

Supporting higher education graduates' early careers: strategic framework and maturity model for the field of information and communication technologies

Pažur Aničić, Katarina

Doctoral thesis / Disertacija

2017

Degree Grantor / Ustanova koja je dodijelila akademski / stručni stupanj: **University of Zagreb, Faculty of Organization and Informatics Varaždin / Sveučilište u Zagrebu, Fakultet organizacije i informatike Varaždin**

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:211:139289>

Rights / Prava: [In copyright](#) / [Zaštićeno autorskim pravom.](#)

Download date / Datum preuzimanja: **2024-04-25**



Repository / Repozitorij:

[Faculty of Organization and Informatics - Digital Repository](#)





University of Zagreb

Faculty of Organization and Informatics

Katarina Pažur Aničić

**SUPPORTING HIGHER EDUCATION
GRADUATES' EARLY CAREERS:
STRATEGIC FRAMEWORK AND MATURITY
MODEL FOR THE FIELD OF INFORMATION AND
COMMUNICATION TECHNOLOGIES**

DOCTORAL THESIS

Varaždin, 2017

DOCTORAL THESIS INFORMATION

I. AUTHOR

| | |
|---|---|
| Name and surname | Katarina Pažur Aničić |
| Date and place of birth | December 2 nd 1987, Varaždin |
| Faculty name and graduation date for level VII/I | University of Zagreb, Faculty of Organization and Informatics |
| Faculty name and graduation date for level VII/II | University of Zagreb, Faculty of Organization and Informatics |
| Current employment | University of Zagreb, Faculty of Organization and Informatics |

II. DOCTORAL THESIS

| | |
|---|--|
| Title | Supporting higher education graduates' early careers: strategic framework and maturity model for the field of information and communication technologies |
| Number of pages, figures, tables, appendixes, bibliographic information | 250 pages, 266 bibliographic references, 30 Tables, 21 Figures, 10 Appendixes |
| Scientific area and field in which the title has been awarded | Social Sciences, Information and Communication Sciences |
| Supervisors | Prof. Blaženka Divjak, PhD Assoc. Prof. Samo Pavlin, PhD |
| Faculty where the thesis was defended | University of Zagreb, Faculty of Organization and Informatics |
| Thesis mark and ordinal number | 136 |

III. GRADE AND DEFENCE

| | |
|--|---|
| Date of doctoral thesis topic acceptance | March 15 th 2016 |
| Date of doctoral thesis submission | May 8 th 2017 |
| Date of doctoral thesis positive grade | July 11 th 2017 |
| Grading committee members | Prof. Vjeran Strahonja, PhD, committee chair Prof. Diana Šimić, PhD Prof. Jacqueline A. Stefkovich, PhD |
| Date of doctoral thesis defence | September 1 st 2017 |
| Defence committee members | Prof. Vjeran Strahonja, PhD, committee chair Prof. Diana Šimić, PhD Prof. Jacqueline A. Stefkovich, PhD |
| Date of promotion | |



University of Zagreb

Faculty of Organization and Informatics

KATARINA PAŽUR ANIČIĆ

**SUPPORTING HIGHER EDUCATION
GRADUATES' EARLY CAREERS:
STRATEGIC FRAMEWORK AND MATURITY
MODEL FOR THE FIELD OF INFORMATION AND
COMMUNICATION TECHNOLOGIES**

DOCTORAL THESIS

Research supervisors:

Prof. Blaženka Divjak, PhD, University of Zagreb
Assoc. Prof. Samo Pavlin, PhD, University of Ljubljana

Varaždin, 2017

PREFACE

At the beginning of this thesis I would like to express my sincere gratitude to my mentors - professor Blaženka Divjak from the University of Zagreb, Faculty of Organization and Informatics, and professor Samo Pavlin from the University of Ljubljana, Faculty of Social Sciences – for sharing their professional knowledge, but also for their patience, motivation and guidance in research and writing of this thesis.

Besides my mentors, I would like to thank to professor Diana Šimić for her insightful comments and support during the entire research project, as well as to the members of grading and defence committee – professor Jacqueline A. Stefkovich and professor Vjeran Strahonja.

Special thanks goes to my PhD colleague Krunoslav Arbanas for his active involvement in conducting the systematic literature review and writing of related research papers.

I would like to use this opportunity to express my sincere gratitude to the management and all individuals from the institutions where the research was conducted - for their time and knowledge invested in assistance for carrying out the research. Furthermore, my sincere gratitude goes to all participants of round tables, workshops and model evaluation taken within this research - their contribution to the research is really appreciated and has helped me to achieve results of better quality.

As the research and writing of this thesis was conducted during the turbulent period in my private life I would like to thank my husband Hrvoje and my daughter Leonora for their patience and apologize for all the time when the work on the thesis took me away from them, which was often a case.

Finally, my heartfelt gratitude goes to all those who helped me to get over being a perfectionist and encouraged me in the process of finishing the thesis.

ACKNOWLEDGEMENTS

This research was co-financed by the European Union within the European Social Fund under the Operational programme Human Resource Development 2007-2013, within the call *Research fellowships for the professional development of young researchers and postdocs*, Grant HR.3.2.01-0154 (*Development of a model for supporting graduates' early careers*). The project duration was 15 months – from June 30th 2015 until September 29th 2016. The author of this thesis was the primary researcher and the project lead. The research was also partially financed by the Croatian Science Foundation under the project HigherDecision IP-2014-09-7854 (*Development of a methodological framework for strategic decision-making in higher education – a case of open and distance learning (ODL) implementation*). Some of the parts of this thesis were presented at conferences and prepared in the form of research papers for the publication in several scientific journals, as follows:

- Pažur Aničić, K., Divjak, B. & Arbanas, K., 2017. Prestige and collaboration among researchers in the field of education and career development of ICT graduates: Is there a cross-fertilization of research and knowledge?, accepted for publishing in *Journal of Information and Organizational Sciences*.
- Pažur Aničić, K., Divjak, B. & Arbanas, K., 2017. Preparing ICT Graduates for Real-World Challenges: Results of a Meta-Analysis. *IEEE Transactions on Education*, Volume: 60, Issue: 3, pp.191–197.
- Pažur Aničić, K., 2016. Supporting graduates' early careers: strategic framework and maturity model, *HKO kvalifikacije – za tržište, društvo ili pojedinca?*, The National Council for the Development of Human Potential, Zagreb, October 27-28, 2016 (poster and oral presentation – received award for the best research work of young scientists)
- Pažur Aničić, K. & Divjak, B., 2015. Supporting student retention and employment capabilities within higher education institution: four case studies research. *25th European Access Network (EAN) conference: Retrospective for Perspective: Access and Widening Participation 1991-2041*, May 2016, Dublin, Ireland (oral presentation)
- Pažur Aničić, K. & Divjak, B., 2015. Development of Strategic Framework for Supporting Higher Education Graduates Early Careers. In *8th International Conference of Education, Research and Innovation (ICERI 2015) Proceedings*. pp. 3722–3731.
- Pažur Aničić, K., 2015. Strategic Framework and Maturity Model for Supporting Graduates' Early Careers, *Croatian Qualifications Framework: Knowledge and*

Creativity, The National Council for the Development of Human Potential, Zagreb, October 22-23, 2015 (poster and oral presentation)

A description of research methodology and a short presentation of research results are also contained within the project report and the final project booklet “How to prepare students for the labour market challenges?”, which are also available at the project webpage¹. The booklet of research results was published in September 2016, from the authors K. Pažur Aničić and B. Divjak, both in Croatian and English language.

¹ Webpage of the project *Development of a model for supporting graduates' early careers*: <http://cpsrk.foi.hr/razvoj-modela-za-pruzanje-podrske-diplomantima-u-ranom-razvoju-karijera>

ABSTRACT

In recent years, several national and European strategic documents have recognized the need for closer cooperation among education, businesses and other stakeholders in order to ensure better graduate employability. In this context, it is important to consider not only the quality of study programmes, but also an integrated system for providing support to students within higher education institutions (HEIs).

The main goal of this research was to explore how different elements of student support systems are currently organized at European universities and to develop a strategic framework for supporting higher education graduates' early careers within HEIs, as well as to propose a maturity model focused on study programmes in the field of information and communication technologies (ICT). The research was carried out in several steps involving predominantly qualitative and, to a lesser extent, quantitative research methods, following a five-step methodology for maturity model development based on the design science research paradigm.

The final scientific contribution of this thesis is a comprehensive and reliable maturity model for supporting graduates' early careers within HEIs, based on the strategic framework which fulfils the requirements for both relevance and rigor in design science research. This final maturity model was tested at four HEIs in Croatia and demonstrates significant social contributions in the form of guidelines and recommendations for enhancing the maturity of the HEIs in Croatia for study programmes in the field of ICT.

In a broad sense, the results of this research affect relevant stakeholders, including students, alumni, employers and HEIs, which can use the research results not only as tools for the problem-solving of issues related to graduates' employment, but also as guidelines for creating stimulating policies on the individual, institutional and national levels.

Keywords: *case study research, design science research, graduate early careers development, higher education, maturity model, qualitative research, quality assurance, strategic framework, strategic planning*

SAŽETAK

Posljednjih godina nekoliko europskih i nacionalnih strateških dokumenata ističe potrebu za boljim povezivanjem obrazovnog sustava s gospodarskim sektorom i ostalim interesnim dionicima, kako bi se osigurala bolja zapošljivost diplomanata. U tom kontekstu važno je uzeti u obzir, ne samo kvalitetu studijskih programa, već cjelokupan integrirani sustav pružanja podrške studentima u okviru visokih učilišta (VU).

Glavni cilj ovog istraživanja bio je istražiti način na koji su različiti elementi sustava pružanja podrške studentima u ranom razvoju karijera organizirani na europskim sveučilištima te razviti strateški okvir za pružanje podrške diplomantima u ranom razvoju karijera u okviru VU, uz prijedlog pripadajućeg model zrelosti usmjerenog na studijske programe u području informacijsko-komunikacijskih tehnologija (IKT). Istraživanje je provedeno kroz nekoliko koraka koji uključuju prvenstveno kvalitativne istraživačke metode te u manjoj mjeri kvantitativne metode, a slijede metodologiju za izgradnju modela zrelosti u pet koraka temeljenu na principima istraživačke paradigme znanosti o dizajniranju.

Konačan znanstveni doprinos ove disertacije je sveobuhvatan i pouzdan model zrelosti za pružanje podrške diplomantima u ranom razvoju karijera u okviru VU temeljen na strateškom okviru koji zadovoljava zahtjeve relevantnosti i rigoroznosti znanosti o dizajniranju. Konačan model zrelosti testiran na četiri VU u Republici Hrvatskoj (RH) te pokazuje značajan društveni doprinos u obliku smjernica i preporuka za povećanje razine zrelosti VU u RH, za studijske programe u području IKT-a.

U širem kontekstu ovo istraživanje ima utjecaj na relevantne dionike, uključujući studente, alumnije, poslodavce i VU koji mogu koristiti rezultate istraživanja kao alat za djelomično rješavanje problema zapošljivosti diplomanata, ali također i kao smjernice za kreiranje poticajnih politika na individualnoj, institucionalnoj i nacionalnoj razini.

Ključne riječi: *istraživanje studije slučaja, znanost o dizajniranju, rani razvoj karijera diplomanata, visoko obrazovanje, model zrelosti, kvalitativno istraživanje, osiguranje kvalitete, strateški okvir, strateško planiranje*

EXTENDED ABSTRACT

The opening chapter of this thesis begins with a review of the importance of the employability of graduates in both scientific and social contexts. The introduction provides an overview of the most important strategic initiatives at the national and European levels, as well as an overview of relevant projects conducted in recent years in the field of graduate employability, with a special emphasis on graduates in the field of information and communication technologies (ICT). Following a brief elaboration of the importance of the research topic, this chapter presents the four research goals, five research questions and two research hypotheses of this research. Additionally, the chapter provides a brief description of the methodology used in this research, which is based on the design science research paradigm. The chapter concludes with a reference to the scientific and social contributions of the research.

The second chapter deals with the employability of graduates from a macro perspective. To achieve a better understanding of further research steps, this chapter first describes the basic terminology related to employability and early career development, presents an overview of some of the existing theoretical models related to the employability and elaborates on graduate employability as a part of the university's third mission. The second part of the chapter offers detailed insight into current initiatives in the field of graduate employability from two perspectives: the implications of strategies and policies at the European Union and global levels and the results of relevant projects at the European and international levels. As one of its most important contributions, this chapter provides insight into the importance of higher education institutions (HEIs) in preparing students for their transitions to the labour market and their early career development.

In accordance with the recognized importance of HEIs in preparing students for their early career development, the *third chapter* moves from the macro perspective of employability to the mezzo perspective at the level of HEIs. In this context, the importance of strategic planning for graduate employability within HEIs is stressed, and the advantages of such an approach are explained. Strategic planning is also discussed in relation to the processes of quality assurance within higher education, and an overview of the models used for quality assurance in higher education is provided. The chapter provides a link to the stakeholders in the system of higher education who are closely connected to the processes of strategic planning and quality assurance in relation to the preparation of graduates for their early career development and who play an important role in conducting the research.

Since this empirical research focuses on graduates in the field of ICT, the *fourth chapter* addresses this topic in detail. The chapter first provides an overview of current employability trends of the ICT professionals and the predictions for the future. This introduction provides a good basis for the subsequent systematic literature review of 7179 papers from five databases (the IEEE Xplore Digital Library, the ACM Digital Library, Scopus, ScienceDirect and the Web of Science), of which 761 were analyzed at the level of the abstract and 155 were analyzed in depth. This systematic literature review is important because it provides insight into the number of publications and covered topics related to the higher education and early career development of professionals in the field of ICT from the early beginnings of the discipline until today. It also indicates potential areas for further research. In general, the results of the systematic literature review show that a very low proportion of papers actually propose ways to improve the employability of ICT graduates within HEIs, although many authors point out problems in graduate employment and emphasize the need for improvement in this context. These findings indicate the importance of such scientifically based models as the one developed within this research. The societal importance of this model is evident through the overview of current employability trends of the ICT professionals and the predictions for the future, which are presented in the first part of this chapter.

Following this discussion of the importance of the development of a scientifically based model with social applications for increasing the employability potential of graduates within HEIs in the field of ICT, it was important to identify a model with appropriate characteristics: in this case, a maturity model. Therefore, the *fifth chapter* defines maturity models and describes their basic elements and methodologies for their development. Based on existing maturity models recognized in the literature, this chapter also proposes a structure and description for the elements of the maturity model for supporting graduates' early career development in the context of higher education and, thus, provides a basis for the development of the model through empirical research.

The *sixth chapter* is the most extensive, since it presents a detailed description of the empirical research methodology. The study includes predominantly qualitative and, to a lesser extent, quantitative research methods; thus, it follows a mixed method research approach. The research follows the principles of the design science research paradigm, which is centred on building and evaluating innovative artefacts to solve complex real-world problems and which appears to be a common approach for the design of maturity models. The final strategic framework and

maturity model were developed using the adapted five-step methodology for maturity model development: 1) *Identify a need or new opportunity* – contains references to the previous chapters, which elaborate the need for such a model; 2) *Define the scope* – identifies the initial key process areas and practices within HEIs, which are important for graduates' career development, 3) *Design the model* – conducts four case studies of HEIs in Europe (Vienna University of Economics and Business; University of Belgrade, Faculty of Organisational Sciences; University West in Trollhättan and The University of Edinburgh) and presents an initial proposal for the strategic framework and maturity model practices, 4) *Evaluate the design* – examines the content and construct validity of the model using the knowledge of experts and students and the reliability of the model through its testing at four HEIs with study programmes in the field of ICT in Croatia (Josip Juraj Strossmayer University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology Osijek; University of Zagreb, Faculty of Electrical Engineering and Computing; University of Zagreb, Faculty of Organization and Informatics; University of Applied Sciences VERN), and 5) *Reflect the evolution* – the last stage in the development of the maturity model.

The ***seventh chapter*** is the central chapter in this thesis, since it presents the results of the study conducted according to the methodology described in the sixth chapter. These results are divided into three main parts and presented in relation to the defined research objectives, research questions and hypotheses. The first result is the initial strategic framework for supporting graduates' early career development within HEIs. This framework comprises 110 practices that are recognized as important for supporting students' employment capabilities within HEIs according to four key process areas: 15 within the strategic planning of graduate employability, 35 within curriculum design and delivery, 34 within student support and 26 within the provision of extra-curricular activities. The second result is a final strategic framework with accompanying maturity model for supporting graduates' early career development within HEIs. This model contains the 65 most important practices within the four key process areas, together with a detailed description of the five maturity levels for each practice: 13 within the strategic planning of graduate employability, 26 within curriculum design and delivery, 16 within student support and 10 within the provision of extra-curricular activities. The third result refers to the model's testing at four HEIs with study programmes in the field of ICT in Croatia. The model yields results related to the current maturity of HEIs in Croatia in terms of preparing graduates for their early career development in the field of ICT,

with recommendations on how to increase these levels of maturity according to the key process areas and dimensions of organizational capabilities.

The ***eighth and final chapter*** discusses the conclusions of the conducted research in the context of its planned scientific and social contributions. The scientific contributions are achieved primarily through the development of a comprehensive and reliable maturity model for supporting graduates' early career development based on a strategic framework that fulfils both the relevance and the rigor requirements of design science research. The social contributions are accomplished through testing of the model in practice. In a broad sense, the research affects the end users, including students, alumni, employers, HEIs and other relevant stakeholders, that can use the research outcomes as both tools for problem-solving related to issues of graduates' employment and guidelines for creating stimulating policies on the individual, institutional and national levels. In addition to presenting the research contributions, this chapter highlights the limitations of the research and provides suggestions for future work.

Keywords: *case study research, design science research, graduate early careers development, higher education, maturity model, qualitative research, quality assurance, strategic framework, strategic planning*

PROŠIRENI SAŽETAK

Uvodno poglavlje ove disertacije započinje pregledom važnosti teme zapošljivosti diplomanata s pozicije istraživačke i društvene relevantnosti. Uvod donosi kratak pregled najvažnijih strateških inicijativa na nacionalnoj i europskoj razini te pregled relevantnih projekata provedenih posljednjih godina u području zapošljivosti diplomanata, s posebnim naglaskom na zapošljivosti u području informacijsko-komunikacijskih tehnologija (IKT). Nakon kratke elaboracije važnosti teme istraživanja, postavljena su četiri istraživačka cilja i pet istraživačkih pitanja te dvije hipoteze istraživanja. Nastavak poglavlja donosi kratak opis metodologije koja je korištena u istraživanju, a koja se temelji na istraživačkoj paradigmi znanosti o dizajniranju. Poglavlje završava navođenjem očekivanog znanstvenog i društvenog doprinosa istraživanja.

Drugo poglavlje obrađuje temu zapošljivosti diplomanata s makro perspektive. Radi lakšeg razumijevanja daljnjeg tijeka istraživanja ovo poglavlje najprije donosi opis osnovne terminologije vezane uz zapošljivost i rani razvoj karijera, pregled nekih postojećih teorijskih modela zapošljivosti te ističe zapošljivost diplomanata kao dio treće misije sveučilišta. Drugi dio poglavlja pruža detaljniji uvid u trenutne inicijative na području zapošljivosti diplomanata s dva aspekta: implikacije iz strategija i politika na razini Europske Unije i na globalnoj razini te rezultati relevantnih projekata u europskom i međunarodnom prostoru. Kao jedan od važnijih doprinosa, ovo poglavlje pruža uvid u važnost visokih učilišta (VU) u pripremi studenata za prelazak na tržište rada i njihov rani razvoj karijera.

Sukladno prepoznatoj važnosti VU u pripremi studenata za rani razvoj karijera, **treće poglavlje** spušta se s promatranja zapošljivosti na makro razini upravo na mezo razinu VU. U tom kontekstu, naglašena je važnost strateškog planiranja zapošljivosti diplomanata u okviru VU te su navedene prednosti takvog pristupa. Strateško planiranje također je dovedeno u relaciju s procesima osiguranja kvalitete u visokom obrazovanju te je dan pregled modela koji se koriste za osiguranje kvalitete u visokom obrazovanju. Poglavlje donosi i poveznicu prema dionicima u sustavu visokog obrazovanja koji su usko vezani uz procese strateškog planiranja i osiguranja kvalitete u kontekstu pripreme diplomanata za njihov rani razvoj karijera, a koji imaju važnu ulogu i u provođenju samog istraživanja.

S obzirom da je empirijsko istraživanje fokusirano na diplomante u području IKT-a, **četvrto poglavlje** se detaljno bavi upravo tom tematikom. Poglavlje najprije donosi pregled trenutnih trendova zapošljivosti stručnjaka u području IKT-a te predikcija za budućnost. Ovaj uvod pruža

dobru podlogu za provođenje sustavnog pregleda literature koji je obuhvatio 7179 znanstvenih radova iz pet baza podataka (IEEE Xplore Digital Library, ACM Digital Library, SCOPUS, ScienceDirect i Web of Science), od kojih je njih 761 analizirano na razini sažetka, a 155 u cijelosti. Sustavan pregled literature važan je jer daje uvid u broj publikacija i obuhvaćenih tema vezanih uz visoko obrazovanje i rani razvoj karijera stručnjaka u području IKT-a od početka discipline pa sve do danas. Također pruža i uvid u potencijalna istraživačka područja. Generalno, rezultati sustavnog pregleda literature ukazuju na veoma malu zastupljenost radova koji govore o načinima poboljšanja zapošljivosti diplomanata u području IKT-a u okviru VU, iako velik broj autora ističe probleme u njihovom zapošljavanju te potrebu za poboljšanjem u tom kontekstu. Ovi rezultati ukazuju na važnost znanstveno utemeljenog modela poput onog razvijenog u okviru ovog istraživanja. Društvena važnost razvijenog modela je vidljiva kroz pregled trenutnih trendova zapošljivosti stručnjaka u području IKT-a te predikcija za budućnost koji su prezentirani u prvom dijelu ovog poglavlja.

Nakon prepoznate važnosti razvoja znanstveno utemeljenog modela koji ima i društvenu primjenu na povećanje potencijala zapošljivosti diplomanata u okviru VU u području IKT-a, bilo je važno prepoznati model odgovarajućih karakteristika: u ovom slučaju to je model zrelosti. **Peto poglavlje** stoga donosi definiciju modela zrelosti, opis njihovih osnovnih elemenata te opis metodologije za razvoj modela zrelosti. Temeljem postojećih modela zrelosti prepoznatih u literaturi, ovo poglavlje kao zaključak donosi prijedlog strukture i opis elemenata modela zrelosti za pružanje podrške diplomantima u ranom razvoju karijera u okviru VU te na taj način pruža podlogu za razvoj samog modela kroz empirijsko istraživanje.

Šesto poglavlje je najopširnije s obzirom da donosi detaljan opis metodologije empirijskog istraživanja. Istraživanje uključuje prvenstveno kvalitativne istraživačke metode te u manjoj mjeri kvantitativne metode, što ga karakterizira kao mješovito istraživanje. Istraživanje slijedi principe istraživačke paradigme znanosti o dizajniranju koja se temelji na kreiranju i evaluaciji novih artefakata primjerenih za rješavanje stvarnih kompleksnih problema te se pokazala prikladnom za izgradnju modela zrelosti. Konačan strateški okvir i model zrelosti razvijeni su slijedeći prilagođenu metodologiju od pet koraka za razvoj modela zrelosti: 1) *prepoznavanje potrebe ili prilike* - referencira se na prethodna poglavlja koja su elaborirala potrebu za ovakim modelom, 2) *definiranje opsega* – identificira inicijalna ključna procesna područja i prakse u okviru VU važne za razvoj karijera diplomanata, 3) *razvoj modela* - uključuje provođenje istraživanja četiri studije slučaja na VU u Europi (Wirtschaftsuniversität Wien; Sveučilište u

Beogradu, Fakultet organizacionih nauka; University West u Trollhätanu te University of Edinburgh) te donosi inicijalan prijedlog praksi strateškog okvira i modela zrelosti, 4) *evaluacija modela* – podrazumijeva provjeru sadržajne i strukturne valjanosti modela korištenjem znanja eksperata i studenata te provjeru pouzdanosti modela kroz testiranje na četiri VU koja provode studijske programe u području IKT-a u Republici Hrvatskoj (Sveučilište Josipa Jurja Strossmayera u Osijeku, Fakultet elektrotehnike, računarstva i informacijskih tehnologija Osijek; Sveučilište u Zagrebu, Fakultet elektrotehnike i računarstva; Sveučilište u Zagrebu, Fakultet organizacije i informatike i Veleučilište VERN) te 5) *održavanje daljnjeg razvoja modela* kao posljednja faza u razvoju modela zrelosti.

Sedmo poglavlje predstavlja središnji dio ove disertacije s obzirom da donosi rezultate istraživanja provedenog prema metodologiji opisanoj u šestom poglavlju. Rezultati su podijeljeni u tri osnovna dijela te prezentirani u relaciji s postavljenim ciljevima istraživanja, istraživačkim pitanjima i hipotezama. Prvi rezultat jest inicijalan strateški okvir za pružanje podrške diplomantima u ranom razvoju karijera u okviru VU. Ovaj okvir sadrži 110 praksi prepoznatih kao važnih za podršku razvoju kapaciteta zapošljivosti studenata u okviru VU prema četiri ključna procesna područja: 15 u području strateškog planiranja zapošljivosti diplomanata, 35 u području razvoja i provođenje kurikulumu, 34 u području podrške studentima i 26 u području pružanja izvannastavnih aktivnosti. Drugi rezultat je finalni strateški okvir s pripadajućim modelom zrelosti za pružanje podrške diplomantima u ranom razvoju karijera u okviru VU. Ovaj model sadrži 65 najvažnijih praksi u četiri ključna procesna područja, zajedno s detaljnim opisom pet razina zrelosti za svaku praksu: 13 u području strateškog planiranja zapošljivosti diplomanata, 26 u okviru razvoja i provođenja kurikulumu, 16 u okviru podrške studentima te 10 u području pružanja izvannastavnih aktivnosti. Treći rezultat odnosi se na testiranje modela na četiri VU koja provode studijske programe u području IKT-a u Republici Hrvatskoj te donosi rezultate o trenutnoj zrelosti VU u Republici Hrvatskoj za pripremu diplomanata za njihov rani razvoj karijera u području IKT-a, uz preporuke za povećanje razine zrelosti po pojedinim ključnim procesnim područjima i dimenzijama organizacijske sposobnosti.

Posljednje, **osmo poglavlje**, donosi zaključke provedenog istraživanja u kontekstu planiranog znanstvenog i društvenog doprinosa istraživanja. Znanstveni doprinos ostvaren je prvenstveno kroz razvoj sveobuhvatnog i pouzdanog modela zrelosti za pružanje podrške diplomantima u ranom razvoju karijera temeljenog na strateškom okviru koji zadovoljava zahtjeve relevantnosti

i rigoroznosti znanosti o dizajniranju. Društveni doprinos ostvaren je kroz testiranje kreiranog modela u praksi. U širem kontekstu ovo istraživanje ima utjecaj na krajnje korisnike istraživanja koji uključuju studente, alumnije, poslodavce, VU i ostale relevantne dionike, a koji mogu koristiti rezultate istraživanja kao alat za djelomično rješavanje problema zapošljivosti diplomanata, ali također i kao smjernice za kreiranje poticajnih politika na individualnoj, institucionalnoj i nacionalnoj razini. Osim osvrta na doprinos istraživanja, ovo poglavlje naglašava ograničenja istraživanja, no također pruža i prijedloge za daljnje istraživanje.

Ključne riječi: *istraživanje studije slučaja, znanost o dizajniranju, rani razvoj karijera diplomanata, visoko obrazovanje, model zrelosti, kvalitativno istraživanje, osiguranje kvalitete, strateški okvir, strateško planiranje*

TABLE OF CONTENTS

| | |
|--|-----------|
| 1. INTRODUCTION..... | 1 |
| 1.1. RESEARCH TOPIC | 2 |
| 1.2. RESEARCH OBJECTIVES, RESEARCH QUESTIONS AND HYPOTHESES | 5 |
| 1.3. DESIGN SCIENCE RESEARCH METHODOLOGY | 6 |
| 1.4. SCIENTIFIC AND SOCIETAL CONTRIBUTIONS..... | 13 |
| 1.5. CHAPTER RELEVANCE..... | 14 |
| 2. GRADUATES' EMPLOYABILITY | 17 |
| 2.1. GENERAL THEORY | 17 |
| 2.1.1. Terminology and definitions related to employability | 17 |
| 2.1.2. Theoretical models of employability | 20 |
| 2.2. GRADUATES' EMPLOYABILITY AS A PART OF UNIVERSITIES' THIRD MISSION..... | 22 |
| 2.3. CURRENT DEVELOPMENTS ON GRADUATES' EMPLOYABILITY | 25 |
| 2.3.1. Relevant strategies and policies..... | 25 |
| 2.3.2. Relevant projects..... | 28 |
| 2.4. CHAPTER RELEVANCE..... | 34 |
| 3. HIGHER EDUCATION MANAGEMENT ON GRADUATES' EMPLOYABILITY | 35 |
| 3.1. HIGHER EDUCATION STAKEHOLDERS | 37 |
| 3.2. HIGHER EDUCATION MANAGEMENT AND GRADUATES' EMPLOYABILITY | 42 |
| 3.2.1. Strategic planning processes in higher education | 42 |
| 3.2.2. Benefits of strategic planning of graduates' employability in higher education | 45 |
| 3.3. QUALITY ASSURANCE PROCESSES IN HIGHER EDUCATION..... | 46 |
| 3.3.1. Relationship between quality assurance and strategic planning | 48 |
| 3.3.2. Quality models used in higher education..... | 49 |
| 3.3.2.1. Business models for quality assurance used in higher education..... | 50 |
| 3.3.2.2. Business models for quality assurance adapted for higher education..... | 53 |
| 3.4. CHAPTER RELEVANCE..... | 54 |
| 4. GRADUATES' EMPLOYABILITY IN THE FIELD OF ICT | 56 |
| 4.1. CURRENT TRENDS OF EMPLOYABILITY OF ICT PROFESSIONALS | 58 |
| 4.2. SYSTEMATIC LITERATURE REVIEW ON THE EDUCATION AND CAREER DEVELOPMENT OF GRADUATES IN THE FIELD OF ICT | 60 |
| 4.2.1. Literature review procedure..... | 61 |
| 4.2.2. Research results | 63 |
| 4.2.2.1. Research topics according to the years | 64 |
| 4.2.2.2. Clusters of research topics | 66 |

| | | |
|-----------|---|-----------|
| 4.2.3. | <i>Main conclusions from the systematic literature review</i> | 68 |
| 4.3. | PARTICULARITIES OF EDUCATION AND CAREER DEVELOPMENT OF ICT GRADUATES | 70 |
| 4.4. | CHAPTER RELEVANCE..... | 74 |
| 5. | MATURITY MODELS AS STRATEGIC MANAGEMENT TOOLS..... | 75 |
| 5.1. | DEFINITION OF MATURITY MODELS | 77 |
| 5.2. | MATURITY MODEL ELEMENTS | 78 |
| 5.3. | MATURITY MODEL DESIGN METHODOLOGY | 80 |
| 5.4. | MATURITY MODEL FRAMEWORK FOR SUPPORTING HIGHER EDUCATION GRADUATES’ EARLY CAREERS..... | 84 |
| 5.4.1. | <i>Elements of maturity model for supporting graduates’ early careers</i> | 84 |
| 5.4.1.1. | Key process areas..... | 84 |
| 5.4.1.2. | Practices | 84 |
| 5.4.1.3. | Dimensions of capability | 85 |
| 5.4.1.4. | Capability assessment criteria..... | 86 |
| 5.4.2. | <i>Structure of the maturity model for supporting graduates’ early careers</i> | 87 |
| 5.5. | CHAPTER RELEVANCE..... | 90 |
| 6. | EMPIRICAL RESEARCH | 92 |
| 6.1. | STEP 1: IDENTIFY A NEW NEED OR OPPORTUNITY | 97 |
| 6.2. | STEP 2: DEFINE THE SCOPE | 99 |
| 6.2.1. | <i>Definition of key process areas</i> | 99 |
| 6.2.1.1. | Strategic planning of graduates’ employability | 106 |
| 6.2.1.2. | Curriculum design and delivery..... | 107 |
| 6.2.1.3. | Student support services | 112 |
| 6.2.1.4. | Extra-curricular activities..... | 116 |
| 6.2.2. | <i>Initial list of practices recognized from the literature</i> | 117 |
| 6.3. | STEP 3: DESIGN THE MODEL | 121 |
| 6.3.1. | <i>Identification of practices</i> | 121 |
| 6.3.1.1. | Case study research..... | 121 |
| 6.3.1.2. | Focus groups with stakeholders | 146 |
| 6.3.2. | <i>Description of maturity levels</i> | 148 |
| 6.4. | STEP 4: EVALUATE THE DESIGN..... | 150 |
| 6.4.1. | <i>Model validity</i> | 152 |
| 6.4.1.1. | Content validity..... | 153 |
| 6.4.1.2. | Construct validity..... | 158 |
| 6.4.2. | <i>Model reliability</i> | 162 |
| 6.5. | STEP 5: REFLECT THE EVOLUTION | 166 |
| 6.6. | CHAPTER RELEVANCE..... | 168 |

| | |
|--|------------|
| 7. RESEARCH RESULTS | 170 |
| 7.1. STRATEGIC FRAMEWORK FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS | 171 |
| 7.2. MATURITY MODEL FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS | 183 |
| 7.2.1. <i>Practices within the key process area of Strategic planning</i> | 185 |
| 7.2.2. <i>Practices within the key process area of Curriculum design and delivery</i> | 189 |
| 7.2.3. <i>Practices within the key process area of Student support</i> | 195 |
| 7.2.4. <i>Practices within the key process area of Extra-curricular activities</i> | 199 |
| 7.3. MODEL'S TESTING AT HEIS IN THE FIELD OF ICT IN CROATIA | 202 |
| 7.3.1. <i>Maturity of HEIs in the field of ICT in Croatia</i> | 202 |
| 7.3.2. <i>Recommendations for enhancing the maturity of HEIs in Croatia in the field of ICT</i> .. | 206 |
| 7.3.2.1. Recommendations for the area of Strategic planning | 206 |
| 7.3.2.2. Recommendations for the area of Curriculum design and delivery | 208 |
| 7.3.2.3. Recommendations for the area of Student support | 210 |
| 7.3.2.3. Recommendations for the area of Extra-curricular activities | 213 |
| 7.4. CHAPTER RELEVANCE | 216 |
| 8. CONCLUSION | 219 |
| 8.1. SCIENTIFIC CONTRIBUTION | 219 |
| 8.2. SOCIETAL CONTRIBUTION | 221 |
| 8.3. LIMITATIONS OF THE STUDY | 222 |
| 8.4. IMPLICATIONS FOR FURTHER RESEARCH | 224 |
| REFERENCES | 225 |
| APPENDIX | 251 |
| APPENDIX A: SYSTEMATIC LITERATURE REVIEW SEARCH PROCEDURE | 251 |
| APPENDIX B: LIST OF PAPERS WITHIN <i>ICT EDUCATION</i> DATASET | 252 |
| APPENDIX C: LIST OF PAPERS WITHIN <i>ICT CAREER</i> DATASET | 257 |
| APPENDIX D: REQUEST FOR PERMISSION TO CONDUCT CASE STUDY RESEARCH | 260 |
| APPENDIX E: INFORMED CONSENT FORM | 261 |
| APPENDIX F: CASE STUDY PROTOCOL | 263 |
| APPENDIX G: INVITATION LETTER TO PARTICIPATE IN MODEL EVALUATION | 267 |
| APPENDIX H: LIST OF EXPERTS WHO PARTICIPATED IN THE MODEL EVALUATION | 273 |
| APPENDIX I: FULL HAMMING DISTANCE MATRIX | 274 |
| APPENDIX J: REQUEST FOR PERMISSION TO MODEL APPLICATION | 275 |

LIST OF TABLES

| | |
|--|-----|
| TABLE 1. CONNECTIONS AMONG THE RESEARCH OBJECTIVES, RESEARCH QUESTIONS, RESEARCH HYPOTHESES AND RESEARCH METHODS..... | 16 |
| TABLE 2. RESEARCH QUESTIONS FOR CONTENT ANALYSIS OF PAPERS INCLUDED IN SLR | 63 |
| TABLE 3. REPRESENTATION OF RESEARCH TOPICS WITHIN <i>ICT EDUCATION</i> CLUSTERS (IN %)..... | 67 |
| TABLE 4. REPRESENTATION OF RESEARCH TOPICS WITHIN <i>ICT CAREER</i> CLUSTERS (IN %) | 67 |
| TABLE 5. COMPARISON OF DIFFERENT MATURITY MODELS' ELEMENTS..... | 79 |
| TABLE 6. A FRAMEWORK FOR THE DEVELOPMENT OF MATURITY MODEL FOR SUPPORTING GRADUATES' EARLY CAREERS | 82 |
| TABLE 7. SUMMARY OF FOCUS GROUP 1 FOR THE IDENTIFICATION OF KEY PROCESS AREAS | 102 |
| TABLE 8. SUMMARY OF FOCUS GROUP 2 FOR THE IDENTIFICATION OF KEY PROCESS AREAS | 103 |
| TABLE 9. EXPLANATION OF KEY PROCESS AREAS | 104 |
| TABLE 10. INITIAL LIST OF KEY HIGHER EDUCATION PRACTICES CONTRIBUTING TO GRADUATE EMPLOYABILITY RECOGNIZED FROM THE LITERATURE..... | 119 |
| TABLE 11. LIST OF CASE STUDY QUESTIONS | 122 |
| TABLE 12. CHARACTERISTICS OF HEIs INCLUDED IN CASE STUDY RESEARCH | 134 |
| TABLE 13. LIST OF CASE STUDY INTERVIEWEES | 137 |
| TABLE 14. FIRST-CYCLE CODING RESULTS..... | 144 |
| TABLE 15. SECOND-CYCLE CODING RESULTS | 145 |
| TABLE 16. FINAL MATURITY MODEL CHARACTERISTICS | 149 |
| TABLE 17. FOCUS GROUPS PARTICIPANTS FOR THE EVALUATION OF PRACTICES | 155 |
| TABLE 18. CRITERIA AND RESULTS OF CONTENT VALIDITY CALCULATION..... | 157 |
| TABLE 19. HAMMING DISTANCES FOR EXPERTS' EVALUATIONS | 161 |
| TABLE 20. HIT RATIO CALCULATION FOR EXPERTS' SORTINGS OF KEY PRACTICES | 162 |
| TABLE 21. 15 PRACTICES WITHIN THE KEY PROCESS AREA OF <i>STRATEGIC PLANNING</i> | 172 |
| TABLE 22. 35 PRACTICES WITHIN THE KEY PROCESS AREA OF <i>CURRICULUM DESIGN AND DELIVERY</i> . | 174 |
| TABLE 23. 34 PRACTICES WITHIN THE KEY PROCESS AREA OF <i>STUDENT SUPPORT</i> | 176 |
| TABLE 24. 26 PRACTICES WITHIN THE KEY PROCESS AREA OF <i>EXTRA-CURRICULAR ACTIVITIES</i> | 179 |
| TABLE 25. CAPABILITY ASSESSMENT CRITERIA OF 13 PRACTICES WITHIN THE AREA OF <i>STRATEGIC PLANNING</i> | 185 |
| TABLE 26. CAPABILITY ASSESSMENT CRITERIA OF 26 PRACTICES WITHIN THE AREA OF <i>CURRICULUM DESIGN AND DELIVERY</i> | 189 |
| TABLE 27. CAPABILITY ASSESSMENT CRITERIA OF 16 PRACTICES WITHIN THE AREA OF <i>STUDENT SUPPORT</i> | 195 |
| TABLE 28. CAPABILITY ASSESSMENT CRITERIA OF 10 PRACTICES WITHIN THE AREA OF <i>EXTRA-CURRICULAR ACTIVITIES</i> | 199 |

| | |
|--|-----|
| TABLE 29. PRACTICES WITH THE HIGHEST CAPABILITY WITHIN HEIS IN CROATIA..... | 205 |
| TABLE 30. PRACTICES WITH THE LOWEST CAPABILITY WITHIN HEIS IN CROATIA..... | 205 |

LIST OF FIGURES

| | |
|--|------------|
| FIGURE 1. DESIGN SCIENCE FRAMEWORK FOR THE DEVELOPMENT OF THE MATURITY MODEL FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS..... | 7 |
| FIGURE 2. STRUCTURE OF THE FINAL MATURITY MODEL FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS | 12 |
| FIGURE 3. HIGHER EDUCATION STAKEHOLDER MAP..... | 41 |
| FIGURE 4. FLOWCHART OF THE SYSTEMATIC LITERATURE REVIEW STEPS | 61 |
| FIGURE 5. FREQUENCY OF RESEARCH TOPICS WITHIN ICT EDUCATION ACCORDING TO YEARS..... | 65 |
| FIGURE 6. FREQUENCY OF RESEARCH TOPICS WITHIN ICT CAREERS ACCORDING TO YEARS | 65 |
| FIGURE 7. DESCRIPTION OF CAPABILITY DIMENSIONS WITHIN MATURITY MODEL FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS..... | 86 |
| FIGURE 8. DESCRIPTION OF CAPABILITY ASSESSMENT CRITERIA WITHIN MATURITY MODEL FOR SUPPORTING GRADUATES' EARLY CAREERS..... | 87 |
| FIGURE 9. RELATIONSHIP BETWEEN A STRATEGIC FRAMEWORK AND A MATURITY MODEL FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS..... | 88 |
| FIGURE 10. HIERARCHICAL STRUCTURE OF THE MATURITY MODEL FOR SUPPORTING HIGHER EDUCATION GRADUATES' EARLY CAREERS, BASED ON THE STRUCTURE OF CMM | 88 |
| FIGURE 11. RESEARCH METHODS USED IN THE DEVELOPMENT OF MATURITY MODEL FOR SUPPORTING GRADUATES' EARLY CAREERS | 93 |
| FIGURE 12. RESEARCH HODOGRAM | 96 |
| FIGURE 13. HEIs CHOSEN FOR MULTIPLE-CASE DESIGN | 126 |
| FIGURE 14. RELATIONSHIPS BETWEEN THE RESEARCH QUESTION AND THE INTERVIEW QUESTIONS | 138 |
| FIGURE 15. TRIANGULATION IN EVALUATING KEY PRACTICES | 151 |
| FIGURE 16. MATURITY LEVELS OF HEIs IN CROATIA EDUCATING STUDENTS IN THE FIELD OF ICT ACCORDING TO KEY PROCESS AREAS IN GENERAL | 203 |
| FIGURE 17. MATURITY LEVEL OF HEIs IN CROATIA EDUCATING STUDENTS IN THE FIELD OF ICT ACCORDING TO CAPABILITY DIMENSIONS IN GENERAL..... | 204 |
| FIGURE 18. NUMBER OF PRACTICES AT A CERTAIN CAPABILITY DIMENSION WITHIN THE KEY PROCESS AREA STRATEGIC PLANNING FOR HEIs IN CROATIA..... | 206 |
| FIGURE 19. NUMBER OF PRACTICES AT A CERTAIN CAPABILITY DIMENSION WITHIN THE KEY PROCESS AREA CURRICULUM DESIGN AND DELIVERY FOR HEIs IN CROATIA..... | 208 |
| FIGURE 20. NUMBER OF PRACTICES AT A CERTAIN CAPABILITY DIMENSION WITHIN THE KEY PROCESS AREA STUDENT SUPPORT FOR HEIs IN CROATIA | 211 |
| FIGURE 21. NUMBER OF PRACTICES AT A CERTAIN CAPABILITY DIMENSION WITHIN THE KEY PROCESS AREA OF EXTRA-CURRICULAR ACTIVITIES FOR HEIs IN CROATIA | 214 |

LIST OF ABBREVIATIONS

| | |
|---------|--|
| ACM | Association for Computing Machinery |
| BSC | Balanced scorecard |
| CAQDAS | Computer-Assisted Qualitative Data Analysis Software |
| CDD | Curriculum design and development |
| CEDEFOP | European Centre for the Development of Vocational Training |
| CMM | Capability Maturity Model |
| CS | Computer science |
| CVR | Content validity ratio |
| ECTS | The European Credit Transfer and Accumulation System |
| EFQM | European Foundation for Quality Management |
| EHEA | European Higher Education Area |
| eMM | e-Learning Maturity Model |
| ENQA | European Association for Quality Assurance in Higher Education |
| ESG | Standards and Guidelines for Quality Assurance in the European Higher Education Area |
| EU | European Union |
| FOI | Faculty of Organization and Informatics |
| FOS | Faculty of Organizational Sciences |
| GDP | Gross domestic product |
| HEI | Higher education institution |
| ICT | Information and communications technologies |
| IEEE | Institute of Electrical and Electronics Engineers |
| KA | Key area |
| OECD | Organisation for Economic Cooperation and Development |
| PCDA | Plan-Do-Check-Act |
| PDP | Personal development planning |
| RQ | Research question |
| SLR | Systematic literature review |
| TQM | Total quality management |
| UK | United Kingdom |
| WU | The Vienna University of Economics and Business |

1. INTRODUCTION

The employability of highly-educated young people and their preparation for transition to the labour market within the higher education institutions (HEI) has been a topical issue in recent years. Accordingly, at the level of the European Union (EU), strengthening the potential employability of young people is a key development priority. The relevance of this topic arises from the European Union's key strategies for the period from 2014 to 2020, which particularly emphasize the importance of education and innovation and set a key target of 75% employment for the population aged 20 to 64 (European Commission 2010b; European Commission 2010c). In that context, focus is put on the modernization of higher education, including processes related to graduate employability and transition from higher education to the labour market among the most important areas within HEIs (European Commission/EACEA/Eurydice 2014). One of the Europe 2020 flagship initiatives, *Youth on the Move*, puts special emphasis on the modernizing agenda of higher education, including an initiative of benchmarking university performance and educational outcomes in a global context in terms of curricula, governance and financing, as well as by building national qualification frameworks, maintaining strong partnership with business sector and further development of career guidance services (European Commission 2010c; European Commission 2010d). The newest priorities for the European collaboration in the field of education emphasize the quality and relevance of learning outcomes, lifelong learning strategies and, especially, modernization of the synergy among teaching, research and innovation, which is obtained by connecting HEIs with local communities and through innovative approaches to increase the relevance of education programmes (European Commission 2015). Most recently, *A New Skills Agenda for Europe: Working together to strengthen human capital, employability and competitiveness* was published (European Commission 2016a). This strategic document shows that the situation has failed to change much in recent years and stresses that education providers, on the one hand, and employers and learners, on the other, have different perceptions of how well graduates are prepared for their transition to the labour market. Therefore, HEIs have the task of equipping graduates with relevant and up-to-date skills, which requires systemic reforms in education and the modernization of higher education in collaboration with relevant stakeholders.

