0.00
	Avg	81.25	25.56
	Mod	100.00	0.00
Elective	Max	100.00	100.00
	Min	0.00	0.00
	Avg	18.75	74.44
	Mod	0.00	100.00

3.3. Ownership of the HEIs that implement the study programs

Table 8 contains data on the number of IT subjects observed from the perspective of ownership of the HEIs that implement the study programs.

Table 8. Ownership of the HEIs that implement the study programs – the number of IT subjects

		State	Private
All	Max	5	4
	Min	1	1
	Avg	2.00	1.83
	Mod	1	1
Compulsory	Max	2	2
	Min	0	0
	Avg	0.88	1.00
	Mod	1	1
Elective	Max	4	2
	Min	0	0
	Avg	1.13	0.83
	Mod	0	0

IT subjects are present in all study programs regardless of whether they are implemented at state or private HEIs. When comparing studies conducted at state and private HEIs, we conclude that the maximum and average number of IT subjects are higher in studies at state HEIs (other indicators are identical).

Compulsory IT subjects are present in studies conducted at both state and private HEIs. Compulsory IT subjects are present in most study programs both at state and private HEIs. However, a higher percentage of study programs conducted at private HEIs implement compulsory IT subjects (5 study programs, i.e., 83.33%) when compared to the study programs conducted at state HEIs (5 study programs, i.e., 62.50%). Study programs conducted at private HEIs display a higher average number of compulsory IT subjects, while the other indicators are identical.

Elective IT subjects are present in studies conducted at both state and private HEIs. Elective IT subjects are present in half of the study programs conducted at both state and private HEIs. Study programs conducted at state HEIs display a higher maximum and average number of elective IT subjects, while the other indicators are identical.

In study programs conducted at state HEIs, there is a higher maximum and average number of elective subjects compared to compulsory subjects, but the mode is descending (the minimum is identical). Study programs conducted at private HEIs have a higher average number and mode of compulsory subjects compared to elective subjects (other indicators are identical).

Table 9 contains data on the percentage participation of compulsory and elective IT subjects in the total number of IT subjects in study programs conducted at private/state HEIs.

Table 9. Ownership of the HEIs that implement the study programs – percentage participation of compulsory and elective IT subjects

		State	Private
Compulsory	Max	100.00	100.00
	Min	0.00	0.00
	Avg	52.50	63.89
	Mod	100.00	100.00
Elective	Max	100.00	100.00
	Min	0.00	0.00
	Avg	47.50	36.11
	Mod	0.00	0.00

The average percentage participation of compulsory subjects is higher when compared to elective subjects in study programs conducted at private HEIs, as the same participation indicator of elective subjects is higher than compulsory subjects in the case of study programs conducted at state HEIs. Other indicators are identical.

3.4. Undergraduate Academic Studies

Table 10 contains data on the number of IT subjects in undergraduate academic studies.

Table 10. Undergraduate academic studies - number of IT subjects

		A	S	P
All	Max	5	5	3
	Min	1	5	1
	Avg	3.00	5.00	2.00
	Mod	-	5	-
Compulsory	Max	1	1	1
	Min	1	1	1
	Avg	1.00	1.00	1.00
	Mod	1	1	1
Elective	Max	4	4	2
	Min	0	4	0
	Avg	2.00	4.00	1.00
	Mod	-	4	-

Notes: A – all study programs; S – study programs implemented at state HEIs; P – study programs implemented at private HEIs

IT subjects are present in all undergraduate academic study programs considered (3 study programs). The average number of IT subjects is 3.00, the maximum is 5, and the minimum is 1. The average, maximum, and minimum number of IT subjects are higher in study programs conducted at state HEIs (1 study program) when compared to those at private HEIs (2 study programs).

Compulsory IT subjects are present in all undergraduate academic study programs, whether conducted at private or state HEIs. Each of the study programs has one compulsory IT subject.

Elective IT subjects are present in 2 study programs of undergraduate academic studies (66.67%), i.e., in all study programs conducted at state HEIs (1 study program; 4 subjects) and in half of the study programs conducted at private HEIs. The average number of elective IT subjects is 2.00, the maximum is 4, and the minimum is 0. The average, maximum, and minimum number of elective IT subjects are higher in study programs conducted at state HEIs (1 study program) when compared to those at private HEIs (2 study programs).

Table 11 contains data on the percentage participation of compulsory and elective IT subjects in the total number of IT subjects in undergraduate academic studies.

