

# INFORMATION SOURCES AND FACTORS INFLUENCING ENROLMENT IN ICT AND STEM UNIVERSITY STUDY PROGRAMMES

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**ABSTRACT:** *In a demanding and increasingly competitive higher education marketplace, the awareness of the reasons why prospective students choose a certain study programme and information sources they use during their decision-making process is essential to develop institutional positioning, thus requiring deeper understanding. This paper aims to explore students' decision-making processes, focusing on the information sources and factors influencing their decisions. The results contribute to the understanding of factors influencing students' decision-making and provide the evidence about the factors and information sources influencing Information and Communication Technology (ICT) and Science, Technology, Engineering and Mathematics (STEM) students' choice, which can serve as implications for higher education policy makers and companies operating in these fields.*

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## 1 INTRODUCTION

In today's highly competitive and increasingly complex higher education marketplace, where students can choose among many options, factors enabling higher education institutions (HEIs) to attract and retain students, as well as information sources used by prospective students when applying to an HEI, request a deeper understanding. The importance of attracting and retaining students in Science, Technology, Engineering and Mathematics (STEM) and Information and Communication Technology (ICT) study areas is of highest interest because ICT and STEM expertise is regarded as an imperative for future economic growth based on knowledge and technological innovations (EC, 2015; CIC, 2014). In accordance with Europe 2020 flagship initiative Digital Agenda for Europe, Europe

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will need more qualified staff to support its strategic orientation in fostering sustainable development of the European Union through development and implementation of digital technologies (EC, 2010; EC, 2014). STEM skilled labour is also insufficient (EP, 2015) and “effective cooperation with employers” is needed (EP, 2015, p. 24).

Owing to the awareness that during the last decade the European Union member countries have been continuously reporting and alerting about the young population’s decreasing interest to enrol in STEM study areas (EC, 2007; OECD, 2008), a need has emerged to deepen the understanding about students’ decision-making processes and to gather scientific evidence about the information sources and factors affecting prospective students’ choice when selecting an HEI offering ICT and STEM study programmes in order to provide the support for enhancements of HEIs’ marketing policies. The awareness about the reasons why students choose a certain HEI and information sources they use during their decision-making process is essential to develop institutional positioning in an increasingly competitive higher education marketplace. Thus, this paper aims to answer the following question: *What are the information sources and factors that influence the ICT and STEM students’ decision-making process related to choosing a specific higher education institution and a study programme?*

There is only a limited research base regarding the issues. Moreover, to the best of our knowledge, research providing evidence from Croatia regarding this subject is rather scarce as well. The originality of this study stems from the fact that this is believed to be the first such study carried out among students at the University of Rijeka. Given that the questionnaire can be used to survey factors affecting students’ choice in most other higher education institutions should be considered as an important added value of this work.

The paper thus begins with a brief theoretical background related to the choice, information sources and decision-making in the higher education context, institutional positioning, as well as an ICT and STEM skills gap in the labour market. In the subsequent section, it addresses the empirical research with data analysis, followed by the concluding discussion that also indicates limitations of the study and suggests a proposal for future research.

## 2 LITERATURE REVIEW

When making a decision about which study programme and HEI to select and attend, prospective students are influenced by a wide range of various influence factors. Sources of information and factors affecting students’ choice are important dimensions in the students’ decision-making process (Kiel & Layton, 1981; Simões & Soares, 2010).

### 2.1 Choice in higher education

Due to the constant and intense changes occurring in the last decades, the higher education marketplace has been transformed to a highly marketised, competitive environment

(Soutar & Turner, 2002), and the phenomena of choice and decision-making in higher education have become an area of growing research interest. In today's increasingly competitive and diverse higher education marketplace, students have many options and choices available to choose from and have to engage in a serious decision analysis in order to make an informed decision.

According to Foskett (1999), choice is a continuous, complex and multifactorial process that involves different sources influencing an individual's decision. Early structural models by Gambetta (1996), Roberts (1984) and Ryrice (1981), proposed to predict and explain participation and progression of students in higher education, explain the choice in the context of institutional, economic and cultural confines, with the central argument of choice as an irrational process. On the contrary, to adverse such argument, the economic models of choice, as proposed by Becker (1975), are based on beliefs that students make rational choices based on calculations of the relative rates of returns associated with participating in a particular higher education study programme. Yet, a third group of structural models explaining choices are based on the individual's subjective reasoning in the decision-making process and on the importance of an individual's personality. In accordance, Hodkinson et al. (2012) argue that "choice is a rational process that is constrained by a realistic perception of opportunities and shaped by individual personality" (Payne, 2003, p. 13). Hemsley-Brown (1999) follows this view and confirms in her study that future students have pragmatic reasons for making choices, which are found to be influenced by family background, culture and life history. Foskett & Hemsley-Brown (2001) develop an integrated model which synthesises elements of the previous three models, in which choice is not a fully rational action and includes both key choice influencers and choosers. In this paper, choice is considered as an expression of students' preferences at a particular moment of the students' decision-making process (Maringe, 2006).