At the national level, priorities and goals for the period from 2015 to 2017 follow the same problematics and emphasize the need for integration of the system of education and the world of work (Vlada Republike Hrvatske 2014). Taking into account the current national Strategy

of Education, Science and Technology for the Republic of Croatia (Ministarstvo znanosti obrazovanja i sporta 2014, p. 154) - which aims, among other goals, to build a system of career guidance for students in cooperation with businesses, the entrepreneurial sector, employment services and other stakeholders in order to contribute to better student profiling and ensure better connections between education and the labour market - Pažur Aničić & Divjak (2015) concluded that the employability of higher education graduates is a very relevant social topic in this area of research. Within this framework, the Law on the Croatian Qualification Framework can be recognized, as can the efforts of the National Council for Development of Human Potentials (Ministry of Science Education and Sports of the Republic of Croatia 2013).

As can be seen from actual policies at the European and national level, significant attention has been devoted to graduates' employability, and a need for better connections between higher education systems and the world of work. The main goal of this research is to contribute to this topic by developing a strategic framework and maturity model for HEIs that provide study programmes in the field of information and communication technologies (ICT), to support their graduates' early careers. The final maturity model developed within this thesis follows the principles of strategic planning and quality assurance within higher education.

1.1. Research topic

The employability of graduates and their transition from the system of higher education to the world of work has been a topic of several comprehensive research projects in the EU and globally in the last 15 years. The field was pioneered by the *Careers after Higher Education: a European Research Study* (CHEERS) (Internationales Zentrum für Hochschulforschung Kassel [INCHER-Kassel] 2000) and *Research into Employment and professional FLEXibility* (REFLEX) projects (Research Centre for Education and the Labour Market [ROA] 2008). Many later research projects used the data obtained from REFLEX and CHEERS to discuss different issues in graduates' early careers. *Higher Education as a Generator of Strategic Competences* (HEGESCO) focused on the role of higher education in generating student strategic competences for employability (HEGESCO 2007), TUNING Educational Structures in Europe provided guidelines for the definition of learning outcomes and description of different study programmes in the European Higher Education Area (EHEA), with a purpose to better understand curricula and make them comparable (Lokhoff et al. 2010), *Tracking Learners' and Graduates' Progression Paths* (TRACKIT) provided an overview of activities developed by HEIs and national agencies to track students and graduates (Gaebel et al. 2012),

Development of Higher Education Management Systems (DEHEMS) researched the role of higher education management systems in graduate employability (Melink & Pavlin 2011), *Emerging Modes of Cooperation between Private Sector Organisations and Universities* (EMCOSU) emphasized the importance of different modes of cooperation between academia and industry for enhancing graduates employability (Melink et al. 2014) and the EUROGRADUATE feasibility study sought to determine whether a sustainable study on Europe's higher education graduates could be established (Mühleck et al. 2016).

It is clear that strategic documents at the EU level, as well as research projects that have been or are still being conducted, indicate a need for further work on enhancing graduates' employability within the system of higher education and ensuring their smooth transition to the world of work. A short overview of recent strategic documents and projects indicates graduate employability as the relevant social topic.

To illustrate the scientific relevance of the research within this dissertation, the author conducted a systematic literature review (SLR) of publications related to the education and career development of future professionals in the field of ICT. Results of this SLR are presented in **Chapter 4** of this thesis and partially within the research papers from Pažur Aničić et al. (2017a; 2017b). The literature review included a total of 7179 papers from the following databases: the IEEE Xplore Digital Library, the ACM Digital Library, SCOPUS, ScienceDirect and the Web of Science. The analysis included 10 research questions related to the curricula, competencies, teaching methods, cooperation with employers, employability and career development of higher education graduates in the ICT domain. The results show that a very low proportion of papers propose ways to improve graduate employability, even though a large number of authors point out problems related to the employment of higher education graduates in the field of ICT and discuss the need for improvement in this context. Therefore, within this research, the main goal is to explore the system of support mechanisms within HEIs for the early career development of graduates in the field of ICT and to create a strategic framework with an accompanying maturity model for supporting graduates' early careers applicable to HEIs.

Generally, maturity models are instruments that provide guidelines for the transformation of real-world phenomena from their initial stages to their optimal stages. The basic purpose of maturity models is to describe maturity levels of a certain phenomenon; however, to apply maturity models in practice, it is also necessary to discover current and desired maturity levels

and to include adequate measures based on the descriptive, prescriptive or comparative purposes of the maturity models (Mettler & Rohner 2009; Pöppelbuß & Röglinger 2011). As such, maturity models serve as useful benchmarking and managerial tools. In this thesis, the logic of maturity models was applied to higher education systems, with a focus on the role of HEIs in preparing graduates for their future early careers in the labour market. As one reason for the use of maturity models, Mettler & Rohner (2009) stress the pressure on organizations to retain competitive advantages, reduce costs, improve the quality of products or services, etc. Pažur Aničić & Divjak (2015) recognized that, in terms of higher education, there is a certain pressure on HEIs, which is evident from the key strategies and policies at the EU and national levels, to educate graduates who will be employable following graduation. They concluded that, in this sense, the capability of HEIs to provide highly mature support services for contributing to the better employment of graduates during their early career development is of high importance.

Although the developed maturity model will be, with some modifications, applicable to educational institutions in different fields, there are several reasons for focusing this research on the education of future ICT professionals, as identified in previous researches related to this thesis (Pažur Aničić & Divjak 2015; Pažur Aničić et al. 2017a). The EU has recognized the current lack of ICT skills and the several hundreds of thousands of unfilled ICT-related vacancies as an issue and has, in response, launched the *Grand Coalition for Digital Jobs 2013-2016*, followed by the *Digital Skills and Jobs Coalition* in 2016 (European Commission 2016b). These coalitions follow the goals of the *Digital Agenda for Europe* initiative (European Commission 2010a) and seeks to solve the identified problems related to the lack of digitally skilled professionals by making ICT careers more attractive, aligning higher education curricula with the needs of the industry, reducing labour market mismatches, recognizing the qualifications of ICT professionals based on the existing e-competence framework, etc. Moreover, the ICT sector is directly responsible for 5% of the European gross domestic product (GDP) (European Commission 2010a), the demand for digitally-skilled professionals has grown by 4% annually in the last ten years (European Commission 2016a) and predictions about future trends in ICT professional jobs and demand in Europe from 2012 to 2020 present three scenarios, all of which involve potential demand exceeding predicted numbers of ICT graduates (Gareis et al. 2014). Implications for HEIs providing study programmes in ICT are most evident from the data indicating that the most desirable ICT specialists are those with higher levels of education. In particular, statistics drawn from the main characteristics of ICT

specialists in the EU show that, compared to the percentage of overall workers with tertiary education (32.6%), a higher percentage of ICT specialists (56.5%) have attained a tertiary level of education (Eurostat 2016).

1.2. Research objectives, research questions and hypotheses

Within the framework of this research, the main aim is to explore the system of supporting graduates' early careers and to propose an adequate strategic framework and accompanying maturity model. The main purpose of this model is to provide guidelines for HEIs and related stakeholders in their endeavours to improve the employability of graduates and smooth their transitions from the system of education to the world of work.

According to the identified research problem, several **research objectives** are proposed:

***Research objective 1:** To explore and identify key higher education system determinants aimed at supporting graduates early careers.*

***Research objective 2:** To develop the strategic framework for supporting higher education graduates' early careers in the field of ICT.*

***Research objective 3:** To develop a maturity model for supporting higher education graduates' early careers in the field of ICT.*

***Research objective 4:** To determine the current maturity level of higher education institutions in the Republic of Croatia in supporting graduates' early careers in the field of ICT, and provide recommendations about further strategic development.*

Since this research has an exploratory character, applies primarily qualitative research methods and is oriented toward the development of theory, it is guided by several **research questions**:

***Research question 1:** Which are the key higher education systems' determinants that have a major impact on the preparation of higher education graduates for their early careers?*

***Research question 2:** Which are the key higher education institutions' practices having impact to the preparation of higher education graduates for their early careers?*

Research question 3: *Which are the capability assessment criteria of key higher education institution's practices having impact to the preparation of higher education graduates for their early careers?*

Research question 4a: *What is the current level of maturity of HEIs in Republic of Croatia regarding the preparation of ICT graduates for their early careers?*

Research question 4b: *What are the possible improvements in preparation of ICT graduates for their early careers in the Republic of Croatia?*

In addition to the research objectives and research questions, the author proposes two **research hypotheses** related to the development of the final strategic framework and maturity model:

H1: *Developed strategic framework for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will fulfil both relevance and rigor requirements of design science research.*

H2: *Developed maturity model for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will be both comprehensive and reliable.*

1.3. Design science research methodology

The research was carried out in several steps involving predominantly qualitative and, to a lesser extent, quantitative methods; thus, it can be characterized as a mixed method research (Creswell 2009). In this research, the author applied the design science research paradigm (Hevner et al. 2004; Vaishnavi & Kuechler Jr. 2008), which has been found to be an appropriate approach for designing maturity models (Mettler 2010; Carcary 2011). According to Carcary (2011), design science is “a problem solving paradigm that involves building and evaluating innovative artifacts in a rigorous manner to solve complex, real-world problems, make research contributions that extend the boundaries of what is already known, and communicate the results to appropriate audiences”. Hevner et al. (2004) claim that design science is a paradigm typical of information system researches because it creates and evaluates mostly IT artefacts intended to solve organizational problems; however, they also recognized clear explorations of organizations, policies and work practices as designed artefacts. Most recently, Pournader et al. (2015) have illustrated a multi-disciplinary approach to design science by applying it in the

development of a novel human resource-planning framework in projects, and Neff et al. (2014) have applied a design-oriented research approach in the development of a maturity model for service systems in heavy equipment manufacturing enterprises.

Design science guidelines propose three main cycles, which can be described as follows (Hevner et al. 2004; Hevner 2007; Pournader et al. 2015):

- 1) the **relevance cycle** includes individuals, groups and any other stakeholders related to the system and seeks requirements in the contextual, real-world environment of the problem;
- 2) the **rigour cycle** contributes to the design of artefacts based on the literature review and other knowledge sources; and
- 3) the **design cycle** represents a cycle through which the initial set of artefacts created during the relevance and rigour cycles is evaluated and justified until a satisfactory result is achieved.

Figure 1 shows the adapted (Hevner et al. 2004; Hevner 2007; Pournader et al. 2015) design science framework for the maturity model for supporting graduates in their early careers, which was created as a result of this research. The initial version of this framework was presented by Pažur Aničić & Divjak (2015) and updated in accordance with the conducted research steps of maturity model development, as presented later within this thesis.

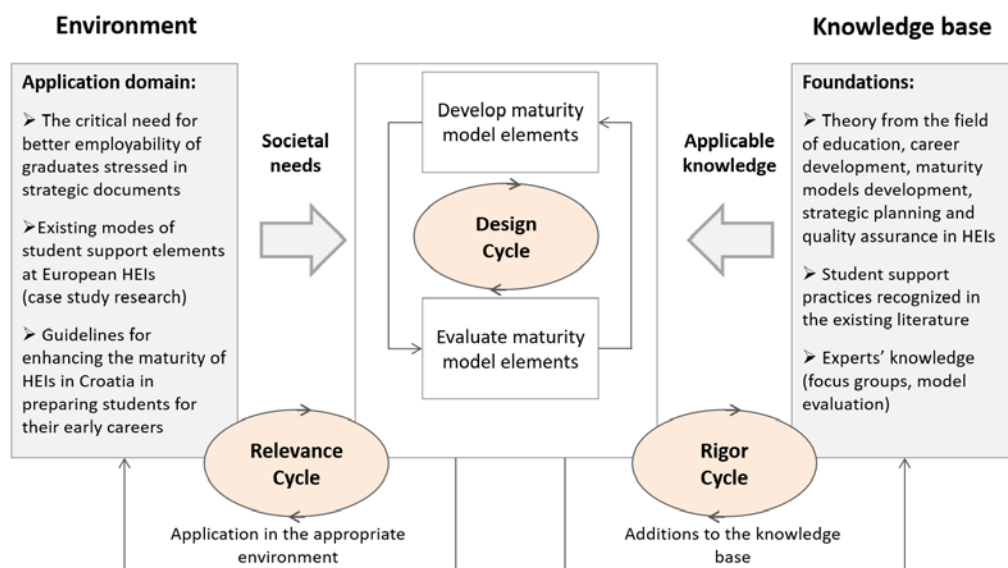


Figure 1. Design science framework for the development of the maturity model for supporting higher education graduates' early careers [adapted from Hevner et al. (2004), Hevner (2007) and Pournader et al. (2015)]

Following design science principles, this research was carried out through an adapted five-step methodology for maturity model development (Mettler 2010), which was initially presented in the work of Pažur Aničić and Divjak (2015) and in more detail later in **Chapter 6** of this thesis:

1) Identify a need or new opportunity

The first step of the research is elaborated in detail in several chapters: **Chapter 2** elaborates the issue of graduates' employability on the macro level, **Chapter 3** elaborates the role of the higher education as a service system in enhancing graduates' employability from the perspectives of strategic planning and quality assurance, taking into account all the relevant stakeholders, and **Chapter 4** elaborates the focus on ICT graduates through the results of a systematic literature review of research papers and relevant statistics showing a high demand for professionals in ICT-related jobs.

2) Define the scope

After identifying the need for the development of a model to improve graduates' preparation for their transition to the labour market, it is necessary to define the scope of research. According to Eisenhardt (1989), specifying constructs *a priori* helps "to shape the initial design of theory-building research", which has an impact on future research steps and increases their focus on important elements. In this step, the initial elements of the strategic framework and the accompanying maturity model were defined based on the review of different maturity models. These elements include key process areas, practices, dimensions of capability and capability assessment criteria. To determine the specific HEI process areas that contribute to better graduate employability, focus groups with a panel of experts were conducted. Additionally, a content analysis of different strategic documents, frameworks and policies was used to determine an initial list of relevant practices within recognized HEI key process areas that contribute to better graduate employability.

3) Design the model

The main research method used in this third step of the strategic framework and maturity model development was the case study research. According to the methodology proposed by Yin (2014), the case study research was conducted through the following five phases:

- **Design phase** – This phase defined the questions for the case study research, the propositions, the units of analysis, the logic that connects the data to the propositions and the criteria for the interpretation of the results based on the results of step two (*Define the scope*) in the maturity model design. The units of analysis were the

HEIs, and the information about the cases was collected through interviews with key players at HEIs.

- **Preparation phase** – The main goal of this phase was to collect informed consent from the study participants and to define a protocol for conducting case study research through semi-structured interviews.
- **Data collection** – In this research, the main data sources were semi-structured interviews with various experts at four European HEIs, as well as available documentation. From previous case study research, it is evident that between 4 and 10 cases usually works well, while fewer than 4 cases are insufficient to generate theory (Eisenhardt 1989; Stake 2006, p. 22). The author has chosen cases based on several criteria, using a combination of purposive and theoretical sampling (Silverman 2013), of which the development of institutional support for graduates' employability was among the most important. The author has also considered differences in education systems, countries' socio-economic environments and the focus of study programmes to the ICT domain in the choice of cases. Therefore, the chosen HEIs for conducting the case study research were: Austria, Vienna University of Economics and Business; Republic of Serbia, the University of Belgrade's Faculty of Organisational Sciences; Sweden, University West in Trollhättan; and United Kingdom (UK), The University of Edinburgh.
- **Results analysis** – The very first important step in the analysis was the within-case analysis, which helped the researcher manage the enormous volume of collected data early in the analysis process. After the author became familiar with each case as a stand-alone entity, it was time to conduct a cross-case synthesis, which is a technique for synthesising the information collected from different case studies in order to search for patterns among cases (Eisenhardt 1989; Yin 2014). Therefore, the principles of multiple case study analysis were applied (Stake 2006). In this process, several coding methods, both manual and supported by Computer-Assisted Qualitative Data Analysis Software (CAQDAS), were used (Saldaña 2013).
- **Results sharing** – The results of the case study research were expected to lead to the proposal of an initial strategic framework with defined key process areas and a list of practices.

In designing the initial strategic framework to support graduates' early careers, in addition to the case study research, which included four HEIs in Europe, it was also important to include the perspectives of other relevant stakeholders, such as employers (who are direct beneficiaries of HEIs' outputs), representatives of HEI decision-makers, managerial and supporting institutions in the system of higher education, alumni and current students. Therefore, the author gathered inputs from various groups of stakeholders through focus groups. It is important to stress that, for theory-building research, it is legitimate to alter or add data collection methods during a study, if such alteration is likely to provide new theoretical insight or better ground the theory (Eisenhardt 1989).

Another important part of this research step is the description of maturity levels for practices contained within final model. However, this step was not conducted immediately after the definition of the initial set of practices that represents the strategic framework for supporting graduates' early careers within HEI, but after the assessment of content validity, which is a part of the fourth step of maturity model development (*Evaluate the design*). As evident from the design science framework presented in **Figure 1**, the design cycle considered several iterations of designing and evaluating artefacts, which are interrelated.

4) Evaluate the design

In this research step, the goal was to ensure validity and reliability of the developed strategic framework and maturity model. Validity can be defined in different ways, but it mostly concerns how the research findings match reality. Validity is assessed by such methods as triangulation, in which multiple data collection methods are used, and member checking/respondent validation, in which the model is evaluated by, among others, the people interviewed during the case studies (Cohen et al. 2011; Merriam & Tisdell 2015). The content validity of the strategic framework was checked using the experts' and students' knowledge and different measures such as the content validity ratio (CVR), as well as the knowledge of different stakeholders through the focus groups. The construct validity was assessed using the *Q-sorting* technique based on the experts' knowledge, which served as a basis for calculating the Fleiss' Kappa coefficient and the hit ratio. Since validity considers both rigor and relevance, this step refers to hypothesis H1. Reliability is also known as consistency, and it refers to the extent to which research findings can be replicated over time or across different groups of respondents (Cohen et al. 2011; Merriam & Tisdell 2015). In this case, the reliability of the final strategic framework and maturity model were assessed by testing the model at four HEIs

in Croatia that offer ICT study programmes. This step was designed to verify the model's applicability for determining the maturity of different HEIs in preparing their graduates for employability. The results of this phase refer to hypothesis H2, while the reliability refers to the model's comprehensiveness in terms of its coverage of the domain and its trustworthiness in terms of demonstrating the findings, among others.

5) *Reflect the evolution*

The evolution portion of maturity models' design is important because of the way in which organizations' roles change over time. In this particular case, as the student support system within HEIs changes and evolves, the maturity model should be redesigned accordingly. Since the research within this doctoral dissertation is time-constrained, it will not extensively cover this portion of the maturity model design process; however, some suggestions for further development of the maturity model will be provided based on the results regarding the model's reliability.

In terms of the design science paradigm, throughout the entire process of conducting research, it is important to take into account the relevance of the research in relation to the environment and the rigor of the research with regard to existing knowledge. The *relevance* of this research is reflected in the results of previous studies, which indicate the need for better preparation of students for the labour market; analyses of relevant documents referring to higher education; and case study research in several European universities. Finally, the relevance cycle was designed to result in implications for practice via guidelines for enhancing graduates' employability within HEIs based on testing the final maturity model at four HEIs in Croatia. The *rigor* of this research is assured through a systematic review of scientific literature in the research field, by founding the research in strategic framework elements drawn from existing literature and through using expert knowledge in the development and validation of the final strategic framework and maturity model. As a result of the rigor cycle, the research adds to the existing knowledge base in the field of graduate employability and early career development, especially within the fields of ICT, the HEI strategic management and quality assurance processes, and maturity model design and development.

The final strategic framework and maturity model for supporting higher education graduates' early careers contains 65 practices within four key process areas (*Strategic planning of graduate employability, Curriculum design and delivery, Student support and Extra-curricular activities*) and four dimensions of capability (*Plan-Do-Check-Act*), each of which is described by five maturity levels. Its structure and main elements are based on the idea behind the development of Capability Maturity Model for Software (CMM) (Paulk et al. 1993; Paulk et al. 1993) and E-learning Maturity Model (eMM) (Marshall 2006a; Marshall 2006b; Marshall 2007) described in more detail in **Chapter 5**. The basic structure of the newly-developed maturity model is shown in **Figure 2**.



Figure 2. Structure of the final maturity model for supporting higher education graduates' early careers²

² This figure is presented first in the booklet “How to prepare students for the labour market challenges?” resulted from the project *Development of a model for supporting graduates' early careers*.

1.4. Scientific and societal contributions

In accordance with the set research objectives and hypotheses, the expected scientific contributions of the rigor cycle of this research were as follows:

- 1) Contribution to the systematization and increasing knowledge in the field of education and career development of future ICT professionals.*
- 2) Development of a comprehensive strategic framework for supporting higher education graduates' early careers within higher education institutions, in the field of ICT.*
- 3) Development of accompanying maturity model for supporting higher education graduates' early careers within higher education institutions, in the field of ICT.*

In addition to their scientific contributions, the results of this research offer significant social contributions with respect to their applicability for solving the current problems and challenges of higher education in the form of guidelines for the design of HEIs' practices for supporting graduates in their early careers. As a concrete societal contribution, the thesis provides guidelines for enhancing the maturity of the HEIs in Croatia for study programmes in the field of ICT, as a result of the relevance cycle.

1.5. Chapter relevance

This initial chapter provides a brief overview of the research topic, the research objectives and the research questions, followed by a short description of the research methodology. The aim of this chapter is to provide a better understanding of the research project within this thesis and to make it easier to follow the direction of the thesis.

To demonstrate the complexity of conducted research, a short summary of the most important indicators related to the model development is presented as follows:

- Case study research was conducted at four HEIs from four different European countries that provide study programmes in the field of ICT;
- Interviews with 27 persons were conducted at studied HEIs, with a total duration of around 1000 minutes;
- 110 practices were detected in the process of interview transcripts coding;
- 13 stakeholders participated in focus groups related to the detection of key process areas;
- 26 stakeholders participated in focus groups related to the detection of practices;
- 31 stakeholders participated in focus groups related to the model evaluation;
- 22 experts and 12 students participated in the model evaluation;
- Final model was tested at four Croatian HEIs that provide study programmes in the field of ICT.

This introductory chapter provided a short overview of the research topic and research methodology; however, for better understanding of the research scope it is also important to stress what this research is not about. The main limitations related to the research topic of this thesis can be summarized as follows:

- This thesis does not research particularities of ICT employability domains in greater detail (i.e. the content of curriculum for study programmes in the field of ICT or the development of ICT specific competencies); instead, it put focus on practices within HEIs with study programmes in the field of ICT and tests the model in the ICT domain.
- This thesis does not address problems related to the topics of graduate employability surveys (how to design the employability questionnaire) and does not address in detail the issues of the centrality of empirical data for any development related to employability; however, it address the importance of graduate surveys and data collected by conducting such surveys for improvements of certain HEIs' practices.

Further limitations related specifically to empirical research and research results will be elaborated later.

As a conclusion of this introductory chapter, **Table 1** presents connections among the research objectives, research questions, hypotheses and methods and, therefore, provides an overview of the entire research project.

Table 1. Connections among the research objectives, research questions, research hypotheses and research methods

| Research objectives | Research questions | Research hypotheses | Research methods |
|---|--|--|--|
| O1: To explore and identify key higher education system determinants aimed at supporting graduates' early careers. | RQ1: Which are the key higher education systems' determinants having a major impact on the preparation of higher education graduates for their early careers? | | Review of relevant strategic documents and projects related to graduate employability Content analysis of HEIs' strategic documents and other relevant literature Focus groups with experts |
| O2: To develop the strategic framework for supporting higher education graduates' early careers in the field of ICT. | RQ2: Which are the key higher education institutions' practices having impact to the preparation of higher education graduates for their early careers? | H1: Developed strategic framework for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will fulfil both relevance and rigor requirements of design science research. | Content analysis of HEIs' strategic documents and other relevant literature Case study research at four HEIs in Europe Focus groups with stakeholders Experts' and students' knowledge – calculated content validity ratio (CVR) and average values Experts' knowledge – Q-sorting method (calculated Fleiss' Kappa and Hit ratio) |
| O3: To develop a maturity model for supporting higher education graduates' early careers in the field of ICT. | RQ3: Which are the capability assessment criteria of key higher education institution's practices having impact to the preparation of higher education graduates for their early careers? | | Description of capability assessment criteria (maturity levels) for each practice Testing the final maturity model at four HEIs in Croatia in the field of ICT |
| O4: To determine the current maturity level of higher education institutions in the Republic of Croatia in supporting graduates' early careers in the field of ICT, and provide recommendations about further strategic development. | RQ4a: What is the current level of maturity of HEIs in Republic of Croatia regarding the preparation of ICT graduates for their early careers? RQ4b: What are the possible improvements in preparation of ICT graduates for their early careers in the Republic of Croatia? | H2: Developed maturity model for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will be both comprehensive and reliable. | Testing the final maturity model at four HEIs in Croatia in the field of ICT |

2. GRADUATES' EMPLOYABILITY

2.1. General theory

As already stated in the introductory chapter, the employability of highly educated young people and their preparation for the transition to the labour market within HEIs is a topical issue at the level of the EU. To better understand the challenges related to this topic, it is important to first define the main terms related to graduates' employability. This chapter first presents a brief overview of the main terms related to graduates' employability and early career development. The second part emphasizes graduate employability as a part of the universities' third mission. The third part of this chapter elaborates in more detail the latest developments related to the topic of graduates' employability within different strategies and research projects at the European level and worldwide, as well as their implications for the research within this thesis.

2.1.1. Terminology and definitions related to employability

The concept of *employability* is not new, and there exist different understandings and definitions of employability in the recent literature, as can be found in the overview provided by Mcquaid & Lindsay (2005). In its simplest form, employability can be understood as a probability of getting a job or the "ability to be employed" (Finn 2000). However, for graduates is not important only to get a job, but this job should be meaningful and related to their study field. According to the extended definition proposed by the Confederation of British Industry (CBI) (2007, p. 11), employability is "a set of attributes, skills and knowledge that all labour market participants should possess to ensure they have the capability of being effective in the workplace – to the benefit of themselves, their employer and the wider economy". A similar, but more extensive definition proposed by Pavlin et al. (2011, p. 29) places employability in the context of higher education and defines it as "a multidimensional concept explained on the individual level as one's capabilities of retaining a self-rewarding job, in employers' organisations as human resource requirements for fulfilling operational tasks and on the societal level as a system facilitator between (higher) education, the labour market and civil lives". Based on the definition given by the European Centre for the Development of Vocational Training (CEDEFOP) (2008, p. 70), the European Commission (2011, p. 4) accepted the usage of the term employability as "the combination of factors which enable individuals to progress

towards or get into employment, to stay in employment and to progress during career”. As can be seen from the above-mentioned definitions, the term employability is mostly defined as a person-centred construct, considering, according to the dictionary definition, “the quality of character of being employable” (Green et al. 2013, p. 11) and can be described with three component dimensions – *career identity*, *personal adaptability*, and *social and human capital* (Fugate et al. 2004). Mcquaid & Lindsay (2005) provided a more holistic framework of employability that recognizes factors affecting employability as *individual factors*, *personal circumstances* and *external factors*. In line with the understanding of employability as a person-centred construct, the major responsibility for career development is put on individuals and not their employers. However, since the first employment after graduation is used as one of the main indicators of higher education quality, HEIs have tended to take responsibility for enhancing students’ employability through their provision of education and learning activities, as well as different support services, taking into account the employers’ needs (Bach et al. 2014; Cai 2013). In that process, the potential of graduates as perceived from employers became an important topic. Moreover, this intermediate role of HEIs between graduates and employers is important because the educational experience affects persons’s individual characteristics of being employable. Generally, employability in the context of higher education may be defined in terms of “certain characteristics of individuals graduating from higher education” (Holmes 2013). A graduate’s employability refers to the capacity of a higher education alumni “to obtain and/or create work” (Kinash & Crane 2015, p. 150).

Employment, although semantically very similar to employability, has a completely different meaning in the context of the relationship between higher education and the world of work. According to Pegg et al. (2012, p. 7), employability is often described through the pedagogy for employability, “which relates to the teaching and learning of a wide range of knowledge, skills and attributes to support continued learning and career development”, while employment is considered a HEIs’ outcome that may be measured through graduate studies. According to Teichler (2009), the term employment can be considered in different ways, as follows (pp. 88-89):

- the “quantitative and structural development” of graduates’ position in the work system,
- the “process of hiring staff or becoming employed” in the context of transition from education to the world of work, and
- employment conditions, considering the “elements typically fixed in formal or informal contractual relations between employees and employers”.

According to these definitions, graduates with the highest levels of employability skills are expected to have better chances of being employed in the labour market. From the definitions, it can be also presumed that higher education should develop whole persons and, as a consequence, that graduates should be able to find employment within their chosen careers. However, the demanding world of work pressures students to continually develop themselves in order to adapt to new challenges and be attractive to employers. Moreover, employment status does not depend solely on these employability skills; it also concerns several other factors, such as field of study, the development of the industry in which a given graduate is search for his/her first employment, etc. Holmes (2013) recognized HEIs as ideally playing two roles in relation to graduate employment: first, they should follow what is happening with graduates entering employment through tracer studies, and second, they should take steps to increase the likelihood of their graduates gaining appropriate employment. Therefore, HEIs and their efforts to cooperate with the employers in such areas as curriculum design and delivery, student and staff mobility, research and development activities, provision of extra-curricular activities and career-related services etc., are recognized as very important factors influencing the future employment of graduates.

Once graduates leave higher education, they face with the process of transition from study to work, search for their first employment and future career on the labour market. The term *career* refers, in general, “to typical or actual sequences of employment and work tasks within occupational life-spans” (Teichler 2009, p. 91), while *early career* refers to the first years after graduation. Based on their research results related to the transition from higher education to the world of work in several European countries, Allen, Coenen and Humburg (2011, p. 53) concluded that strong links between higher education and the labour market improve graduates’ chances of finding rewarding jobs after graduation. Their results also indicate the importance of HEIs facilitating a rapid transition to the labour market, since graduates who start to search for jobs after they have finished their studies do not turn to their HEIs for help (Allen, Coenen, & Humburg 2011, pp. 33-34).

The provided definitions of employability and employment indicated the complexity and different meanings of those constructs, as well as different factors that affect a person’s employability potential. What is important for this thesis is the recognized importance of HEIs in increasing the employability potential of their graduates, which should consequently result in increasing their chances to get a meaningful jobs (jobs related to their study field) in a short period after the graduation. The focus of the empirical research within this thesis is therefore

put on HEIs practices which should contribute to this significant role of HEIs in supporting graduates' success in their early careers. In the context of this thesis, term *early career* refers to the graduates' transition from higher education to the labour market and obtaining their first jobs in the studied domain.

Although this research is focused on ICT, it is important to emphasize that the literature stresses that careers do not depend to a great extent on the specific field of study (Teichler 2009, p. 17). Thus, the maturity model developed within the frame of this research will also be, with minor modifications, applicable to other study fields.

The findings of Johnston (2003) provide good conclusions for this subchapter. She recognized that much graduate employment research in the UK focuses on the following: 1) large-scale statistical analyses of graduate experiences in the form of surveys; 2) large-scale statistical collections of official national or international statistics, 3) economic analyses of graduate employment, 4) conceptual analyses of changes in society, higher education and the economy, 5) employers' perceptions of their needs and accounts of their recruitment practices, 6) studies combining theoretical explanations with empirical investigations, 7) career-based investigations, and 8) studies of professional socialisation and learning. From this list of most common research topics, it is clear that research focusing on the role of higher education in enhancing graduates' employability is lacking.

2.1.2. Theoretical models of employability

Employability and related concepts are often defined in the existing literature through different models, which place these concepts into a broader context and illustrate their relationships with connected constructs. Thus, in this chapter, a short review of existing models is important for understanding graduates' career development and transition to the world of work in the context of HEIs.

Knight & Yorke (2002) developed the USEM model of employability that contains four main interconnected variables that affects the employability: *understanding* (U) of *subject-specific and generic skills* (S), *efficacy beliefs* (E) which includes personal qualities and *metacognition* (M).

The CareerEDGE model (Dacre Pool & Sewell 2007) also emphasizes individual characteristics —namely, *emotional intelligence, self-esteem, self-confidence and self-efficacy*

— as the main factors impacting individuals’ employability potential. However, this model also contains a group of elements affecting employability potential that can be related to the context of higher education: *career development learning, work and life experience, generic skills development and degree subject knowledge, understanding and skills.*

The Framework of Career Oriented Attitudes and Employability (Jain & Jain 2013) emphasizes four elements that contribute to better competitive strength for employability: *career tasks involvement, career goal sensitivity, career purpose social networking and career linked self-efficacy.* However, the framework also includes connections to *development-oriented institutional climate, career counselling and career planning,* which can be considered elements inherent to HEIs. Therefore, this model indicates that HEIs have a certain influence on individuals’ employability, even though this topic is not researched or tested within the research frame.

The Centre for Research on Education and Lifelong Learning (CRELL) proposed a *Conceptual Framework towards a Benchmark on Education for Employability* (Arjona Perez et al. 2010, p. 9) indicating that higher education plays three roles in graduates’ employment: *stimulating motivation, building skills important for the workplace and facilitating the job search* (European Commission 2011, p. 4).

Based on their literature review on graduate employability, Sumanasiri et al. (2015) concluded that most of the studies are related to the conceptualisation of employability and rarely to its operationalization. As one of the reasons they recognized the lack of consensus among different stakeholders on the concept of graduate employability.

Generally, the literature in this field recognizes two types of researchers (Pavlin et al. 2013, p. 81):

- 1) those who believe that “higher education institutions are the main drivers” of the development of employability skills and, as such, play the most important role in graduates’ career success, and
- 2) those who believe that “social background and individual circumstances in relation to the macroeconomic situation” determine graduates’ success in gaining and retaining employment.

From the presented models, it can be concluded that it is usually a combination of both individual and institutional factors that affect graduates’ employability potential. For the

purpose of this thesis, it is important to stress that, in the context of preparing graduates for their early careers, the emphasis is on solely those factors related to the higher education system, including factors related to primary HEIs and their connections with relevant stakeholders.

2.2. Graduates' employability as a part of universities' third mission

The previous subchapter indicated that most of the definitions and theoretical models on employability and employment indicated the unavoidable role of higher education in preparing employable individuals. Therefore, this subchapter stresses this role of higher education putting it in the perspective of the universities' 3rd mission.

In addition to teaching and research, as core aspects of their mission, universities are seen as catalysts of social growth and the knowledge economy. Therefore, in recent decades, universities have associated by many authors with a third mission, which generally considers all activities not covered within its primary missions of teaching and research. While some authors understand this third mission as one of commercial engagement and discusses the phenomenon of “entrepreneurial university” (e.g. Etzkowitz et al. 2000; Nelles & Vorley 2010), others (e.g. European Indicators and Ranking Methodology for University Third Mission E3M 2008) explain it as a broader concept, involving contributing to the society in the following dimensions: *technology transfer and innovation*, *continuing education* and *social engagement*. Of the many directions pursued by the present discourse on the third mission of universities, Culum et al. (2013, p. 169) extracted three basic perspectives from the literature: 1) the third mission as an economic or technological pursuit related to innovation and economic development, 2) the third mission as a university-community civil relationship aimed at educating students to be responsible and active citizens and 3) the third mission as an integrated concept focused on making all three sectors (public, private and non-profit) relevant for cooperation.

In addition to these broad understandings of universities' third mission, preparing graduates for their early careers should also be considered a primary dimension, since employable graduates contribute to the knowledge economy and the development of society as a whole on a large scale. However, in the context of educating employable graduates, it is important to stress that HEIs should produce not only productive individuals, but also “socially responsible citizens who are professional in what they do” (Culum et al. 2013, p. 167). The importance of this third mission in relation to graduate employability can be also found in the work of McCaffery (2010,

p. 28) who proposed that universities should have, among others, the aim of generating a “highly educated and trained population” with a wide range of skills for performing “specialised activities necessary to sustain a complex society”.

To succeed in achieving these set goals, today’s HEIs face a variety of challenges, such as a dynamic socio-economic environment, globalization, the paradigm of the knowledge society, the expansion of ICT and its application in the processes of teaching and learning, expanding opportunities for widening participation in higher education, better profiling of HEIs’ study programmes in line with labour market needs etc. (Divjak 2014; McCaffery 2010, pp. 10-24). HEIs must confront this environment in innovative ways, particularly through the processes of quality assurance and strategic planning aimed at increasing graduate employability potential.