Table 11. Undergraduate academic studies – percentage participation of compulsory and elective IT subjects

		A	S	P
Compulsory	Max	100.00	20.00	100.00
	Min	20.00	20.00	33.33
	Avg	51.11	20.00	66.67
	Mod	-	20.00	-
Elective	Max	80.00	80.00	66.67
	Min	0.00	80.00	33.33
	Avg	48.89	80.00	33.33
	Mod	-	80.00	-

Notes: A – all study programs; S – study programs implemented at state HEIs; P – study programs implemented at private HEIs

By comparing compulsory and elective IT subjects, we conclude that the average (51.11%), maximum (100.00%), and minimum percentage participation (20.00%) of compulsory IT subjects regarded in the total number of IT subjects in undergraduate academic study programs is higher. This ratio differs in study programs conducted at state and private HEIs. In study programs conducted at state HEIs, the percentage participation of elective subjects is higher when compared to the compulsory subjects. Study programs conducted at private HEIs display higher average and maximum percentage participation of compulsory subjects compared to elective subjects, while the minimum participation is identical.

Table 12 contains an overview of IT subjects in undergraduate academic study programs.

Table 12. Undergraduate academic studies – IT subjects

	State institutions	Private institutions
Compulsory courses	<ul style="list-style-type: none"> • Business Informatics 	<ul style="list-style-type: none"> • Information Systems in Tourism and Hotel Management • Business Informatics
Elective courses	<ul style="list-style-type: none"> • Information Systems Development • Quantitative Software Analysis in Hotel Management and Tourism • Business Information Systems • Information and Communication Technologies in Hotel Management and Tourism 	<ul style="list-style-type: none"> • Digital Marketing • Information Systems in Tourism and Hotel Management

Business Informatics plays a prominent role among compulsory IT subjects. Subjects related to Information Systems are the most prevalent among elective IT subjects.

3.5. Undergraduate Professional Studies

Table 13 contains data on the number of IT subjects in undergraduate professional studies.

Table 13. Undergraduate professional studies – number of IT subjects

		A	S	P
All	Max	4	2	4
	Min	1	1	1
	Avg	1.57	1.25	2.00
	Mod	1	1	1
Compulsory	Max	2	2	2
	Min	1	1	1
	Avg	1.29	1.25	1.33
	Mod	1	1	1
Elective	Max	2	0	2
	Min	0	0	0
	Avg	0.29	0.00	0.67
	Mod	0	0	0

Notes: A – all study programs; S – study programs implemented at state HEIs; P – study programs implemented at private HEIs

IT subjects are present in all study programs of undergraduate professional studies considered (7 study programs). The average number of IT subjects is 1.57, the maximum is 4, and the minimum is 1 (mode – 5 study programs, i.e., 71.42%). The average and maximum number of IT subjects are higher in study programs conducted at

private HEIs when compared to those at state HEIs, while the minimum number and mode are identical. Compulsory IT subjects are present in all study programs of undergraduate professional studies, whether conducted at private or state HEIs. The average number of IT compulsory subjects is 1.29, the maximum is 2, and the minimum is 1 (mode – 5 study programs, i.e., 71.42%). The average number of compulsory IT subjects is higher in study programs conducted at private HEIs when compared to those at state HEIs, while the other indicators (maximum, minimum, and mode) are identical.

Elective IT subjects are only present in 1 study program of undergraduate professional studies (14.29%; 2 subjects). This study program is conducted at a private HEI and represents one-third of such study programs. We conclude that there are no elective IT subjects in study programs conducted at state HEIs. The average number of elective IT subjects in undergraduate professional studies is 0.29, the maximum is 2, and the minimum is 0 (mode – 6 study programs, i.e., 85.71%).

Table 14 contains data on the percentage participation of compulsory and elective IT subjects in the total number of IT subjects in undergraduate professional studies.