## 2.2 Decision-making in higher education

In recent literature (Lunenburg, 2010; Lee & Chatfield, 2011; Wadhwa, 2016), decision-making process is broadly comprehended as a problem solving process, undertaken by individuals in the process of making choices. Decision-making models have been developed from the theory of consumers' purchase behaviour, which defines purchase behaviour as a process or a series of stages that include arousal, information search, evaluation of alternatives, purchase decision and post purchase feelings (Kotler, 2003).

Chapman (1986) was amongst the pioneers in transposing the buying behaviour theory into the education context, suggesting that students and their parents go through a series of stages in the process of selecting an HEI or a study programme. The stages include: (1) pre-search behaviour, (2) search behaviour, (3) application stage, (4) informed decision, and (5) application (Maringe, 2006). In the stage of pre-search behaviour which involves students' early thoughts about their future careers, prospective students are exposed to information about HEIs and are becoming aware of them. Since some of the lasting perceptions and attitudes are developed during this stage, HEIs aiming to extent their

recruitment markets should recognize the importance of this early decision-making stage to improve their presence in the passive minds of future students. At the stage of search behaviour, prospective students already make a selection of several potential HEIs and begin to search and use available information sources to make an informed decision, while looking for data that meets their range of decision criteria (Maringe, 2006). At this stage, HEIs should maximise the availability of their information sources to facilitate the prospective students' decision-making process. In the application stage students submit their applications to the selected HEIs. Since prospective students tend to make multiple applications, there is still time to influence their choice by considering their applications promptly, responding quickly to communication requests and developing strategies ensuring a high standard of customer care (Sargeant, 1999). The term *decision* assumes the actual acceptance of the offer by the prospective student, followed by the final stage of the process, in which the applicant turns up for registration.

In relevant scientific literature (Lee & Chatfield, 2011), research on choice and decision-making process in the higher education context has been conducted at three levels: (1) the global level which shows why students choose to study out of their home country, (2) the national level at which students' choice of a certain HEI is in focus, and (3) the choice of a study programme which received the least attention.

Dreher & Poutvaara (2005) argue that at the global level, cultural and economic factors have the most influential impact on shaping the international students migration markets. Bauer et al. (2000) identify "push and pull" factors which impact the students' decision-making process in the international higher education market, explaining push factors as those relating to obstacles in higher education admission and attainment in home countries, scarcity of career opportunities, low economic standards, disagreement and disappointment with the general political climate, as well as political violence and deprivation of certainty in the government's ability and willingness to improve living conditions (Dzvimbo, 2003). According to Borjas (1994) and Bauer et al. (2000), pull factors attracting students to countries in the developed world are high educational standards in host countries, high teaching quality, availability and opportunities for future postgraduate study, a safe study and political environment, economic capabilities that include prospect of future employment, availability of part time jobs, and opportunities for study funding, including the opportunities for state assisted funding for family members.

The choice of HEI within countries gained prevalent interest among researchers and has been studied extensively. James et al. (1999) in their research conducted in Australia, found that field of study preferences, institutional reputation, course reputation, course entry scores, as well as easy access to home and institutional characteristics have a much more significant impact on future students' choice of HEI than costs. In accordance to that, Price et al. (2003) conducted a research in England, resulting in its extension by adding further dimensions that were found to have an influence on prospective students' decisions and choice of HEI, i.e. applicants to undergraduate study programmes considered the teaching reputation of HEIs more important than their research profiles. Foskett et al. (2006) confirm the growing tendency of considerations of economic factors among the student

population (i.e. part time job opportunities to supplement their incomes, accommodation costs and family home proximity), considering them as obstacles during the times of financial concerns or economic crises. Since the financial considerations have become increasingly more important to students, it was suggested to reconsider the meaning and importance of factors influencing prospective students' HEI choice.