The latest report from the *European Association for Quality Assurance in Higher Education* (ENQA) project’s *Transparency of European Higher Education through Public Quality Assurance* (EQArep) (Bach et al. 2014) stresses that, in response to strong competition in the labour market and the evolution towards a more knowledge-based society, there has been increasing interest in higher education in Europe, especially in terms of its quality. The project results show that 16% of stakeholders seek information on HEI quality to evaluate the quality of graduates for recruitment processes, while student support systems and graduate employability are recognized as two of the most important factors influencing the decision to further collaborate with certain HEIs, along with the content of study programmes; strategic planning, management & governance; qualifications of teaching staff etc. (Udam et al. 2014).

The European Commission has concluded that education and training systems should provide “the best possible support” for the graduate labour market success through three phases: 1) preparation for employment, 2) transition from education to employment and 3) stay in employment and progress in career (European Commission 2011, p. 5). Of these three phases, the second one (transition from education to employment) has not yet been addressed (Council of the European Union 2012). Educational institutions could contribute to this phase, for example:

...through career guidance and counselling, through stronger links between education and training institutions and relevant stakeholders, through the alignment of curricula with labour market needs, through strengthening entrepreneurship education, through placements in companies, through more transparent information on learning outcomes

and through more responsive education and training policies which reflect labour market skills needs... (Council of the European Union 2012)

Moreover, the *Eurostat Regional Yearbook 2015* identifies “improving the quality of higher education by making degree courses more relevant for the world of work” as one of four main challenges of tertiary education in Europe until 2020 (Eurostat 2015, p. 92).

This subchapter stresses the unavoidably role of HEIs in preparing graduates for their transition from education to employment, but it also indicates there is an evident room for improvement in achieving that goal. Especially, the processes of strategic planning and quality assurance should emphasize on practices that support the development of student employability potential within HEIs and enable their smooth transition to the labour market. This chapter further research current developments in the area of graduate employability and the role of HEIs, as evident from strategic documents and relevant project, in order to get insight into the work done on this topic most recently and detect areas for future work.

2.3. Current developments on graduates' employability

2.3.1. Relevant strategies and policies

Beginning with the Europe 2020 strategy (European Commission 2010c) and continuing through its several main initiatives and the Strategic Framework - Education & Training 2020 (European Commission 2016e), employability in general has been positioned as an important issue for the near future. A *Digital Agenda for Europe* initiative (European Commission 2010a), is supported by the *Agenda for New Skills and Jobs* (European Commission 2010b), which focuses on supporting activities and stimulating initiatives for preparing young people for the transition to the labour market, fostering university-business cooperation, addressing innovation and entrepreneurial skills in curricula, matching labour market needs, etc., with a focus on the skilled workforce as an essential asset contributing to the goals of Europe 2020. In addition to the *Agenda for new skills and jobs*, the publication *New skills and jobs in Europe: Pathways towards full Employment*, which was published in 2012, provides evidence of the European employment situation based on 17 comparative research projects at the European level (European Commission 2012b). In order to support the further development of education, the European Council invited the member states, to raise

... the performance of education and training systems, and overall skill and competence levels, for instance by linking the worlds of work and education more closely, and by ensuring effective communication and strong partnerships between the relevant policy areas, education and training sub-sectors, the social partners, and different levels of governance. (Council of the European Union 2013)

Above-mentioned strategic documents indicated industry/employers as a crucial partner of any HEI that strives to equip its graduates with the high-level employability skills and enhancing their employability potential. In that context, different modes of university-business cooperation (i.e. student internship, projects in collaboration with employers, invited lectures from industry representatives) play an important role since they enable students' direct connection with the world of work and the acquisition of relevant employability skills already during their studies. Within the *State of the European University-Business Cooperation*, improving the employability of future graduates is stressed among the most evident benefits of the university-business cooperation for students, together with increasing their skills and improving their learning experience (Davey et al. 2011, p. 28). Conclusions from the latest

university-business forum held in Brussels in 2015 stress, as one of the important issues, “building the capacity of higher education to cope with the constantly changing environment” when focusing its contribution to the society, which is evident in (among others) the production of employable graduates (Allinson et al. 2015, pp. 3-4). The panellists also agreed that there is a need to develop new metrics for educators to recognize their efforts to develop innovative methods and approaches in relation to university-business cooperation and to give more attention to voices of employers and other relevant external stakeholders in the evolution of the HEI.

Most recently, highlights from the European Commission’s 2014 to 2015 *Working Group on the Modernization of Higher Education* propose that government should establish the overarching vision for higher education together with key stakeholders, in order to create a higher education “landscape that balances the objectives of quality, efficiency and responsiveness”, while reforms should be accompanied by appropriate monitoring and evaluation measures (European Commission 2016d, p. 10). One priority is improving employability, with an emphasis on improving higher education study programmes, including the shift from traditional teacher-centred learning to student centred-learning that includes more innovative teaching approaches such as the problem-based learning and work-based learning, as well as the improvement in career guidance. Special emphasis is placed on the combination of national and institutional student tracking and student survey systems as a powerful tool for effectively informing policy development; however, this indicates that the usage of these kinds of data is still not recognized or widespread within higher education practices (European Commission 2016d, p. 11). These results are in line with those from the EUROGRADUATE feasibility study that recognizes the lack of comparable national-level data on graduate employment and provides recommendation on the development and implementation of the European Graduate Survey (EGS). Data collected from such survey should provide valuable information that could be used as indicator of the achievement of the set goals within the EU strategic documents (Mühleck et al. 2016). *A New Skills Agenda for Europe: Working together to strengthen human capital, employability and competitiveness*, which is one of the latest relevant strategic documents at the EU level, set main actions to be carried out before the end of 2017 (European Commission 2016a). These actions were centred around three key streams of work: 1) improving the quality and relevance of skills formation, 2) making skills and qualifications more visible and comparable and 3) advancing skills intelligence, documentation and informed career choices. These actions are aimed to achieve, among others:

- A better understanding among universities of the performance of graduates, which is considered necessary for universities to understand trends on the graduate labour market, realize how readily their alumni find jobs and adjust their curricula accordingly. This can be achieved through graduate tracking initiatives.
- Increased learning opportunities through more work-based learning and university-business partnerships, greater support for learner mobility and more opportunities to validate non-formal and informal learning (European Commission 2016a).

From the abovementioned key points extracted from strategic documents at the EU level, it can be concluded that there is a need to develop a comprehensive framework to enable improved planning, monitoring and evaluation of the activities within HEIs that contribute to student employability, including cooperating with industry, tracking students' employability, adjusting study programmes to the labour market needs, improve career guidance etc. The main goal is for HEIs to become more mature in one of their most important roles: contributing to society through the production of skilled and employable graduates.

Besides in Europe, the employability of young people appears to be a relevant issue worldwide. In Australia, the government plans to provide support for enhancing the employability of young people by investing \$840.3 million over four years in a *Youth Employment Package* to assist vulnerable young people in gaining employment (Australian Government 2015b). Among the most important of the related initiatives is the *Youth Employment Strategy*, which was announced in the 2015–16 budget and which seeks primarily to improve employment outcomes for Australia's young people and make it easier for them to enter the workforce. Other supporting initiatives in Australia, such as the Youth Jobs PaTH, are designed to support young people in gaining and improving the employability skills and real work experience necessary for them to get and keep a job, including by providing incentives for employers to hire these young people (Australian Government 2015b). The government's holistic and integrative approach to addressing the problem of youth employability can also be seen in other initiatives focused on helping Australian small businesses create more work experience opportunities for the country's unemployed. This includes, particularly, its young people by ensuring national wage subsidy pool, from which employers will be able to access wage subsidies as soon as the person starts the job and internship placements to help young job seekers undertake valuable work experience (Australian Government 2015a).

In Canada, the *Youth Employment Strategy* represents the government's commitment to helping young people, including, particularly, those facing barriers to employment, gain the information and the skills, work experience and abilities needed to successfully transition into the labour market. This is a horizontal initiative involving three main programme streams which includes funding for employers to: 1) help young people facing barriers to employment to improve their skills and knowledge needed to participate in the current and future labour market, 2) design and deliver activities that will inform young people about possible career paths and provide them valuable work experience and 3) create summer job opportunities for students (Government of Canada 2016).

This short reflection to the initiatives in countries outside the Europe indicates that the topic of graduate employability and their preparation for future careers within HEIs is important globally.

2.3.2. Relevant projects

The most systematic work on the employability of higher education graduates and related topics, such as the cooperation between HEIs and the private sector, has been done through a series of connected EU projects, starting with CHEERS (Internationales Zentrum für Hochschulforschung Kassel [INCHER-Kassel] 2000) and later, REFLEX (Research Centre for Education and the Labour Market [ROA] 2008). The REFLEX project, which examined graduates five years after their graduation in 2000, was carried out by research groups in 16 different countries.

After REFLEX, the HEGESCO project (HEGESCO 2007), which addressed the contribution of the higher education system to the competence development and employability of graduates, was launched. HEGESCO provided valuable insight into the situation of the graduate labour market on the basis of an international quantitative survey among graduates conducted four to five years after their graduation in more than 20 European countries. Among other important findings, HEGESCO research results indicated strong connections between HEIs and the labour market and the acquisition of work experience related to the study field during higher education as key factors contributing to graduates' successful transitions from higher education to the world of work. For the research within this thesis, the most important are the implications of a complementary survey of 150 HEIs and employer organizations within the frame of the HEGESCO project. The results of this study indicated several practices that HEIs should follow

in order to equip graduates with skills considered desirable by employers. These practices include:

- Fostering both professional and generic competences within the higher education curriculum by considering, first, revisions to curriculum development processes;
- Collaborating with employers, as primary stakeholders of higher education, in the preparation of graduates for the world of work through, for example, providing internship for students;
- Providing active learning modes which support generating desired competences;
- Providing career-related activities, such as career days, through the organized work of career centres;
- Ensuring quality control through the use of student evaluation surveys, employer surveys, curriculum evaluations, etc. (HEGESCO 2007)

Recognized practices indicate the need for certain improvements to higher education management system related to graduates' employability in the aspects of curriculum design and development, collaborations with employers, quality assurance and career development support.

The DEHEMS project was a kind of continuation of HEGESCO, with the basic goal of connecting the concepts and dimensions of graduates' success in their careers in selected domains and professional fields of study with the expectations, practices and future challenges of HEIs (Melink & Pavlin 2011). The research results of the DEHEMS project were based on extensive interviews from higher education stakeholders from six countries: Austria, Germany, Italy, Poland, Slovenia and Turkey. These research results indicate a need to improve the connection between HEIs and the world of work and highlight graduate surveys as powerful tools for improving study programmes. The DEHEMS project identifies *personal characteristics*, *family background*, the *learning process*, *teaching characteristics* and *employment characteristics* as explanatory variables for labour market success (Grotkowska et al. 2011, p. 72). Although DEHEMS researched a number of study domains, it found that intense use of internships and work placements as teaching modes had a positive impact on job satisfaction. The implications of the research project within this thesis primarily recognize practices controlled by HEIs, such as the organization of study programmes and collaborations with employers, as important for the future labour market success of graduates. More concrete, project results related to the recognized current characteristics and future challenges in the

education within the engineering domain should be emphasized, as those are most closely related to the ICT domain, which is in the focus of this research. According to the academic point of view, graduates in engineering domains are expected to be flexible and capable to adapt to the rapid technological changes; therefore, their education should be based on practically oriented study programmes that include different modes of cooperation with industry such as research projects and internship. Future challenges indicated the importance of student-centred learning and development of career services that should assist students in recruitment processes and maintain alumni networks (Pavlin 2011, p. 305). These results shift focus from study programmes to career related services, which are given a great emphasize within the newly-developed maturity model for supporting graduates' early careers that resulted from this thesis.

One of the most recent European projects on the topic of the connection between HEIs and the world of work was EMCOSU, the main goal of which was to identify professional competences and disparities among formal qualifications, acquired knowledge and employers' demands (Melink et al. 2014). As has already been mentioned, the practices of strategically cooperating with business, increasing the practical orientation of teaching and enhancing traineeships and internships were recognized as areas of future changes within HEIs. Like HEGESCO and DEHEMS, EMCOSU also recognized several areas of HEIs in which improvements could lead to better graduate employability, such as cooperation with business and the embedding of new modes of pedagogy in curriculum teaching and learning.

Within the TRACKIT project, which provided factual information on reasons, uses and methods for graduate tracking, the main data collection methods included a survey of national rectors' conferences and individual HEIs, conducted in 31 countries; expert interviews and focus groups; and site visits in 11 European countries to 23 HEIs and other relevant organizations (Gaebel et al. 2012). Among other benefits, the results of this project indicated that tracking is useful for overall institutional development (including provision of learning but also student support services), benchmark with other universities, assessing the impact of educational reforms and, thus, support processes of institutional leadership and quality assurance. The results of this project offer another perspective on the HEI practices that can contribute to better graduate employability. Specifically, it is not only the curriculum content and the implementation of adequate pedagogical aspects that is important, but also the monitoring and evaluation of their provision and the usage of these results for improvements.

In the process of monitoring and evaluation of certain higher education practices, data collected through graduate survey provide valuable inputs.

Most recently, the already mentioned EUROGRADUATE feasibility study was conducted, with the main aim of exploring whether a sustainable study on Europe's higher education graduates could be established (Mühleck et al. 2016). The research findings showed that, following the REFLEX survey (done in 2005) and the HEGESCO survey (done in 2008), there were few studies covering high numbers of European countries, and the available data on graduates' employability from existing databases (census data) were limited in some variables and insufficient for monitoring and analysing the career development of higher education graduates (Ryška & Zelenka 2015). Moreover, the results showed that European countries' approaches to studying graduates' careers are heterogeneous and that, although many countries have a tradition of national-level graduate surveys, there is no consistency in their methods of collecting these data (Mühleck & Hauschildt 2015). On the other hand, the results illustrated a strong consensus among higher education stakeholders regarding the need for a unique European Graduate Survey that should "provide insights and results directly relevant to developing policy measures and steering higher education" (Grabher et al. 2015, p. 3). Like the findings of the TRACKIT project, the results of the EUROGRADUATE study indicate the need for strategic planning processes that would lead to better quality of service for supporting graduate employability within HEIs. This could be achieved using information from graduate surveys, which serve as both the evaluation mechanisms for many higher education practices and the inputs for new actions and improvements to those practices.

The results of several projects conducted on the international level also contribute to this topic and have implications for the research within this thesis. A draft from the *Global Graduate Employability Research* project presents the results of 700 survey responses submitted by students, graduates, employers, higher education teachers and career development professionals, mostly based in Australia (Kinash et al. 2014). The results indicate 12 different strategies that increase graduates' employability: final semester projects, career advice and employment skill development, engaging in extra-curricular activities, international exchanges, mentoring, attending networking or industry information events, part-time employment, developing graduate portfolios, profiles and records of achievement, membership/engagement in professional associations, social media/networks, volunteering/community engagement and work experience/internships/placements. Each of these is perceived as more or less important from the perspectives of each of the four main groups of stakeholders: students, graduates,

higher education personnel and employers (Kinash et al. 2014). These results serve as a good basis for the development of initial key process areas and practices for increasing graduates' employability within HEIs for the maturity model for supporting higher education graduates' early careers.

Insights from members of another relevant stakeholder group, as represented by 414 career advisory staff members from institutions in 25 countries, offer a similar perspective on the actions necessary for enhancing graduates' employment capabilities, evident in the key recommendations from The International Graduate Insight Group Ltd. (i-graduate) research on supporting graduate employability within HEIs (2011, pp. 7-9):

- Ensuring a common understanding of the definition of employability among all stakeholders, which can be achieved by including graduate employability as an institutional strategy;
- Raising students' awareness of their own responsibilities in developing their employability potential;
- Involving academic staff in the development and delivery of employability skills within the curriculum;
- Engaging both prospective students and alumni;
- Increasing opportunities for students to gain accreditation for employability activities both within and outside the curriculum by maximising the value of extra-curricular activities, such as volunteering;
- Encouraging activities designed to support business development and entrepreneurship;
- Promoting co-operative education, which involves integrating work experience, work placements and internships into degree programmes as core elements; and
- Engaging with employers.

These methods for enhancing graduates' employability, as described from the perspective of career advisory staff members, more or less summarize the findings of other mentioned projects and provide a starting point for the research into relevant practices as part of a maturity model for supporting graduates' early careers within HEIs.

The Good Practice Report articulates the cohesive, embedded, entire-institution approaches to employability as one of the main four strategic national recommendations in the context of graduate employability and stresses the need for embedding employability, not only into curriculum, but in a wide spectrum of higher education practices (Kinash et al. 2016, p. 9).

As a summary of this subchapter, this entire-institution approach is recognized as follows:

- Strategic planning of higher education practices aimed at supporting graduate employability potential and their transition to the labour market within HEIs;
- Improvements in curriculum design and delivery processes, including shift to student-centred approach, involvement of pedagogical approaches that encourage students' active learning, cooperation with employers in the provision of learning and teaching activities etc.;
- Maintaining effective relationships with alumni, collecting information about graduate employment and using that information for the improvement of certain higher education practices and supporting quality assurance processes;
- Provision of different student support activities, such as career related activities or extra-curricular activities.

2.4. Chapter relevance

This introductory chapter on graduates' employability is important for several reasons:

- It provides an understanding of basic terms related to graduates' employability and their early career development;
- It explained the employability of graduates as a part of the third mission of universities and therefore proved the unavoidable importance of the position of graduates' employability within HEIs;
- It provides insight into current developments and issues in the EU and elsewhere through a review of several project results and their implications for the research conducted within this thesis and, finally,
- It indicates the important role of HEIs in graduates' employability.

To further develop the strategic framework and maturity model presented within this thesis, the most important implications for higher education systems are those drawn from current practices of graduate career tracking and project results, which can be summarized as follows:

- To balance scientific and professional skills in education programmes;
- To address development of both hard and soft skills through the curriculum;
- To pay attention to the development of entrepreneurial skills;
- To use both traditional and innovative modes of teaching and learning, such as student-centred and problem-solving learning;
- To provide students with more work-related experience and internships during their studies;
- To establish better links with employers;
- To establish and maintain effective networks with alumni;
- To provide students with extra-curricular activities;
- To recognize students' informal and non-formal experiences;
- To establish or further develop the career services within HEIs and
- To collect data from graduates studies and use them for further development of higher education practices.

It can be concluded that this chapter indicates a need for the development of a managerial tool to help HEIs effectively use resources like data from tracer studies to improve certain processes and practices in order to ensure better graduate employability.

3. HIGHER EDUCATION MANAGEMENT ON GRADUATES' EMPLOYABILITY

The previous subchapter on issues related to graduate employability and career development on the macro level indicates that HEIs play a significant and important role in preparing graduates for the world of work. This subchapter focuses on the mezzo level of HEIs by examining their role in supporting graduate employability in more detail, placing the employability of graduates in the context of higher education strategic management and quality assurance processes.

As indicated in *Chapter 2*, the latest European strategies and policy documents and research papers emphasize the strategic role of HEIs in the preparation of employable graduates that will contribute to the development of society as whole. To better understand higher education as a service system contributing to improved graduate employability, this chapter first provides a description of higher education stakeholders. Afterwards, the chapter provides an overview of strategic planning processes within HEIs and their relation to quality assurance processes as important components of successfully preparing graduates to transition to the world of work within the higher education system.

In his book on higher education and the world of work, Teichler (2009) claimed that the extensive research on the relationship between higher education and the world of work has not yet reached a beneficial degree of quality and that improvements are still needed (p. 17). Among others, he argued that it is necessary to find more convincing strategies “to measure the extents and the ways higher education ‘matter’ for employment and work” (p. 18). He further stressed that the current research on the relationship between higher education and the world of work provides unsubstantial guidance for decision making in higher education, proposing a need to improve the methods and measures for determining the importance of certain higher education factors for graduate employment (p. 17). To develop such models and methods, collaboration between researchers and practitioners is critically important, as will be done within this research through the set of research methods from both the rigor and the relevance cycle. Certainly, one of the reasons graduate employability matters is that graduates' career success is seen as a direct measure of the quality of higher education.

Although there is a clear focus on students as the customers of higher education and particularly on the quality of service they receive, this service is limited largely to the process of education and not to its main purpose: to prepare students for their transition into the labour market. What can be perceived from a short review of existing quality assurance and excellence models, which is described in detail later in this chapter, is that very little attention has been paid to quality in the context of the employment of graduates once they finish their higher education. Another shortcoming of existing models is that they rarely connect with other stakeholders. Although HEIs are seen as service systems that interact with the environment, these connections typically refer to graduates as outcomes of the higher education system and input of the labour market, often failing to consider the constant collaboration with employers and other stakeholders in processes of quality assurance.

One of the main conclusions is that current practices in HEI quality management require a shift from the traditional areas of accreditation and focus on teaching and research performance, and to improve approaches that place students' teaching and learning experiences at their centre, but also includes the quality of administrative and service functions within HEIs (Becket & Brookes 2008; Firdaus 2006a). The reason for this shift lies in a fact that, of the different customers of higher education, students as its main customers should be given the highest priority. The student-centred approach considers, not only teaching and learning experiences, but the overall higher education experiences. This includes the provision of a wide range of extra-curricular activities such as student involvement in different student organizations and participation in student competitions, then the provision of career related activities through the work of career services, as well as the provision of activities related to student academic development. In the process of planning and delivery of such services, HEIs should include also the perspective from employers as the main customers of the output of higher education system, but as well take into account regulatives and inputs from managerial and supporting institutions in the system of higher education.

Thus, there is a clear need for strategic planning related graduate employability in order to ensure the quality of the higher education system for all relevant stakeholders.

3.1. Higher education stakeholders

To better understand the employability of graduates in the context of higher education, it is important to understand higher education as a service system in which students are not only consumers, but also active participants and co-producers in delivery of teaching and learning processes, as well as the provision of different higher education services (Brenders et al. 1999; McCaffery 2010, p. 274). Moreover, higher education as a service system depends to a large extent on the needs and requirements from other stakeholders that affect higher education processes.

According to Fitzsimmons, service can be defined as “a time-perishable, intangible experience performed for a customer acting in the role of co-producer” (Fitzsimmons and Fitzsimmons 2008, p. 4). A service system can be considered a complex and adaptive “value-coproduction configuration of people, technology, other internal and external service systems and shared information”, all of which work together to create value (Spohrer et al. 2007). In this system, when one party does something for another, the results benefit both (Maglio et al. 2009). Compared to some other disciplines, service science is a relatively new interdisciplinary area of study; it started growing around late 2004, when it was related primarily to the work of the IBM Research Center (Glushko 2008; Spohrer & Maglio 2008).

Lella et al. (2012) report that, in the existing literature on service science and service systems, universities are among the least understood systems, even though they are very common. Universities can be considered service providers, and their main role is to transform students’ knowledge through different interactions among students and university (Spohrer et al. 2007). On the other hand, the definition of service clients in this case is not a simple question because universities manage coproduction relations among multiple clients, including students, the government, employers and other stakeholders. Another theory stressing the relationship between HEIs and the environment is the Triple-Helix thesis, which considers the university-industry-government triffecta as a distinct system with its own mission, even if each of its partners also develops its own mission/differentiation (Leydesdorff 2013). To develop a reputation of excellence, accomplish its 3rd mission by producing higher quality graduates and satisfy the outcomes of all stakeholders, universities must excel in relationships with all stakeholders (Lella et al. 2012; Spohrer et al. 2007).

Among the most important elements of any given service system are the so-called *stakeholders*. Stakeholders can be defined as “influencers who have a direct or indirect stake in affecting an organisation’s actions, objectives and policies and can be inside or outside the organisation” (Aarrevaara & Dobson 2013, p. 160). Two main categories of stakeholders can be distinguished: internal stakeholders, which have formal roles within HEIs, and external stakeholders, which impact or are impacted by HEIs. Stakeholders differ in the influence they have over the institution, as well as in the degree of importance they represent for the institution, based on their power, legitimacy and degree of urgency, as can be found in the overview of the previously conducted empirical research related to HEIs’ stakeholders presented in the work of Alves et al. (2010). In the context of graduate employability, the following stakeholders can be identified as the most important: government, students, employers, higher education personnel (managers, teaching and non-teaching staff), alumni and different supporting institutions.

This subchapter presents a short description of the different stakeholder groups that are generally applicable to every higher education system in the context of enhancing graduates’ employability.

Internal stakeholders of the higher education system:

- **Students** – As has already been mentioned, students are not only customers of higher education processes, but also active participants who interact with the processes of service delivery. For this reason, HEIs should focus on improving students’ experiences throughout the student lifecycle, from pre-entry through graduation to the alumni period (McCaffery 2010, p. 274; European Commission/EACEA/Eurydice 2014). However, some research results show that students’ influences within HEIs are evident only in their evaluations of teaching, without evident impact to other aspects of institutional management (Aarrevaara & Dobson 2013, p. 170).
- **Institutional managers** – Institutional managers in the context of HEIs include rectors and vice-rectors at the university level and deans and vice-deans at the level of individual faculty (as well as the equivalents of these positions in different higher educational systems). Since strategic and policy documents at the EU level (*Chapter 2*) push HEIs towards certain reforms in order to improve their performance and overall quality in supporting students’ transitions to the world of work within HEIs, institutional managers as key players at the strategic level of HEIs, have the tough task of achieving set goals.

- **Teaching staff** – The literature refers to teachers as academics with one of the primary roles within higher education in training students for their future career (Pavlin et al. 2013, p. 63). With respect to this primary role, teachers may be considered among the most important stakeholders having a direct impact to the development of graduate employability skills through the provision of learning and teaching activities.
- **Non-teaching staff** – In addition to teaching staff, who have a direct impact on the employability of graduates, the task of producing employable graduates also falls, in an indirect way, to the other professionals in higher education, such as career service officers, career counsellors, alumni officers, librarians, professionals in charge of university-business cooperation, etc.

External stakeholders of the higher education system:

- **Government** – National governments are the principal funding providers for most HEIs in most European countries; therefore, they represent some of the most important external stakeholders of HEIs.
- **Industry/Employers** – Within the Triple-Helix Model (Leydesdorff 2013), industry is considered, together with government, the most important stakeholder in higher education. The reason for this stems very clearly from the identification of industry as the main consumer of higher education systems' final "product": graduates entering the labour market.
- **Regulatory and supporting institutions** – This category includes all institutions whose work affects HEIs, such as accreditation and quality assurance agencies, which lay down certain rules and activities that the HEI has to respect. It also includes different non-governmental organizations at the national and international levels whose core work involves higher education, such as the European University Association (EUA), the European Association of Institutions in Higher Education (EURASHE), the University-Business Cooperation Network (UIIN), the Institute for Educational Development (IRO) in Croatia, etc. Through their work, these institutions contribute to the development of higher education policies and practices; however, their recommendations and activities are not obligatory for HEIs.
- **Alumni** – The former students of a given HEI collectively represent a valuable stakeholder and partner capable of providing important information related to the improvement of higher education practices through graduate studies.

Based on the above description of the main internal and external stakeholders of the higher education system, the author proposes the HEI stakeholder map shown in **Figure 3**, which places higher education within the broader context of a society influenced in different ways by graduates, as the outputs of the higher education service system. With respect to the recognized need for the development of models and methods for determining the importance of certain higher education determinants for graduate employability in collaboration with researchers and practitioners, representatives of all the described stakeholder groups will be involved in the development of maturity model for supporting graduates' early careers described in *Chapter 6 (Empirical research)*.

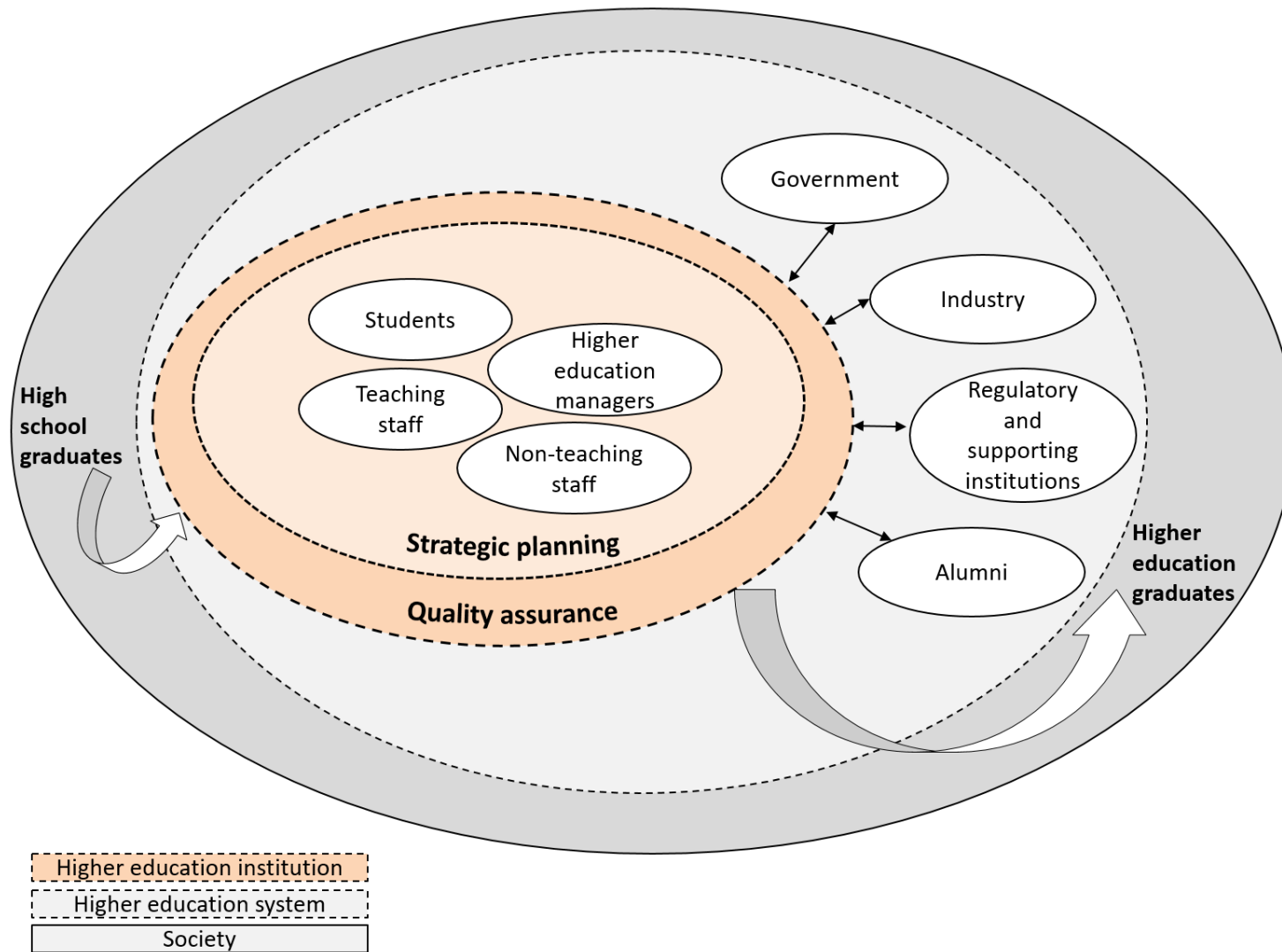


Figure 3. Higher education stakeholder map

3.2. Higher education management and graduates' employability

The literature shows that the term *management* is relatively new in higher education, dating back to the 1960s when it was first used to refer to institutional planning. By contrast, *governance* and *leadership* in higher education refer to the processes of institutional decision-making and policy development. Accordingly, governance involves setting conditions for university managers, influencing decisions and guiding people, while management is responsible for the operationalization of plans and the achievement of goals according to government-approved policies and procedures (McCaffery 2010, pp. 34-41; Taylor & De Lourdes Machado 2006). Therefore, it is not surprising that the literature on higher education management often uses and interchanges terms like *strategic planning* and *decision-making*.

3.2.1. Strategic planning processes in higher education

Strategic planning can be defined as “a set of concepts, procedures, and tools designed to help leaders, managers, and planners think, act, and learn strategically” in achieving organizational missions and goals (Bryson 2004, p. 15). It also refers to the “disciplined effort to produce fundamental decisions and actions that shape and guide what an organization (or other entity) is, what it does, and why it does it” (Bryson 2004, p. 6).

Strategic planning arises from the business sector and refers to continuous and systematic planning processes that, in the long term, lead to successful business results. Divjak and Begičević Redep (2016, p. 74) claim that HEIs take responsibility for their work and development and that, therefore, even 30 years ago, they began to apply theories and practices of strategic planning and strategic decision making taken from the business sector. Although this approach has yielded some positive results, higher education has a number of specific characteristics that make it necessary to not only adapt approaches taken from the business sector, but also develop new models of strategic decision-making specific to higher education, in order to better align institutions with their external environments, help them accomplish their mission and set goals and create expected public value (Divjak and Begičević Redep 2016, p. 74). In her book on strategic planning in higher education, Hinton (2012) pointed that, in the beginning, strategic planning in higher education was viewed as “a tool to articulate institutional mission and vision, help prioritize resources, and promote organizational focus” (p. 7). Several applications of strategic planning in higher education can be found in the literature (i.e. Kahveci et al. 2012; Luhanga 2010; Tohidi et al. 2010); however, these are based primarily on examples

of the application of strategic planning to concrete higher education systems, rather than on methodologies of how to apply strategic planning in general. Moreover, these examples do not address strategic planning of graduate employability within HEIs in particular.

Strategic planning is usually observed through the *strategic management cycle*, which generally consists of three phases: 1) strategy formulation, 2) strategy implementation and 3) strategy evaluation (Byars et al. 1996, p. 6). The Higher Education Funding Council for England (HEFCE) also proposes a three-step planning process, which involves: 1) planning as generating ideas and analyzing plan, 2) documenting the plans, and 3) implementation of set plans and monitoring of their progress in order to adapt future strategies (Higher Education Funding Council for England [HEFCE] 2000, pp. 6-7).

As has already been elaborated, strategic planning is closely related to *strategic decision-making*, a process that determines strategic planning processes. Divjak & Begičević Ređep (2015) propose a four-step strategic decision-making cycle, which follows the so-called Deming PDCA (plan-do-check-act) cycle through the following phases: 1) identification and research of the problem, 2) design of decision-making methodology, 3) implementation and monitoring of the strategic decision and 4) evaluation of the effects of the strategic decision. A parallel can be done with the three phases of strategic management cycle proposed by Byars et al. (1996, pp. 6-7), including strategy formulation, strategy implementation and strategy evaluation; namely, the strategy evaluation phase comprises both monitoring progress (check) and initiating corrective action (act) and, thus, can be said to follow the same steps as the Deming cycle.

It can be concluded that the four phases of Deming cycle provide a common basis for the processes of strategic planning within HEIs, including: 1) planning of practices and activities, 2) implementation of activities according to the set plans, 3) evaluation and monitoring of conducted activities and 4) analysis of the results from monitoring phase and discussion about potential improvements that should be included in new cycle of strategic planning. Here, it is important to stress that this cycle of strategic planning is iterative and the results of the last step (*continuous improvement*) provide inputs for the initial (*planning*) phase of a new strategic planning cycle. Moreover, different higher education stakeholders should be consulted in different phases of strategic planning related to graduate employability within HEIs.

In addition to the four phases of strategic planning and decision-making, it is also important to understand the different levels of strategy that should be covered within the process of strategic planning. *Strategy* is another term in management theory that can be explained and understood in different ways. In general, an organizational strategy is essential for guiding strategic decisions, stimulating coordination within different HEI organizational units and increasing motivation of all employees through aligning the three main organizational elements: *aims*, *capabilities* and *opportunities* (McCaffery 2010, pp. 97-99). Strategy, as a main term related to strategic planning, can be observed, according to Rademakers, at five levels, from the most broad at the top to the more specific at the bottom, described as follows:

- “*Strategic vision* – Rough sketch of desired long term future
- *Strategic guidelines* - Broad principles setting general direction
- *Strategic framework* - Outline of main objectives and initiatives
- *Strategic roadmap* – General plan of targets, actions and roles
- *Strategic blueprint* – Comprehensive plan detailing most activities“ (Rademakers, 2014. p. 22)

In order to be successful in preparing graduates for their transition to the labour market, HEIs must first refer to graduates’ employability in their *strategic visions*. Some universities, such as the University of Edinburgh (University of Edinburgh 2012), address the employability of graduates in their strategic plans, but it is not unusual for universities to have separate strategies related to graduates’ employability (Edge Hill University 2013; University of Bradford 2012a; University of Hull 2011; University of Kent 2013).

Hinton (2012, p. 7) elaborates that many early strategic planning efforts within higher education produced documents that described an institution, but did little to motivate a process of the strategy implementation. Over years, the situation changed little. Today, it is still possible to find several different strategic plan documents for different HEIs, but few tools and little information on the implementation and success of these strategic plans. Shah and Nair (2014) argue that the literature on the development and implementation of strategies in universities is limited. As one of the reasons for strategy implementation failure, Alexander (in Kalali et al. 2011) highlights the lack of proper models to guide managers in the effective strategy implementation, while Divjak (2016) reported the lack of higher education leaders’ knowledge and skills on strategic planning and leadership. Hinton concluded that, spending time on the development of comprehensive strategic plans that are never implemented results in frustration

among the staff and faculty working on the plans, ultimately creating internal environments with negative attitudes toward strategic planning (2012, p. 8).

Therefore, this research focuses on strategic guidelines and a strategic framework that should help HEIs define more specific targets and actions in the form of a strategic roadmap and blueprint. As a proper tool for supporting the implementation of the strategic framework, the author recognizes maturity models that focus on organizational capabilities as one of the main elements of strategy, which will be explained in more detail in **Chapter 5**. Furthermore, this focus on institutional capabilities leads to another managerial term: performance. Ten years ago, *performance management* was a relatively novel phenomenon within higher education, understood as “a method of connecting organizational objectives to the people who are there to carry them out”; this definition emphasized processes instead of systems (McCaffery 2010, pp. 162-163). In keeping with this perspective, it can be concluded that the maturity model for supporting graduates’ employability should contribute to improving the performance of HEIs in the context of enhancing graduates’ employability and, consequently, realizing the third mission of universities.

3.2.2. Benefits of strategic planning of graduates’ employability in higher education

As a short conclusion of the subchapter on strategic planning within HEIs, it is useful to stress some of its benefits. In the context of enhancing graduates’ employability within higher education, a parallel with the benefits of strategic planning (Bryson 2004, pp. 11-13) can be described as follows:

- *Promotion of strategic thinking, acting and learning* – In planning support for graduate employability, this promotion refers especially to engaging in continuous conversations with HEIs’ internal and external stakeholders, as proposed within **Figure 3**, in order to gather information about the internal and external environment that could be used for further improvement of different HEIs practices.
- *Improved decision making* – When it is part of strategic planning, decision-making focuses on crucial issues and helps organizations clearly formulate and communicate their strategic intentions to the relevant stakeholders. In order to organize all relevant elements of the higher education system to support graduates’ employability, strategic planning helps to make relevant decisions at the institutional level about practices that

are most important for enhancing graduates' employability and communicate them to relevant stakeholders.

- *Enhanced organizational effectiveness* – The employability of HEIs' graduates, as an aspect of strategic planning, can help HEIs direct all relevant resources in the necessary direction (e.g. to organize processes of systematic data collection on graduates' employability and use the collected data for appropriate actions to support graduates' employability capabilities during their studies).
- *Enhance effectiveness of broader societal systems* – The skills and knowledge of graduates in the process of transitioning from higher education to the labour market are the main outputs of HEIs, which contribute to creating public value and to the broader societal system by producing skilled graduates in response to labour market demand.
- *Benefit the people involved* – If all the employers and stakeholders are striving for the same goal (in this case, producing graduates with the desired knowledge and skills), according to very clear objectives and guidelines, they will be more successful in their performance and, consequently, in achieving the set goals. They will also be more satisfied if they know what is expected of them.

While strategic planning is not a substitute for strategic thought, action and learning, it is useful for improving them, which is one of its most obvious benefits (Bryson 2004, p. 15). The presented benefits of strategic planning in higher education appear to present a good answer to the mentioned issues related to ensuring graduates' employability.

3.3. Quality assurance processes in higher education

After elaborating on the processes of strategic management, this subchapter explores in more detail the quality assurance processes that exist in higher education and their importance for supporting graduates' employability. It also illustrates the connection between strategic management and quality assurance in the context of higher education.

The term *quality* is highly related to the term *excellence*, which refers to something outstanding that is distinguishable from normal expectations or that has “a quality that surpasses a defined threshold in a particular field” (Brusoni et al. 2014, p. 22). In the context of higher education, due to the prevalence of different viewpoints, there is no single, unique definition for either *quality* or *excellence*. One of the main reasons quality in HEI is so challenging is that *quality* has different meanings for different stakeholders and can be considered a multi-dimensional

construct (Becket & Brookes 2008). In the EHEA, quality assurance is considered a developmental process that involves the use of different approaches and methods (Brusoni et al. 2014, p. 33). This is in line with the findings of Hasan & Al-Kassem (2014) who stress that the definitions of quality faces transitions over time based on changes to customers' needs and demands. It is, therefore, very challenging to reach a consensus among all stakeholders on which measures and indicators are the most important for measuring higher education quality and, consequently, excellence.

Harvey and Green (in Harvey & Knight 1997, p. 2) proposed five different ways of thinking about quality: 1) quality as exceptional, 2) quality as perfection or consistency, 3) quality as fitness for purpose, 4) quality as value for money and 5) quality as transformation. Quality as fitness for purpose is related to the customer and seems to pose certain challenges in the context of higher education, which can be seen as a service system involving different stakeholders and consisting of inputs, transformation processes and outputs. The last of these comprises both tangible and intangible outputs, as well as value additions that also refers to graduate employment (Becket & Brookes 2008). Schindler et al. (2015) provided strategy for defining quality by specifying indicators that reflect desired inputs and outputs which, in the higher education, comprises four main categories: *administrative indicators*, *student support indicators*, *instructional indicators* and *student performance indicators*. All of these will be, to some extent, incorporated in the development of strategic framework and maturity model for supporting higher education graduate employability within the empirical research (**Chapter 6**).