Table 14. Undergraduate professional studies – percentage participation of compulsory and elective IT subjects

		A	S	P
Compulsory	Max	100.00	100.00	100.00
	Min	50.00	100.00	50.00
	Avg	92.86	100.00	83.33
	Mod	100.00	100.00	100.00
Elective	Max	50.00	0.00	50.00
	Min	0.00	0.00	0.00
	Avg	7.14	0.00	16.67
	Mod	0.00	0.00	0.00
Notes: A – all study programs; S – study programs implemented at state HEIs; P – study programs implemented at private HEIs				

By comparing compulsory and elective IT subjects, we conclude that the average (92.86%), maximum (100.00%), and minimum percentage participation (50.00%), as well as the mode (100.00%), of compulsory IT subjects in the total number of IT subjects in undergraduate professional studies, are higher. This ratio differs in study programs conducted at state and private HEIs because there are no elective IT subjects in study programs conducted at state HEIs; all subjects are compulsory. This situation results in compulsory IT subjects displaying an average and minimum percentage participation of 100.00% in study programs conducted at state HEIs, which is higher participation when compared to study programs conducted at private HEIs (maximum and mode are

identical). In study programs conducted at private HEIs, elective IT subjects display a maximum and average percentage participation higher than those in study programs conducted at state HEIs (minimum and mode are identical).

Table 15 presents a summary of IT subjects in undergraduate professional studies.

Table 15. Undergraduate professional studies – IT subjects

	State institutions	Private institutions
Compulsory courses	<ul style="list-style-type: none"> • Informatics in Hotel Management • Informatics • Information Systems in Tourism • Application of Information Technologies / Information and Communication Technologies 	<ul style="list-style-type: none"> • Informatics in Business • Informatics and Mathematics in Hospitality • Business Informatics • Information Systems
E.C.	-	<ul style="list-style-type: none"> • Communication Technologies • E-business

Informatics is prevalent among compulsory IT subjects. In this category of IT subjects, subjects related to information systems are also noticeable.

3.6. Master Academic Studies

IT subjects are present in all master academic study programs considered (2 study programs). IT subjects are offered at private (1 study program) and state HEIs (1 study program). Each study program has one IT subject classified as elective. There are no compulsory IT subjects.

Table 16 provides a review of IT subjects in master academic studies.

Table 16. Master academic studies – IT subjects

	State	Private
C.C.	-	-
E.C.	<ul style="list-style-type: none"> • Internet Technology 	<ul style="list-style-type: none"> • Intelligent Software Application in Tourism

3.7. Master Professional Studies

There is only one hospitality-related master professional study program at a state HEI. The only IT subject in this study program, classified as an elective. There are no compulsory IT subjects.

Table 17 provides a review of IT subjects in master professional studies.

Table 17. Master professional studies – IT subjects

	State	Private
C.C.	-	-
E.C.	<ul style="list-style-type: none"> • E-business in Hotel Management 	-

3.8. PhD Academic Studies

There is only one hospitality-related PhD program at a state HEI. And there are 2 IT subjects, both classified as electives. There are no compulsory IT subjects.

Table 18 provides a review of IT subjects in PhD academic studies.

Table 18. *PhD academic studies – IT subjects*

	State	Private
C.C.	-	-
E.C.	<ul style="list-style-type: none"> • Intelligent Information Systems • Management of Tourism Resources through GIS 	-

4. CONCLUSION

Regardless of the level and type of study and ownership of the institution that implements them, all hospitality study programs offer IT subjects. In terms of the level of study, master programs have the fewest IT subjects, while compulsory subjects are only present in undergraduate programs (all study programs), and compared to electives, they constitute the majority of IT subjects. Elective IT subjects are present in all master's and PhD study programs and one-third of undergraduate study programs.

Regarding the type of study, academic studies implement more IT subjects compared to professional studies. Compulsory subjects are present in the majority of professional and half of academic studies, while elective subjects are present in the majority of academic and one-fifth of professional studies. In academic studies, elective subjects constitute the majority of IT subjects. However, in professional studies, compulsory subjects comprise the majority of IT subjects.

On average, state studies implement more IT and elective IT subjects, while private studies implement more compulsory subjects. Compulsory subjects are present in the majority of state and private studies. However, the average number of compulsory subjects is higher in state ones. Elective subjects are present in half of the study programs – state and private. When we compare compulsory subjects to elective ones, they have a higher share in IT subjects in both state and private studies, but the share is higher in private ones.

We also examined individual undergraduate academic, undergraduate professional, master academic, master professional, and PhD academic studies at state and private HEIs. Undergraduate academic studies especially highlight Business Informatics (compulsory) and subjects in the sphere of Information Systems (elective), while undergraduate professional studies focus on Informatics (compulsory).

The proposal is that IT competencies are developed as subject and cross-subject competencies. The subjects should be divided into five groups:

- Informatics;
- E-business;
- IT and systems in hospitality;
- Digital marketing in hospitality;
- Robotics and artificial intelligence in hospitality.

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