The choice of a study programme closely relates to the choice of a higher education institution. Accordingly, James, Baldwins and McInnis' (1999) research in the area of study programme choice and decision identifies several factors influencing prospective students' study programme preferences: the entry criteria (possibility of enrolment based on school results), reputation of the study programme among employers, graduate satisfaction from the study programme, graduate employment rates from the study programme, teaching quality in a given study programme, approaches to teaching and learning, and assessment of the study programme. Study programme flexibility was found rather important especially among mature students and single parents students (James et al., 1999).

### 2.3 Information sources

To gather relevant information about a product or a service, various sources of information in the decision-making process need to be analysed. Murray (1991) and Boyle et al. (2011) identify two different information sources, internal and external. Accordingly, Beatty & Smith (1987) and Simões & Soares (2010) classify external information sources as interpersonal, media, neutral, and retailer, while Olshavsky & Wymer (1995) assort information sources as consumers' direct inspections of products or services, interpersonal sources (e.g. relationships), marketer-controlled sources (e.g. advertising), reseller information (e.g. catalogues), and third-party independent sources (e.g. consumer reports).

In the higher education context, the usage and relevance of distinct information sources have been explored, such as HEIs' websites, HEIs' open door days, media reports, brochures, leaflets, parents, teachers, and others. The research focusing on prospective students' information relevance and requirements found that the majority of prospective students rely on information sources developed by the HEI (such as HEIs' websites, brochures, leaflets, flyers), while career services and interpersonal sources, like parents and teachers for example, are found to be less important (Veloutsou et al., 2004; Briggs & Wilson, 2007). Taylor (1974), Schaninger (1976), Dowling (1986), Beatty & Smith (1987) and Heinström (2003) confirm the connection between individual factors and preferences for information sources. Briggs & Wilson (2007) show evidence on differences in preferences of information sources depending on gender and study programme area. Boone et al. (2004) identify differences between individual personalities and the chosen higher education study programmes.

## 2.4 Institution positioning in higher education

In the turbulent and increasingly demanding higher education marketplace, applicants or prospective students compete for the most preferred HEIs, while HEIs compete for the best students. Thus, HEIs should take advantage of their strengths and position themselves around the aspects they are successfully fulfilling and are about to become excellent in (Maringe, 2006).

According to Wilson & Gilligan (2012, p. 354), positioning is „the process of designing an image and value so that customers within target segments understand what the company or brand stands for in relation to its competitors“. Accordingly, positioning as a process consists of three essential principles: (1) establishing and developing an institutional brand or image, (2) determining market segments and (3) creating a communication strategy that emphasizes the institutional proficiency to deliver its products and services to customers within a certain market segment. The above indicates that understanding prospective students' purchase behaviour, identification of choice and their decision-making process can contribute to create an HEI's positioning strategy.

## 2.5 ICT and STEM skills gap in the labour market

Policy makers in Europe and globally have identified the high growth sectors and thus recognise and foresee ICT and STEM skills shortages. According to Cedefop (2014, in Berger & Frey, 2016), 40% of European firms stated they lack workers with adequate skills. By 2020 companies will be able to absorb 756,000 additional workers in ICT only (Hüsing, Korte & Dashja, 2015). The gap is also widening in STEM skilled workers supply and demand (Cedefop, 2014, in Berger & Frey, 2016). Unless employers' needs are met by the educational system, they will have to resort to other options, such as specialised training programmes or labour force immigration. For employers, these solutions are costly, time-consuming and may slow down growth. Croatia is one of the countries where the society struggles with high unemployment rates coexisting with skill shortages in some fields (EC, 2017). A better alignment of the number of students in ICT and STEM is needed to address the labour market needs.

## 3 EMPIRICAL RESEARCH

Following the research questions, four hypotheses grounded on previous research have been submitted to data analysis to explore the information sources and factors affecting students' choice of a particular ICT or STEM study programme and a particular HEI. The proposed research hypotheses are:

H1: More important factors influencing the ICT and STEM students' decision-making process are personal interest, graduate employment, academic and teaching reputation.

H2: Less important factors influencing the ICT and STEM students' decision-making

process are parental guidance and the current students' influence.

H3: More important information sources used by ICT and STEM students during their decision-making process are websites and organised HEI visits (i.e. the HEI open-door days).

H4: Less important information sources used by ICT and STEM students during their decision-making process are interpersonal information sources (i.e. friends and acquaintances' recommendations and social networks).