In the European higher education system, quality assurance processes seem to be well developed. The EHEA was established in 2010 on the 10-year anniversary of the Bologna process to ensure a more comparable and compatible system of higher education in Europe through actions related to curriculum reform, quality assurance, recognition, mobility and social dimensions (European Higher Education Area 2010; European Union 2015b). The work of the EHEA is closely connected with the work of the ENQA, which was established in 2000 for the main purpose of promoting quality assurance in European higher education. In some of its latest publications (Bach et al. 2014; Brusoni et al. 2014), the ENQA has stressed the need for improvements in the higher education area, due to the move towards a more knowledge-based economy and a more competitive labour market environment in which higher education graduates search for their first employment. Since 2005, ENQA has published, together with several partner institutions (European Association for Quality Assurance in Higher Education, European Students' Union, European University Association, European Association of

Institutions in Higher Education, Education International, BUSINESSEUROPE, European Quality Assurance Register for Higher Education), several versions of its *Standards and Guidelines for Quality Assurance in the European Higher Education Area* (ESG), the latest of which was released in May 2015 (European Association for Quality Assurance in Higher Education [ENQA] et al. 2015). This document stresses that quality assurance in HEIs should consider the needs and expectations of not only all students, but also other stakeholders and society, through the processes of internal and external quality assurance. The standards for quality assurance proposed by the ENQA are divided into three parts: internal quality assurance, external quality assurance and quality assurance agencies. For the purpose of this thesis, most relevant are the internal quality assurance standards, which include:

- 1) Policy for quality assurance
- 2) Design and approval of programmes
- 3) Student-centred learning, teaching and assessment
- 4) Student admission, progression, recognition and certification
- 5) Teaching staff
- 6) Learning resources and student support
- 7) Information management
- 8) Public information
- 9) On-going monitoring and periodic review of programmes
- 10) Cyclical external quality assurance.

For each of these 10 standards, there are also guidelines for quality assurance, which will be considered as a basis for the development of the strategic framework and maturity model, as elaborated later in *Chapter 6* within the description of key process areas.

3.3.1. Relationship between quality assurance and strategic planning

Quality assurance within higher education can hardly be observed as separate from strategic planning because it is also among most important tasks at the level of higher education governance and leadership. The most direct relationship is evident from the quality assurance cycle, which contains steps equivalent to the strategic planning processes based on the Deming cycle, and which is, in the context of the implementation of quality assurance in vocational education and training institutions, described by the National Commission for Further and Higher Education as follows:

- *Planning*: Set up clear, appropriate and measurable goals and objectives in terms of policies, procedures, tasks and human resources.
- *Implementation*: Establish procedures to ensure the achievement of goals and objectives (e.g. development of partnerships, involvement of stakeholders, allocation of resources and organisational/operational procedures).
- *Evaluation*: Design mechanisms for the evaluation of achievements and outcomes by collecting and processing data in order to make informed assessments.
- *Review*: Develop procedures in order to achieve the targeted outcomes and/or new objectives. After processing feedback, key stakeholders conduct the discussion and analysis in order to devise procedures for change.” (National Commission for Further and Higher Education [NCFHE] 2013, p. 12)

Similarly, the quality assurance framework for further education and work-based learning (Education and Training Inspectorate [ETINI] 2015, p. 2) also proposes a cycle of activities related to self-evaluation and quality improvement planning, which includes the following steps: 1) self-evaluation report and quality improvement plan, 2) implementation of the quality improvement plan, 3) review of progress and effectiveness of actions from previous quality improvement plans and 4) self-evaluation of current provision.

In the context of processes and practices, as the main units of observance within the higher education management system, it can be said that strategic planning following the plan-do-check-act steps also ensures process quality. Therefore, the maturity model developed within this thesis and its incorporated plan-do-check-act steps can be used not only as a strategic framework, but also as a quality assurance tool within HEIs.

To provide a better understanding of the different quality assurance models used in higher education, together with their positive and negative characteristics in the context of ensuring graduates’ employability, the next subchapter presents a short overview of the quality assurance models applied to the higher education system.

3.3.2. Quality models used in higher education

Although there are numerous models and various approaches for quality in higher education, the literature on quality models and definitions of quality in higher education indicates that there is still no consensus concerning the best way to define, manage and measure quality in higher education (Becket & Brookes 2008; Schindler et al. 2015). The latest developments in

quality assurance in the EHEA, as evident from the work of ENQA, indicate that there is still a clear need for the development of higher education quality management systems. Similarly as with the strategic planning, quality assurance processes in higher education also have background in business sector, as evident from a large number of business quality models used for assessing higher education quality. However, some approaches of developing the quality models particularly for higher education can also be found in the literature. The review of 95 articles published in 19 journals between 1996 and 2006 provided by Becket & Brookes (2008; Brookes & Becket 2007) extracted several different quality management models applied in higher education or developed particularly for higher education. Some of the most relevant models in the context of this thesis are described in the following subchapters.

3.3.2.1. Business models for quality assurance used in higher education

Since students' learning is recognized as a main product of HEI, several quality models have been developed that consider students' learning as a central construct, but are still based primarily on business models (Becket & Brookes 2008).

There are several different scales to measure service quality, each of which has a different approach concerning what to measure. For example, SERVPERF considers only the customer's perception of service quality, SERVQUAL compares the customer's perception of the received service with expectations and the evaluated performance scale measures the gap between the actual and ideal performance of a feature (Firdaus 2006a). The SERVQUAL scale, developed by Parasuraman et. al. consists of five dimensions: *reliability*, *empathy*, *responsiveness*, *assurance* and *tangibility* and is a widely used scale for assessing different aspects of higher education quality and students' satisfaction with higher education as a service (Çerri 2012; Clewes 2003; Yousapronpaiboon 2014).

Another group of models used to assess higher education quality are based on total quality management (TQM) procedures, which aim to improve organizational performance and customer satisfaction. In general, the TQM concept considers a long planning period, including the preparation and execution of annual quality programmes and taking into account all organizational procedures and principles and ensuring commitment of all employees, with the final goal of improving organizational performance, accomplishing the desired visions and customer satisfaction levels of HEIs (Asif et al. 2013; Hasan & Al-Kassem 2014; Ho & Wearn 1996). Ho & Wearn (1996) recognized that, by respecting the principles of TQM, an

organization could improve its *effectiveness, efficiency, cohesiveness, flexibility* and *competitiveness*. To assist in the successful accomplishment of goals, critical success factors are crucial. In the literature, different sets of critical success factors and related items in higher education can be found, including management/leadership, customer satisfaction and involvement, process management, human resource management, supplier involvement/partnership, training and learning, strategic quality planning, continuous improvement, benchmarking etc. (Asif et al. 2013). Hasan & Al-Kassem (2014) describe three generic approaches to TQM in higher education, as follows: 1) a customer focus, with a basis in staff development, in order to encourage students' preferences and self-reliance; 2) a staff focus, in order to respect all institutional procedures, rules and priorities; and 3) a focus on service agreement positions. As is the case with the SERVQUAL, one of the most important uses of TQM in education also considers students as the customers of educational services and assesses their satisfaction with educational processes. However, Asif et al. (2013) recognized that certain problems with the implementation of TQM become evident when taking into consideration a broader perspective of HEI customers, including such key stakeholders as employers, supporting institutions and government, but those could be overcome by taking into consideration the views and requirements of different stakeholder groups.

Except the TQM principles, some authors also recognized that the implementation of HEI quality assurance mechanisms in compliance with ISO 9001 standards and *European Foundation for Quality Management (EFQM) Excellence Model*, via their process-based approach to management, is particularly common (Kasperaviciute 2013; Moldovan 2012; Rosa et al. 2012). The EFQM Excellence Model consists of nine criteria divided between enablers (*leadership, people, strategy, partnership & resources* and *processes, products & services*) and results (*people results, customer results, society results* and *business results*), where enablers define what organizations do to achieve excellence and results cover what organizations have already achieved (European Foundation for Quality Management [EFQM] 2015). The EFQM has been applied to a wide range of organizations, including several higher education systems (Arjomandi et al. 2009; Spasos et al. 2008; Tari & Madeleine 2010). Calvo-Mora et al. (2006) analyzed the relationships among EFQM enablers in the context of managing HEIs, thereby splitting process management into educational, research and administrative processes. Findings from research on HEIs' motives to apply EFQM conducted by Kasperaviciute (2013) show that their main external motives are market competitiveness and the satisfaction of stakeholders' needs (one of which also involves producing more qualified employees), while their internal

motives are related to improving performance (e.g. in academic and administrative processes). Based on the EFQM, the results of *Development of Accreditation in Engineering Training and Education* (DAETE) project propose a self-assessment matrix for continuing and professional education, with five levels of evolutionary stages, as follows:

- *Level 1 (no processes)*: Quality depends solely on the individual
- *Level 2 (basic processes)*: Process awakening
- *Level 3 (intermediate processes)*: Vision through processes, professionalization and a guarantee of quality
- *Level 4 (sophisticated processes)*: Systematic assessment and improvement of processes
- *Level 5 (excellent processes)*: Aiming for external excellence (Markkula et al. 2011, pp. 12-13)

This model provides a kind of connection with maturity models because it contains evolutionary stages, which can be understood as maturity levels.

Another leadership and performance management framework adopted in the educational sector is known as the *Baldrige Excellence Framework* (Baldrige Performance Excellence Program 2016). This framework includes the following seven critical areas for performance excellence: 1) leadership, 2) strategy, 3) customers, 4) measurement, analysis and knowledge management, 5) workforce, 6) operations and 7) results.

The balanced scorecard (BSC) is an approach originally proposed by Kaplan and Norton (1992) that allows managers to observe their organizations from four interconnected perspectives: the *customer perspective*, the *financial perspective*, the *innovation and leadership perspective* and the *internal business perspective*. Although it is initially proposed for profit organizations, a BSC for non-profit organizations, including an adaptation for education institutions, has recently been proposed. Al-Hosaini & Sofian (2015) recognized that the purpose of using a BSC for non-profit organizations is in “improving performance effectiveness and enhancing service value for their customers”, while the purpose of using one for profit organizations is mainly to achieve target financial results. A review of BSC usage in HEIs provided by Al-Hosaini & Sofian (2015) shows that the four standard perspectives of the BSC (financial, customer, internal business process and learning and growth) can be applied to HEIs as well, as long as the financial perspective is switched with the customer perspective or another non-

profit perspective, such as *community participation, innovation, strategic partnership and scientific research excellence*. Chalaris and Poustourli (2012) offered another example of the application of the BSC to higher education, with the following modifications from the original BSC: the *financial* perspective is replaced by the *teaching and research work* perspective, the *customer* perspective is replaced by the *students and partners* perspective (the customers of HEIs), the *learning* perspective is replaced by the *human and financial resources* perspective, and the *internal processes* perspective remains the same.

3.3.2.2. Business models for quality assurance adapted for higher education

Though many business models for quality assurance are used in higher education systems, the literature also recognizes the adaptation of some business models to ensure a better fit with the characteristics of these systems.

Taking into account the five gaps recognized in TQM, all relevant stakeholders and the concept of higher education as a service, Ho and Wearn (1996) developed the TQM model of Excellence for higher education (HETQMEX) which is aimed at improving the higher education customer satisfaction. HETQMEX is based on fundamental concepts of service quality: *five-S (structurize, systemize, sanitize, standardize, self-discipline), marketing and education quality control, quality control circles, ISO 9000, total preventive maintenance and TQM*.

Based on SERVPERF and SERVQUAL, Firdaus (2006b) created Higher Education PERFormance-only (HEdPERF), a performance-based measurement scale for assessing specific determinants of service quality within higher education systems. The HEdPERF scale contains the following six dimensions: *non-academic aspects, academic aspects, reputation, access, programme issues and understanding*. The moderating scale of HEdPERF–SERVPERF represents a combination of the dimensions of HEdPERF and SERVPERF and assesses: *non-academic aspects, academic aspects, reliability and empathy* (Firdaus 2006a).

Another model adapted for HEIs, the higher education quality assessment model (HEQAM), consists of eight main objectives: *curriculum, staff, career prospects, infrastructure, e-services, library services, administrative services and location* (Noaman et al. 2013). This last model provides a good connection with the recognized elements relevant for the employability of students.

Finally, a recent review of the different existing HEI quality models and factors influencing service quality in higher education resulted in the proposal of six main factors contributing to perceived service quality in higher education: *physical aspects, reliability, competence, personal interaction, course structure and policy* (Prasad & Jha 2013).

3.4. Chapter relevance

From *Chapter 3*, it can be concluded that a more systematic and strategically oriented approach for enhancing the employability of graduates is needed within HEIs and in relation to relevant stakeholders. Since this need was first recognized from the literature on graduate employability, it was important to observe higher education as a service system with a certain role in society and to elaborate from this point of view.

Quality of higher education is a topic of interest from both the scientific and professional point of view. Although there is an evident work from different authors on the adaptation of existing or the development of new quality assurance models for the system of higher education, some limitation can still be recognized. From the presented short review of different quality models most commonly used in higher education systems, it can be concluded that none is focused particularly on the employability of graduates. Instead, it is clear that, though these models focus on students as customers of higher education systems, they are usually very broad and comprehensive in terms of the HEI elements they cover. Even though there is a recognized need for a student-centred approach in quality assurance, none of the described models put focus on graduate employability as a main outcome of higher education service system; instead, the focus is more on the student learning and teaching experiences and other elements of higher education service quality. Those certainly affect graduate employability potential to some extent but more extensive connections with relevant stakeholders, especially the employers as the main consumers of higher education output, are missing. Moreover, existing models mainly focus on measuring the current service quality, without providing guidelines for potential improvement. However, the ESG is the widely accepted among HEIs in European countries for ensuring their internal and external quality assurance. The limitation of ESG is recognized primary in the lack of more explicit focus on careers services and different extra-curricular activities as important for supporting graduates employability. Moreover, the ESG does not provide description of maturity levels for certain practices that could be used by HEIs as guidelines for improvement.

Therefore, the author recognized a need for development of model with the following characteristics: 1) the model focuses on enhancing graduate employability potential within HEIs, 2) the model consists of HEIs' practices that contribute to the development of graduates' employability skills, 3) the model provides guidelines for improvements of the current levels of institutional capabilities, 4) the model connects processes of strategic planning and quality assurance within HEIs. Based on these assumptions, the author further elaborates the development of a maturity model for supporting graduate employability within HEIs within the scope of this thesis in *Chapter 5*.

Therefore, the main implications of this chapter can be summarized as follows:

- The chapter presents a stakeholder map for the higher education system, along with descriptions for each stakeholder in the context of graduate employability. This stakeholder map provides an important basis for further empirical research within the empirical part of this thesis.
- The chapter referred to the processes of quality assurance and strategic planning, which should be the drivers of actions to improve capabilities of higher education practices that contribute to enhancing graduates' employability.
- This chapter presents the benefits of strategic planning in higher education related to the employability of graduates, together with a brief description of strategic planning processes and related issues in higher education.
- This chapter provides an overview of different models used for quality assurance in higher education and indicates their shortage in focusing to the student employability.

4. GRADUATES' EMPLOYABILITY IN THE FIELD OF ICT

As indicated in the *Introduction*, the strategic framework and maturity model developed within this thesis focus primarily on the education of ICT graduates. After considering employability in general and further narrowing the focus to the role of HEIs in preparing graduates for the world of work in the previous chapters, this chapter elaborates in more detail the issues and challenges related to the education and employability of ICT graduates. First, a short definition of the ICT sector and ICT professionals is provided, as used for the analysis of ICT labour market.

As stated in the IS 2002 report “Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems” (Gorgone et al. 2002, p. 10), the information systems related fields of academic studies have a huge variety of different names, including Information Technology, Information Systems, Information Technology Systems, Computer Information Systems, Management Information Systems, Business Information Systems, Information Management, Informatics, Information Science, Information, etc.

As a result of the European e-skills forum, three main categories of e-skills were defined: ICT practitioners skills, ICT user skills and e-Business skills. The research within this thesis is focused on graduates' possession of *ICT practitioners's skills*, defined as:

...the capabilities required for researching, developing and designing, managing, the producing, consulting, marketing and selling, the integrating, installing and administrating, the maintaining, supporting and service of ICT systems (European Commission 2004, p. 5),

and *e-Business skills* defined as:

...the capabilities needed to exploit opportunities provided by ICT, notably the Internet, to ensure more efficient and effective performance of different types of organisations, to explore possibilities for new ways of conducting business and organisational processes, and to establish new businesses (European Commission 2004, p. 5)

A widely accepted definition of the European *ICT sector*, defined according to the Organisation for Economic Co-operation and Development (OECD), shows that ICT comprises both the sectors of (European Commission 2014, p. 2):

- *ICT manufacturing* (manufacture of electronic components and boards; computers and peripheral equipment, communication equipment, consumer electronics; magnetic and optical media) and
- *ICT services* (wholesale of computers, computer peripheral equipment and software; wholesale of electronic and telecommunications equipment and parts; software publishing; telecommunications; computer programming, consultancy and related activities; data processing, hosting and related activities; web portals; repair of computers and communication equipment).

The term *information industries* can also be found in the analyses provided by OECD, including the manufacture of computer, electronic and optical products and the information and communication services (publishing activities, audiovisual and broadcasting activities, telecommunications, and IT and other information services) (OECD 2015, p. 25). However, it is important to stress that ICT specialists find their employment in many other sectors. The statistics show that 55% of ICT practitioners work in user industries, rather than in the ICT industry itself (European Commission 2012a) and therefore indicate the important contribution of the ICT sector to the overall economic growth.

For the purpose of this thesis, it is important to emphasize the focus on graduates in the field of ICT in the context of the development of a strategic framework and maturity model for supporting graduates' early careers that consider the following:

- Research in higher education practices contributing to the employability of graduates will be conducted at four European HEIs conducting study programmes in the field of ICT;
- The evaluation of the model will be done at four HEIs conducting study programmes in the field of ICT in Croatia and
- Different stakeholders related to HEIs in the field of ICT will be included in certain phases of model design.

To simplify the communication of this study, the abbreviation ICT will be used when referring to the discipline as the focus of this research.

This chapter first presents a short overview of current trends of ICT professionals' employability, followed by the systematic literature review on the education and career development of graduates in the field of ICT. Afterwards, the chapter concludes with an

overview of stressing some specificities of ICT-related programmes and their implications for further empirical research within this thesis.

4.1. Current trends of employability of ICT professionals

To illustrate a complete picture of the problems of supply and demand in the market for ICT graduates, this subchapter provides statistics on and insight into the real market.

The impact of the ICT sector to the development of the global economy is evident from some of the latest statistics. According to OECD statistics, information industries are characterized with productivity levels more than 60% higher than those in the overall business sector, showing higher than average levels of labour productivity across all OECD economies (OECD 2015, p. 37). The EU statistics show that, in 2010, the ICT services sector in Europe (excluding Telecoms) was the only segment recording a structural increase since the beginning of the crisis in 2008 (European Commission 2014). In 2012, the value added from the ICT sector in the EU represented 4.0% of the EU's GDP (European Commission 2014). The importance of ICT lies in the fact that the ICT sector is not only directly responsible for 5% of European GDP, but also has a significant impact on the productivity of almost all other sectors, as well as on the well-being of society in general (European Commission 2010a). On the global level, in many countries, the labour productivity of the ICT sector is higher than that of the overall economy (OECD 2016).

On one hand, the ICT sector has a high level of importance within the total economy, with tendencies toward further growth. This trend implies a need for an increased number of skilled workers who will contribute to further growth. Current data show that the ICT sector represented 2.7% of total EU employment in 2010 and that the share of ICT employment within total employment has remained stable in nearly all European countries (European Commission 2014). The newest data for 2014 show that nearly 8 million persons, representing 3.7% of total employment, were employed in 2014 as ICT specialists in the EU (Eurostat 2016). In general, the share of ICT specialists as a percentage of total EU employment in 2014 (3.7%) was higher than in 2011 (3.2%). A comparison for the years 2010 and 2014 shows growth in the number of ICT specialists in most European countries (Eurostat 2016). The situation in the EU regarding the employment of ICT specialists across the economy in 2014 can be compared to the high employment of ICT specialists across the economy, as a share of total employment, in 2014 worldwide (i.e. 4.66% in Canada, 4.07% in the United States, 3.79% in Australia) (OECD 2016).

While, on one hand, there is a high demand for ICT specialists and a high level of employment of ICT specialists across the economy as a share of total employment, on the other hand, many countries are facing difficulties trying to fill vacancies for jobs requiring ICT specialist skills. According to CEDEFOP, there was a current lack of supply of labour with ICT skills in Europe, with 700,000 uncovered vacancies, and it was expected that 90% of jobs will require some sort of ICT skills by 2015 (European Commission 2016c). At the same time, as the data indicate a growing number of ICT specialists, on average 38% of enterprises in EU with at least 10 employers are also facing challenges finding candidates for those positions (Eurostat 2016). According to the 2015 Talent Shortage Survey (ManpowerGroup 2015), IT jobs represent one of the ten hardest jobs to fill. As reasons for their difficulties in filling jobs, 35% of hiring managers stress a lack of available candidates, 34% report a lack of technical competencies, 22% recognized a lack of experience, and 17% says that a lack of workplace competencies is a barrier for filling the job positions (ManpowerGroup 2015). Presented statistics show that people with the high-level ICT practitioners' and e-business skills are in high demand not only in Europe, but also globally.

The implications for HEIs are most evident from the data indicating that, among ICT specialists, the most desirable are those with higher levels of education. Statistics on the main characteristics of ICT specialists in the EU show that, compared to the total population of employed individuals (32.6%), more ICT specialists (56.5%) have completed tertiary education (Eurostat 2016). This is a very important indicator of the importance of higher education in the preparation of future ICT professionals for employment. Thus, new efforts are needed to build better bridges between education and work.

Current predictions of future trends in ICT professional jobs and demand in Europe from 2012 to 2020 present three different scenarios: the "*Main Forecast Scenario*" predicts a growth from 7.4 million jobs in 2012 to 7.9 million in 2020, the "*Stagnation Scenario*" predicts growth to 7.8 million jobs in 2020, and the third scenario, called "*Disruptive Boost*," predicts an optimistic number of 8.1 million jobs in 2020 (Gareis et al. 2014). In all three cases, the demand potential exceeds the predictions regarding the number of ICT graduates and indicates the importance of education of future ICT professionals. The EU has recognized the lack of ICT skilled workers and the several hundreds of thousands of unfilled ICT-related vacancies as an issue. In response, it launched the *Digital Agenda for Europe* (European Commission 2010a), one of seven flagship initiatives within the Europe 2020 strategy (European Commission 2010c), the main aim of which is to define the key role that ICT will play in the upcoming decade if Europe

wishes to succeed. This initiative is supported by the *Grand Coalition for Digital Jobs 2013-2016*, followed by the *Digital Skills and Jobs Coalition* in 2016 (European Commission 2016b), as well as the *Agenda for New Skills and Jobs* (European Commission 2010b). All of these initiatives focus on the skilled workforce as an essential asset contributing to the success of the Europe 2020 goals. Therefore, they emphasize the need to support activities aimed at preparing young people for their transition to the labour market, better connections between HEIs and industry, development of students entrepreneurial skills etc.

4.2. Systematic literature review on the education and career development of graduates in the field of ICT

As stated by Webster and Watson (2002), an effective literature review is an essential feature of any educational project that facilitates theory development, indicates areas involving extensive research and detects areas of potential research. According to Kitchenham (2004, pp. 1-2), there are several reasons for undertaking a systematic review, which can be, in the context of this thesis, described as follows:

- 1) to provide insight into the current research conducted on the education and career development of graduates in the field of ICT from the early beginnings of the discipline;
- 2) to observe trends during the time, including the content of published papers and clusters of research topics in the field; and
- 3) to provide guidelines for further research and models development, based on the indicated research gaps.

More particularly, the main purpose behind conducting systematic literature review (SLR) is to detect whether there exist certain models applied to the education and career development in the ICT domain that are based on the principles of strategic planning and quality assurance in higher education or there is a need for the development of such models. Additionally, SLR will provide insight to some particularities of the education of future professionals in the ICT domain.

To accomplish this, a systematic literature review, involving an initial pool of 7179 research papers read by title, 761 papers analyzed on the level of the summary and 155 analyzed in depth, was conducted. This comprehensive literature review was conducted according to the general SLR steps proposed by Kitchenham (2004) and guidelines proposed by Webster and Watson (2002). The SLR was conducted during 2014 and 2015, and the methodology and partially

results of the systematic literature review were published in the form of research papers (Pažur Aničić et al. 2017a; 2017b). **Figure 4** presents flowchart of the paper search and data analysis methods within the SLR.

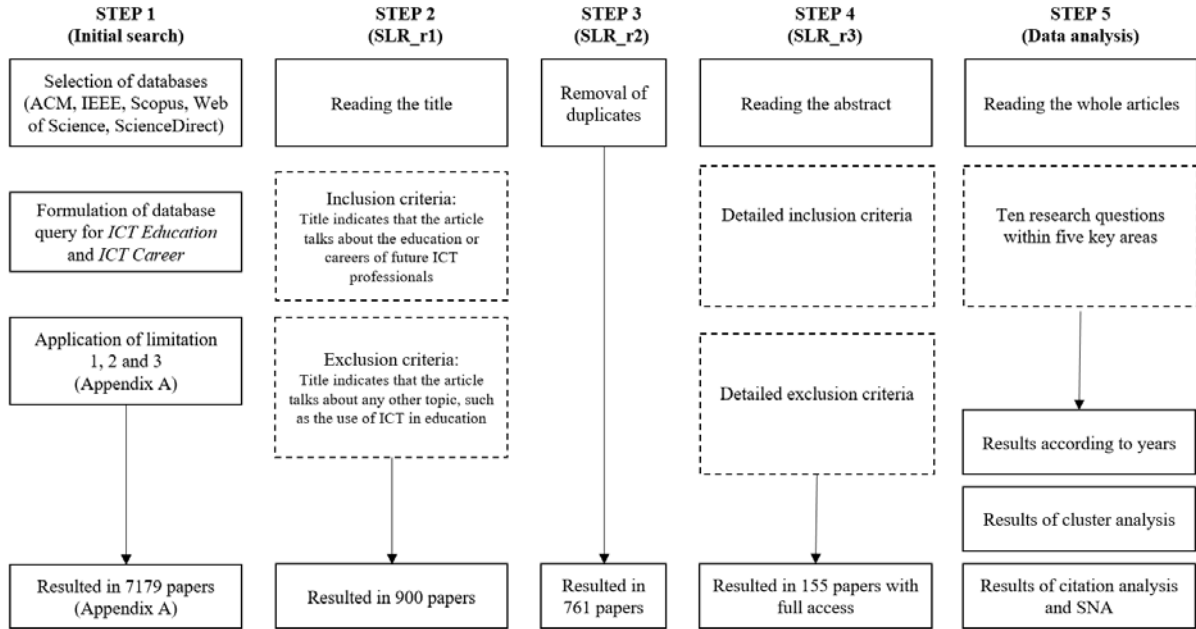


Figure 4. Flowchart of the systematic literature review steps

4.2.1. Literature review procedure

The literature search procedure presented in this subchapter, developed and conducted by the author of this thesis, is described in detail within the paper *Preparing ICT Graduates for Real-World Challenges: Results of a Meta-Analysis* (Pažur Aničić et al. 2017a). In the initial step, the database query was applied within the two databases maintained by the largest professional associations in the research field: the ACM Digital Library and the IEEE Xplore Digital Library and three databases that are considered to contain the most relevant research papers in the spectrum of scientific fields: Scopus, ScienceDirect and Web of Science. Terms used for database query are divided in three categories:

- 1) The terms related to the **ICT domain**, including variations of related terms: *computer science, information system, IS, information technology and IT*.
- 2) The terms related to **education**, including: *education*, graduate*, student*, curricul* and program**
- 3) The terms related to the **future careers and employment positions** of students, as well as to the competences required for these future jobs, including: *job, career, profession*, employ*, skill* and competenc** (Pažur Aničić et al. 2017a).

The initial database query, after all limitations were applied, returned 7179 papers, each of which was read by title. According to title, 900 papers were selected for the second review phase (SLR_r1). To be considered for further analysis, it was important that the title indicates that the paper talks about the education or careers of future ICT professionals. Following the exclusion of identical papers, 761 papers were read by abstract (SLR_r2) and considered for further analysis if the abstract indicated that the paper addresses one of the following topics: *”issues and challenges in ICT education; new approaches/methods in ICT education; required skills and competences of information systems graduates; information science/information technology models and standards; case study including some general methodology or career development of ICT professionals in general”* (Pažur Aničić et al. 2017a). The inclusion criteria for the third review phase resulted in 178 papers to be read in detail (SLR_r3). Of these, the author had access to 155 full papers to be included in the final analysis: 101 within the *ICT Education* dataset and 54 within the *ICT Career* dataset, some of which are identical in both datasets. More detailed search procedure and the numbers of papers included in each stage are presented in **Appendix A**. Finally, the search resulted in two datasets referred later in text as: *ICT Education (101 papers)* and *ICT Career (54 papers)*. Full list of papers included in the final *ICT Education* and *ICT Career* datasets are presented in **Appendix B** and **Appendix C**.

Short review of the history and trends in ICT education research conducted by Pažur Aničić et al. (2017a; 2017b) served as a basis for further analysis of papers included in SLR_r3. This review showed that the literature, with slight variations over the period of time, mainly refers to the following aspects:

- 1) “Changes in curriculum design and delivery;
- 2) Changes in teaching methods;
- 3) Issues in employability of future ICT professionals;
- 4) Importance of skills for future employment and perceived gaps as seen by employers and
- 5) The need for closer cooperation between academia and industry” (Pažur Aničić et al. 2017a)

This short review of the history and trends in ICT education research and the consultations with several researchers helped to construct the final set of 10 research questions (RQs) within five categories/key areas (KA), that guided the content analysis of papers from SLR_r3, as shown in **Table 2**.

Table 2. Research questions for content analysis of papers included in SLR*[source: (Pažur Aničić et al. 2017a), Copyright © IEEE, 2017]*

| Key area | Research question | |
|----------|-------------------|---|
| KA1 | RQ1a) | Does the paper stress the need for changes in curriculum design and delivery? |
| | RQ1b) | Does the paper propose changes in curriculum design and delivery? |
| KA2 | RQ2a) | Does the paper stress the mismatch between learning outcomes of ICT graduates and skills requirements from the labour market? |
| | RQ2b) | Does the paper stress the importance of both technical and soft skills for ICT graduates? |
| KA3 | RQ3a) | Does the paper stress the need for different/new teaching and assessment methods in the education of ICT professionals? |
| | RQ3b) | Does the paper propose different/new teaching and assessment methods in the education of ICT professionals? |
| KA4 | RQ4a) | Does the paper stress the need for improvement in the collaboration with employers within the education of ICT professionals? |
| | RQ4b) | Does the paper propose possible solutions on how to improve the collaboration between ICT academics and ICT practitioners? |
| KA5 | RQ5a) | Does the paper research issues with the employability of ICT graduates, employers' requirements, etc.? |
| | RQ5b) | Does the paper propose possible ways to achieve better employability of ICT graduates? |

In addition to the author of this thesis, another doctoral student in the field of information sciences was engaged in the SLR_r3 phase, in order to avoid excessive bias or subjectivity from the author's point of view. The researchers each read the papers independently and recorded their answers to the 10 research questions in separate Excel tables, supported with the Mendeley reference management system. The hit ratios above 90% for both *ICT Education* and *ICT Career* datasets showed a high level of agreement between the two researchers; however papers with inconsistency in the researchers' observations were reread in order to achieve consensus in the final dataset for the analysis (Pažur Aničić et al. 2017a).

4.2.2. Research results

Research results showing the number of publications and their topic fluctuations over time are presented in the research paper by Pažur Aničić et al. (2017a). They reported a positive trend in the number of papers published between 1990 and 2000 for both *ICT Education* and *ICT Career* papers included in SLR_r1, with the tendency being towards growth after 2000, which indicates the contemporary importance of these topics. The results of citation analysis conducted by Pažur Aničić et al. (2017b) indicate that most highly cited and co-cited papers in *ICT Career* were published in the mid-1990s and those are mostly research papers addressing ICT job skills requirements. On the other hand, the most frequently cited papers in *ICT*

Education were published ten years later by the ICT associations (ACM and IEEE) and are related to recommendations for curriculum development.

Characteristics of two datasets were further described using the social network analysis (SNA) approach (Pažur Aničić et al. 2017b). Taking into consideration only co-citations within networks, the *ICT Career* network is found to be more interconnected. This network comprises only two components of connectivity, one of which contains the majority of the analyzed papers organized around the work of Nelson (1991), Lee et al. (1995) and Todd et al. (1995). On the other hand, the *ICT Education network* consists of eight components of connectivity, but there are no groups of researchers identified; instead, the analysis suggests that six isolated components are the result of authors' self-citations. However, in both networks, there are many independent studies based on divergent research backgrounds. In both datasets there are mostly isolated papers (24 in *ICT Career*, 79 in *ICT Education*) that lack any connections to other papers and only several papers that enjoy prestige which, in this case, is shown by a given paper being referenced in many other papers. Moreover, there are not many papers that cite other papers from the network, which indicates low connection between the researchers in the area. (Pažur Aničić et al. 2017b)

4.2.2.1. Research topics according to the years

For the purpose of this thesis, the author further analyzed the frequency of appearance of each research question and key area in papers included in SLR_r3 dataset over a five-year publication period, with the exception of papers published before 2000, which includes papers from the beginning of the discipline. From **Figure 5**, which is based on the *ICT Education* dataset, it is clear that the representation of papers addressing the needs for curriculum innovations (RQ1a), issues in the employability of ICT graduates (RQ5a) and the importance of both hard and soft skills (RQ2b) largely increased over the observed period. Studies stressing the importance of soft skills were more popular topic in the last period than in earlier periods.

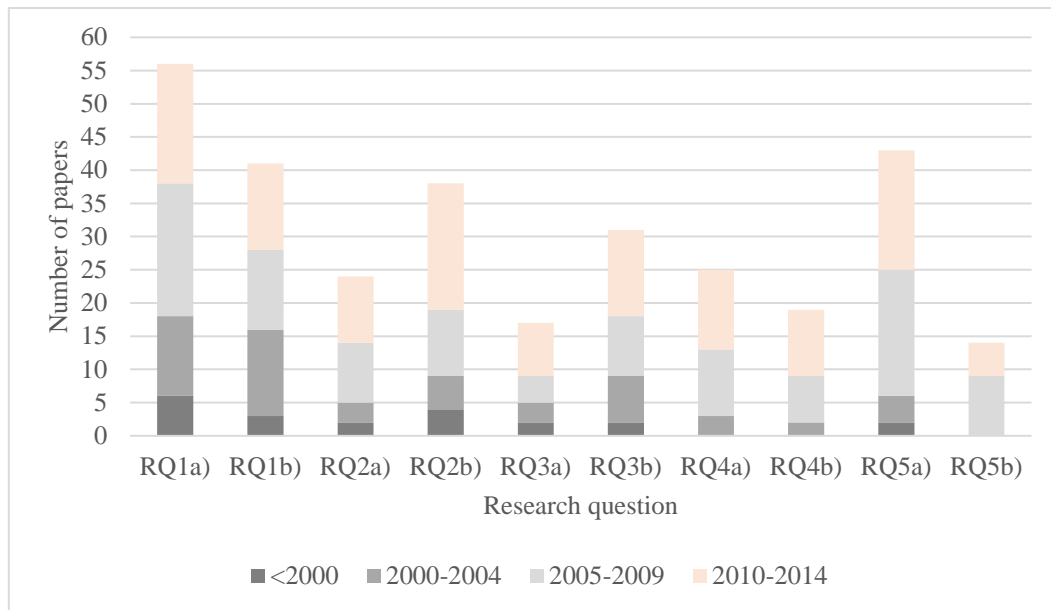


Figure 5. Frequency of research topics within ICT Education according to years

The characteristics of papers related to *ICT Careers* (**Figure 6**) reflect a very high proportion of papers stressing issues related to graduates' employability (RQ5a) and, again, the importance of both hard and soft skills for the entire period (RQ2b). However, few papers offered solutions to enhance graduates' employability (RQ5b), despite a slight positive trend in this context. Except the need for changes in curriculum design and delivery (RQ1a), all other topics are represented in relatively smaller numbers.

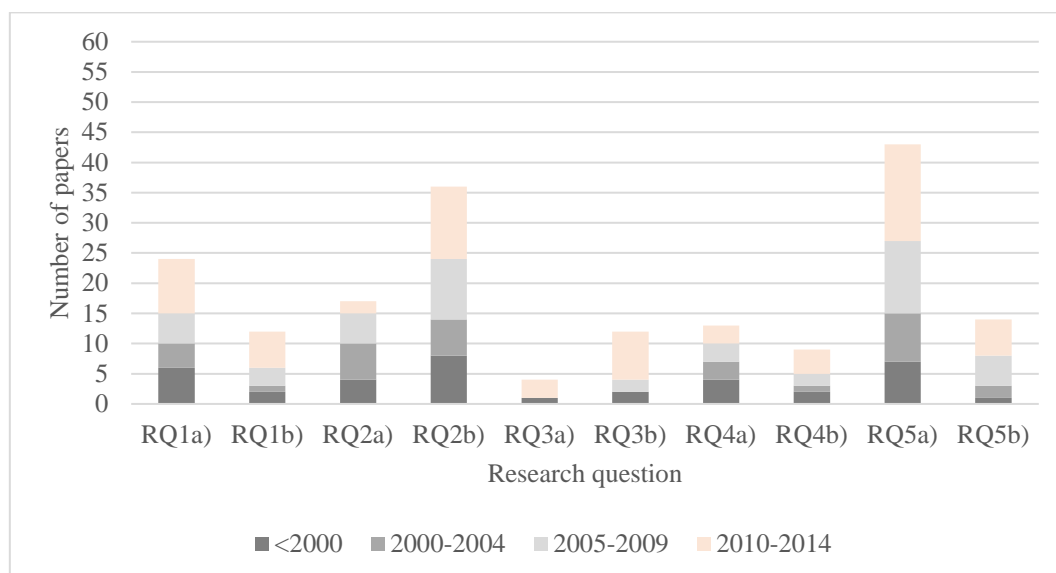


Figure 6. Frequency of research topics within ICT Careers according to years

In general, based on the analysis of the entire set of 155 papers from SLR_r3, Pažur Aničić et al. (2017a) concluded that a big gap was perceived between RQ5a and RQ5b, illustrating that, though many authors recognized issues related to the employment of ICT graduates, few proposed solutions regarding challenges in the area of education and career development of future ICT professionals. Therefore, scientific literature indicates certain mismatches between the output of the higher education system, in terms of ICT graduates and their competences, and the expectations of the global labour market.

4.2.2.2. Clusters of research topics

To get additional insight into the most prevalent topics within two datasets, *cluster analysis* was conducted by applying hierarchical algorithm for binary data in the statistical program R. According to Li (2005), document clustering represents a typical application of binary data clustering, where each document is represented as a binary vector and elements indicate the presence of, in this case, the answer to the research question.

The results of the cluster analysis show the grouping of 10 analyzed RQs in the existing scientific literature. As a result, publications on *ICT Education* were arranged around three clusters. **Table 3** shows the characteristics of each cluster according to the representation of research questions. The characteristics of the clusters can be summarized as follows:

Cluster 1: Teaching method enhancement (29 papers) – The smallest cluster, organized around papers proposing new teaching methods that lack stronger connections to the other two clusters.

Cluster 2: Holistic approach to employability enhancement (36 papers) – Papers advocating a holistic approach to change in the education of ICT professionals, with an emphasis on the employability of ICT graduates, which is strongly connected with recognized needs for changes in curricula and better collaboration between academia and industry. The importance of both hard and soft skills and mismatches between observed and expected skills are represented in more than half the papers in this cluster.

Cluster 3: Changes in curriculum and its delivery (36 papers) – This cluster is strongly connected with *Cluster 2* because it stresses the need for changes in curricula; however, papers in this cluster place more emphasis on solutions to problems.

Table 3. Representation of research topics within *ICT Education* clusters (in %)

| Cluster | Research question | | | | | | | | | |
|-----------|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | RQ1a | RQ1b | RQ2a | RQ2b | RQ3a | RQ3b | RQ4a | RQ4b | RQ5a | RQ5b |
| Cluster 1 | 17,24 | 24,14 | 3,45 | 31,03 | 37,93 | 86,21 | 6,90 | 10,34 | 0,00 | 10,34 |
| Cluster 2 | 63,89 | 11,11 | 55,56 | 58,33 | 11,11 | 16,67 | 63,89 | 41,67 | 88,89 | 30,56 |
| Cluster 3 | 77,78 | 83,33 | 8,33 | 22,22 | 5,56 | 0,00 | 0,00 | 2,78 | 30,56 | 0,00 |

Within the literature related to *ICT Careers*, three clusters are recognized. The overarching issue in all three clusters is graduates' employability (**Table 4**).

Cluster 1: Holistic approach to employability enhancement (19 papers) – These papers are focused primarily on issues related to the employability of graduates, which is closely related to the mismatch between graduates' expected and observed skills. The changes in curriculum design and delivery, as well connections to employers, are also given significant attention. The papers in this cluster also propose possible solutions for reducing problems of employability.

Cluster 2: Issue in graduates' employability (20 papers) – In addition to recognizing issues related to graduates' employability and future career development, these papers mostly emphasize the importance of both hard and soft skills and the need for curriculum changes, but also propose improvements in teaching methods.

Cluster 3: Employability and soft skills enhancement (15 papers) – All of the papers in this cluster stress issues related to graduates' employability, and 60% connect this employability with the importance of both hard and soft skills. Interestingly, the papers in this cluster do not address any other research question, except the need for better collaboration between academia and industry.

Table 4. Representation of research topics within *ICT Career* clusters (in %)

| Cluster | Research question | | | | | | | | | |
|-----------|-------------------|-------|-------|-------|-------|-------|-------|-------|--------|-------|
| | RQ1a | RQ1b | RQ2a | RQ2b | RQ3a | RQ3b | RQ4a | RQ4b | RQ5a | RQ5b |
| Cluster 1 | 42,11 | 42,11 | 57,89 | 47,37 | 0,00 | 10,53 | 42,11 | 47,37 | 78,95 | 68,42 |
| Cluster 2 | 80,00 | 20,00 | 30,00 | 90,00 | 20,00 | 50,00 | 15,00 | 0,00 | 65,00 | 5,00 |
| Cluster 3 | 0,00 | 0,00 | 0,00 | 60,00 | 0,00 | 0,00 | 13,33 | 0,00 | 100,00 | 0,00 |

It is obvious that both cases yield very similar clustering, with *Holistic approach to employability enhancement* being the common cluster. The results of the clustering for both the *ICT Career* and *ICT Education* sets of papers are presented in the work of Pažur Aničić et al. (2017a). These results follow four clusters, with the relation to the presented clusters for *ICT education* and *ICT career* datasets as follows:

Cluster 1: Employability and soft skills enhancement (14 papers) – This is the smallest cluster in this clustering, and it is almost identical to *Cluster 3* within *ICT Careers*. It includes papers stressing the issues of graduates' employability and the importance of both soft and hard skills.

Cluster 2: Holistic approach to employability enhancement (54 papers) – This is the largest cluster, representing the combination of *Cluster 2* from *ICT Education* and *Cluster 1* from *ICT Career*. The papers in this cluster stress the need for changes to all the observed segments, except teaching methods; however, they rarely propose any solutions.

Cluster 3 (37 papers) Teaching method enhancement – This cluster is similar to *Cluster 1* within *ICT Education*; they are both focused on new teaching methods within the education of ICT professionals.

Cluster 4 (37 papers) Changes in curriculum and its delivery – This cluster is almost identical to *Cluster 3* within *ICT Education*. Papers within this cluster focus on curricula, and they both stress the need for change and propose concrete plans for curricula and delivery.

The four final clusters show the correlations among papers related to the education and career development of future ICT professionals, indicating various connections between the two topics. The only cluster that is not represented is *Cluster 2* from *ICT Career*. This is the cluster called *Issues in graduates' employability*, and it is connected to the other four clusters through the recognized problem of graduates' employability. The final *Cluster 2 (Holistic approach to employability enhancement)* represents the strongest connection between the two research areas.

4.2.3. Main conclusions from the systematic literature review

The systematic literature review resulted in several outputs relevant to the research area of the education and career development of future professionals in the field of ICT, which provide a good basis for further research within this thesis. The conclusions presented in this subchapter are in line with those presented in the work of Pažur Aničić et al. (2017a; 2017b).

The most important result for the further development of strategic framework and maturity model within this thesis is the evident gap between the large quantity of papers stressing the issues in the employability of ICT graduates and employers' requirements (RQ5a) and a

substantially smaller number of papers that propose possible ways to improve the employability of ICT professionals (RQ5b), both within the *ICT Education* and *ICT Career* dataset. Moreover, the content analysis of the research papers included in this analysis shows that most are based on individual case studies or examples of good practice, with very few providing a broader perspective of the identified problem area or the development of comprehensive models as the one developed within this research. This is also evident from the citation analysis, which extracted only a few well-cited papers that provided fundamental results based on comprehensive research. General conclusion is that, within the existing scientific literature on the education and career development of ICT graduates, the model that focuses on supporting graduate employability within HEIs and incorporates principles of strategic planning and quality assurance was not found.

The nearly equal representation of the 10 observed research topics across the *ICT Education* and *ICT Career* sets of papers indicates that the development of future ICT professional education in relation to the skills desired by employers should integrate employability issues within the formal education process. These findings indicate the need for a strategic approach within HEIs to connect all of the relevant elements of education and employability and include relevant stakeholders in the process of strategic planning and quality assurance (Pažur Aničić et al. 2017a).

Finally, it is evident that a comprehensive theoretical framework should be developed to both enable more structured further research and guide HEIs in designing curricula, services and strategies for the employability of ICT graduates. Within this thesis, that will be achieved through the development of a strategic framework and maturity model for supporting graduates' early careers within HEIs in the field of ICT. Therefore, the results of the systematic literature review contribute to the first step of maturity model design *1) Identify a new need or opportunity*.

Additional detailed conclusions and implications for further research, based on the systematic literature review, can be found in the related work of Pažur Aničić et al. (2017a; 2017b). The results of the systematic literature review serve to further elaborate the particularities of the employability characteristics of ICT graduates, as provided in the following subchapter.

4.3. Particularities of education and career development of ICT graduates

In line with the results of systematic literature review and the current trends on the ICT labour market, this subchapter discusses particularities of the education and career development of graduates in the field of ICT, and elaborates them in the context of further research according to the recognized five key process areas: curriculum design and delivery, knowledge and skills of future ICT professionals, teaching methods, collaboration between academia and industry and future employment and career development in the labour market (Pažur Aničić et al. 2017a).

The curriculum design and delivery of ICT-related programmes is given a strong emphasise within the analyzed scientific literature. One of the particularities of the observed educational field is its connection to a very dynamic labour market and the requirements of the ICT industry. The industry in which ICT graduates seeks their first employment changes rapidly and there is a challenge for HEIs providing study programmes in the field of ICT to respond to these changes by providing students with up-to-date curriculum content. The new trends in the emerging field of ICT affect changes in the education of future ICT professionals, including new emerging topics into curriculum. This is among the biggest challenges in education of future ICT professionals because changes in curriculum require certain time and efforts from the higher education management and teaching staff. The endeavours from the ACM professional and scientific computing societies on computing curricula resulted in several curricula recommendations over the years, for the areas including Computer Engineering, Computer Science, Information Systems, Information Technology and Software Engineering (Association for Computing Machinery [ACM] 2017). Continuous updates of those recommendations indicate the need for the constant revisions of ICT-related curricula, with the special emphasize on the monitoring of its relevance and compliance with the changes in the external environment, evident mostly in the requirements of the ICT industry. In that process, communication with relevant external stakeholders, especially with the industry representatives and professional organizations, should be done. As the curriculum design and development process requires a certain time from the planning phase to its implementation, it should consider the predicted changes in the ICT industry already in the planning phase. Namely, graduates starting a certain study programme should be equipped with the skills and knowledge that would be relevant on the labour market in several years after they enter the university. Therefore, in the process of planning a new curriculum it might be helpful to use the predictions about future

trends in ICT, using for example the *Gartner Hype Cycle* methodology that provides an overview of how certain technology or their application will evolve over time (Gartner 2017).

Another important attribute of an ICT curriculum is its practicality, which considers that the skills and knowledge students acquire during their studies are relevant for their future jobs. Except the curriculum content, which should be up-to-date with the newest developments in the study field, the curriculum practicality should be supported with teaching methods that contribute to the development of the desired skills. The systematic literature review showed that the most cited papers included in SLR are comprehensive studies related to knowledge and skills that future information systems professionals should possess to successfully perform their jobs (Cheney et al. 1990; Lee et al. 1995; Nelson 1991; Todd et al. 1995). As evident from the conducted systematic literature review, and supported with some newest research on the topic (Pažur Aničić & Arbanas 2015), both hard and soft skills are desired by the prospective employers of ICT graduates. For the development of those skills within the curriculum, it is not important only to address them in learning outcomes, but also to support their development using the right learning and teaching methods, such as project-based learning (Fincher & Petre 1998), peer learning (Rice et al. 1999), active learning (Pigford 2001; Timmerman & Lingard 2003), team learning (Neufeld & Haggerty 2001), studio-based teaching and learning (Carbone & Sheard 2002; Simpson et al. 2003), etc. To ensure that learning outcomes address relevant knowledge and skills, it is important to include employers and other stakeholders in the process of curriculum design and to take into account relevant initiatives, such as the European e-Competence Framework (European Committee for Standardization [CEN] 2014), Skills Framework for the Information Age (SFIA), relevant generic skills and the already mentioned work of professional associations, such as the IEEE and the ACM.

To overcome the indicated shortage of ICT professionals, various types of university-business cooperation were already recognized as important for the preparation of higher education graduates for future employment, from both the scientific literature and results of several projects. *Global graduate employability research* supports these findings, with 74% of students, 74% of graduates and 87% of employers indicating work experience and internships as the most desirable employability strategies (Kinash et al. 2014, p. 21). The same study stresses internships and employment during college as activities contributing to graduates' employability potential. University-business cooperation also consider employers' involvement in curriculum delivery, such as through the invited lectures, student projects or thesis done in the cooperation with industry. This might be achieved in different ways, either by providing

mentors from industry for students' projects and thesis, or by allowing students to work on a real industry projects during their studies. The importance of better connection between higher education and the world of work in several aspects – research & development and commercialisation of its results, mobility of students and academics, curriculum development and delivery, entrepreneurship, governance and lifelong learning - is also evident from the *University-Business Cooperation Ecosystem Model* (Davey et al. 2011).

In the last few years, there have also been some emerging topics not covered by the research questions within the conducted systematic literature review, such as entrepreneurship and entrepreneurial spirit among ICT graduates (Ali & Aliyar 2012; Doboli et al. 2010; Pardede & Lyons 2012). These topics are in line with the latest trends in the dynamic ICT market, as evidenced by the number of start-up companies representing innovative small or medium enterprises, usually based on ICT. Accordingly, the role of universities as incubators for start-ups has also raised questions.

Literature also indicates that ICT graduates are lacking the information about possible career opportunities and career paths during their studies (Calitz et al. 2011). This can be overcome by the development of career services within HEIs that provide a wide range of career-related activities, such as providing information on job opportunities and labour market, helping students to prepare themselves for the presentation in front of potential employers by providing services of reviewing and correcting job applications, preparation for the interviews, creating student portfolios etc.

As the idea behind this thesis is to provide a strategic framework with an accompanying maturity model applicable to different types of ICT-related study programmes, it is important to emphasize that, for example, the content of ICT curriculum will not be examined in detail. Instead, the emphasis will be on practices applicable to HEIs of different characteristics which provide study programmes related to different areas of ICT. Taking into account this focus to practices, it is very likely that the final model will also contain a significant number of practices applicable to other study fields, although the focus of the research is on HEIs in the field of ICT. This can be further elaborated with the importance and reality of the above-mentioned topics evident from the research findings of the relevant projects related to graduates' employability and the implications of policy documents referring to education in general provided in **Chapter 2**. From those, the need for the integration of new active learning and teaching modes into the curriculum, enhancing the development of both professional and

generic skills, employers' inclusion in study programmes (e.g. through internships, guest lectures or employer involvement in curriculum design), the acquisition of relevant work experience during higher education, empowering university-business cooperation on a more formal basis etc., were recognized as key factors for generating students competences. From the above insights, it can be concluded that there are some common challenges facing both education in general and ICT education in particular.

4.4. Chapter relevance

While *Chapter 2* and *Chapter 3* focus on different aspects of graduate employability in general, this chapter emphasizes the employability of graduates in the field of ICT and provides the following contributions:

- It provides an understanding of the ICT discipline;
- It explains the focus of this research on the field of ICT;
- It provides insight into current trends related to employability of ICT professionals, indicating a need to better prepare ICT graduates within HEIs for their future careers;
- It provides insight into the scientific literature related to the education and career development of future ICT professionals through a comprehensive and systematic literature review of the current state of the art. This literature review indicates a need for a more holistic approach to providing better institutional support to enhance graduates' employability.

Overall, it can be concluded that this chapter, in accordance with the conclusions of the previous two chapters, indicates the need for better preparation of graduates for the world of work within HEIs, particularly in the field of ICT. This reinforces the author's thesis concerning the need for a comprehensive model to help HEIs provide adequate support for their graduates during their early career development. *Chapter 5*, therefore, introduces the concept of maturity models, which have been recognized as appropriate models for the proposed problem.

5. MATURITY MODELS AS STRATEGIC MANAGEMENT TOOLS

To introduce the chapter about maturity models, it is important to elaborate which types of models have been observed and why maturity models are considered the most suitable for the observed problem.

First, *Chapter 2.1.2* introduced and discussed the development and use of different employability and career-related models. These models, along with the definitions of terms related to employability and employment, indicated the crucial role of HEIs in preparing graduates for their future careers and served as a basis for elaborating the focus of this research to the institutional level.

Once the research's focus on HEIs was set, it was important to identify existing models and the role of graduate employability within these models. In the literature on higher education, the most popular and well-developed models are related to quality in higher education. *Chapter 3.3.2* reviewed the most common models for quality assurance within HEIs, including both the business models used within HEIs and models adapted or developed particularly for HEIs. The review concluded that existing models are usually very broad and comprehensive in terms of HEI elements, but that none focuses specifically on graduates' employability.

Finally, one of the reasons for conducting a systematic literature review on the education and career development of graduates within the field of ICT, as presented in *Chapter 4*, was to determine the existence of other types of comprehensive models that could be applied to HEIs. The results show that there are no existing comprehensive models, but that there is a need for a more holistic and strategic approach to enhancing graduates' employability within HEIs.

The primary conclusion of all of these analyses is that there is a clear need for a model to not only identify the elements important for enhancing graduates' employability and illustrate their relationships, but also to provide guidelines for enhancing graduates' employability in the future.

To address the existing research gaps identified through the literature review, a maturity model was determined to be the most suitable model for two main reasons: 1) the subject of this research are HEIs's practices contributing to graduate employability and 2) maturity model focuses primarily on organizational processes and practices. The first and the most popular

model of this kind was the Capability Maturity Model for Software (CMM) launched by the Software Engineering Institute, which is a roadmap for the improvement of process capabilities and a tool for benchmarking (Paulk, Curtis, et al. 1993; Paulk, Weber, et al. 1993). Since then, maturity models have been proposed by researchers in several different domains, such as project management (Andersen & Jessen 2003; González et al. 2007), IT management (Becker et al. 2009; Carcary 2011), knowledge management (Kulkarni & Freeze 2004), business process management (Röglinger et al. 2012), etc. The application of maturity models in the context of educational organizations can also be found, related to project management (Demir & Kocabaş 2010) and e-learning (Marshall & Mitchell 2002). However, it is important to stress that the literature on maturity models focuses primarily on the area of software process improvements and that examples of the application of maturity models to HEIs are rare. The review of educational maturity models provided by Duarte & Martins (2013) recognized nine educational maturity models, none of which is focused on graduate employability. Based on the discussion of their strengths and weaknesses, the authors concluded that the existing educational maturity models have too broad spectrum, and do not suggest real higher educational practices within process areas; therefore, they recognized the need for enhancing the provision of educational maturity models.

The author of a comprehensive e-Learning Maturity Model (eMM) stressed that, in the complex area of e-learning, the assessment of capability involves “reducing large amounts of detail into a broader overview that supports management decision making and strategic planning” (Marshall 2006b, p. 9). By providing a roadmap to improve process capabilities and serve as a tool for benchmarking, maturity models show a common attribute with the strategic framework, as defined in *Chapter 3*. This direct connection between maturity models and strategic planning supports the author’s intention to develop a maturity model for supporting the early careers of higher education graduates based on the proposed strategic framework.

This chapter has four main goals: 1) to provide a definition of maturity models, 2) to describe the main elements of maturity models 3) to elaborate the design methodology for developing maturity models and 4) to provide a framework for the development of a strategic framework and accompanying maturity model for supporting graduates early careers.

5.1. Definition of maturity models

This subchapter brings definitions of maturity models based on the literature. Maturity models can be classified as theoretical conceptual models with a primary purpose of providing guidelines for organizations on how their capabilities evolve and transform from an initial stage, through several stages of maturity, to the desired final maturity stage (Mettler & Rohner 2009; Mettler 2010; Pöppelbuß & Röglinger 2011). According to Mettler & Rohner (2009), the term maturity itself implies “an evolutionary progress in the demonstration of specific ability or in the accomplishment of a target from an initial to a desired or normally occurring end stage”.

The categorization of maturity models in the context of design science is an important topic of discussion. On one hand, maturity models are seen as an output of the design science process, since they are models that provide an answer to the question “what are the elements of an ideal solution?” in the form of maturity levels descriptions. On the other hand, maturity models can be used as a method as they involve answering the question “how can the ideal solution be achieved?” and provide guidelines for performing a certain task (March & Smith 1995; Mettler & Rohner 2009; Mettler 2010; Pöppelbuß & Röglinger 2011).

Typically, maturity models serve three main purposes, as described by Pöppelbuß & Röglinger (2011):

- *Descriptive:* The main purpose is the as-is assessment of the current level of organizational capabilities with respect to given criteria. The results can be reported to internal and external stakeholders.
- *Prescriptive:* The maturity model indicates desirable maturity levels and provides guidelines on improvements to certain process capabilities.
- *Comparative:* Maturity models allow for internal and external benchmarking and, therefore, can be used for comparative purposes.

The system of higher education can be said to be an organization for which a maturity model may be useful instrument for not only balancing internal needs, but also adapting to environment circumstances (Mettler & Rohner 2009). From another point of view, higher education can be seen as a service system comprising all system elements, including government, industry, regulatory and supporting institutions and alumni as the external stakeholders and higher education managers, teaching staff, non-teaching staff and students as the internal stakeholders of the higher education system, which were described in more detail

in *Chapter 3*. In this sense, the subject of this research is the maturity of HEIs to support graduates in their early career development. According to their characteristics, this research proposes that maturity models can be used as a strategic framework for supporting and enhancing graduates' employability within HEIs.

5.2. Maturity model elements

Usually, maturity models refer to processes. However, Mettler & Rohner (2009) recognized that assessing the maturity of organizational design requires not only the process perspective, but also the perspectives of people and objects. Such maturity models are, thus, multi-dimensional. Generally, Mettler (2010) recognized the following basic elements of maturity models:

- a number of maturity levels (usually three to six),
- a descriptor for each maturity level,
- a generic description or summary of the characteristics of each maturity level as a whole,
- a number of dimensions (i.e. key process areas),
- a number of elements (i.e. processes and practices) for each dimension and
- a description of each element as it might be performed at each level of maturity.

For better understanding of a logic behind maturity models and the connections between the main maturity model elements, the hierarchical structure of the CMM can be described as following (Paulk, Curtis, et al. 1993, p. 29):

- *Maturity levels* indicate process capabilities and contain key process areas;
- *Key process areas* achieve certain goals and are organized by common features;
- *Common features* address implementation or institutionalization and contain key practices and
- *Key practices* describe infrastructure or activities.

The literature introduces several different types of maturity models, all of which have adapted maturity model elements according to their specific situations. **Table 5** presents a brief overview of some existing models and their main elements.

Table 5. Comparison of different maturity models' elements

| Maturity model | Year | Elements | Reference |
|--|-------------|--|---|
| Capability Maturity Model (CMM) | 1993 | Maturity levels (initial, repeatable, defined, managed, optimizing) Key process areas (18 key process areas) Key Practices within key process areas Common Features (commitment to perform, ability to perform, activities performed, measurement and analysis, verifying implementation) | (Paulk, Curtis, et al. 1993; Paulk, Weber, et al. 1993) |
| Measuring project maturity in organisations | 2003 | Ladder of maturity (project, programs, portfolio management) Dimension of maturity (attitude, knowledge, action) Measurement scale (1-dissagree completely, 6-agree completely) | (Andersen & Jessen 2003) |
| IT Capability Maturity Framework | 2011 | Maturity levels (initial, basic, intermediate, advanced, optimized) Capability interlinked layers (strategy, macro and micro layer) Critical processes (for each of the layers) | (Carcary 2011) |
| Knowledge Management Capability Assessment Model | 2004 | Capability levels (difficult/not possible, possible, encouraged, enabled/practiced, managed, continuously improved) Knowledge capability areas (expertise, lessons learned, knowledge documents, data) General goals for each capability level translated into general goals for each knowledge capability area (related to behavior, and infrastructure) Specific practices mapped to specific goals | (Kulkarni & Freeze 2004) |
| Situational Maturity Model (illustrated on the example of hospital supplier relationship management) | 2009 | Maturity stages (three different 5-point Likert type scales, one for each maturity dimension) Domain specific dimensions (strategy, tactics, operations) Maturity dimensions (objects, processes, people) Assessment items (for all the combinations of two dimensions) | (Mettler & Rohner 2009) |
| E-learning Maturity Model Version Two (eMM) | 2006 | Capability assessment criteria (not assessed, not adequate, partially adequate, largely adequate, fully adequate) Process categories (learning, development, support, evaluation, organization) Processes (10 within learning, 7 within development, 6 within support, 3 within evaluation and 9 within organization) Dimensions of process capability (delivery, planning, definition, management, optimization) | (Marshall 2006a; Marshall 2006b) |

For the purposes of the maturity model for supporting graduates' early careers that is developed within the scope of this research, the most relevant existing model is the eMM, since its application also falls within HEIs. Since this e-learning maturity model is based on the CMM methodology, the maturity model for supporting graduates' early careers will also follow CMM

principles. In general, most maturity models are based on the CMM, since it is among the first and the most comprehensive maturity models; however, all have specific characteristics related to their referenced types of capabilities.

Within the scope of this research, the maturity model for supporting graduates' early careers is developed from the beginning, and existing maturity models serve only to provide guidelines and a framework for how to design certain elements.

5.3. Maturity model design methodology

The development of maturity models in the literature is associated with design science, which is a problem-solving paradigm focused on designing and evaluating innovative artefacts to solve real-world problems, taking into account both the societal relevance of the problem and the rigor requirements based in the existing knowledge (Carcary 2011; Hevner et al. 2004; March & Smith 1995).

Although numerous examples of maturity models exist in the literature, there is little literature on how to build maturity models. Pöppelbuß and Röglinger (2011) proposed a framework of general design principles for maturity models organized into three groups, depending on their *basic* (describing stages and maturation paths), *descriptive* (a diagnostic tool applied for the assessment of as-is capabilities of an entity with respect to given criteria) or *prescriptive* (indicating how to identify desirable maturity levels and providing guidelines for the improvements) purpose of use.

In line with Hevner et al.'s (2004) principles of design science, Becker et al. (2009) proposed a procedure model for developing maturity models using the following stages, some of which are repeatable: 1) problem definition, 2) comparison of existing maturity models, 3) determination of development strategy, 4) iterative maturity model development, 5) conception of transfer and evaluation, 6) implementation of transfer media and 7) evaluation of the maturity model. Based on Hevner et al.'s (2004) seven guidelines for design science, Becker et al. (2009) also provided requirements for the development of maturity models (shown in **Table 6**).

Mettler (2010) provided an overview of three different maturity model design methodologies and proposed a five-step design methodology to develop the maturity model that is also found to be most appropriate for application within this research: 1) identify need or new opportunity, 2) define scope, 3) design model, 4) evaluate design and 5) reflect evolution.

Since the research within this thesis follows the design science paradigm, it is important to connect all requirements for the development of the maturity model, as well as the steps in the development of the maturity model, with the principles of design science. **Table 6** connects these ideas and provides a short description and identification of the methods that were used in each step of the maturity model design, thus providing a framework for development of maturity model for supporting graduates' early careers.

Table 6. A framework for the development of maturity model for supporting graduates' early careers
[according to (Becker et al. 2009; Hevner et al. 2004; Mettler 2010)]

| Guidelines for design science in Information Systems Research (Hevner et al. 2004) | Requirements for the development of maturity models (Becker et al. 2009) | Elements of the design process of maturity models (Mettler 2010) | Description | Methods used in the development of maturity model for supporting graduates' early careers |
|---|---|--|--|---|
| Guideline 1: Design as an artifact | Requirement 1: Comparison with existing maturity models | Step 1: Identify need or new opportunity | The purpose of this step is to ensure that no artefact is developed for the same domain. | Review of relevant strategic documents, projects and scientific papers related to graduate employability, strategic management and quality assurance in higher education Systematic literature review of papers on ICT education and career development Review of maturity models and methodology for their development |
| Guideline 2: Problem relevance | Requirement 5: Identification of problem relevance Requirement 6: Problem definition | Step 1: Identify need or new opportunity Step 2: Define scope | The research problem should be both innovative and relevant to researchers and/or practitioners. The application domain and intended benefits of the maturity model should be determined prior to the design. | Review of relevant strategic documents and projects related to graduate employability in higher education Content analysis of HEIs' strategic documents and other relevant literature |
| Guideline 3: Design evaluation | Requirement 3: Evaluation | Step 4: Evaluate design | A multi-methodological procedure should be used for the evaluation of model validity (both content and construct) and reliability. | A content validity check via student and expert evaluations (calculated content validity ratio (CVR) and average values) and focus groups with stakeholders A construct validity check via Q-sorting, (calculated Fleiss' Kappa and hit ratio) |

| | | | | |
|---|---|---|---|---|
| | | | | A reliability check via the testing of the model at four HEIs in Croatia |
| Guideline 4: Research contributions | Requirement 1: Comparison with existing maturity models | Step 1: Identify need or new opportunity | Scientific and societal contributions should be identified. | Contributions to the field of supporting graduates' early careers within HEIs from the scientific and the societal perspective should be achieved. |
| Guideline 5: Research rigor | Requirement 4: Multi-methodological procedure | Step 3: Design model | A variety of appropriate research methods should be applied. | Rigor is evident from the use of such theoretical knowledge as scientific literature and expert knowledge in different phases of the model design. |
| Guideline 6: Design as a search process | Requirement 2: Iterative procedure Requirement 3: Evaluation | Step 3: Design model Step 4: Evaluate design | Both the design and evaluation steps should be performed iteratively. | Different methods are combined in the process of the model design: a systematic literature review, case study research, focus groups with experts and higher education stakeholders, etc. The evaluation of model design is done in two phases: a validity check and a reliability check. The description of maturity levels as a part of model design phase is done after the model validity is ensured. |
| Guideline 7: Communication of research | Requirement 7: Target publication of results | Step 5: Reflect evolution | Research results should be communicated to the appropriate audience (scientific community, HEIs, employers, professional organizations, etc.) | The research results published in the form of a PhD dissertation, project outcomes, conferences and several research papers. |

5.4. Maturity model framework for supporting higher education graduates' early careers

Based on the introduction to maturity models provided in the previous subchapters, this subchapter presents a framework for the maturity model for supporting graduates' early careers within HEIs, which was initially presented in the paper of Pažur Aničić and Divjak (2015). This framework describes the basic elements and overall structure of the maturity model and introduces the development of the final maturity model, which is described in detail in *Chapter 6 (Empirical research)*.

5.4.1. Elements of maturity model for supporting graduates' early careers

This subchapter first describes basic elements of maturity model for supporting higher education graduates early careers, recognized as *key process areas, practices, dimensions of capability and capability assessment criteria*.

5.4.1.1. Key process areas

Institutional capabilities are usually divided into several main categories, which are also called process areas. In the context of the strategic framework and maturity model for supporting graduates' early careers, the *key process areas* can be defined, based on the definitions proposed for CMM by Paulk, Weber, et al. (1993), as building blocks indicating the main areas on which HEIs should focus in order to improve their support for enhancing graduates' employability, such as strategy development, quality assurance, curriculum design and delivery, student support services, relationships with alumni, provision of extra-curricular activities for students, etc. Each process area can contain several *processes*, which, according to Marshall (2006a, p.3; 2006b, p. 9) define "an aspect of the overall ability of institutions to perform well in the given process area", thus breaking down the complex area of institutional work to smaller parts that can be assessed separately. In the context of HEIs, the identification of key process areas is not straightforward, since many processes are, to some degree, interrelated.

5.4.1.2. Practices

At a lower level of observance, each process is broken down within each dimension into *practices* that describe how the desired process outcomes might be achieved by an institution. These practices could be either essential for the successful achievement of a certain process or simply useful in supporting the outcomes of a particular process (Marshall 2006a, p. 5). For the

purposes of this research, no distinction will be made between the essential and useful practices; instead, all relevant practices for supporting graduates' early careers within HEIs will be detected. Examples of such practices include HEIs' ability to collect and use information on the employability of graduates, provide career services for students, incorporate work-based activities and internships within their curricula, etc.

5.4.1.3. Dimensions of capability

The main concept of each maturity model is *capability*. In this context, *capability* describes the ability of a HEI to ensure that the education and services it provides to students support and enhance the development of their employability skills and employment upon graduation. Organizational capability is described through *dimensions of capability*. In the original CMM (Paulk, Curtis, et al. 1993, p. 31), dimensions of capability are represented in hierarchical maturity levels, including initial, repeatable, defined, managed and optimized level. In this way, capabilities are assessed in a layered and progressive manner. A more holistic approach to capability can be found in the eMM, in which the dimensions of capability, including *Delivery*, *Planning*, *Definition*, *Management* and *Optimization*, are described in a synergistic manner Marshall (2006a; 2006b). As described by the same author, this synergy implies a holistic organizational approach, meaning that an organization with capabilities in all dimensions for all processes will be more capable than one with capabilities only in certain process dimensions. Furthermore, strong capabilities in a particular dimension supported by strong capabilities in other dimensions will lead to success in the desired process outcomes. From the maturity point of view, it can be said that an organization achieves a higher level of maturity when it is highly capable in all dimensions (Marshall 2006a, p.4; Marshall 2006b, pp.10-11).

Following the synergistic logic of organizational capabilities proposed by Marshall (2006a; 2006b) and starting from the idea of the maturity model as a strategic framework, the author propose dimensions of capability using the Deming PDCA cycle, with four phases (Plan-Do-Check-Act) that are repeated iteratively. The application of PDCA cycle can also be found in the development of *A Self-Assessment Model for Quality Management and Organisational Development for Continuing and Professional Education* (Markkula et al. 2011), which, as already indicated in **Chapter 3**, share some common characteristics with maturity models. **Figure 7** explains each capability dimension of maturity model for supporting graduates' early careers in more detail, based on the four PDCA phases (Borys et al. 2012) and the description of capability dimensions from eMM (Marshall 2006b, p. 11).

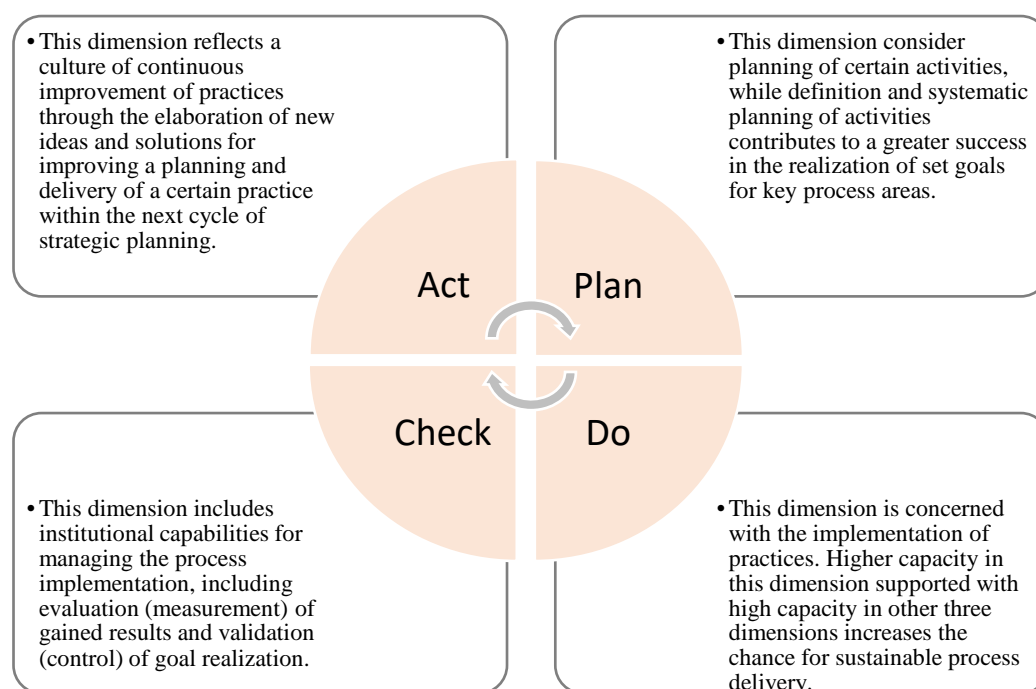


Figure 7. Description of capability dimensions within maturity model for supporting higher education graduates' early careers

[adapted from (Borys et al. 2012 Marshall 2006b, p. 11)]

One example of how this approach affects the overall maturity of HEIs in supporting and enhancing graduates' employability is as follows: if an HEI provides support for students' career development, but without an established careers service and without an evaluation mechanism for the work of careers service, the overall maturity of the key process area is lowered.

5.4.1.4. Capability assessment criteria

The purpose of *capability assessment criteria* is to rate the performance of each practice of a certain process on a pre-defined scale that could be either qualitative or quantitative. The scale of capability assessment criteria represents possible *maturity levels*. In this model, the capability assessment criteria show how well a given HEI is performing for each practice within each dimension of capability. Usually, capability assessment criteria are proposed on a kind of Likert items scale with such defined values as (Marshall 2006a, p. 5; 2006b, p. 13): *not assessed, not adequate, partially adequate, largely adequate* and *fully adequate*. These qualitative values can also be supplemented with quantitative values. In this maturity model for supporting higher education graduates' early careers, maturity levels are defined in the form of a textual descriptor for each of the relevant practices. Generic descriptors, on their own, would not be sufficiently specific to determine an accurate maturity level. Textual descriptors, by contrast, serve the

prescriptive use of the maturity model because they can provide guidelines on how to achieve higher levels of maturity in each practice. General descriptions of maturity levels are provided in **Figure 8**.

| | |
|--------------------------------------|--|
| Level 5 Fully adequate | The given practice is formally defined within the HEI, the institution is consistent in its performance and there is documented reflection on the usage of the practice for further improvements. |
| Level 4 Largely adequate | The given practice is formally defined within the HEI, and there is consistency in performance, but the institution is lacking suggestions for potential improvements in the given practice in the future. |
| Level 3 Partially adequate | The given practice is formally defined within the HEI to some degree, but it still lacks consistency in performance. |
| Level 2 Initial | There is some evidence of the given practice at the HEI, but this performance can be mostly characterised by the following attributes: <i>ad hoc</i> , <i>informal</i> and <i>inconsistent</i> . |
| Level 1 Not assessed | There is no evidence of the given practice at the HEI . |

Figure 8. Description of capability assessment criteria within maturity model for supporting graduates' early careers

5.4.2. Structure of the maturity model for supporting graduates' early careers

Given the definition of a strategic framework as an outline of objectives and initiatives (Rademakers 2014, p. 22) and the definition of a maturity model as one that provides guidelines for organizations to increase their capabilities from an initial stage, through several stages of maturity, to the desired end stage of maturity (Mettler & Rohner 2009; Mettler 2010; Pöppelbuß & Röglinger 2011), the author proposes a relationship between these two concepts, as shown in **Figure 9**. As evident, this strategic framework contains three main elements: *key process areas*, *practices* and *dimensions of capability*. Dimensions of capability based on the PDCA cycle give a strategic dimension to the framework. The maturity model additionally contains *capability assessment criteria*.

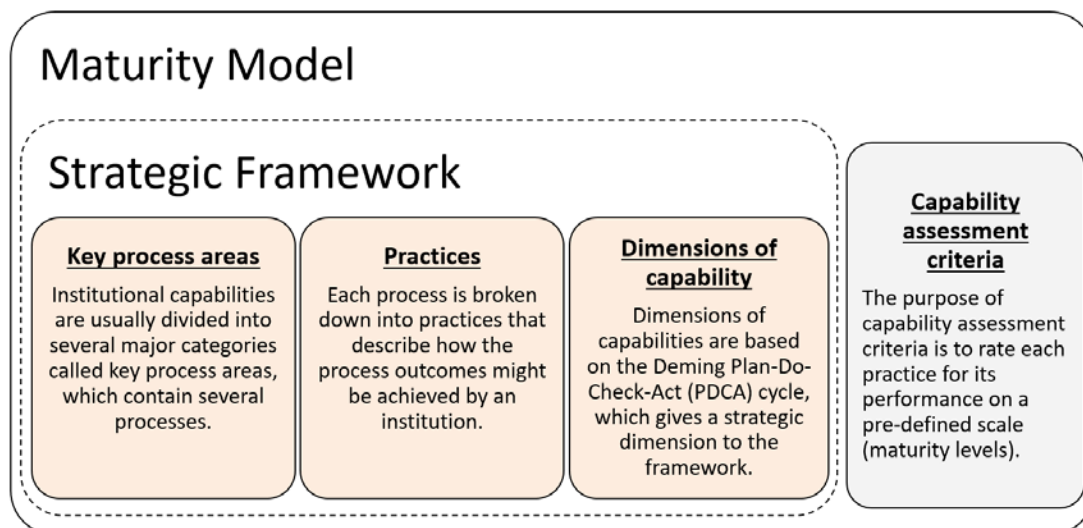


Figure 9. Relationship between a strategic framework and a maturity model for supporting higher education graduates' early careers
[adapted from (Pažur Aničić & Divjak 2015)]³

Based on the descriptions of the main maturity model elements for supporting higher education graduates' early careers, and following the hierarchical structure of the CMM (Paulk, Curtis, et al. 1993, p. 29), **Figure 10** illustrates the hierarchical structure of the maturity model for supporting graduates' early careers and explains the connections among the main elements of the maturity model.

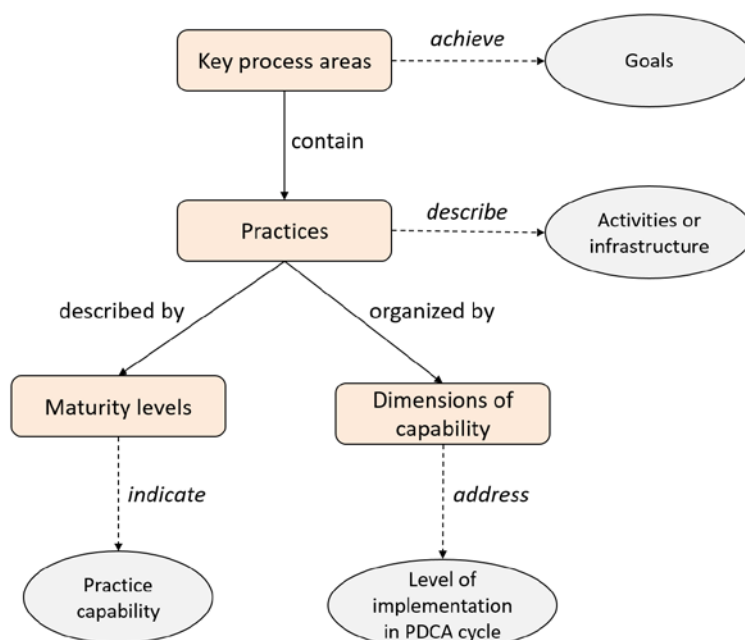


Figure 10. Hierarchical structure of the maturity model for supporting higher education graduates' early careers, based on the structure of CMM
[adapted from Paulk, Curtis, et al. 1993, p. 29]

³ This figure is presented in the booklet “How to prepare students for the labour market challenges?” resulted from the project *Development of a model for supporting graduates' early careers*

The proposed hierarchical structure helps to summarize the main structure of the strategic framework and maturity model for supporting higher education graduates' early careers:

- **Key process areas** in the context of higher education include strategic planning, curriculum design and development, alumni relationships, quality assurance, etc. Each of these key process areas seeks to *achieve certain goals*.
- Each key process area is divided into several processes containing different **practices**, which *describe activities or infrastructures* within certain key process areas that, together, contribute to the achievement of process areas goals.
- Practices are organized according to **dimensions of capabilities**, which *address the level of implementation* of certain practices on the levels of planning (plan), implementing (do), evaluating and controlling the implementation of certain practices and their effects (check) and elaborating new ideas for practice improvement in the next planning cycle (act).
- Finally, each practice at a certain dimension of capability has defined five **maturity levels or capability assessment criteria** (not assessed, initial, partially adequate, largely adequate and fully adequate) that *indicate practice capability*.

5.5. Chapter relevance

This chapter has provided a detailed explanation of maturity models as useful benchmarking and strategic tools. In addition to providing a basic definition of maturity models, the chapter defines all elements of maturity models, not only in general, but also specifically applied to the problem of supporting graduates' early careers within HEIs. In addition to elaborating on the various maturity model elements, the chapter also describes the maturity model design methodology in line with the principles of design science and describes a basic structure of the strategic framework and maturity model for supporting graduates' early careers that are developed within the scope of this thesis. Therefore, the chapter provides a comprehensive perspective on the development of maturity models, which are the focus of this research. This concluding subchapter elaborates on the advantages of maturity models for supporting graduates' early careers, as Marshall and Mitchell (2002) provided, for an e-learning maturity model:

- A maturity model for supporting HE graduates' early careers could provide a roadmap for HEIs looking to improve their processes for enhancing graduates' employability. As a tool providing guidance for HEI managers and practitioners, a maturity model will help institutions improve the structure and strategic orientation of their decision-making processes. Therefore, it can be said that the maturity model will fulfil its *prescriptive function*.
- The maturity model will provide support for institutional planning by allowing HEIs to benchmark their current capabilities, identify the areas in which improvements will produce the most immediate value and identify and prioritize necessary improvements in current practices regarding graduates' employability. By serving as a tool for benchmarking, the maturity model will fulfil its *comparative function*.
- The advantage of maturity models is that they can be easily understood by all higher educational stakeholders, without a need to examine detailed reports or metrics. Therefore, the proposed maturity model could encourage greater involvement by different groups of stakeholders.