### 3.1 Methodology

Relevant quantitative data was collected by an anonymous self-administered online questionnaire in Croatian used as a part of a larger study aimed to explore perceived service quality, students' satisfaction, study efficiency, positive word-of-mouth behaviour, reasons for choosing a particular study programme and information sources used during the decision-making process (Mestrovic, 2017), using Google Docs Forms distributed by email to undergraduate and graduate students of the University of Rijeka Departments in ICT and three STEM subjects: biotechnology, mathematics and physics.

The survey was conducted in the period of two months, during the middle of the summer semester of the academic year 2014/2015. Amongst 873 students enrolled and surveyed in this study, 214 questionnaires returned usable and valid for data analysis. While research in the information search area and social media interaction and validation in the student recruitment process use larger samples (e.g. Rutter, Roper & Lettice, 2016), scale developers in the marketing area (Parasuraman, Zeithaml & Berry, 1988; Markovic, 2006) and in higher education research (Wilkins & Huisman, 2011) used a sample size of 200 to analyse group data, thus a convenience sample of 24.51 % achieved for this research was considered as an adequate sample size.

For the data analysis, Statistica 12.7 software was used. After confirming the reliability of the measurement instrument assessed by Cronbach's Alpha, simple descriptive statistics were used as appropriate to examine the respondents' demographic profile, information sources used by the respondents during their decision-making process and factors influencing their choice for a particular STEM or ICT study programme and HEI.

### 3.2 Sample description

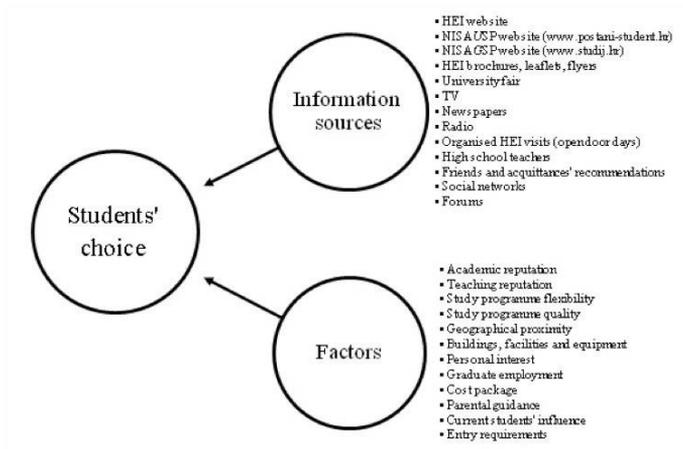
The current study examines the demographic variables of gender, age, study programme level, study programme area, tuition fee and students' success achieved during the studies. From the 214 respondents in this study, 140 (65.42 %) were female and 74 (34.58 %) were male. The calculated mean age of respondents was 22, with the majority of the students being between 21 and 23 years old (48.60 %). Among the total number of respondents, 95 were students of ICT (44.39 %) and 119 respondents (55.61%) were students enrolled

in STEM study programmes. 142 respondents were students enrolled in undergraduate study programmes (66.36 %) and 72 enrolled in graduate study programmes (33.64 %). All of them were full-time students and most of them did not pay tuition fees due to the study success awarded by the Ministry of Science and Education of the Republic of Croatia (MSE) grants (85.98 %). The majority of the students were successful and had a very good average grade during the study (46.26 %), followed by the good grade (29.44 %), excellent (18.22 %) and sufficient (6.07 %).

### 3.3 Research instrument

A quantitative approach was used in this research. Based on the extensive literature review, for the purpose of this study an online questionnaire was used (Mestrovic, 2017) to explore perceived service quality, students' satisfaction, study efficiency, positive word-of-mouth behaviour, reasons for choosing a particular study programme and information sources used during the decision-making process. It was created in Google Docs Forms and distributed by email to undergraduate and graduate students of the University of Rijeka Departments in ICT and three STEM subjects. The research instrument consisted of seven parts: measure of perceived service quality, measure of overall students' satisfaction, items concerning reasons for choosing a study programme, items concerning information sources used in the decision-making process, efficiency in studying, positive word-of-mouth recommendations, demographic characteristics, and an open question enabling participants to add their suggestions. To achieve the research aim, this study focused on the parts of the survey that administers the respondents' agreement with statements considering the factors affecting students' choice and the sources of information used by students when selecting an HEI, as shown in Figure 1.