Finally, it is important to address potential criticisms of maturity models, which are, as recognized by Marshall & Mitchell (2002), often aimed at these models' prescriptive natures. The maturity model developed in the scope of this thesis will provide a framework indicating a set of good practices and possible levels of maturity, which could serve as a self-assessment

tool and a source of guidance for HEIs striving to enhance the employment capabilities of their graduates. However, it cannot be claimed that institutions undertaking initiatives that differ from those described in this model will be unsuccessful or unable to achieve continual improvement in their processes.

6. EMPIRICAL RESEARCH

The previous chapter provided an outline for the strategic framework and maturity model that are developed within the scope of this research. The present chapter presents a detailed description of each of the five steps of maturity model development, along with the methods used and the results obtained. As it was explained in *subchapter 5.4.2* and shown in **Figure 9**, the strategic framework serves as a basis for the development of a maturity model, which differs only in the addition of capability assessment criteria. Therefore, when referring to the development of a maturity model within this thesis, the development of a strategic framework is also considered.

As was already stated in the introduction, this empirical research was conducted over the course of several steps involving predominantly qualitative and, to a lesser extent, quantitative research methods, which characterizes it as a mixed method research (Creswell 2009), following the: 1) guidelines for design science in information systems (Hevner et al. 2004); 2) requirements for the development of maturity models, as proposed by Becker et al. (2009) and 3) steps for the development of maturity models in terms of design decisions (Mettler 2010).

This introduction to empirical research presents a short overview of the research methods used in each of the five steps of the maturity model design, according to Mettler (2010) and as shown in **Figure 11**. It also examines the connections among the research steps, the methods used and the results of each phase within the research hodogram (**Figure 12**). This chapter is divided into five subchapters, which follow the five steps of maturity model design and provide detailed descriptions of research methods used in each step, previously presented as a research plan in the work of Pažur Aničić and Divjak (2015) and the introductory chapter of this thesis.

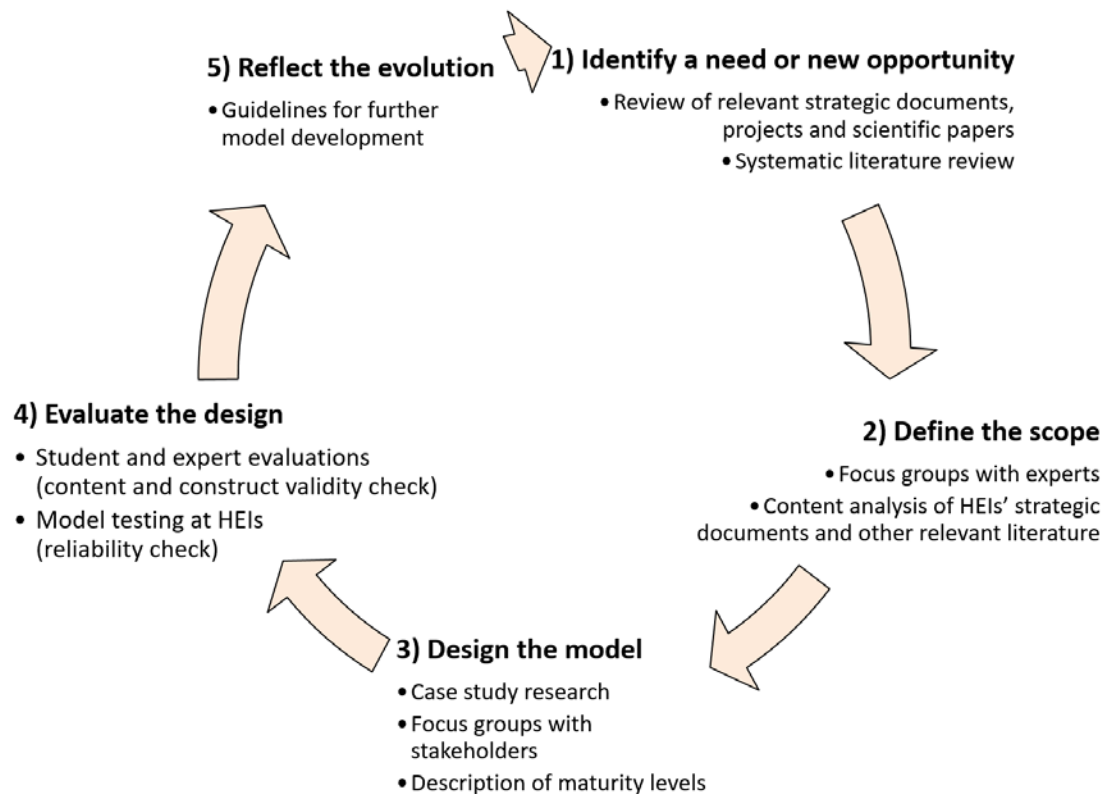


Figure 11. Research methods used in the development of maturity model for supporting graduates' early careers [according to steps proposed by Mettler (2010)]

1) Identify a new need or opportunity

In this first phase of maturity model design, it is important to identify a need for the design of such a model. In the context of supporting higher education graduates' early careers, this need is evidenced by *strategic documents and policies* at both EU and national levels and by *relevant projects and scientific papers* related to graduate employability, strategic management and quality assurance in higher education (**Chapter 1,2 and 3**). To elaborate the need for such a model for HEIs in the field of ICT, a *systematic literature review* of scientific papers in the field of education and the career development of graduates in the field of ICT was conducted (**Chapter 4**). Finally, after the need for a holistic model for enhancing graduates' employability within HEIs was recognized, this first step was concluded with the elaboration of *maturity models*, which are recognized as an appropriate strategic management tool for the identified problem (**Chapter 5**).

2) Define the scope

Since higher education systems are very dynamic and complex systems, it is useful to define the scope of the research in order to shape further research and focus on important elements. In relation to the elements of a maturity model, the process of defining the model's scope is

equivalent to the determination of *key process areas* and their main *practices* impacting the employability of graduates. In this phase, the author conducted a *content analysis of the strategic documents of different HEIs* and other *relevant literature* in order to identify key process areas and the initial list of practices. The findings were amended through the results of a *focus groups with experts*, which had two main aims: 1) to determine the most important key areas of HEIs in preparing students for their early careers and 2) to detect the key persons at HEIs that could help in determining all of the practices that contribute to graduates' employability.

3) Design the model

The third phase in the maturity model design is the most comprehensive, since it identifies all relevant practices within previously defined key process areas. A preliminary list of practices constructed within 2) *Define the scope* serves as a basis for conducting several *case studies* at different HEIs in Europe. In addition to this case study research, to design a maturity model for supporting graduates' early careers, it is also important to include the perspectives of other relevant stakeholders, including employers, teaching staff, representatives of managerial and supporting institutions, alumni and current students. Inputs from various groups of stakeholders were gathered through *focus groups*. After the key practices were defined, this design phase also described the capability assessment criteria (maturity levels) for each practice.

4) Evaluate the design

The model was evaluated on two levels: 1) a validity check level (including content and construct validity) and 2) a reliability check level (Cohen et al. 2011; Merriam & Tisdell 2015). Validity addresses questions of how research findings match reality; therefore, this phase required the *knowledge of experts and students*. For each of the recognized practices, the evaluators were asked to evaluate: 1) whether or not the practice is relevant, important or essential for supporting graduates' early careers within higher education (content validity) and 2) to which key process area the practice belongs (construct validity). The reliability of the model refers to the extent to which the research findings can be replicated with other groups of respondents, and this was assessed by *testing the model at four HEIs in Croatia in the field of ICT* with the purpose of determining whether the maturity model covers all possible maturity levels for each practice.

5) Reflect the evolution

The evolution portion of maturity model design is important because of the way in which the roles of organizations change over time. In this particular case, as the student support system changes and evolves, the maturity model should be redesigned accordingly. Since the research within this doctoral dissertation is time-constrained, this dissertation will not involve this portion of the maturity model design process in any extended way. However, some suggestions for the further development of the maturity model will be provided based on the results of the model evaluation.

Figure 12 on the next page presents the research hodogram, including the research steps, methods used, the relevance and rigor within each cycle and the results of each phase. The research methods marked in grey represent those that contribute to the relevance of the research, while those marked in orange represent methods referring to the rigor of the research. As can be seen, the model development includes iterative processes since the steps 3) *Design the model* and 4) *Evaluate the model* are to some extent interrelated.

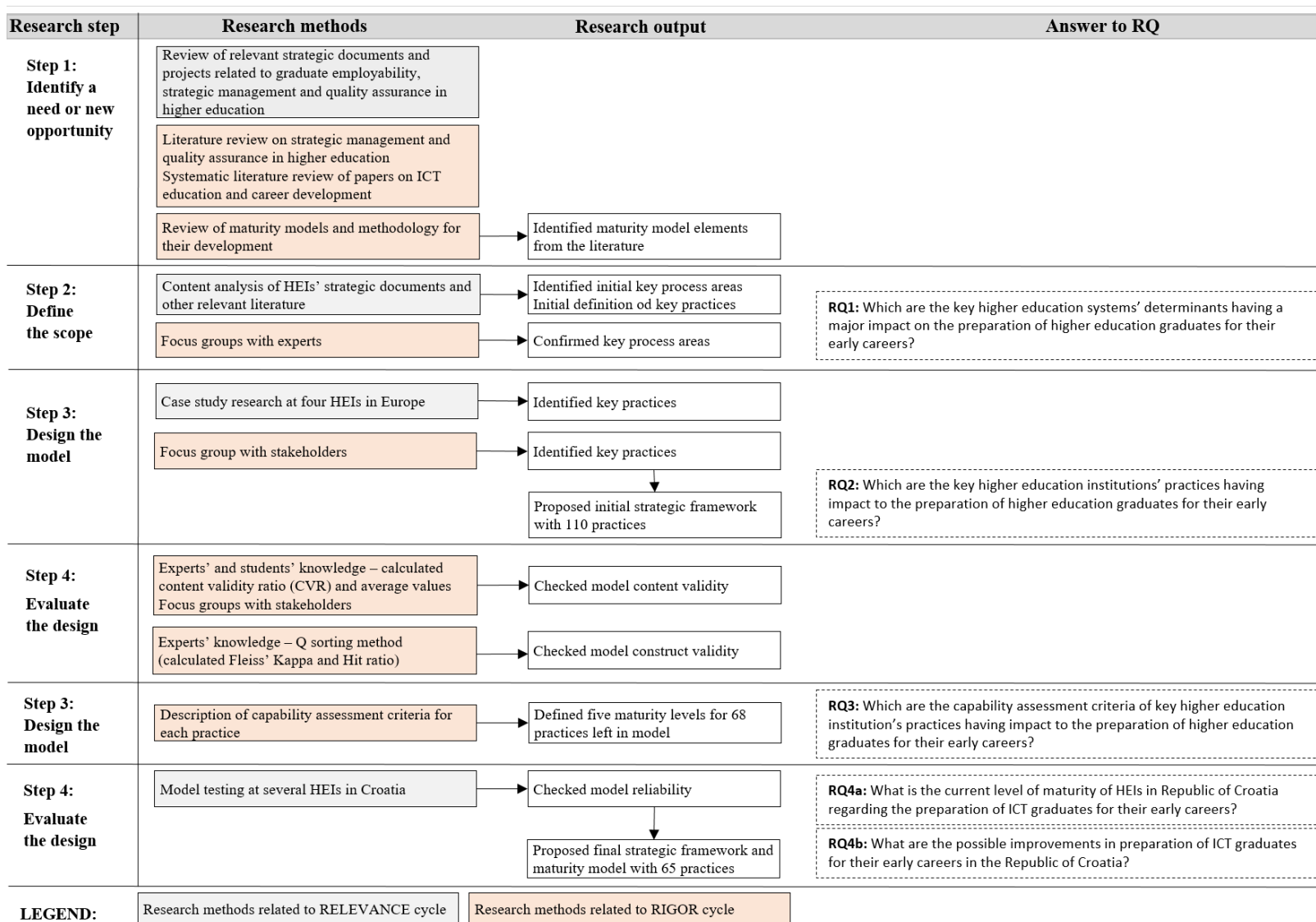


Figure 12. Research hodogram

6.1. Step 1: Identify a new need or opportunity

The initial step in the design of every maturity model is to recognize a need or an opportunity for such a model. Within this thesis, the need for a model that will provide comprehensive guidelines for HEIs in supporting their graduates' employability has been recognized and elaborated in several chapters. This subchapter summarizes these findings:

Chapter 2

This chapter examined the relevant strategic documents at the EU and national level and concluded that there is a need to develop a strategic framework model to enable better planning, monitoring and evaluation of the activities within HEIs that contribute to the better employability of students, including cooperation with industry, tracking of students' employability, etc., with the main goal of helping HEIs become more mature in one of their most important roles: contributing to society through the production of skilled and employable graduates.

The results of recent EU projects in the field of graduate employability indicate that there are several areas within HEIs that need to be improved in order to provide graduates with higher education experiences that contribute to their employability potential. Thus, a model that provides guidelines to HEIs for implementing these areas in a way that allows them to better prepare graduates for the world of work would be very helpful.

In summary, ***Chapter 2*** indicated a need for the development of a managerial tool to help HEIs effectively use resources like data from tracer studies to improve processes and practices in order to ensure better graduates employability.

Chapter 3

Chapter 3 addressed strategic planning and quality assurance in higher education from the perspective of the universities' third mission: to contribute to society, including through the employability potential of their graduates. In addition to being a part of universities' third mission, the employability of graduates is also seen as a direct measure of the quality of higher education. The chapter concluded that there is still a clear need for the development of quality management and quality assurance systems, besides ESG that is widely applied, to measure the extent and the ways in which higher education matters for employment and work.

Therefore, this research focuses on building strategic guidelines and a strategic framework that should help HEIs define more specific targets and actions in the form of a strategic roadmap and blueprint. As a proper tool for supporting the implementation of the strategic framework, the maturity model focuses on organizational capabilities as one of the main elements of strategy.

Chapter 4

Finally, the conducted systematic literature review on the education and career development of future ICT professionals presented in ***Chapter 4*** provides good insight into the problem domain, and the results show the existence of a research gap and a need for future work in the research field. Areas of cooperation with employers and graduates' employability are found to be little represented in the existing scientific literature on higher education and the career development of future ICT professionals. Furthermore, no relevant model contributing to improvements in these contexts was found.

Chapter 5

Based on the results of ***Chapter 2***, ***Chapter 3*** and ***Chapter 4***, a maturity model is recognized as an appropriate strategic management tool for helping to solve the identified societal problems related to graduates' employability. Moreover, the comprehensive systematic literature review conducted within ***Chapter 4*** showed that no model of this kind can yet be found within the scientific literature related to the education and career development of graduates within the field of ICT.

6.2. Step 2: Define the scope

After the need for the development of a model that will contribute to the better preparation of graduates for their transition from the system of higher education to the labour market has been acknowledged, it is necessary to define the scope of the research. Eisenhardt (1989) stressed that the purpose of specifying constructs *a priori* is “to help to shape the initial design of theory-building research”. This design impacts future research steps by focusing them on important elements. A basis for defining the scope of the research can be found in the main elements of the maturity model, as proposed in **Figure 9**. This second step in the maturity model design process refers to the definition of basic key process areas and an initial list of practices that will be used to prepare the next research step: 3) *Design the model*. Defining key process areas is not simple, since all of the processes are interrelated to some degree. As has already been elaborated, higher education is a complex system that can be observed from different viewpoints, such as quality assurance, strategic planning, etc., which impact the system elements that are recognized to be the most relevant. Key process areas are defined in two steps: 1) a short review of relevant literature and projects and 2) focus groups with experts.

6.2.1. Definition of key process areas

In the context of graduates’ employability, it is important to determine and describe HEIs’ key process areas containing practices that contribute to the employability of graduates. For observing the higher education management system and determining the components of this system in the context of graduates’ employability, Pavlin et al. (2011, pp. 46-47) emphasize the following five higher education determinants: 1) study programme characteristics, 2) selection policies, reception and orientation for students entering, 3) teaching and learning modes, 4) study-related experiences and 5) support services for students. Based on the results of the HEGESCO project (HEGESCO 2007), improvements in the following areas of the higher education management system can be identified as important for enhancing graduates’ employability: 1) curriculum design and delivery processes (including both generic and specific skills, active teaching modes, collaborations with employers, etc.), 2) provision of career-related activities through the development of career centres and 3) the collection and use of feedback from relevant stakeholders (students, alumni, employers) to further improve different processes. In the Pedagogy for Employability, Pegg et al. (2012, p. 45) emphasized three key areas required for successfully preparing graduates for employability: 1) learning,

teaching and assessment; 2) work experience; and 3) building an institutional culture that promotes employability.

Although the literature indicates some important key process areas, it is necessary to amend these process areas with some elements from the rigor cycle. The most appropriate technique to accomplish this is a focus group with relevant experts, with the experts' knowledge representing a knowledge base for amendments and additions. A *focus group* is a qualitative technique that represents an adjunct to a group interview. It relies not on the back and forth between an interviewer and a group, but, rather, on the interactions among members of the group, who discuss topics moderated by the researcher (Cohen et al. 2011, p. 436). Focus groups were first used in marketing research in the 1950s (Merriam & Tisdell 2015, p. 113). Today, their usage is growing in business and political circles, as well as in educational research (Cohen et al. 2011, p. 436). Focus groups can be useful for many different purposes, including, amongst others, developing an orientation toward a particular field of focus (Cohen et al. 2011, p. 436). This is the case with the focus groups conducted within this research. Usually, focus groups are not used as a stand-alone method; instead, they are typically employed within a multi-method research design, with three main purposes:

- “To clarify, extend or qualify findings produced by other methods
- To feed back research findings to study participants (Bloor et al., 2001:90)
- To identify research foci or develop research questions prior to the conduct of the main study” (Silverman 2014, p. 208).

Within this research step, there are two main purposes for conducting a focus groups:

- 1) To extend or clarify the key process areas that are important within the system of higher education for exploring support for graduate employability, as recognized from the literature;
- 2) To identify the focus of further research and to provide some basis for the preparation of a case study questionnaire.

The main characteristics of focus groups can be summarized as follows:

- Focus groups usually consist of small groups of six to eight people who share certain characteristics;
- An informal group discussion focuses on particular topics, based on predetermined questions;

- The discussion is led by a moderator, who actively encourages group members to discuss the given topic with one another;
- The discussion is recorded and the data are transcribed and analyzed using a variety of techniques for qualitative data analysis (Silverman 2014, p. 206).

For the purposes of this research, purposive sampling was used to include individuals who were well versed in the research topic (Merriam & Tisdell 2015, p. 114). A short description of conducted research groups and the initial results are presented in the work of Pažur Aničić & Divjak (2015). The focus groups consisted of experts with rich experience in leading HEIs, as well as different stakeholders of the higher education system, all of whom were team members of the project *Development of a methodological framework for strategic decision-making in higher education – a case of open and distance learning (ODL) implementation*, financed by the Croatian Science Foundation. The focus groups were held during the *Strategic Planning within Higher Education* workshop, which was held at the Faculty of Organization and Informatics in Varaždin from 9 to 11 July 2015. The purpose of the focus groups was to determine all of the relevant areas of the higher education system that contribute to the employability of graduates, as well as to provide a focus for further research and answer the first research question:

Research question 1: Which are the key higher education systems' determinants having a major impact on the preparation of higher education graduates for their early careers?

To accomplish these objectives, two research questions for the focus groups were set:

- *Question 1:* In your opinion, which are the most important *key areas/process categories* (activities, structures, processes, actors, etc.) of HEIs in preparing students for their early careers?
- *Question 2:* At your institution, who are the *key persons* that could help in determining all the elements within HEI that contribute to students' employability?

The participants were divided in two groups, each of which engaged in a 30 minute long moderated discussion. In Group 1, the moderator was the PhD candidate, and in Group 2, the moderator was the PhD candidate's mentor. Before the focus groups were conducted, a consultation was held between the PhD candidate and the mentor in order to reconcile the rules for moderating the discussion. Furthermore, before the focus groups, the PhD candidate held a

short presentation, during which all the focus groups participants were introduced with research topic, the research plan and the purpose of the focus groups. The focus groups participants were also asked for permission to record the discussions for future analysis.

There are three main methods for analysing focus group data (Silverman 2014, pp. 210-220): quantitative content analysis, qualitative thematic analysis and constructionist methods. The main method used to analyze the focus groups discussion within this research was qualitative thematic analysis. The transcript of the discussion was read, and identified key process areas were marked when they were recognized within the discussion. This analysis of transcripts served as a control technique since both moderators summarized the recognized key process areas and identified persons immediately after the focus groups were finished. **Table 7** and **Table 8** summarize the results of the focus groups discussion.

Table 7. Summary of focus group 1 for the identification of key process areas

| |
|--|
| Moderator: PhD candidate |
| Participants' expertise |
| <ol style="list-style-type: none"> 1) Associate Professor, Vice-dean for Finance, Supervisor of Student Support and Career Development Centre 2) Full Professor of Computer Science at the Department of Computer Science at the Faculty of Science 3) Assistant Professor at the Department of Business Informatics, Faculty of Economics 4) Vice Principal for Digital Education, Professor of Education & Technology at the School of Education 5) Postdoctoral Student 6) Representative of Employers, PhD candidate 7) Teaching Assistant, PhD candidate |
| Identified key process areas |
| <ol style="list-style-type: none"> 1) Strategy 2) Curriculum 3) Quality assurance 4) Alumni relationship 5) Support services 6) Teaching 7) Research & Development (R&D) |
| Identified key persons |
| Support services – career services officer, Curriculum – vice-rector, Alumni – officer, Quality – quality assurance team/vice-rector for learning and teaching, Strategy – management, employers and other stakeholders |

Table 8. Summary of focus group 2 for the identification of key process areas

| |
|--|
| Moderator: PhD candidate's mentor |
| Participants' expertise |
| <ol style="list-style-type: none"> 1) Full Professor – Tenure, former Vice-dean for Finance and current Dean 2) Full Professor – Tenure, former Vice-rector for Students and Study Programmes and Vice-dean for Science and International Relations; Member of the National Council for Human Potential Development 3) Associate Professor, Member of the Quality Board 4) Full Professor, PhD in Engineering, Head of the University Media and Learning Division 5) Assistant Director for Education and Customer Support, University Computing Centre 6) PhD Candidate |
| Identified key process areas |
| <ol style="list-style-type: none"> 1) Strategy 2) Curriculum 3) Quality Assurance 4) Alumni 5) Student services 6) Research & Development (R&D) 7) Teachers 8) Infrastructure 9) Extra-curricular activities |
| Identified key persons |
| Director of ICT centre, ministry, head of a sector for quality assurance, mentors, vice-rector for students, education and quality assurance, head of the study programme, deans and vice-deans, head of career center services and lifelong learning |

From the above summary of the focus groups results, it is clear that there are five key process areas that the groups recognized as important: *Strategy*, *Curriculum*, *Support Services*, *Alumni Relationships* and *Quality Assurance*. Both group discussions also recognized the importance of *Teachers* (Group 1 indirectly recognized it through *teaching*) and indicated the potential importance of *R&D*. Group 2 recognized two additional areas that should be further analyzed to determine whether they should be observed as a separate key process areas or as parts of other process areas: *Infrastructure* and *Extra-curricular activities*. Before making a decision regarding which key process areas will provide a basis for further analysis and the development of the final strategic framework and maturity model, it is important to research these areas in more detail. Therefore, **Table 9** first presents the combination of key process areas identified by the focus groups and then explains the reasons for merging some of the groups, together with a parallel to ESG internal standards and guidelines. The list of four proposed key process areas is further elaborated within separate subchapters, which have two main purposes:

- 1) To provide short overviews of each key process area;
- 2) To provide insight into the main key processes and the practices they contain in order to set a basis for further research into the key practices within the case studies research.

Table 9. Explanation of key process areas

| Key process areas | Group 1 | Group 2 | Explanation |
|---------------------------------------|--|--------------------------------|--|
| Strategic planning | Strategy | Strategy | Strategy development and implementation, especially in relation to the employability of graduates, is among the most important key process areas. This area was recognized by both focus groups and includes <i>Policy for quality assurance</i> guidelines from ESG. |
| Curriculum design and delivery | Curriculum Teaching | Curriculum Teachers | Curriculum design and delivery is recognized as important by the previous review of relevant literature, the project results and the focus groups. Since one focus group recognized teachers as another relevant area and the other indicated teaching, the author propose further research into practices related to teachers as part of the curriculum, as elaborated further within subchapter 6.2.1.2 . This key process area includes <i>Design and approval of programmes; Student-centred learning, teaching and assessment; Teaching staff, partially Learning resources and student support, and On-going monitoring and periodic review of programmes</i> from ESG. |
| Student support | Support services Alumni relationships | Student services Alumni | Support services comprise a wide range of activities across different areas. Among these, career support is the most relevant for supporting graduates' early careers; however, some of the practices of other support services, such as academic services, are also included. Both focus groups recognized alumni relationships as an important area. Relationships with alumni involve different aspects, such as alumni donations. Since this research focuses only on those alumni relations that play a role in enhancing graduates' employability, alumni will also be observed as an aspect of student support services. This key process area includes partially <i>Learning resources and student support</i> and <i>Information management</i> from ESG. |
| Extra-curricular activities | | Extra-curricular activities | Although Group 1 did not mention extra-curricular activities, these were recognized as important both by Group 2 and the literature and, therefore, are included as another key process area of the maturity model. Extra-curricular activities include a broad range of activities, such as work in student organizations or student unions, participation in different student competitions, volunteering, sport activities, entrepreneurship initiatives, etc. This key process area includes partially <i>Learning resources and student support</i> from ESG. |
| | Quality Assurance | Quality Assurance | Both focus groups recognized the importance of quality assurance processes. Subchapter 3.3 elaborated on quality assurance processes within higher education as integrative processes that comprise several different areas within HEIs. Since |

| | | | |
|--|-----|----------------|---|
| | | | the quality assurance cycle follows the plan-do-check-act steps, which will be used as a capability dimension in the observance of higher education practices in defined areas, quality assurance is actually integrated into all key process areas. Therefore, there is no need to observe it as a separate process area. |
| | | Infrastructure | Group 2 recognized infrastructure as another key area of relevant processes. Subchapter 6.2.1.2. indicates that infrastructure (location, materials, etc.) can also be observed within a broader understanding of curriculum delivery. This is similar to the provision of adequate infrastructure for student support services and extra-curricular activities. Therefore, infrastructure is not observed as a separate key process area, but is instead integrated within the other key areas. |
| | R&D | R&D | Research and development activities were recognized within only one focus group as influential for graduates' employability while the other group mentioned the potential importance of student involvement in R&D activities; therefore, R&D will not be observed as one of the key process areas. However, some questions referring to R&D activities will be included in the case study questions in order to determine whether certain R&D practices are relevant for graduates' employability. |

As ESG guidelines are widely represented, it is important to make a parallel with internal guidelines which were recognized within **Chapter 3** as relevant for the development of maturity model within this thesis. From the list of 10 guidelines, most could be directly connected to one or more key process area, *Information management* and *Policy for quality assurance* are integratively included in check and act phases of PDCA cycle for most of the practices, *Student admission, progression, recognition and certification* and *Public information* can be recognized within several key process areas while *Cyclical external quality assurance* is not in the focus of this research.

This subchapter answers **Research question 1: Which are the key higher education systems' determinants having a major impact on the preparation of higher education graduates for their early careers?**

The answer is in defined **four key process areas**: *Strategic planning*, *Curriculum design and delivery*, *Student support* and *Extra-curricular activities*, each of which is described in the next subchapters.

6.2.1.1. Strategic planning of graduates' employability

This process area is concerned with the institutional management and planning related to enhancing and supporting graduates' employability. Two basic elements of every strategy are: 1) its mission, which indicates the purpose of the organization, and 2) its vision, which shows where the organization wants to be in future. The mission of HEIs, as already elaborated in *Chapter 3*, is primarily focused on teaching and research. However, universities also have a third mission, which is concerned with their contribution to society. In relation to the concept of a mission, a vision describes where an organization wishes to be in the future. A good example of a higher education mission and vision that reflect the employability of graduates as an important issue are those published in *The University of Edinburgh Strategic Plan 2012-2016* which states:

"Vision: To recruit and develop the world's most promising students and most outstanding staff and be a truly global university benefiting society as a whole.

Mission: The mission of our University is the creation, dissemination and curation of knowledge. As a world-leading centre of academic excellence we aim to:

- (...)
- provide the highest quality learning and teaching environment for the greater wellbeing of our students and deliver an outstanding educational portfolio
- produce graduates fully equipped to achieve the highest personal and professional standards
- (...)"(University of Edinburgh 2012)

Defining a vision and a mission in such a way that they directly reflect the employability of graduates helps to guide all future organizational steps in the strategic planning process in the same direction. The following important step in the strategic management process is to define organizational objectives, which are normally "stated in terms of a desired level of attainment within a specific time frame" (Byars et al. 1996, p. 16). To achieve objectives in a desired timeframe, institutions must implement a strategy. The institutional-level strategy is the most important because it guides strategies at lower levels. For example, within HEIs, an institutional strategy is usually followed by a learning and teaching strategy, an employability strategy and different strategies at the levels of faculty, departments or other organizational units. Strategies are usually accompanied by policies and action plans at the level of different organizational units, designed to guide decision-making and support concrete actions at

different levels of organization in implementing their strategies. When implementing these strategies, available resources and the commitment of higher education managers are the main asset for success.

Within a higher education system, the *Strategic planning* process area is independent from the university type or the field of study at a lower level, as it represents some concepts that are universal to all types of HEIs. For the purpose of this thesis, it is important to observe the mention of employability in higher education strategic documents and strategic planning processes, since these affect all other processes within an institution.

6.2.1.2. Curriculum design and delivery

To understand the importance of curriculum in graduates' employability, it is important to provide a broader perspective of the concept of employability. Dacre, Pool and Sewell (2007) proposed the CareerEDGE model, already mentioned in **Chapter 2**. This model includes some individual characteristics, but also reflects characteristics that could be attained through a curriculum: *career development learning*, *work & life experience*, *degree subject knowledge*, *understanding & skills* and *generic skills*. Similar elements can be found in Bennett et al.'s (1999) model of course provision, which contains *disciplinary content*, *disciplinary skills*, *workplace awareness*, *workplace experience* and *generic skills*. Some strategies rest on the premise that the development of knowledge, skills and attitudes for employability within higher education is best embedded within the curriculum and, therefore, stress the importance of all aspects of this curriculum (University of Bradford 2012a). Furthermore, what is really important in the context of embedding employability in the curriculum is the comprehensive approach that includes embedding employability skills within the curriculum, enhancing students' employability through the co-curricular and extra-curricular activities and engaging employers in the curriculum design and development (Pegg et al. 2012; Yorke & Knight 2006).

To introduce the key process area associated with curriculum design and delivery, it is important to understand the term *curriculum* and its related concepts. Furthermore, the term *curriculum* is often associated with the term *study programme*; thus, it is important to understand the connection and differences between the two. While a study programme considers goals and study content, a curriculum is usually a broader concept that comprises a student's entire experience within the processes of formal education. Thus, in addition to the goals and content of the study program, a curriculum covers teaching and evaluation methods

and resources for implementing the processes of teaching and learning. These processes are aimed at students, who should be placed in the centre of the teaching process. Direct connection between curriculum and study programme is in the pre-defined learning outcomes of a study programme that provides basis for the curriculum development (Divjak & Begičević Ređep 2016, p. 71).

This process area is concerned with all aspects of a curriculum, including its standard elements such as curriculum *aims, intended learning outcomes, content, learning, teaching and assessment methods*. Several extended versions of curricula, such as the so-called *curricular spider web* proposed by van den Akker, contain additional aspect (in this case, *teacher role, materials & resources, grouping, location and time*) (in van den Akker et al. 2009, p. 11). Divjak and Begičević Ređep (2016, p. 72) also identified *student workload, student support, incoming students' competences, recognition of prior learning, qualification framework, inclusion policies in education and the system of quality assurance of studies and achieving learning outcomes* as basic curriculum elements.

The literature shows that, in order to ensure quality of curriculum, the curriculum design and development process should follow the iterative cycle of planning, implementing, evaluating and analysing (van den Akker et al. 2009, p. 15; Stabback 2016). Divjak and Begičević Ređep (2016, p. 73) also proposed a cyclic plan for identifying and verifying learning outcomes as one of the basic curriculum elements, and their proposed steps could be considered to follow the four steps of the PDCA cycle. Therefore, the logic of the PDCA cycle, which has already been mentioned as a basis for both strategic planning and quality assurance processes can also be found in curriculum design and development. Hussain et al. (2011) recognized that curriculum evaluation has special importance “because the goals of education can be attained only through valid reliable curriculum” that is updated on a regular basis in order to fulfil new and emerging labour market needs.

It is important to stress that curriculum development can be observed at different levels, such as the national level (e.g. large national curriculum reforms which are most common for pre-tertiary education and not for the higher education) and the programme or course level (e.g. modifications to small-scale activities). What is important is that the same principles apply to all the situations. Short descriptions of the main elements of a curriculum are provided below.

6.2.1.2.1. Aims and objectives

The main purpose of the aims and objectives of a curriculum is to answer the following question: *Towards which goals are the students learning?* If the purpose of teaching in higher education is to develop graduates who are highly employable, this should be supported through consistent policy frameworks and action plans at the institutional level, and considerations for employability should be embedded throughout the main aspects of the curriculum (Pegg et al. 2012; Yorke & Knight 2006).

6.2.1.2.2. Learning outcomes

According to Beljo Lučić et al. (2011, p. 18), learning outcomes consider “knowledge and skills and the associated autonomy and responsibility which a person has acquired through learning and which the person proves after the learning process is completed”. They can be defined as statements of what a student is expected to know, understand and be able upon completion of a learning process (European Union 2015a, p. 10; Gudeva et al. 2012). Learning outcomes are very important elements of a curriculum because they affect the curriculum’s content, teaching methods and assessment (Divjak 2008, p. 9).

In recent years, several globally important projects related to learning outcomes in higher education have been conducted. The OECD, through a series of feasibility study reports on the *Assessment of Higher Education Learning Outcomes* (AHELO) (Braun & Bily 2013; Tremblay 2013; Tremblay et al. 2012) emphasizes the shift from a focus on input-based conceptions (e.g. number of classes taken or study time) to outcome-based conceptions (e.g. the knowledge and skills obtained by graduates). Another comprehensive project, the *Competences in Education and Recognition* (CoRe) project related to the *Tuning Educational Structures in Europe* project, provides a guide for formulating degree programme profiles, including programme competencies and learning outcomes (Lokhoff et al. 2010).

Several different approaches to research learning outcomes can be found in the scientific literature. Based on the analysis of scholarly documents Prøitz’s (2010) recognized two dominant debates on issues of learning outcomes: 1) whether learning outcomes should be stated in “full-ended, stable, pre-defined and measurable terms” or in “open-ended, flexible terms with limited opportunities for measurement” and 2) learning outcomes as tools for accountability purposes. Other research results indicate a need to link learning and assessment activities with learning outcomes (Potgieter 2012), propose methodologies for writing

descriptors based on learning outcomes in higher education (Gudeva et al. 2012), discuss students' self-reporting of learning outcomes as a measure of student learning (Douglass et al. 2012) and propose conceptual models for intended learning outcomes supporting curriculum development (Tangworakitthaworn et al. 2013).

6.2.1.2.3. Content

Curriculum content considers the subject matter to be taught in order to achieve curriculum objectives and learning outcomes. Within each course, content is usually organized in smaller units called lectures. It is important that curriculum content is coherent, meaning that, at the course level, the content represents a certain topic and is connected with the content of other courses. Moreover, the curriculum content should be connected to the defined learning outcomes at the programme level (Divjak 2008, p. 9). In the EHEA, learning outcomes reflect the content of the programme supported by European Credit Transfer System (ECTS) where ECTS credits “express the volume of learning based on the defined learning outcomes and their associated workload” (European Union 2015a, p. 10).

6.2.1.2.4. Teaching methods

The selection and application of appropriate teaching methods is highly important for successful content delivery. Teaching methods should support the achievement of learning outcomes; thus, it is important to detect which learning experiences are most suitable for the achievement of which learning outcomes. Although lecture-based teaching methods are still “important for developing theoretical and abstract contextual knowledge”, there is also a need for more active learning approaches which involve more active student engagement in the learning process and shift the role of the teacher from a lecturer to a facilitator of student activities (Pegg et al. 2012, p. 32). One approach that emphasize this shift is student-centered learning (Wright 2011). The European Commission recently recognized the need to increase learning opportunities through more work-based learning and business-education partnerships (via collaborations with social partners) at the level of higher education as “a proven springboard to good jobs and to developing labour market-relevant skills, including transversal and soft skills” (European Commission 2016a, p. 13). Accordingly, in coming years, particular attention will be given to innovation in pedagogy, including support for flexible curricula and the promotion of interdisciplinary and collaborative approaches within institutions. Therefore, new learning methods, such as *work-based learning activities* (Costley & Dikerdem 2012), *experience-based learning* (Matsuo et al. 2008), *practice-based learning* (Hynes et al. 2011),

cooperative education programmes (Coll et al. 2002), *problem-based learning (PBL)* (Intayoad 2014; Pažur Aničić & Mekovec 2016) etc., are increasingly finding their place within ICT-related higher education curricula.

6.2.1.2.5. Assessment methods

The assessment of student work is a process through which a teacher monitors and evaluates results (outcomes) of student learning through different activities. Assessments should be related to the set learning outcomes and should allow and encourage further learning (Divjak 2008, p. 12). In order to enhance employability through curricula, assessment arrangements should differ from those typically found in most of the academic programmes. In this context, the literature discusses such methods as self-assessment and peer assessment. Peer assessment activities are found to encourage students to think critically and objectively judge their own and their peers' performance, as well as to offer constructive comments about possible improvements for future work (Yu & Wu 2011). In general, peer assessment and self-assessment are recognized as positive methods for developing students' critical thinking. However, they also demand considerable time and effort on the part of the teacher to organize, manage and control the assessment process (Chen 2010; Martínez-González & Duffing 2007).

6.2.1.2.6. Teacher's role

In the context of graduate employability and early careers, those who have the greatest impact on graduates' early success in the labour market are certainly academics: the professionals who work at HEIs as assistants, associate professors or full professors. In addition to teaching and research, one of the primary roles of these individuals within higher education is training students for their future career (Pavlin et al. 2013, p. 63). These academics impact graduates' employability in many different contexts, especially within the current environment of internationalisation, globalisation, shifts from elite higher education to mass higher education, an increasing focus on students' entrepreneurship skills, etc.

Academics' work affects students in different ways, beginning with the creation of a curriculum that provides students with basic professional knowledge. Academics also enable collaborations with employers, which provide students with their first insights into the world of work, they choose adequate learning and teaching methods that contribute to the development of desired generic and entrepreneurial skills, but they also participate in preparing students to be good citizens in society. In order to successfully enable students' personal

development through the curriculum, it is important for institutions to provide opportunities for staff to consider their own personal and professional development, which in turn, increase their understanding of the importance of doing the same for their students (see Pegg et al. 2012, p. 17). The continuous development of academics is especially important in today's global environment, when environmental changes and the increasing focus on universities' third mission place pressure on universities to extend traditional teaching and learning to new teaching methods that include different projects involving collaborations with other stakeholders, internships, work-based learning activities, etc. In the context of the incomplete reform of the Bologna process, Leoni (2014) recognized university teachers as being unable to meet the educational challenges of modern employment conditions. He saw the outdated pedagogical and didactic instrumentations used by university teachers as a main problem preventing students from acquiring and developing necessary competences that could be fostered by alternative methods like problem-based learning and teaching. In its publication *A New Skills Agenda for Europe*, the European Commission recognized teachers as the individuals who have most impact on learners' performance in higher education and who help learners acquire higher and more relevant skills by introducing new teaching and learning methods (European Commission 2016a, p. 15). The Commission emphasizes the need to support teachers' professional development to enhance innovative teaching practices, including ways of using and bringing digital tools into the classroom and stimulating entrepreneurial mindsets.

Other curriculum elements (materials and resources, grouping, location and time) are closely related to the main elements described above and are important for the successful delivery of a curriculum.

6.2.1.3. *Student support services*

It is difficult to clearly define which processes and practices belong under the area of *Student support services*. These services vary from institution to institution based on type, size, country, tradition, etc. This subchapter describes the most common student support-related services recognized as *career services*, *personal development planning* and *alumni relationships*.

6.2.1.3.1. *Career services*

Since the focus of this research is on the employability and early career development of higher education graduates, among the most important practices within HEIs are those related to career guidance and counselling, which are usually organized within *career services*. Lazić (2012, p. 3) elaborated a new paradigm of career guidance that recognizes careers as life-long learning processes of skills acquisition and shifts the emphasis from career selection to career building. Therefore, the career guidance process should ensure that graduates remain responsible for their future career development and ready to adapt to changes in the working environment. Accordingly, the focus of career services within HEIs is not on psychological testing (as is traditional), but is instead on a whole set of activities that:

- Encourage students to discover their potential and think about their future careers already during their studies;
- Provide students appropriate information on the labour market opportunities in the studied domain;
- Support students in making appropriate decisions about their professional development;
- Support the development of students' employability through the provision of different activities.