Figure 1: *Conceptual framework*



Source: Authors

To achieve the aim of the study, it was decided to use and adapt the selected items from previous inventories developed around the factors influencing students' choice (James et al., 1999; Price et al., 2003; Briggs, 2006; Simões & Soares, 2010). The participants were asked to rate their agreement with the statements considering the factors that influenced their HEI and study programme choice, including their personal interest in the study programme area, academic reputation, teaching reputation, programme flexibility, study programme quality, geographical proximity, academic support facilities, graduate employment, cost of package, family influence, current and former students' influence and entry requirements, using a five-point Likert type scale anchored by 1 (strongly disagree) and 5 (strongly agree). To explore the information sources used during their decision-making process, the respondents were asked to select the sources of information they used when selecting an HEI using a multiple choice scale. All survey questions were mandatory.

Cronbach's alpha value for the entire measurement instrument was 0.958 and demonstrated an excellent reliability according to DeVellis (2001). The subscale with items concerning the reasons for choosing a study programme achieved an acceptable Cronbach's alpha value of 0.662, thus it should be interpreted and used considering its limitations (Hair et al., 2006).

#### 4 RESULTS

Following previous research (James et al., 1999; Price et al., 2003; Briggs, 2006; Simões & Soares, 2010), participants were asked to rate their agreement with the proposed statements. For the purpose of the analysis, agreement to the statements rated as strongly disagree was coded with 1, 2 for disagree, 3 for neutral, 4 for agree and 5 for the statements rated as strongly agree. The mean (M) scores were calculated for each factor, as shown in Table 1.

Table 1: Mean scores of factors influencing the HEI and study programme choice

Factor	1 (strongly disagree)		2 (disagree)		3 (neutral)		4 (agree)		5 (strongly agree)		Total	
	n	%	n	%	n	%	n	%	N	%	M	SD
Academic reputation	50	23.36	34	15.89	42	19.63	70	32.71	18	8.41	2.87	1.322
Teaching reputation	64	29.91	32	14.95	58	27.10	39	18.22	21	9.81	2.63	1.339
Study programme flexibility	43	20.09	41	19.16	37	17.29	61	28.50	32	14.95	2.99	1.374
Study programme quality	15	7.01	40	18.69	24	11.21	78	36.45	57	26.64	3.57	1.257
Geographical proximity	34	15.89	23	10.75	23	10.75	73	34.11	61	28.50	3.49	1.413
Buildings, facilities and equipment	40	18.69	23	10.75	34	15.89	77	35.98	40	18.69	3.25	1.381
Personal interest	5	2.34	5	2.34	2	0.93	53	24.77	149	69.63	4.57	0.829
Graduate employment	4	1.87	7	3.27	21	9.81	55	25.70	127	59.35	4.37	0.925
Cost package	20	9.35	12	5.61	38	17.76	71	33.18	73	34.11	3.77	1.241
Guidance from parents	171	79.91	18	8.41	15	7.01	8	3.74	2	0.93	1.37	0.845
Current students' influence	150	70.09	28	13.08	10	4.67	22	10.28	4	1.87	1.61	1.086
Entry requirements	142	66.36	24	11.21	19	8.88	16	7.48	13	6.07	1.76	1.244

Source: Authors

The table above shows that personal interest, marked as “strongly agree” by 149 respondents and “agree” by 53 respondents, is closely followed by realistic career considerations (i.e. graduate employment), marked as “strongly agree” by 127 respondents and “agree” by 55 respondents, and financial aspects (i.e. cost package), marked as “strongly agree” and “agree” by a majority of the respondents (i.e. 73 and 71, respectively). These factors have the greatest impact on the students’ choice of a study programme and an HEI. Accordingly, the obtained mean scores are as follows: 4.57 for personal interest, 4.37 for graduate employment and 3.77 for cost package.

Study programme quality, geographical proximity and academic support facilities (buildings, facilities and equipment) are the fourth, the fifth and the sixth most influential factors in choosing the right study programme or HEI, respectively. The majority of the respondents (57 “strongly agreed” and 78 “agreed”) consider study programme quality as a moderately important factor (mean score 3.57), while geographical proximity (mean score 3.49) and academic support facilities (mean score 3.25) are found to be less important.

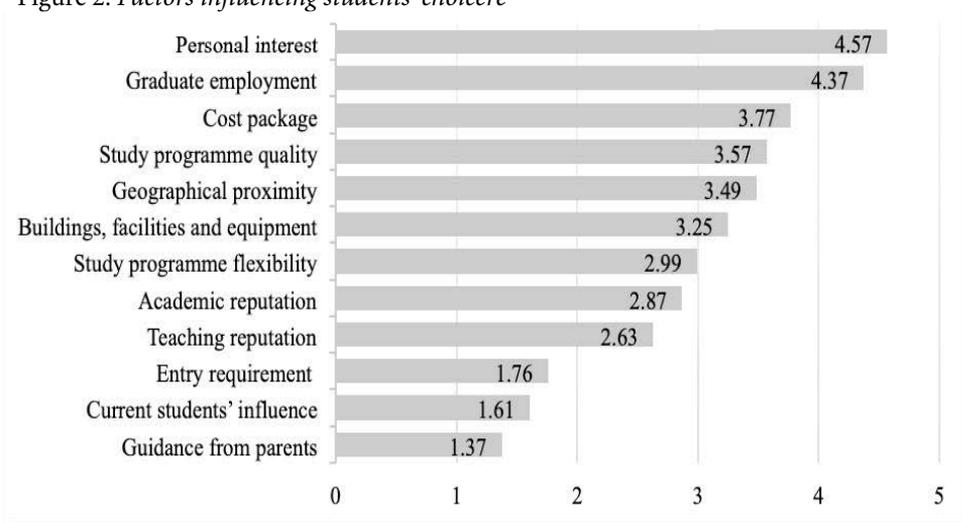
While study programme flexibility, academic reputation and teaching reputation are found to be even less important factors affecting students’ choice, the least important factors are entry requirements, the current students’ influence and parental guidance. 17.29 % of the total number of respondents were “neutral” considering the study programme flexibility and its influence on their choice, 20.09% “strongly disagreed”, 19.16 % of the respondents “disagreed”, 28.50 % “agreed” and 14.95 % of the respondents “strongly agreed” to having been influenced by the study programme flexibility, which resulted in its total mean value of 2.99. 39.25 % of the respondents (respectively 50 and 34) either “strongly disagreed” or “disagreed” that the academic reputation had an impact on their choice of a study programme and an HEI, 42 respondents were “neutral” and 41.12% of the total number of respondents either “agreed” or “strongly agreed” that the academic reputation as a factor that made an impact on their study programme and HEI choice, resulting in the total mean of 2.87. The teaching reputation with the mean score of 2.63 was found to have an even lower impact, with the majority of respondents choosing “strongly disagreed”, “disagree” or “neutral” in relation to its influence.

The least important factors were entry requirements and the current students’ influence, followed by parental guidance as a factor with the absolutely lowest influence. Entry requirements were found to have an impact only on 13.55 % of the respondents, who either “agreed” or “strongly agreed” to it having an influence, 19 respondents were “neutral”, while the majority of students (77.57 %) either “strongly disagreed” and “disagreed” to the statement that entry requirements had an impact on their study programme and HEI choice, with the mean value of 1.76. The current students’ influence was found to have an impact only on 26 respondents, who either “agreed” or “strongly agreed”, 10 respondents were “neutral”, while the majority of students (178) either “strongly disagreed” and “disagreed” to the statement that the current students’ influence had an impact on their study programme and HEI choice, with the mean value 1.61. The guidance from parents was found to have the lowest impact: only 10 respondents either “agreed” or “strongly

agreed”, 15 respondents were “neutral”, while the majority of students (88.31 %) either “strongly disagreed” or “disagreed” with the statement that guidance from parents had an impact on their study programme and HEI choice, resulting in the total mean value of 1.37.

Figure 2 demonstrates the factors influencing the students’ choice in selecting an HEI and a study programme. The factors are shown in a descending order, from the most important to the least important one.

Figure 2: *Factors influencing students' choice*



Source: Authors

The second aim of this research was to explore the sources of information used by students when evaluating which HEI and study programme to attend. To achieve that aim, the respondents were asked to select the sources of information, using a multiple choice scale suggesting the following information sources: HEI website, the National information system for application for undergraduate study programmes (NISAUSP) website (i.e. [www.postani-student.hr](http://www.postani-student.hr)), the National information system for application for graduate study programmes (NISAGSP) website (i.e. [www.studij.hr](http://www.studij.hr)), HEI brochures, leaflets, flyers, University fair, TV, newspapers, radio, organised HEI visits (i.e. open-door days), high school teachers, friends and acquaintances’ recommendations, social networks, forums and other (with the possibility to add and describe any additional source of information). The results are summarised in Table 2.