Lazić & Janković Barović (2012, pp. 6-7) organized the career services at universities around the following four types of activities:

- *Career Information* – a group of activities oriented toward offering information about career opportunities through different media, such as web pages, social media, workshops, interviews, etc.
- *Career Counselling* – a group of activities aimed at providing support for individuals and their personal development in order to help them make the right decisions about their future careers. Counselling activities include assessing individuals' needs and capabilities, encouraging them to research their own potential and providing opportunities for further study and employment. Career counselling can be carried out whether as a group or individual activity.
- *Career Education* – a group of activities related to assisting young people in improving their knowledge and skills that will enable them not to choose the right career, but to be able to respond to the constant changes of today's dynamic labour market. Career education is provided through a variety of courses, seminars, lectures, trainings, etc.

- *Liaison with the business world* – a group of activities oriented toward developing opportunities for direct or indirect contact for mutual benefit between students and employers through visits to companies, practical work, formal or informal meetings between students and employers, different educational activities in which employers take part as lecturers, etc.

Most of the mentioned career service activities can also be found in the *Handbook on career counselling* (UNESCO 2002a).

6.2.1.3.2. Personal development planning

Since one of the aims of career services is to teach individuals how to plan and make decisions related to learning, employment and future career, personal development planning (PDP) processes can be observed in this context. The *Guidelines for HEI progress files* defines PDP as “a structured and supported process undertaken by a learner to reflect upon their own learning, performance and/or achievement and to plan for their own personal, educational and career development” (in The Quality Assurance Agency for Higher Education 2009, p. 5). In general, based on the descriptions from The Quality Assurance Agency for Higher Education (2009), PDP:

- is an inclusive process that support the idea of lifelong learning, continuous education, future employment and life-wide activities;
- is integral to learning alongside curricular and extra-curricular activities; and
- involves students themselves, tutors, peers and other relevant stakeholders.

PDP includes activities and evidence that can be used to explore and record the progress of a student’s employability, such as skills auditing, action planning, personal profiling, personal and academic records, development plans, progress files, learning portfolios, e-portfolios, learning logs and experiential and/or reflective diaries. Several different approaches to PDP may be recognized, with respect to its inclusion within HEI processes: *discrete* (separate from curriculum, not obligatory), *linked*, *embedded*, *integrated* and *extended* (including both curricular and extra-curricular activities). Like the curriculum development process, the PDP cycle is also based on four activities that follow the four steps of Deming’s PDCA cycle: 1) gathering evidence of learning experience and achievement; 2) reflecting on learning experiences and achievement; 3) identifying needs and creating development plans and 4) reviewing progress towards the achievement of goals set. All of the mentioned PDP

characteristics are proposed by The Quality Assurance Agency for Higher Education (2009, pp. 5-8).

Regarding its characteristics, PDP can be considered both an integral part of the curriculum and a part of student support processes. Since PDP activities involve support from teachers, tutors, peers, career counsellors and other significant stakeholders, for the purposes of this study, PDP is initially considered a part of student support services.

6.2.1.3.3. *Alumni relationships*

Alumni have already been mentioned as relevant stakeholders of the higher education system. Since alumni have passed through HEIs as former students, they can provide valuable information to HEIs by reflecting on how their study experiences contributed to their future employment and career development. Information from alumni are usually collected through so-called *tracer studies*, also known as graduate employability studies, alumni surveys, graduate career tracking, etc. Pavlin et al. (2013, p. 86) see data obtained from tracer studies as a “key methodological tool for attaining insights into the relationships between study programmes and perceived job requirements”. Different examples of tracer studies can be found in the literature, but most collect data from graduates organized around the following areas covered within the HEGESCO questionnaire: study programme, other educational and related experiences, transition from study to work, first job after graduation, employment history and current situation, current work, work organization, competencies and knowledge management, evaluation of study programme, values and orientations and personal information (HEGESCO 2007). However, Pavlin and Svetlik (2014) argued that tracer studies are not used widely or consistently enough to improve HEIs because these studies are typically conducted randomly and because decisions within HEIs are usually ad-hoc and based on academics’ personalized and random experiences, rather than on systematically-collected data on the relationship between HEIs’ practices and the world of work.

These studies provide valuable information that can be used to improve not only curricula and study programmes, but also the quality of HEIs and the higher education system in general. For example, Hennemann and Liefner (2010) suggested that HEIs should use the voices of alumni for stimulating changes in educational processes according to the labour market requirements, but also for raising students’ awareness about their future careers. Alumni could be included in HEIs processes in different ways, both formally and informally. For affecting the changes in educational processes, it would be beneficiary to include alumni in the processes

of institutional strategic planning and quality assurance as external partners. Alumni could certainly contribute to the quality of those processes since they have the internal institutional perspective as former students but can also bring the perspective from the external environment. For the benefits of student, successful alumni stories should be promoted through different media and they alumni could be included as guest lecturers within certain courses related to their working position.

6.2.1.4. *Extra-curricular activities*

Co-curricular and extra-curricular activities are recognized as valuable additions to curricular activities that enhance students' employability potential. Although the literature differentiates extra-curricular activities, which are activities that are separate from the formal learning program, from co-curricular activities, which are activities incorporated in formal education that are designed to work in parallel with the curriculum to support employable graduates, both types of activities consider students' voluntary pursuits that take place outside of the regular curriculum (Kinash et al. 2015, p. vi). Co-curricular and extra-curricular activities support students' non-formal and informal learning by developing skills in a wide variety of settings beyond the formal education, whether through work experience, internships, participation in student competitions, engagement in the work of student organizations, volunteering etc.. Developing opportunities for the recognition and validation of skills that can be gained through non-formal and informal learning and pursued through identification, documentation, assessment and certification, with options leading to partial or full qualification, is identified within *A New Skills Agenda for Europe* as a current goal for higher education (European Commission 2016a).

In the context of this thesis, the term *extra-curricular activities* is used for all activities that are not compulsory and integrated into the curriculum, which can take place either within the HEIs or in the wider community and that support both non-formal and informal learning. Extra-curricular activities, therefore, include participation in student competitions, work in student organizations, volunteering or sport activities, students' entrepreneurship initiatives, etc.

Until now, the potential role of extra-curricular activities in developing graduates' employability skills and enhancing their employability potential has been less studied than the role of the curriculum. Because extra-curricular activities are not structured or assessed in the same way that degrees are, students are usually not aware of the importance of extra-curricular

activities in the terms of their careers. By contrast, graduates can typically recognize the importance of extra-curricular activities for their employment (Clark et al. 2015). What makes extra-curricular activities so important is also the fact that employers often value these activities more than students' success in regular curricular activities. A workshop taking place at the University Business Forum highlighted the need for a more integrated and holistic approach, delivering a range of both curricular and extra-curricular experiences to both students and staff, in the context of entrepreneurial teaching and learning (Allinson et al. 2015, p. 17). In addition to alumni and employers, 95% of career staff recognize the value of extra-curricular activities as central to enhancing employability (The International Graduate Insight Group Ltd. [i-graduate] 2011, p. 8). It is interesting that both employers and higher education personnel recognize engaging in extra-curricular activities as being among the strategies for successful employability, while students are not aware of this connection (Kinash et al. 2014, pp. 21-22).

Taking into account the fact that employers consider and alumni confirm that extra-curricular activities are important for both getting and doing a job, HEIs should consider more structured ways of supporting and recognizing student engagement with these activities, as well as raising students' awareness of their importance. One of the latest EU strategic documents, *A New Skills Agenda for Europe*, recognizes that people increasingly learn in settings outside of formal education, including different co-curricular and extra-curricular activities, but that these learning experiences are often unrecognized (European Commission 2016a). This is important because the extent to which HEIs facilitate or provide opportunities for co-curricular and extra-curricular activities can impact development of students' employability skills.

6.2.2. *Initial list of practices recognized from the literature*

In addition to defining key process areas, in order to focus further research, it is also very important to provide an initial list of practices organized within these key areas. To provide a better insight into the main practices according to the recognized key process areas of HEIs, this chapter presents a list of practices that appear in the strategic documents and related guidelines of different universities. The following literature was consulted in the process of defining the relevant practices:

- A toolkit for enhancing personal development planning strategy, policy and practice in higher education institutions (Miller et al. 2011)
- Edge Hill University, Employability Strategy 2013–2018 (Edge Hill University 2013)
- Embedding employability into curriculum (Yorke & Knight 2006)

- eMM Version 2.3 Process Descriptions (Marshall 2007)
- Global graduate employability research: A report to the Business20 Human Capital Taskforce (Draft) (Kinash et al. 2014)
- Pedagogy for Employability (Pegg et al. 2012)
- Personal development planning: guidance for institutional policy and practice in higher education (The Quality Assurance Agency for Higher Education 2009)
- Staff Guide to Embedding Employability in the Curriculum (London Metropolitan University n.d.)
- Standards and guidelines for quality assurance in the European Higher Education Area (ESG)(European Association for Quality Assurance in Higher Education (ENQA) et al. 2015)
- Strategija studija i studiranja Sveučilišta u Zagrebu (2014.-2025.) (Sveučilište u Zagrebu 2014)
- Student affairs and services in higher education: Global foundations, issues and best practices, UNESCO (Ludeman et al. 2009)
- Supporting Graduate Employability: HEI Practice in Other Countries (The International Graduate Insight Group Ltd. (i-graduate) 2011)
- The role of student affairs and services in higher education: A practical manual for developing, implementing and assessing student affairs programmes and services (UNESCO 2002b)
- The University of Edinburgh, Strategic Plan 2012–2016 (University of Edinburgh 2012)
- University of Bradford Curriculum Framework (University of Bradford 2012b)
- University of Bradford, Employability Strategy 2012–2015 (University of Bradford 2012a)
- University of Cambridge, Learning and Teaching Strategy 2012–15 (University of Cambridge 2012)
- University of Edinburgh, College of Science and Engineering Learning and Teaching Strategy 2014–2016 (University of Edinburgh 2014a)
- University of Edinburgh, Developing and Supporting Curriculum (University of Edinburgh 2014b)
- University of Hull, Employability Strategy (University of Hull 2011)
- University of Kent, Employability Strategy (University of Kent 2013)

- University of Oxford, Strategic Plan 2013–2018 (University of Oxford 2013)

The initial list of practices within the recognized key process areas for enhancing graduates employability was extracted from a review of these relevant documents and is shown in **Table 10**. Most of the practices can be recognized, whether directly or indirectly, in more documents. This initial list of practices serves as a basis for conducting case study researches at four HEIs in Europe within *Step 3: Design the model* of the maturity model design.

Table 10. Initial list of key higher education practices contributing to graduate employability recognized from the literature

| Key area | Practice |
|---------------------------------------|--|
| Strategic planning | <ul style="list-style-type: none"> • Institutional policy and strategy explicitly address the employability of graduates • Relevant stakeholders are involved in the (re)development of institutional strategies and policies regarding graduates' employability • Connection and compliance with other relevant strategies and policies are ensured • Institution clearly articulates the specific and interrelated roles of different organization units in delivering the employability strategy • Institutional strategies and policies are regularly and formally reviewed to ensure that aspects of graduates' employability are addressed • Initiatives and decisions related to enhancing and supporting graduates' employability are guided by an explicit action plan or by operational plans based on the institutional strategies |
| Curriculum design and delivery | <ul style="list-style-type: none"> • The curriculum is designed to provide students the opportunity to enhance their employability skills in the changing and competitive graduate labour market • Key employability skills are embedded within the curriculum • Curriculum development is guided by a <i>student-centred approach in which employability skills are considered to be interrelated and must be developed incrementally across the curriculum</i>⁴ • The institution is committed to proactively engaging with employers in the iterative process of the development of curriculum relevant to their needs and up-to-date with trends in the industry domain • Learning outcomes are transparently and directly related to the desired graduate employability skills • The curriculum comprises and reflects a selection of knowledge, skills, values and attitudes relevant and valued by the relevant professions, subject disciplines and wider society • The curriculum supports an appropriate balance between theory and practice |

⁴ The description of student-centred approach may be found in this form in University of Bradford Employability Strategy 2012–2015 (University of Bradford 2012a)

| | |
|------------------------------------|--|
| | <ul style="list-style-type: none"> • Work-based or work-related learning is incorporated into one or more components within the curriculum • Students' education is delivered in partnership with employers, alumni and other professional organizations • Teaching methods encourage independent, active learning and engagement with tasks (every student as a researcher/practitioner) • Pedagogic approaches reflect employment practices, including problem-based learning, work-based activities and other innovative and collaborative teaching methods • Evaluation methods, including peer- and self-assessment, are designed to progressively build student competence • Curriculum monitoring tests how and where the development of employability skills is incorporated into a curriculum and may also suggest potential improvements in teaching and assessment methods • The institution provides teachers' support for their personal development as well as support for implementing new technology and incorporating innovative pedagogical approaches in their courses |
| Student support | <ul style="list-style-type: none"> • The institution provides accessible and high-quality career services that support student employment prospects through the provision of different kinds of career information, counselling and education, in partnership with other relevant stakeholders • Career services develop and maintain relationships with employers and enable their engagement in different activities • The institution maintains an effective alumni network that supports the promotion of successful alumni stories and enables raising the awareness of current students concerning their future careers • The institution conducts follow-up studies on graduates' satisfaction with their study experiences and employment • The institution supports students in using personal development planning tools to record their learning progress and their engagement with co-curricular and extra-curricular activities • The institution provides a tutoring system (including peer support activities and personal tutoring from teaching staff) to guide students' academic plans and educational progress and support them in taking responsibility for their professional development. |
| Extra-curricular activities | <ul style="list-style-type: none"> • The institution provides a framework for the recognition of students' co- and extra-curricular achievements that contribute to their employability • The institution works with the student union and different student organizations to promote different extra-curricular activities as integral and accreditable parts of the student experience • The institution provides students with opportunities to develop their entrepreneurial and innovative skills and support their self-employment initiatives (i.e. start-ups) |

6.3. Step 3: Design the model

Given the definition of the maturity model elements in *Chapter 5* and the initial definition of the key process areas and practices in *subchapter 6.2*, it is possible to begin designing the model. The main method to be used in this part of the research is the case study research. The purpose of conducting case study research is to detect as many as possible relevant practices within the four recognized key process areas aimed at supporting higher education graduates' early labour market careers within HEIs. This step is expected to provide a full list of practices according to the proposed key process areas, which will form the initial strategic framework for supporting higher education graduates' early careers. The shortened version of case study research methodology contained within this subchapter was previously presented at the European Access Network (EAN) conference in May 2016 (Pažur Aničić & Divjak 2016).

6.3.1. Identification of practices

6.3.1.1. Case study research

The case study method is a qualitative research method that provides “an unique example of real people in real situations, enabling readers to understand ideas more clearly than simply by presenting them with abstract theories and principles” (Cohen et al. 2011, p. 289). According to Yin (2014), case study research is conducted in five stages:

- 1) Design phase
- 2) Preparation phase
- 3) Collection phase
- 4) Data analysis
- 5) Results sharing.

6.3.1.1.1. Design phase

In this first step of case study research, there are five components of the research design that are essential: 1) a case study question, 2) its propositions, 3) units of analysis, 4) the logic linking data to the propositions and 5) the criteria for interpretation of findings (Yin 2014, pp. 29-36). This subchapter provides a short description of each component and its application within this research.

6.3.1.1.1. Case study questions

In keeping with the purpose of conducting case study research, the main case study question is: *How is the system of student support for early career development organized in different higher education systems, according to the four key process areas?*

Based on the initial set of practices recognized in 2) *Define the scope* and presented in **Table 10**, a set of sub-questions for case study research is defined as presented in **Table 11**.

Table 11. List of case study questions

| Key area | Case study questions |
|---------------------------------------|---|
| Strategic planning | <ol style="list-style-type: none">1. Can you tell me something about the strategic planning process at your institution?2. Do the strategies at your institution include employability of students and to which extent (separate strategy, part of another strategy)?3. Which stakeholders are included in the process of strategic planning/strategy design (students, employers, alumni...), and to which extent (informal, semi-formal, formal)?4. Does your institution, and on which basis, do the evaluation of strategy?5. On which basis does your institution do the revision of strategy? Which information do you use in that process and how do you collect them?6. How do you evaluate a success of your strategy regarding the employability of graduates?7. Is your strategy accompanied with action plans at the level of different organizational units? |
| Curriculum design and delivery | <ol style="list-style-type: none">1. Can you tell me something about the curriculum development process at your institution?2. How is the employability of graduates included in the curriculum development process?3. Which stakeholders are included in the process of curriculum development (students, employers, alumni...), and to which extent (informal, semi-formal, formal)?4. On which basis does your institution do the revision of curriculum for a certain study programme?5. Are there some specifics in curriculum development process for study programmes in information and communication technologies?6. How do you evaluate a success of curriculum for a certain study programme regarding the employability of graduates? Do you use feedback from students within curriculum revision?7. What is the role of learning outcomes in curriculum design and delivery? How are they connected to the European Qualifications Framework and National Qualifications Framework?8. How are the employability and employability competences (generic and transferable) included in curriculum content? |

| | |
|------------------------------------|--|
| | <ol style="list-style-type: none"> 9. Is there an institutional support for students in continuous development of their personal planning (<i>Personal Development Planning</i>) within curriculum or in the form of extra-curricular activities? Is there any online support for this kind of activities, such as an e-portfolio? 10. How is the mentorship program organized, does each student have a personal mentor? What is the profile of mentors (teachers, senior students...)? 11. Can you describe some teaching methods that are popular as a way to improve students' employability? Are there some examples of work-based learning, problem-based learning, project-based learning etc.? 12. How is the students' assessment performed, do you use methods like <i>self-assessment</i> and <i>peer-assessment</i>? 13. What kind of support activities are available for teachers that help them in preparing their students for employment? 14. How is the teachers' performance measured? |
| Student support | <p><i>Student Support</i></p> <ol style="list-style-type: none"> 1. Can you tell me what kinds of student services are available at your institution? 2. Can you briefly describe the structure and main purpose of your career centre (or any other centre/service), how the centre's management is organized, who makes and approves the yearly action plan and how the centre is financed? 3. Who are the main clients/customers of your services (students, employers, teaching staff, alumni, etc.)? 4. Can you describe the main activities the centre provides for its main customers/target groups? <p><i>Alumni</i></p> <ol style="list-style-type: none"> 1. Could you describe how is the alumni office organized at your institution? 2. Are there some formal procedures of graduates tracking and their career development upon graduation? 3. Are the alumni formally involved in different decision-making bodies or committees (for strategic planning, curriculum development etc.) at your institution? 4. Are there some data collection procedures about alumni satisfaction with their study at your university, is there a practice of using these data for the improvement of certain processes? |
| Extra-curricular activities | <ol style="list-style-type: none"> 1. Can you tell me what kind of extra-curricular activities are organized/exist at your institution (different kind of student competitions, summer schools, workshops in collaboration with employers, volunteering etc.)? 2. How is the recognition system of extra-curricular activities organized at the level of university or particular school/programme? 3. How does your institution support and foster students to take part in different extra-curricular activities? |

| | |
|--|---|
| | <ol style="list-style-type: none"> 4. Which student organizations are active at your university, related to students in ICT, but also in general? 5. Do you support students' entrepreneurship initiatives, for example student start-ups? |
| | <p><i>Collaboration with industry</i></p> <ol style="list-style-type: none"> 1. Could you describe the collaboration of your institution with industry? 2. Could you describe some of the main activities in collaboration with industry focused to better employability of graduates? 3. Are the industry representatives formally involved in different decision-making bodies or committees (for strategic planning, curriculum development etc.) at your institution? 4. How is the collaboration with industry organized within different study programmes, particularly within School of Informatics? 5. Are there some invited lectures, visits to companies, project task, internships etc. in collaboration with industry as a formal part of curriculum? 6. Could you describe the collaboration of your institution with local community? |

Since collaboration with employers, who represent one of the most important stakeholders in enhancing graduates' employability, is important for different practices, these questions are divided from questions concerning the other key process areas within the prepared case study questions.

6.3.1.1.2. Case study question propositions

In addition to the case study questions, several propositions regarding what the researcher should study could be suggested. The propositions are useful to move the research in the right direction and look for the relevant evidence on the studied case. In an exploratory study like this one, it is not necessary to define propositions, because the researcher is not looking for concrete evidences on a certain topic but is rather exploring the case. However, each exploratory research should have stated its purpose (Yin 2014, p. 30). In this context, the idea behind the case study research is to explore all the relevant practices within HEIs that contribute to graduate employability.

6.3.1.1.3. Units of Analysis

Case study questions and their propositions help to focus a research study on a particular unit of analysis: the "case". In this research, the cases are HEIs, rather than the individuals that constitute them. Since institutions are complex systems, the propositions will help to focus the research on only the important elements: those related to enhancing higher education

graduates' employability. In greater specificity, the units of analysis are HEIs providing study programmes in the field of ICT and their practices within four key process areas: *Strategic planning*, *Curriculum design and delivery*, *Student support* and *Extra-curricular activities*. The process of clarifying the units of analysis is known as *bounding the case* (Yin 2014, pp. 33-34).

Another important step in the design phase involves deciding about the case study type. There are four types of case studies, each reflecting a different combination of the following criteria: single/multiple and holistic (single unit of analysis)/embedded (multiple units of analysis). This research can be characterized as a multiple-case study with embedded units of analysis, since it includes cases of four different HEIs from four different countries, where each country represents a different context (Yin 2014, p. 50).

Another important question that arises regarding the units of analysis concerns the threshold number of cases to be conducted. Previous case study research has concluded that between 4 and 10 cases usually works well, while fewer than 4 cases makes it difficult to generate theory (Eisenhardt 1989; Stake 2006, p. 22). Since the case studies conducted within this research serve to extend existing theory (rather than to generate new theory), the intention was to conduct 4 to 5 case studies. When performing a multiple-case study, one of the main objectives is to examine how a given phenomenon performs in different environments. Therefore, it is important to think about three main questions when selecting cases, as proposed by Stake:

- “Is the case relevant to the quintain?
- Do the cases provide diversity across contexts?
- Do the cases provide good opportunities to learn about complexity and context?” (Stake 2006, p. 23)

To choose the cases for analysis, a combination of purposive and theoretical sampling was used. Purposive sampling allows a researcher to choose cases that illustrate certain features or processes related to the interest of the research; however, it requires the researcher to think critically about the parameters of the units of analysis and to choose a sample carefully on this basis (Silverman 2014, pp. 60-61). For the purpose of this research, the cases were analyzed based on not only the information available on their websites concerning the proposed four key process areas, but also the previous experience of mentors and colleagues in collaboration with those HEIs. It is important to stress that not all of the cases were chosen at the beginning of research. Instead, each conducted case provided insight into the practices relevant to the key

process areas, allowing further cases to be chosen based on the data missing for the various practices. Theoretical sampling means that cases are chosen for theoretical (rather than statistical) reasons. Theoretical and purposive sampling are often treated as synonymous because the only difference between the two is when the ‘purpose’ behind purposive sampling is not theoretically defined (Silverman 2014, p. 62). Silverman further claims that cases in qualitative research should always be theoretically guided. In this research, this is the case for the decision about the cases to be included, which depends on the theory related to supporting graduates employability presented in previous chapters. As shown in **Figure 13**, the cases chosen for the purposes of this study are:

- 1) Austria, Vienna University of Economics and Business
- 2) Republic of Serbia, University of Belgrade, Faculty of Organisational Sciences
- 3) Sweden, University West
- 4) UK, University of Edinburgh.

Since each HEI has a different structure, this research will comprise multiple embedded case studies. It is not only the HEIs’ structure that differ, but also their focus on ICT domain. Each of the studied institutions provides study programmes in the field of ICT, but some of them focus more on engineering and informatics while the others focus on the application of ICT in business. A short reference to the ICT-related programmes within each institution is given in the description of cases.

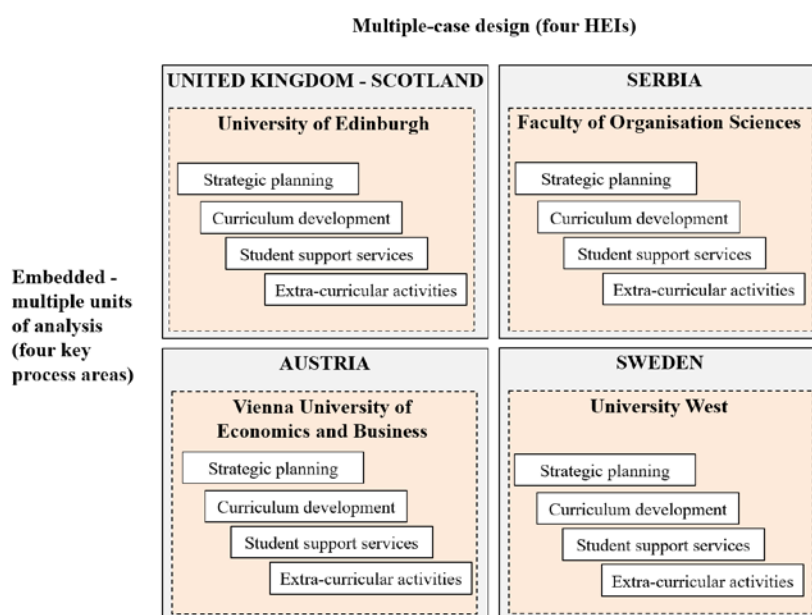


Figure 13. HEIs chosen for multiple-case design [adapted from (Yin 2014, p. 50)]

Short explanations of each of the the chosen cases and their characteristics according to the key process areas are provided below, based on the information available on the HEIs' web pages.

1) Austria, Vienna University of Economics and Business⁵

As stated on its website (Wirtschaftsuniversität Wien [WU] 2016), the Vienna University of Economics and Business (WU) is one of Europe's biggest and most modern universities of economic sciences. It provides education for over 22,000 students at its unique and modern campus, which offers about 100,000 m² of usable area and provides an ideal environment for different types of learning and teaching activities. Altogether, 25,000 students and 1,500 teachers, researchers and administrative staff study and work on the WU campus.

WU has an excellent international reputation, as evidenced by the fact that it is among the fewer than 1% of universities worldwide that can claim triple accreditation by EQUIS, AACSB and AMBA: the three foremost international accreditations for business and economics universities. Furthermore, roughly one in four WU students comes to study there from abroad.

WU offers a study programme in Information Systems at the master's level that provides students with IT-related knowledge and skills, with a particular emphasis on management and research topics.

Excellent, research-led teaching is extremely important to WU. Its 2,100 employees work continuously to improve their teaching and research quality and campus life in all relevant areas, as evidenced by the school's very well-developed quality assurance processes, especially in the area of curriculum design and development. Examples of these quality assurance processes can be seen in the work of the following service units:

- *Program Management and Teaching & Learning Support* – This unit has the main aim of promoting and assuring quality in teaching as one of WU's key objectives. The teaching quality development and teaching quality assurance agendas are closely related to the programme management and development agendas because the focus on quality features permeates all of the processes and activities of WU's academic programmes and programme management on both the individual and the organizational levels. This service unit comprises one staff unit and four line units, which work closely

⁵ Information about the WU presented here can be found at the University's webpage: <https://www.wu.ac.at/en/>

together: Academic Controlling, Evaluation & Quality Enhancement, Teaching Coordination and Teaching & Learning Services.

- *Personnel Development & Planning Office* – The job of this unit is to support and guide interactions between management personnel and staff by offering training courses and consultation services and by developing individualized, custom-designed personnel development instruments. This unit offers a wide range of services for administrative staff, academic staff, WU management and WU professors.

In addition to its very well-developed processes of curriculum design and development, this institution also provides good examples of best practices within student support and career services. Of these, some that are important in the context of this thesis are:

- *ZBP Career Center*– This is an affiliated organization that has operated as a professional interface between studying and the labour market for more than 30 years. It provides services exclusively for students and graduates of WU and other business universities through a wide range of activities covering: jobs and internships, counselling, trainings and different career-related events. In addition to serving students, the ZBP Career Center also serves different employers, including both start-ups and multinational corporations.
- *Study support unit* – This is a contact point for students facing a variety of questions, challenges and problems during their studies. It is one of the three areas covered by the Vice-Rector for Academic Programs and Student Affairs, and is divided in the following three sections: examination organization, study information and admissions.
- *WU Alumni Club* – The WU Alumni Club gives WU graduates a platform for meeting interesting people, making new contacts, exchanging ideas, networking with other professionals and staying in touch with WU through approximately 70 annual events.

2) Republic of Serbia, University of Belgrade, Faculty of Organisational Sciences⁶

As stated on its website (Faculty of Organisational Sciences [FOS] 2016), the *Faculty of Organizational Sciences (FOS)* is a leading faculty in Serbia within the field of management and information systems and technologies. It services around 4,000 students. The main characteristic of this institution that makes it a good case for this research is that many FOS

⁶ Information about the FOS presented here can be found at the Faculty's webpage: <http://www.fon.bg.ac.rs/eng/>

students are actively involved in the work of different student organizations and in numerous extra-curricular activities. Furthermore, the Faculty has well-developed cooperative agreements with leading companies in the region, which give its students the opportunity to improve their knowledge and awareness of business systems during their studies. In fact, the institution was founded in 1969, at the request of a large number of enterprises, with the aim of strengthening the economy by teaching students the latest knowledge in the fields of organization, management and information systems. Today, the FOS has grown and developed into an integral part of society in the fields of information technology, management, operations management, and quality management and standardisation.

Within FOS, there are several programmes related to ICT at both the bachelor's and the master's levels: Information Systems and Technologies – BSc, Information Systems and Technologies – MSc, Software Engineering and Computer Science – MSc, Business Analytics – MSc, E-business and System Management – MSc.

The FOS focuses heavily on its students' co-curricular and extra-curricular activities and supports the work of different student organizations. It is also very proud of the numerous medals won by its students in national and international competitions in both knowledge and sports. Student organizations that are active at FOS include the following:

- *Student parliament* – This is an academic institution body that aims to realize students' rights and protect their interests. The student parliament elects and dismisses student representatives from the bodies of the faculty and other bodies of student involvement. Members of the student parliament have the right to vote in faculty and university bodies on all issues affecting students, teaching quality and teaching reform implementation process. The student parliament is the umbrella student organization for the faculty, and it addresses issues related to student standards, improvements to studying conditions, the coordination of the work of student organizations, the coordination of the projects of student organizations.
- *AIESEC FOS* – AIESEC is the largest student-led organization in the world with a primary focus on fostering leadership in the international environment by providing young people with opportunities to travel, work, volunteer, improve their language skills, get to know different cultures and make lifelong friends.

- *Student Association of the Faculty of Organizational Sciences (SSFON)* – This is an independent, non-profit, non-political association of students from the FOS that works to recognize, secure and protect the interests of students.
- *Association of FOS Students of Informatics (FONIS)* – This student organization brings together future IT experts to participate in professional lectures, courses, competitions and seminars, including work on projects and professional internships in IT.
- *The FOS Centre for Career Development* – This group is a continuation and expansion of an internal project of the FOS personnel database. It provides the knowledge, skills and experience needed for the development of individual careers and supports students in professional and vocational guidance and employment.
- *Case Study Club* – This club connects young leaders who collaborate by learning and sharing experiences with one another. As members of the case study club, these students have the opportunity to organize a large number of projects; work as a team; listen to eminent experts in finance, marketing, consulting and coaching; learn firsthand how to connect theory with practice; and compete in local and international competitions.

The other student organizations also include: ESTIEM LG Belgrade, EkoFON, Debate Club, FOS' Sports society and InterFON magazine. As can be seen from the above-listed active student organizations at the FOS, students have a wide range of opportunities to enrich their student lives and acquire additional competences that could help them in their future careers.

The second main reason the FOS was chosen as a good case practice is its collaboration with industry. The descriptions of the student organizations clearly shows that FOS students frequently cooperate with business partners in the scope of their work. Additionally, at the institutional level, such cooperation is established through strategic partnerships with leading regional and international companies, internship opportunities for students in various areas with more than 700 companies in Serbia, visiting lectures by managers and planned visits by teachers and students through the company visit programme, during which a host company gives lectures and presents good practices, models and modes of work.

3) Sweden, University West⁷

University West in Sweden (University West 2016) can be characterized as a modern university with a focus on studying via work-life collaboration in an attractive and modern study environment. The advantage of this rather small university lies in its dynamic and effective decision-making process and its process for providing students and teachers with opportunities to get to know each other well. These initiatives create a special kind of atmosphere where students can thrive and achieve academic success and are encouraged to take an active role in the learning process by actively seeking knowledge and set their own targets.

The university offers study programmes, second-cycle programmes and a variety of courses in computing and IT, economy and leadership, health and care, teaching and languages, media, the individual and society and technology. One of the programmes related to ICT, there is IT and Management, which is a one-year master's programme in Informatics.

Because of the university's close collaborations among work, life, businesses and society, University West enrolls approximately 11,000 students, of whom 5,000 are full-time students. The institutions' collaborations with the world outside the university represent a key dimension of University West's education and research programmes and enable the programmes to remain relevant and competitive in a changing world. This synergy with the local environment is evident not only in the research, teaching and learning processes, but in the processes of strategic planning, student support and extra-curricular activities. This synergy is one of the most important characteristics of University West, making it a good case for this research, and it is evident primarily through the university's profile of work-integrated learning (WIL). WIL means that students at the university gain work experience while studying. In fact, University West has been commissioned by the government to develop WIL-oriented pedagogies. One example of WIL is the so-called co-op approach, in which studies are sandwiched with periods of paid work.

In addition to providing a good example of cooperation between academia and business within the formal processes of teaching and learning, University West also implements remarkable

⁷ Information about the University West presented here can be found at the University's webpage: <http://www.hv.se/en>

strategic planning processes, which, together, produced the publication *Vision with Strategies towards 2022*.

4) Scotland, UK, University of Edinburgh⁸

The University of Edinburgh (The University of Edinburgh 2016) was officially established in 1583, and today, it is among the best European universities, with around 35,575 students. Due to its size, the University of Edinburgh provides good evidence of all four key HEI process areas contributing to graduates' employability researched within this thesis. Unlike the other three cases, the University of Edinburgh requires the research of relevant processes and practices not only within the single institution (i.e. a faculty or school), but also in the relation to the university as whole.

The particular interest of this research lies in the School of Informatics within the College of Science & Engineering, which offers a wide range of IT-related programmes, including Artificial Intelligence - BSc, Computer Science - BSc and BEng, Software Engineering - BEng, Informatics - MInf, Computer Science and Electronics - BEng, Computer Science and Management Science - BSc, Computer Science and Mathematics - BSc, Computer Science with Management - BEng, Software Engineering with Management - BEng, and a few more.

While curriculum-related practices are examined primarily at the levels of the college and the school, the processes of strategic planning and different student services were examined at the level of the university, through research into the following organizational units:

- *Governance & strategic planning* – This unit is responsible for strategic planning processes at the level of the university. As in any large organization, planning at the University of Edinburgh operates at different levels across the university and is an iterative top-down/bottom-up process. Planning processes involve the development of annual and longer-term plans, which translate the content of the current strategic plan for the overall university into more immediate strategies and targets so that each area within the university can demonstrate its contribution to the achievement of the medium-term objectives and targets set out in the strategic plan.

⁸ Information about the University of Edinburgh presented here can be found at the University's webpage: <http://www.ed.ac.uk/>

- *Careers service* – Provides a comprehensive set of career-related services. The key services include information, advice and guidance through information drop-ins, appointments and information resources. Other services include talks and events, such as the Careers Fair, and the Edinburgh Award, aims to help students learn to excel, increase their impact and stand out from the crowd.
- *Institute for Academic Development* – This unit offers a wide spectrum of activities for both students and academics. Some of these include: guidance and materials for personal tutors, student support teams, and other staff offering academic and personal support to students; information and guidance to help academics consider and develop their approaches to student assessment and feedback; information about the Continuing Professional Development (CPD) Framework for learning and teaching at the University of Edinburgh, including the Edinburgh Teaching Award; an introduction to the Academic Practice course, a Higher Education Academy-accredited course designed for university tutors and demonstrators; etc.
- *Professional development* - Departments across the university offer continuing professional development opportunities, including short courses, evening talks, conferences and seminars in specialist topics for industrial, commercial and public sector professionals in different subject areas.
- *Student Counselling* – The Student Counselling Service offers self-help resources, drop-in presentation workshops, short-term counselling and consultations for students and consultation and development training courses for staff.
- *Edinburgh University Students' Association (EUSA)* – This unit exists to represent students' views and ensure students' experiences are the best that they can be through the provision of services involving entertainment, welfare and representation. One of the main activities of this unit is the coordination of elected student representatives, who gather students' views about various aspects of their studies and university life in general and then communicate that feedback to staff members, suggest solutions and work together with the staff to bring about change. Other activities include peer support activities, which represent great ways for students to learn from fellow students. The EUSA also offers The Advice Place, where a professional advice team offers students free and confidential information on anything and everything that they might need to know. The EUSA is also responsible for the Edinburgh Award, which is a recognition

scheme that helps University of Edinburgh students reflect on their experiences in order to develop skills that increase their employability.

Besides the individual characteristics of each of four chosen cases and their expertise regarding the certain key process area, it is also important to elaborate cases in a broader context of differences in education systems and countries' socio-economic environments. The criteria is shown in **Table 12**. Studied cases cover four European regions: western, north, middle and south-east Europe, which are all characterized by some specificities in educational systems. Cases also include an institution with a several centuries long tradition, two institutions with around 35-years long tradition, as well as one relatively young university. The institutions also differ in their size, expressed in the number of students and employees. Another characteristic that was considered is (de)centralization of processes and activities – the cases covers both the institutions with most of the centralized processes, as well as those with complete decentralization on the faculty level. Different characteristics of HEIs chosen as cases helped researcher to get insight in different organization of practices and help to further develop model that is applicable to different types of HEIs.

Table 12. Characteristics of HEIs included in case study research

| Criteria | WU | FOS, University of Belgrade | University West | The University of Edinburgh |
|---------------------|-----------------------------|-----------------------------|------------------------|-----------------------------|
| Founded | 1975 (dates back from 1898) | 1969/1971 | 1990 | 1538 |
| Region | Middle Europe | South-east Europe | Northern Europe | Western Europe |
| Number of students | ~22,000 | ~ 3500 | ~11,000 (5000 regular) | ~ 36,000 |
| Number of employees | ~2,100 | ~ 250 | ~600 | ~ 13,000 (headcount) |
| Centralization | Centralized | De-centralized | Centralized | Centralized |

6.3.1.1.1.4. The logic linking the data to the propositions

Linking data to propositions requires the types of analytic techniques used to analyze empirical case study evidences. The main analysis technique used in this study will be *coding*. In qualitative research, a *code* is understood as “a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data” (Saldaña 2013, p. 3). Coding will be applied to interview transcripts. The process of coding will follow a manual proposed by (Saldaña 2013) and will be described in more detail within step 4) *data analysis* of the case study research.

6.3.1.1.1.5. Criteria for the interpretation of findings

The data collected within qualitative research are usually not expected to be appropriate for using the types of statistical analyses that enable robust findings, since these consider the application of statistical tests with strictly defined boundaries to confirm statistical evidence. However, some quantitative methods will be used to ensure the validity and reliability of model that will result from coding process. The findings will be further evaluated within step 4) *Evaluate the design* of the maturity model design.

6.3.1.1.2. Preparation phase

The main goal of the second phase in the case study research is to gain informed consent and to define a protocol for conducting the case study. Three main documents resulted from this phase (available in the Appendices):

- ***Request for permission to conduct case study research (Appendix D)*** – This is a formal document that was sent to the representatives of each selected case study institution.
- ***Informed Consent Form (Appendix E)*** – This form was divided into two parts with the following subparts:
 - **Information Sheet** – contains information about project, principle investigator, mentor, organization, about the research, benefits, procedures, publishing, duration, participation and participant selection, reimbursements and who to contact
 - **Certificate of Consent** – statement by the participant and statement by the researcher/person collecting the consent.

The informed consent form was signed by all participants in the case study research.

- ***Case study protocol (Appendix F)*** – This protocol contains a short description of the project, the data collection procedure and the initial list of questions for the case study.

6.3.1.1.3. Data collection

During a case study research, it is possible to obtain data from different data sources. In this research, the main sources were *semi-structured interviews*, which were conducted with various experts involved in the processes of student support at the chosen case study universities, as well as the available documentation (e.g. strategies and policies at the institutional level). The interview as a research method can be defined as “a conversation that has a structure and a purpose” (Brinkmann & Kvale 2015, p. 5). Like any other research method, an interview has several stages. For the purposes of this research, the researcher

followed the seven steps proposed by Brinkmann and Kvale (2015, pp. 128-129): 1) thematizing the interview project, 2) designing, 3) interviewing, 4) transcribing, 5) analysing, 6) verifying and 7) reporting. Since the interviews were conducted as a method within the case study analysis, it is not necessary to elaborate on all of the steps of conducting the interviews (as these are similar to those of conducting case study research). Since the preparation phase for conducting the interviews (preparation of interview questions) was already described in *subchapter 6.3.1.1.1*, this subchapter emphasizes the interview process itself.

After obtaining permission to conduct a case study at a particular HEI, it was important to identify the relevant persons at the institution that could be potential interviewees. For this reason, the researcher not only communicated the purpose of the research to a contact person at each institution, but also engaged in a search of the institutional website in order to identify potential interviewees. It was important to select interviewees that would be able to provide answers to case study questions or provide an overview of some additional practices. In research, the number of interviews depends on the subject of the study. Typically, the number of interviews tends to be around 15 +/- 10, but the best indicator of a sufficient number of interviews is achieving the point of saturation, after which further interviews yield little new knowledge (Brinkmann & Kvale 2015, p. 140). For the purposes of this research, a total of 27 interviews with the representatives of four HEIs were conducted. **Table 13** presents a list of the individuals participating in the interviews and their roles within the institution.

It can be perceived that the list of interviewees cover all the relevant internal higher education stakeholders – higher education managers, teaching staff, non-teaching staff and the representative of students. However, the distinction between these groups of stakeholders cannot be strict in some cases while, for example, most of the higher education managers are also representatives of teaching staff. Similarly, some teaching and non-teaching staff have managerial roles within their departments, centres or other organizational units within HEIs. Additionally, interviewees come from different HEIs organizational units. The interviews were conducted between September and December 2015.