Table 2: *The most used information sources*

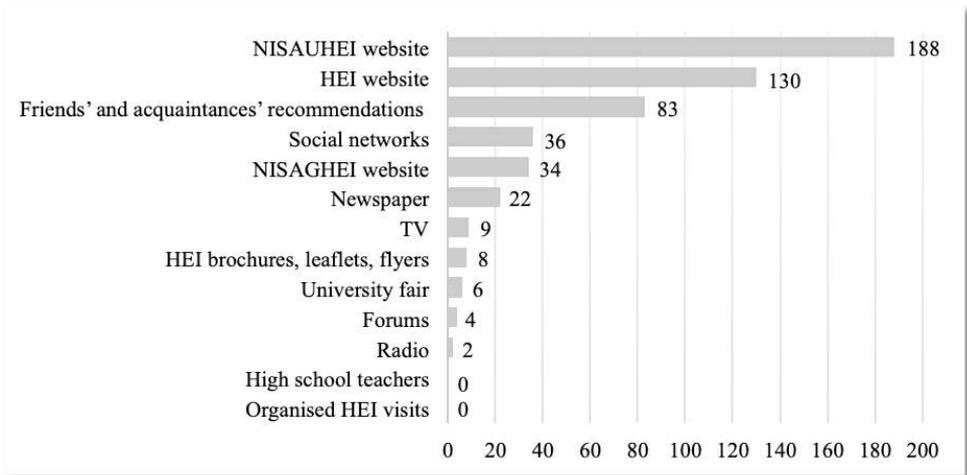
Information sources	Total	
	n	%
HEI website	130	60.7
NISA USP website (www.postani-student.hr)	188	87.9
NISAGSP website (www.studij.hr)	34	15.9
HEI brochures, leaflets, flyers	8	3.7
University fair	6	2.8
TV	9	4.2
Newspapers	22	10.3
Radio	2	0.9
Organised HEI visits (open-door days)	0	0
High school teachers	0	0
Friends and acquaintances' recommendations	83	38.8
Social networks	36	16.8
Forums	4	1.9

Source: Authors

Among the marketer-controlled sources, the National information system for application for undergraduate study programmes (NISA USP) website, i.e. www.postani-student.hr, was the most used source indicated by 188 respondents (87.9%), followed by the HEI website, which was used by 130 (60.7%) respondents. Friends and acquaintances' recommendations (i.e. positive word-of-mouth) and social networks as interpersonal information sources also play a significant role. Friends and acquaintances' recommendations were the third most used information source, noted by 38.8% of the respondents, followed by social networks with 16.8%.

Interestingly, comparing to the NISA UHEI website, the National information system for application for graduate study programmes (NISAGSP) website, i.e. www.studij.hr, was not among the most frequently chosen information sources, since it was used by only 15.9% of the respondents. Students addressed the other marketer-controlled sources less: Newspapers were indicated by 10.3% of the respondents, TV by 4.2%, HEI brochures, leaflets and flyers by 3.7% and the University fair by 2.8% of the respondents.

Finally, forums were chosen by only 4 respondents (1.9%) and radio was marked as used by only 2 respondents (0.9%). It should be noted that high school teachers and organised HEI visits (i.e. the HEI open-door days) were not indicated as information sources at all, therefore, they were found to be irrelevant to the respondents. Figure 3 shows the information sources ranked from the most to the least used one.

Figure 3: *The most used information sources*

Source: Authors

The findings either partially or fully support the proposed hypothesis as follows: (H1) “More important factors influencing the ICT and STEM students’ decision-making process are personal interest, graduate employment, academic and teaching reputation”; (H2) “Less important factors influencing the ICT and STEM students’ decision-making process are parental guidance and the current students’ influence”; (H3) “More important information sources used by ICT and STEM students during their decision-making process are websites and organised HEI visits”; (H4) “Less important information sources used by ICT and STEM students during their decision-making process are interpersonal information sources”. The findings also answer the research questions: What are the most used information sources that prospective students use while evaluating which HEI and study programme to attend and what are the key factors that influence the ICT and STEM students’ decision-making process? Namely, while personal interest and graduate employment exerted the greatest impact, academic reputation and teaching reputation were found to be less powerful choice factors, partially supporting Hypothesis 1 (H1), stating that the most important choice factors influencing the ICT and STEM students’ decision-making process are personal interest, graduate employment, as well as academic and teaching reputation. The current students’ influence and parental guidance were found to be the least important choice factors, thus fully supporting Hypothesis 2 (H2).

According to the preceding results considering the information sources used during the decision-making process, the respondents marked the NISAUSP website as the most used information source, followed by the HEI website, while the NISAGSP website did not prove to be among the most influential information sources. Additionally, the HEI open-door days were found to be irrelevant to the respondents. Therefore, the third hypothesis (H3), stating that more important information sources used by ICT and STEM students during their decision-making process are websites and organised HEI visits, was only

partially supported. While forums and radio were found to be the least important, both high school teachers and the HEI open-door days were not addressed at all, thus found to be totally irrelevant to the respondents. Therefore, the fourth hypothesis (H4), stating that friends and acquaintances' recommendations as well as social networks are less important information sources, was not supported. Further research should explore the reasons for such ICT and STEM students' opinions. This research implies HEIs should reconsider their methods for attracting students while businesses should put greater emphasis on students' employment prospects.

## 5 DISCUSSION AND CONCLUSIONS

To contribute to the understanding of the factors affecting students' choice and the information sources used by ICT and STEM students in the course of their decision analysis related to choosing a study programme and an HEI, a quantitative survey method aiming to extend the limited research on the topic was used. The study provides evidence about the factors and information sources influencing the students' choice.

The conducted analysis shows that three out of four research hypotheses were either fully or partially supported, except the one stating that friends and acquaintances' recommendations and social networks are less important information sources that ICT and STEM students use during their HEI and study programme decision-making process, which was not supported.

The findings indicate that the HEI and study programme decision-making process is a complex multi-criteria process. The evidence demonstrates consistency in respect to the top three factors affecting students' choice: (1) personal interest in a specific study area and (2) employability after graduation, which are partially in accordance with Maringe's (2006) study, and (3) the cost package, as in Hoyt & Brown's (2003) study, which was found to be more important than the study programme quality or academic reputation. In disagreement with previous research (Veloutsou et al., 2004; Briggs (2006); Briggs & Wilson, 2007), the importance of academic reputation was found to be the eighth out of twelve relevant factors affecting students' choice. This highlights the need for HEI adequate positioning and differentiation strategies, including branding followed by effective promotion.

Employability, being the second most important decision-making factor, suggests that employers need to advocate ICT and STEM students' employment perspectives better if they want to increase the number of students enrolling in these fields. This is important in order to ensure sustainable economic growth of relevant sectors.

The findings reveal that the National information system for application for undergraduate study programmes (NISAUSP) website, the HEI website and friends and acquaintances' recommendations are rated among the top three most used sources of information by the majority of respondents, being in line with previous studies reporting the growing

importance of websites (Mentz & Whiteside, 2003; Briggs & Wilson, 2007) and word-of-mouth (Murray 1991; Briggs & Wilson 2007) as information sources in the prospective students' decision-making process. The sample size and the convenience sampling determined a considerable limitation to the generalisability of the findings of the study, partially confirming previous relevant research. Accordingly, a larger-scale survey testing the key findings should be part of future research.

The information search stage of the prospective students' decision-making process represents an opportunity for HEIs to influence their choices, thus requesting the HEIs to contemplate adequate ways for their promotion in the recruitment market and emphasize their promotional messages in the fields that are in fact the most important to students and not the ones assumed to be the most important by HEIs. From the marketing perspective, the implications of this study may be useful to marketing managers as an idea for designing the promotional mix, where websites are found to be the key information sources. The relevance of friends and acquaintances' recommendations as a frequently addressed information source should be considered with closer attention due to their important implications. Certain measures may improve students' satisfaction and, consequently, their positive word-of-mouth as a communication channel. Additionally, it would be useful to further explore why students ignore traditional HEI's promotional tools, such as brochures, leaflets, flyers and other printed material, to play a significant role in their decision-making process.

By using simple descriptive statistics, this study identifies some important views which need to be accentuated. The obtained data could be additionally subjected to a quantitative analysis using inferential statistical tools to investigate gender and study programme area differences of the factors affecting students' choice and the information sources used in the study programme and HEI decision-making process. It could provide additional insights as implications for higher education policy makers and companies operating in these fields. In addition, the findings should be considered as a starting point for further research on the importance, determinants, impacts and outcomes of the factors affecting students' choice and the information sources used by prospective ICT and STEM students during their decision analysis process.

Recognizing and exploiting the above mentioned is essential for the design and development of the HEI's recruitment strategy that allows the institution to compete successfully in the demanding higher education recruitment market. Being aware of the importance and understanding the reasons for choosing a certain HEI, as well as using certain information sources during the students' decision-making process, contributes to the solid foundations for the creation of a proper HEI positioning in the increasingly demanding and competitive higher education marketplace. Based on the findings of this study, useful to policy makers and marketing strategy creators in the services industry in general and in the higher education sector in particular, improvements can be planned across information sources and factors that influence the students' choice of HEIs, as a key factor to attract, educate and retain ICT and STEM students in Croatia.

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