Table 13. List of case study interviewees

| No. | Position/Function |
|-----|---|
| | HE managers |
| 1. | Head of strategic performance and research policy |
| 2. | Vice-dean for academic affairs |
| 3. | Student vice-dean |
| 4. | Vice-dean for international cooperation |
| 5. | Vice-dean for scientific research |
| 6. | Vice rector |
| 7. | Research director |
| 8. | Strategic analyses and performance agreements |
| | Teaching staff |
| 9. | Director of Learning and Teaching at the College level |
| 10. | Director of Teaching at the School of Informatics |
| 11. | Associate professor Managing director of Business International Case Competition |
| 12. | Programme director in Graphic Design |
| 13. | Senior Lecturer in Human Machine Interaction |
| 14. | Teacher in Engineering |
| 15. | Programme Director Informatics |
| | Non-teaching staff |
| 16. | Expert associate for alumni and student internship |
| 17. | Director of Career Services |
| 18. | Academic Engagement Coordinator |
| 19. | Careers consultant |
| 20. | Program & Quality Management |
| 21. | Teaching & Learning Services |
| 22. | Managing director of Career Center |
| 23. | Head of Study Support |
| 24. | Head of Evaluation |
| 25. | Cooperative programme (coop) coordinator |
| 26. | International Coordinator |
| 27. | Career Counsellor |

Both qualitative and quantitative data were collected. Quantitative data can indicate significant relationships not salient to the researcher (Eisenhardt 1989); however, the focus of this research is on qualitative data describing different practices. It is important to stress that, for theory-building research, it is legitimate to alter or add data collection methods during a study, if such alternation is likely to provide new theoretical insight or better ground the theory (Eisenhardt 1989).

The main objective of conducting the interviews was to answer the second research question:

Research question 2: Which are the key higher education institutions' practices having impact to the preparation of higher education graduates for their early careers?

Therefore, it was important to relate this research question with the case study questions, as proposed by Brinkmann & Kvale (2015, p. 158). The author used another step (initial list of practices) to relate the research question to the interview questions, as follows (**Figure 14**):

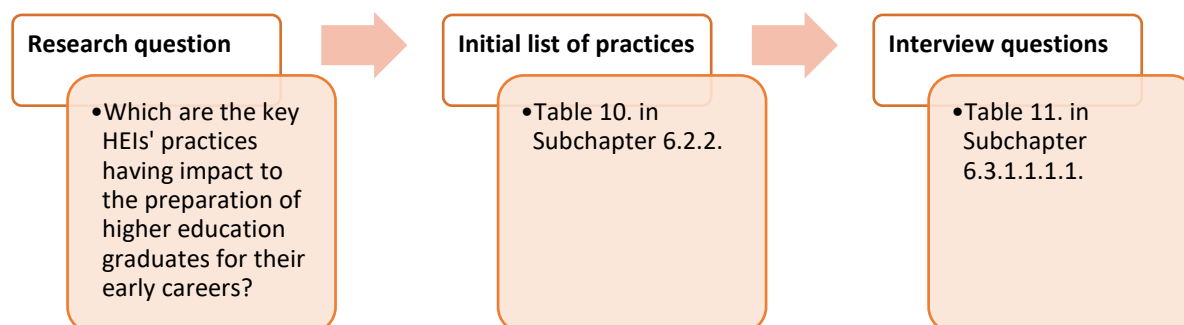


Figure 14. Relationships between the research question and the interview questions

Each group of questions started with a so-called *introductory question* in the following form: “*Can you tell me something about...?*” This gave the interviewees the opportunity to provide their own descriptions of their experience with the topic. However, other types of questions were used as well (Brinkmann & Kvale 2015, pp. 160-162). *Follow-up questions*, which repeat the significant words of a provided answer, were used when the researcher wanted to extend the subject’s answer, as were *probing questions* when the researcher wanted to find out more about certain topic. In the later phases of the interviews, once the interviewees had already provided their spontaneous answers, the researcher sometimes used *specifying and direct questions*. In some cases, when a certain topic of conversation had been exhausted, the researcher used *structuring questions* to indicate a move to another topic. Furthermore, when answers required more explanation, *interpreting questions* were also used. For organization purposes and to propose any question beyond those initially prepared by the researcher, it was very important for researcher to engage in active listening in order to guide the interviews in the right direction in order to obtain all relevant information.

In addition to interviews, additional documentation, such as brochures, leaflets, official documents, etc., was also collected during the case study research.

6.3.1.1.4. Data Analysis

The very first important step of data analysis is the within-case analysis, which helps researchers to cope with the enormous volume of collected data early in the analysis process (Eisenhardt 1989). Once a researcher has become familiar with each case as a stand-alone

entity, it is time to conduct a cross-case synthesis, using techniques relevant to the synthesis of information collected from different case studies, in order to search for patterns among cases (Yin 2014, pp. 164-168). There are several main tactics for data analysis, some of which will be combined during this step of the research process. Based on the initially-defined theoretical constructs, an author can search for within-group similarities and intergroup differences. Thus, the similarities and differences between each pair of cases can be observed, and the data can be analyzed by source. Within this research, the purpose of conducting a case study research approach was to detect and identify all relevant practices within the four defined key process areas. Therefore, the researcher was not interested in comparing the results of the different case studies, but instead sought to identify the whole set of practices determined across all four cases.

One of the most common ways to analyze qualitative data is coding. As already mentioned, in the context of qualitative inquiry a *code* is understood as “a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data” (Saldaña 2013, p. 3). Categorizing and classifying qualitative data in a systematic order by applying and reapplying codes is called *codifying*. This process enables researchers to organize and group similarly-coded data that share certain characteristics into categories. Since the process of coding is not simple and is rarely done right the first time, recoding and recategorizing are common iterative processes in analyzing qualitative data in order to develop theory (Saldaña 2013, pp. 9-10). In this research, coding was applied to the transcripts of the interviews in order to determine the practices within HEIs that contribute to the employability of graduates.

Although there is no standard number of codes, many authors have discussed and provided recommendations regarding appropriate numbers of codes. For example, for projects in education, previous research has suggested generating 80 to 100 codes that should be organized into 15 to 20 categories and subcategories, which should finally be synthesized into five to seven major concepts (Lichtman, in Saldaña 2013, p. 24). The basic point of the coding within this research project was to define four key process areas representing major concepts related to the topic of study. The processes within these key process areas can be understood as categories, and practices are represented by codes.

When coding, it is recommended to create a *codebook*, which should specify the main attributes of each code (Saldaña 2013, p. 25). In this research, the coding will be done with the support

of CAQDAS NVivo 11; however, the codes will parallel a structure outlined in Excel spreadsheets.

As already mentioned, the data in qualitative research are not coded only once; instead, they are recoded two or more times. Coding is usually conducted in two phases (Saldaña 2013):

- *First-cycle coding processes* – The portion of data to be coded from interview transcripts can range from a single word to a full paragraph to an entire page of text (Saldaña 2013, p. 3). First-cycle methods are divided in several subcategories: *grammatical, elemental, affective, literary and language, exploratory, procedural and theming the data* (Saldaña 2013, p. 59). In general, the nature of this research is exploratory; thus, exploratory methods are very likely to be applicable for coding the data from the interviews. Exploratory methods assign preliminary codes to the data before developing and applying more refined coding systems with more specific first- or second-cycle coding methods (Saldaña 2013, p. 141). By contrast, procedural methods, for example, would not be applicable for this research because they consider pre-established coding systems or very specific ways of analysing qualitative data (Saldaña 2013, p. 150).
- *Second-cycle coding processes* – In these processes, the coded portions can be the exact same units as within the first-cycle coding or even reconfigurations of the codes developed thus far (Saldaña 2013, p. 3). Second-cycle coding is more challenging than first-cycle coding because it requires “such analytical skills as classifying, prioritizing, integrating, synthesizing, abstracting, conceptualizing, and theory-building” within the following methods: *pattern coding, focused coding, axial coding, theoretical coding, elaborative coding and longitudinal coding* (Saldaña 2013, pp. 58-59).

Deciding which coding method is best for a certain research study is not a simple decision. In order to choose the right method, it is necessary for the researcher to become familiar with the dataset collected for the analysis in relation to the research question. The coding of the interviews collected during this study has two main purposes:

- To determine different higher education practices contributing to the better employability of graduates, such that each practice represents one code
- For each of the codes, to determine the capability dimension (plan-do-check-act) as the code attribute.

The following is a short description of the combination of coding methods used in this research within the first- (Saldaña 2013, pp. 69-187) and second-cycle (Saldaña 2013, pp. 213-223) coding, together with the transition from one cycle to the next.

First-cycle coding processes

- ***Attribute coding (Grammatical method)*** – Each code is assigned a capability dimension, which can be, in terms of coding, understood as an attribute of a certain code. The attribute category is defined as a Deming cycle with four main attributes: *plan, do, check* and *act*. The purpose of attribute coding is to provide a description of a certain unit of analysis.
- ***Magnitude coding (Grammatical method)*** – Like attribute coding, this type of code is also intended as a coding grammar that serves to refine or specify codes determined during first-cycle coding. Therefore, the capability dimensions can be understood as both “attributes” and “magnitudes”; thus, it can be said that a combination of these two types of coding is used.
- ***Subcoding (Grammatical method)*** – This type of coding represents a way of organizing data into preliminary categories or hierarchies. In this case, subcoding is evident in the use of four pre-defined categories represented as four key process areas as well as the organization of practices within processes during the coding process.
- ***Simultaneous coding (Grammatical method)*** – This type of coding refers to the overlapped occurrence of two or more codes applied to sequential units of qualitative data. Since the codes in the first-cycle coding are applied to individual paragraphs of text referring to a certain practice (code), it is possible that the same paragraph might refer to several different codes. To understand existing practices, it is important to consider the broader context; therefore, the codes are applied not to a single word or sentence, but to paragraphs as a whole.
- ***Structural coding (Elemental method)*** – This type of coding is very suitable for interview transcripts and it usually results in the identification of a large segment of text on a broader topic. Like simultaneous coding, structural coding is also used within this research.
- ***Process coding (Elemental method)*** – Process coding looks for some action or activity in the data that can be recognized through the usage of verbs in the text being coded. Since the main purpose of coding within this research is to detect *practices* within

certain higher education *processes*, this method is also applicable. It is important to emphasize that practices are sometimes not directly addressed by the interviewee (i.e. in the form of a verb); instead, the researcher must sometimes recognize a certain practice from the context.

- ***Holistic coding (Exploratory methods)*** – Since the nature of this research is exploratory, coding using a group of exploratory methods is very likely to be applicable to this research. Holistic coding is a preparatory method for the more detailed coding of data, and it is applicable when a researcher already has a general idea of what to investigate in the data. In this case, a list of initial practices already exists.
- ***Provisional coding (Exploratory methods)*** – This type of coding considers a predetermined list of codes generated from preparatory work, such as a literature analysis. In this research, in addition to the initial list of practices, the researcher has prepared a more detailed list of practices according to the capability dimensions in an Excel spreadsheet in order to guide the coding process. Since provisional codes can be revised, modified, deleted or expanded to include new codes during the collection, coding and analysis of data, the prepared list of codes is redefined simultaneously with the first-cycle coding.

Some authors propose that the construction of categories as the main groupings of constructs should be among the first steps in coding (Cohen et al. 2011, p. 566). The process of constructing categories is highly inductive and, for this research, was already done in **Chapter 6.2** when four main categories of HEIs that contribute to the employability of graduates, called *key process areas* in maturity model, were recognized. Moreover, an initial list of practices was defined based on the literature review. Following the identification of the initial categories, there is a shift to more deductive processes, in which researchers attempt to see whether the categories truly exist in the data (Merriam & Tisdell 2015, p. 210). In this context, the coding within this research is a combination of *deductive* (searching for the confirmation of pre-defined key process areas and practices within the interview transcripts) and *inductive* (identification of new practices based on the interview transcripts) modes.

Altogether, the first-cycle coding involved the transcripts of 27 interviews with a total duration of approximately 1000 minutes. The procedure for the coding was as follows:

- The interview transcripts were prepared and added to the project as internal sources using NVivo software;
- The interviews were read one by one, and when a practice was recognized, it was coded. In the context of NVivo, this means that a new node characterizing a code was created. In terms of the type of node, a *case* was chosen because this type of node allows the researcher to add attributes to each node. Attributes were, in this case, steps from the Deming cycle (plan, do, check and act), which characterize the capability dimensions of the maturity model. Thus, when a practice was recognized within the transcript, the procedure was as follows:
 - If there was no code/node for a certain practice, a new code/node was created and assigned the attribute/capability dimension. The new code/node was also assigned as a subnode to one of the four key process areas: *Strategic planning*, *Curriculum design and delivery*, *Student support* and *Extra-curricular activities*. The whole paragraph of text referring to the practice was marked and assigned to the appropriate code.
 - If there was already a code/node for a certain practice, the whole paragraph of text referring to the practice was marked for that node.
 - In addition to coding in NVivo, the researcher created an Excel table in which practices were structured according to key process areas. The idea of the Excel table was to support the coding process in cases of huge numbers of codes and to organize groups of connected nodes into processes.

The first-cycle coding process yielded the following structure, as shown in **Table 14**.

Table 14. First-cycle coding results

| Key process area | Processes | No. of practices | Capability dimension | | | |
|--------------------------------|---|------------------|----------------------|-----------|-----------|-----------|
| | | | Plan | Do | Check | Act |
| Strategic planning | SP1. Formulation of institutional policies and strategies | 15 | 6 | 3 | 2 | 4 |
| | SP2. Development of action plans | 7 | 1 | 2 | 2 | 2 |
| Curriculum design and delivery | C1. Curriculum design and delivery | 44 | 11 | 19 | 8 | 6 |
| | C2. Teachers | 8 | 1 | 3 | 3 | 1 |
| Student support | SS1. Career information, counselling and education | 19 | 1 | 13 | 4 | 1 |
| | SS2. Alliances with employers | 6 | 1 | 4 | 1 | 0 |
| | SS3. Alumni relationship | 4 | 1 | 3 | 0 | 0 |
| | SS4. Personal development planning | 8 | 2 | 4 | 1 | 1 |
| | SS5. Academic development | 3 | 1 | 2 | 0 | 0 |
| | SS6. Peer-support system | 6 | 1 | 4 | 1 | 0 |
| Extra-curricular activities | EC1. Provision of extra-curricular activities | 15 | 3 | 8 | 3 | 1 |
| | EC2. Student organizations | 7 | 2 | 3 | 1 | 1 |
| | EC3. Student representatives | 8 | 2 | 4 | 1 | 1 |
| Summary: | | 150 | 33 | 72 | 27 | 18 |

After first-cycle coding

Before beginning the second-cycle coding process, a researcher should take time to apply additional methods for reorganizing and reconfiguring the initial work. In this process, for the present study, the following step was applied (Saldaña 2013, p. 194):

- *Code mapping* – The full set of codes obtained through the first-cycle coding was reorganized into a selected list of categories, which were compared to determine whether some could be merged, etc.

In this research, this transition step was merged with second-cycle coding because the coding methods from the second-cycle coding process were applied in parallel with the code mapping.

Second-cycle coding processes

Second-cycle coding methods represent an advanced way of reorganizing and reanalysing data coded through first-cycle coding. In second-cycle coding, the number of codes should decrease (Saldaña 2013, p. 207). As in the first cycle, the methods proposed for the second cycle of coding can also be compatibly mixed and matched. The following methods were used in this research (Saldaña 2013, pp. 213-223):

- **Focused coding** – This type of coding follows, among others, the coding process used in the first cycle. The idea of focused coding in developing theory is to develop the major categories of themes from data, although the categories in qualitative inquiry do not always have sharp boundaries.
- **Axial coding** – This type of coding extends the work of the focused coding and, therefore, was also applied in this research. The purpose of axial coding is to search for dominant and less important categories and to specify the characteristics of those categories. In this way, axial coding reduces the initial number of codes.

Based on the results of the first-cycle coding, the second-cycle coding was conducted in several steps:

- First, the name of each code/node was redefined to clarify the represented practice.
- Some codes were merged, removed or moved to another process category based on their comparisons with other codes. For each such code, there is an explanation in the Excel table.
- Some codes were reorganized within key process areas, resulting in a smaller number of practices.

The second-cycle coding processes yielded the following structure, shown in **Table 15**.

Table 15. Second-cycle coding results

| Key process area | Processes | No. of practices | Capability dimension | | | |
|--------------------------------|---|------------------|----------------------|-----------|-----------|-----------|
| | | | Plan | Do | Check | Act |
| Strategic planning | SP1. Formulation of institutional policies and strategies | 15 | 6 | 4 | 2 | 3 |
| Curriculum design and delivery | C1. Curriculum design and delivery | 28 | 8 | 13 | 4 | 3 |
| | C2. Teachers | 7 | 3 | 2 | 1 | 1 |
| Student support | SS1. Career information, counselling and education | 23 | 3 | 12 | 7 | 1 |
| | SS2. Personal development planning | 11 | 2 | 6 | 2 | 1 |
| Extra-curricular activities | EC1. Provision of extra-curricular activities | 12 | 2 | 8 | 1 | 1 |
| | EC2. Student organizations | 7 | 2 | 3 | 1 | 1 |
| | EC3. Student representatives | 7 | 2 | 3 | 1 | 1 |
| | | 110 | 28 | 51 | 19 | 12 |

In comparison with the results of the first-cycle coding, the differences are as follows:

- The number of processes was cut from 13 to 8 due to the following changes:
 - *SP2. Development of action plans* was merged with *SP1. Formulation of institutional policies and strategies*
 - *SS2. Liances with employers* and *SS3. Alumni relationship* were merged with *SS1. Career information, counselling and education*
 - *SS5. Academic development* and *SS6. Peer-support systems* were merged with *SS4. Personal development planning*
- The total number of practices was cut from 150 to 110 because some practices were merged and some others were recognized as potential maturity levels instead of practices. In this phase of coding, some practices were also removed to another phase of Deming cycle. Accordingly, the number of practices for each dimension is smaller after the second-cycle coding than after the first-cycle coding.

6.3.1.1.5. Results sharing

Since the case study research is only one step within the five-step cycle of the maturity model design, the results of case study research represent the input for the next research step 4) *Evaluate the design*. The list of 110 detected practices represents the initial strategic framework for supporting graduates' early careers within HEIs and is presented in *subchapter 7.1*.

6.3.1.2. Focus groups with stakeholders

Since, in the system of student support for early career development, in addition to HEIs, employers and other relevant stakeholders also play significant roles, it is important to include their perspectives in this phase of model development. Information from employers and other relevant stakeholders was collected through the focus groups held during the round table at the University of Zagreb, Faculty of Organization and Informatics, on 5 November 2015, as a part of the project *Development of a model for supporting graduates' early careers* co-financed by the EU through the European Social Fund.

The idea of this focus groups was to detect any additional practices related to five different groups of stakeholders: students, teachers, alumni, employers and managerial and supporting institutions. These inputs were also used to explore practices detected during the case study research at different universities. The focus groups were performed after the three case study researches were conducted, so they provided good insight into the detected practices and also

indicated some new practices that could be observed in the next case study research. The inputs from the focus groups were not analyzed in detail, but they helped to shape some additional questions for the case study research. The focus groups were conducted as follows:

- First, the researcher provided a short presentation of the research goals and research steps.
- The participants were divided into five groups: students (5 participants), teachers (4 participants), alumni (5 participants), employers (8 participants) and managerial and supporting institutions (4 participants).
- Each group was provided a spreadsheet and asked to provide suggestions for one of the another groups, as follows:
 - Teachers → employers
 - Employers → managerial and supporting institutions
 - Managerial and supporting institutions → alumni
 - Alumni → students
 - Students → teachers
- In the next cycle:
 - Teachers → students
 - Students → alumni
 - Alumni → managerial and supporting institutions
 - Managerial and supporting institutions → employers
 - Employers → teachers
- When one group of stakeholders provided suggestions to another group, the members of the receiving group had time to reflect on the suggestions and write whether the suggestions were feasible or whether there were barriers.
- By reading and reflecting on the suggestions provided within the focus groups, the researcher gain insight into the views of different groups of stakeholders, which helped to determine other potentially relevant practices that were not recognized during the case study research.

The comparison of the focus groups results with the results obtained from case study research, showed that, from the viewpoints of the different stakeholder groups, there were no other relevant practices crucial for supporting graduates' early careers within HEIs, but rather showed that the previously conducted case studies yielded appropriate set of practices.

6.3.2. *Description of maturity levels*

Another important step in *Step 3: Design the model* of maturity model design is the description of maturity levels for practices contained within final model. However, this step was not conducted immediately after the definition of 110 practices which represents the initial strategic framework for supporting graduates' early careers within HEI, but after the assessment of content validity, presented in the following chapter (*Step 4: Evaluate the design*). As elaborated later, the content validity resulted in 68 practices from the initial strategic framework that should be contained within the final maturity model. Therefore, the maturity levels were defined for those 68 practices and served as a basis for assessing the model reliability.

In general, the characteristics of the five maturity levels can be described as in **Figure 8**:

- 1) ***Not assessed*** – There is no evidence of the given practice at the HEI
- 2) ***Initial*** – There is some evidence of the given practice at the HEI, but this performance can be mostly characterized by the following attributes: *ad hoc*, *informal* and *inconsistent*
- 3) ***Partially adequate*** – The given practice is formally defined within the HEI to some degree, but it still lacks consistency in performance
- 4) ***Largely adequate*** – The given practice is formally defined within the HEI, and there is consistency in performance, but the institution is lacking suggestions for potential improvements in the given practice in the future
- 5) ***Fully adequate*** – The given practice is formally defined within the HEI, the institution is consistent in its performance and there is documented reflection on the usage of the practice for further improvements.

However, these general characteristics of the maturity levels cannot be used for all practices; instead, each practice requires unique descriptions of its maturity levels, based on practice-specific characteristics. The descriptions of the maturity levels (altogether 340 descriptions for 68 practices) are based on the author's knowledge about the practices gained through case study research and the analysis of transcript records, and further evaluated through the model's testing at four HEIs. Here, it is important to emphasize that the process of definition of maturity levels was very challenging and demanding, as it was done by a single researcher. Definition of maturity levels descriptors required re-reading of interview transcripts in order to identify different maturity levels of a certain practice at different universities and describe them in a

way that they would be both comprehensive and exclusive. In order to help the researcher to define maturity level descriptions in an appropriate manner, process descriptions from e-learning maturity model were consulted, as this one is also intended to be used by HEIs (Marshall 2007). During the process of defining descriptors for the practices, the initial hierarchical distribution of the practices within the processes, as proposed during the coding cycle presented in **Table 14** and **Table 15**, was rejected because it added to the model complexity and would negatively affect its practicality and applicability to practice. Instead, practices in the final maturity model are organized only within four main key process areas according to four dimensions of capability. Moreover, three additional practices were excluded from the final model as a result of model reliability assessment through the model testing at four HEIs. The final maturity model characteristics are summarized in **Table 16**.

As can be perceived, the HEI practices that contribute to the employability of graduates are best developed at the implementation level (*Do*). The planning phase (*Plan*) is also well developed; however, there is a clear lack of practices in the contexts of implementation monitoring (*Check*) and actions for improvement in the next strategic planning cycle (*Act*).

Table 16. Final maturity model characteristics

| Key process area | No. of practices | Capability dimension | | | |
|--------------------------------|------------------|----------------------|-----------|-----------|----------|
| | | Plan | Do | Check | Act |
| Strategic planning | 13 | 5 | 3 | 2 | 3 |
| Curriculum design and delivery | 26 | 9 | 8 | 6 | 3 |
| Student support | 16 | 3 | 10 | 2 | 1 |
| Extra-curricular activities | 10 | 3 | 5 | 1 | 1 |
| | 65 | 20 | 26 | 11 | 8 |

The results of this phase are presented in more detail in **Chapter 7**, more concrete: **subchapter 7.1.** brings the description of the initial strategic framework containing 110 practices and **subchapter 7.2.** presents final strategic framework and maturity model with descriptions of maturity levels for 65 practices.

6.4. Step 4: Evaluate the design

Since maturity models are widely used in process improvement, their evaluation is an important activity for providing users a confident guide to help them identify the potential improvements in different processes. Moreover, the development of maturity models is seen as a useful way to communicate best practices (Helgesson et al. 2012). Helgesson et al. (2012) stressed that the evaluation of maturity models requires significant effort and that it is not easy for a researcher to decide how to evaluate a newly-developed model or even to understand which evaluation approaches are available. For this reason, they proposed a framework summarizing the evaluation methods that have been used. According to the work of March & Smith (1995), Salah et al. (2014) recognized that maturity model testing should focus on two aspects:

- 1) maturity model constructs should be tested for “completeness, simplicity, understandability, ease of use, operationality, efficiency and impact on the environment and users”, whereas
- 2) maturity model instruments should be tested for “validity and reliability”.

In this research step, the goal is to ensure the validity and reliability of the maturity model. Internal validity, also known as credibility, deals with the question of how the research findings match reality, while reliability, also known as consistency, refers to the extent to which the research findings can be replicated over time or over different groups of respondents. In general, there is not developed consensus within the research community on the appropriate criteria for assessing validity and reliability when conducting qualitative research. However, to achieve trustworthiness of research results and make them have an effect on both theory and practice, it is important that the research studies are conducted in an ethical and rigor manner through the entire research cycle, including data collection and analysis, as well as the results' interpretation and presentation (Merriam and Tisdell 2015, pp. 237-253). This can be achieved through the careful design of research study, which is in this case based on the 1) guidelines for design science in information systems (Hevner et al. 2004); 2) requirements for the development of maturity models, as proposed by Becker et al. (2009) and 3) steps for the development of maturity models in terms of design decisions (Mettler 2010); as described within the **Table 6** and Research hodogram in **Figure 12**.

Helgesson et al. (2012) claimed that there is a lack of studies providing concrete guidance on how to evaluate maturity models as well as a lack of evaluation results for self-developed

maturity models; thus, neither the framework they proposed suggests which evaluation method is the most effective. Instead, their framework only proposes three possible types of evaluation (Helgesson et al. 2012):

- 1) Evaluation done only by the authors of the maturity model, without any outside experts;
- 2) Evaluation done by practitioners who are experts in the domain covered with the maturity model practices;
- 3) Evaluation conducted through the model application in the real contextual environment.

For the purpose of this thesis, the focus will be on the last two types of evaluation. First, to ensure the validity of the model, a group of experts and students was consulted and asked to evaluate the importance of each practice (content validity) in the maturity model and place it in one of the key process areas (construct validity). This step was expected to ensure the model's understandability and internal consistency. In the second step, the model's reliability was evaluated by testing the model to four real cases: HEIs from Croatia providing study programmes in ICT.

In the context of evaluating qualitative research, another important concept is *triangulation*. Triangulation is a process of ensuring that the right information and interpretations have been obtained by using multiple sources or perceptions to clarify meaning (Stake 2006, pp. 33-38). Merriam and Tisdell (2015, p. 246) recognizes triangulation as a principal strategy to ensure validity and reliability in qualitative research. Usually, important findings should have at least three confirmations to ensure that key meanings are not being overlooked. For this purpose, the present research has applied four different sources to ensure that all practices collected within the model are well understood, as shown in **Figure 15**.

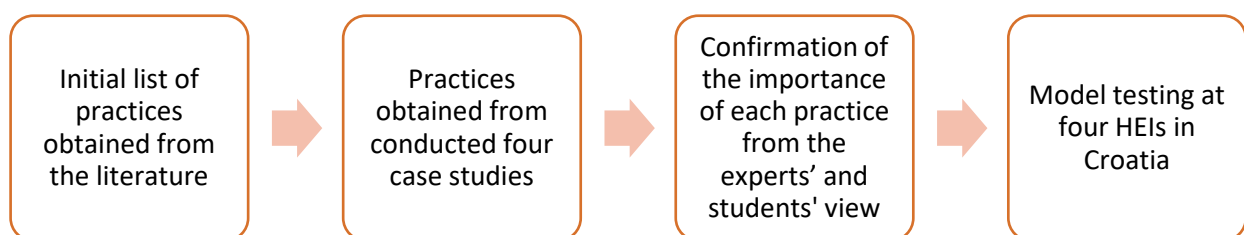


Figure 15. Triangulation in evaluating key practices

6.4.1. *Model validity*

To ensure *validity* of the maturity model instrument, the initial list of practices was evaluated by both experts and students. Experts and students were sent invitations to participate in the evaluation of the model via e-mail, as shown in *Appendix G*. Some of the experts who participated in model validity were previously interviewed during the case studies research, so it can be said that, additional to the triangulation, the member *checks strategy* or *respondent validation* was also applied partially to ensure model validity (Merriam and Tisdell 2015, p. 246). The invitation was sent together with an Excel spreadsheet that served as a form for the model's evaluation. The Excel spreadsheet was prepared in the English language according to the form prepared for a similar purposes within one PhD thesis (Balaban 2011). An Excel spreadsheet was chosen as the most appropriate for several reasons:

- Excel is a widely-used document type that could be sent via e-mail to all the experts and students.
- Since the model for the evaluation is quite comprehensive, an Excel spreadsheet is practical because it allowed the evaluators to save their work during the evaluation process and continue later.
- In comparison with some online tools, in which the evaluators may not have been able to see their responses once they had submitted them, the Excel spreadsheet allowed them to save their evaluations for their own archives.
- The data structures in a prepared Excel spreadsheet allowed the researcher to easily manipulate and further analyze the data. Furthermore, they allowed the researcher to merge the data from several spreadsheets (i.e. several experts' responses) into one.

Before sending the evaluation spreadsheet to the experts and students, the sheet was pre-tested by three persons at FOI (one professor with several years of managerial experience within higher education [the supervisor of the thesis], one non-teaching staff employed in the career centre and one administrative staff with a degree in the English language). This step was conducted for several reasons:

- To detect possible formatting issues in the prepared spreadsheet form;
- To ensure that all practices in the model were understandable;
- To check the spelling and grammar;
- To redefine/modify practices according to comments;
- To estimate the time needed to complete the evaluation.

A completed spreadsheet was returned from 22 experts and 12 students. The term experts in this context considers different higher education stakeholders, including: higher education managers, teaching staff, non-teaching staff, alumni (representatives of employers), representatives of managerial and supporting institutions.

Because of the very heterogeneous group of experts who participated in the model's evaluation, there were several issues that needed to be taken into account in the interpretation of the model's evaluation results:

- The experts were characterized by different educational and professional backgrounds (higher education managers, teaching staff, non-teaching staff, students, alumni and employer representatives, representatives of governance and supporting institutions). Therefore, it was difficult to expect that all would have similar views on the importance and structure of higher education practices important for enhancing graduates' employability within HEIs.
- The experts also came from different countries characterized by different educational system; this affected their view on the importance and structure of different higher education practices.

However, all the experts and students are connected with HEIs in the ICT domain so their evaluations of practices were affected by their knowledge and experience related to this particular domain. This is only not a case with the representatives of managerial and supporting institutions which are related to higher education in general.

The prescribed procedure of model evaluation was used for two purposes: to ensure model content and to ensure construct validity. Detailed results are provided in following subchapters.

6.4.1.1. *Content validity*

To develop the maturity model instrument that demonstrate content validity, the researcher must ensure that the elements of the researched domain, in this context the recognized higher education practices, are both a fair representation of the wider issue being researched (supporting graduate employability within HEIs), and that the practices contained within the model are addressed "in depth and breadth" (Cohen et al. 2011, p. 188). To ensure content validity, input from the 22 experts who returned the completed sheet were taken into consideration to calculate the content validity ratio (CVR) of the scale. Since students' views on the importance of various practices are also relevant, 12 students from different years of

study at the University of Zagreb, Faculty of Organization and Informatics were asked to evaluate the importance of the practices using the same approach as the experts. Detailed information on the expertise of persons involved in the model evaluation is provided in *Appendix H*.

The experts and student were asked to score 110 practices from the initial list using the scale “0 – cannot answer, 1 – not relevant, 2 – important (but not essential) and 3 - essential”. Using the obtained data, the CVR was calculated for each item using a modified Lawsche’s formulation (Lawshe 1975):

$$CVR = (n - N/2) / (N/2)$$

where n is the frequency count of the number of participants who rated an item as either “2 – important or 3 - essential” and N is the total number of respondents. The CVR was modified from the original in order to take the rates 2 and 3 (not only 3) as N . Here, it is important to stress that the lack of an Excel spreadsheet for this kind of evaluation is in allowing respondents to miss entering some data. In other words, it was not possible to mark some cells as obligatory. Therefore, the researcher checked each collected response and asked participants to fill in the missing data, if there were some. However, in the final set for the analysis a few missing data were still found and those were treated as “0 – cannot answer”.

For the panel of 34 experts, a minimum CVR of 0.353 for each item was required to satisfy the five percent level of statistical significance (0.05 alpha level) (Lawshe 1975, Ayre & Scally 2014). In the entire set of 110 practices, only one practice with $CVR < 0.353$ occurred (*Psychometric testing is available to student*). The overall obtained content validity index (CVI), a mean of the CVR values of all the items, of 0.856 for the set of 110 practices evaluated by 22 experts and 12 students (altogether 34 evaluations) shows that, in general, the entire set of practices is considered either “important” or “essential”.

In addition to expert evaluations, additional focus groups with relevant stakeholders with the purpose of obtaining an additional group evaluation of the practices were conducted. Focus groups were held during the round table at the University of Zagreb, Faculty of Organization and Informatics, on 5 May 2016, as a part of the project *Development of a model for supporting graduates’ early careers* co-financed by the EU via the European Social Fund. Participants were divided into four groups related to the four key process areas according to their expertise, as can be seen in **Table 17**. Each group consisted of 7 to 8 participants, who were asked to:

- 1) Indicate the relevance of each practice on a scale from 1 – not important at all to 5 – very important;
- 2) Indicate whether, according to their group opinion, a certain practice belongs to a capability dimension (plan-do-check-act) different than that proposed by the author. The results of this step were important inputs for further model development;
- 3) Indicate whether there were any practices that were not on the list that they would find important.

In some groups, participants splited into two smaller groups which were either evaluating all the practices within the same key process area separately, or the each smaller group evaluated half of the practices. Therefore, if there were two assessments for the same practice within a group, the average value was used for further calculations.

Table 17. Focus groups participants for the evaluation of practices

| Key process area | Focus groups participants |
|--------------------------------|--|
| Strategic planning | 1 student 3 employers 1 representative of higher education management and teaching staff 1 career counsellor and teaching staff 1 representative of governing institution 1 representative of the teaching staff and head of IT programme |
| Curriculum design and delivery | 2 vice-deans for students and study affairs 2 students 1 expert for quality assurance in HE 2 alumni 1 representative of the teaching staff |
| Student support | 2 employers 2 representatives of non-teaching staff (career centre) 1 representative of a supporting institution in the field of career development 1 representative of the teaching staff and career centre 2 students |
| Extra-curricular activities | 1 student 4 employers 2 alumni |

Although the initial model showed a high CVI, decisions about the practices that should be excluded from further analysis were made in several steps, with the final goal being to reduce the number of elements in the final maturity model in order to make it applicable to practice. The model was reduced as follows:

- 1) All the practices with CVRs lower than 0.7 were excluded from further analysis. The CVR value of 0.7 was chosen while all the practices with $CVR < 0.7$ have also lower average values (< 2.2), as calculated within the step 2). Seven practices were excluded as a result of this step.
- 2) In the second round, all practices with an Average < 2.2 were excluded, calculated as a weighted mean where experts were assigned a weight of 2, and students a weight of 1:

$$Average = \frac{2 * \sum_{i=1}^{22} Score_{E_i} + \sum_{k=1}^{12} Score_{S_k}}{2 * n_E + n_S},$$

where $Score_E$ represents the score of each expert, $Score_S$ represents the score of each student, n_E is the total number of experts and n_S is the total number of students. Scores of experts and students used in this formula are those used for calculating the CVR, with a difference that assessments of experts and students who rated a certain practice with “0 – cannot answer”, or where missing data occurred, were excluded from calculating the average values for that practice. From the formula, it is evident that the experts’ evaluations are given double the weight of those of students. As there is no strict rule for setting the limit for the exclusion of practices based on the proposed formula, the author decided to exclude all the practices with average < 2.2 as all seven practices excluded within first step have averages < 2.2 (from 1.77 to 2.18). Moreover, the value of first quartile (Q1) is 2.24. However, several practices below 2.2 have lower assessments from focus groups, while practices between 2.2 and 2.24 have higher assessment from focus groups. Therefore, it was decided to put the limit for exclusion within this step at the average value of 2.2. 17 more practices were excluded as a result in this phase.

- 3) All practices with an average < 2.34 and results of the focus groups ≤ 3.5 were excluded. The average value of 2.34 is the median of the data (Q2). All the practices above median were included in further analysis.
- 4) Finally, each practice was analyzed on the qualitative level, according to the comments and suggestions provided by experts, students and focus groups. This step helps to modify or reward existing practices. In this step, it was also decided that one practice from the key process area *Extra-curricular activities* excluded within the previous step should remain in model in order to close the PDCA cycle. Therefore, the practice with highest evaluations from the *act* phase was left in model. It is also important to emphasize that, based on the suggestions provided by experts, some practices were rephrased or merged for the inclusion in final model. There were also around 10

additional practices proposed by experts, students and focused groups, but the analysis showed that all of them are already contained within the model so there were no new practices added to the model as a result of this step.

The number of excluded practices and those left in the model after each step are shown in **Table 18** and a detailed list of excluded practices is presented in *Chapter 7.1* within the description of the initial strategic framework.

Table 18. Criteria and results of content validity calculation

| Criteria for the exclusion of practices | Number of practices left in the model |
|--|---------------------------------------|
| All practices with CVR < 0.7 excluded | 103 |
| All practices with Average < 2.2 excluded | 86 |
| All practices with Average < 2.34 and focus groups average ≤ 3.5 excluded | 75 |
| Qualitative analysis – comments from experts and focus groups | 68 |

Finally, the four steps for assessing the model's content validity resulted in the retention of 68 practices: 13 within strategic planning, 27 within curriculum design and delivery, 17 within student support and 11 within extra-curricular activities. The overall obtained CVI for this shortened scale of practices is 0.903, which shows its content to be better than of the initial scale with 110 practices (CVI = 0.856).

In the context of assessing the model content validity, limitations are recognized as follows:

- 1) The content validity depends to a large extent on the expertise of persons that evaluated the model. In this context, a group of experts consists of different stakeholders within the system of higher education. It is clear that different groups of stakeholders have different opinion on the importance of practices. However, the idea behind the development of final strategic framework and maturity model is to recognize a set of practices indicated as the most important by the entire group of different stakeholders. If only one group of stakeholders (i.e. only higher education managers or only employers) did the evaluation of practices, the results would probably differ from the ones obtained for the entire group of stakeholders.
- 2) All the students who evaluated the model are from the Faculty of Organization and Informatics so their evaluations are certainly affected by their study experience at this institution. The authors' intention was to involve students from different study years and with different study experience in terms of their involvement in extra-curricular

activities. Another very important characteristic of students was their motivation to participate in the model evaluation so they assessed the practices in the best of their ability.

- 3) For the purpose of calculating the CVR, the proposed scale for evaluating a set of practices has only three values (“0 – cannot answer, 1 – not relevant, 2 – important [but not essential] and 3 - essential”). For calculating the average values, a scale with five values could be more appropriate.
- 4) In terms of decision on which practices should be excluded from the final model, the limitation is in lack of criteria for the model reduction. Therefore, the researcher had to think in terms of model applicability when making decisions on criteria for exclusion of practices from the initial strategic framework with 110 practices.

6.4.1.2. Construct validity

Since a construct itself is an abstract, the purpose of ensuring construct validity actually considers clarifying what is meant by the use of a certain construct (Cohen et al. 2011, p. 188). In the context of this research, the construct validity of the final strategic framework and maturity model must demonstrate that the key process areas used by the researcher are also meaningful in practice, as perceived by different stakeholders.

In order to assess the construct validity, the *card sorting technique*, also known as *Q-sorting*, was applied. According to Straub et al. (2004, p. 390), this technique “combines validation of content and construct through experts and/or key informants who group items according to their similarity”. The main idea of this method is that a panel of experts sorts the recognized practices within one of the four main proposed key process areas. Within the existing literature, the *Q-sorting* method is widely used in, for example, the field of information science research (Straub et al. 2004); however, it lacks extensive application within the educational field. Graham et al. (2012) suggest that it is often appropriate to calculate more than one measure; therefore, the *Q-sorting* technique will serve to calculate the *hit ratio* as the indicator of how many items were placed in the intended key process areas by the experts (Nahm & Solis-Galvan 2002) and the *Fleiss’ Kappa* as the measure of the agreement among more than two raters (Fleiss 1971).

In the context of measuring the consistency of the evaluators' judgments, it is important to understand the distinction between inter-rater agreement and inter-rater reliability, where the reliability scores indicate whether the evaluators tend to classify items in the same group, while inter-rater agreement "is the degree to which two or more evaluators using the same rating scale give the same rating to an identical observable situation" (Graham et al. 2012, pp. 4-5). Graham et al. (2012, p. 7) also recognized three common indexes of inter-rater agreement: the percentage of absolute agreement, various versions of Cohen's Kappa and the intra-class correlation coefficient. Since the *Q-sorting* technique applied to the set of higher education practices will serve as a basis for calculating the *hit ratio* as the measure of the percentage of agreement among evaluators and the *Fleiss' Kappa* as the measure of the agreement among more than two raters, this approach will serve to measure the inter-rater agreement.

For the purpose of conducting a *Q-sorting* technique within this research, the panel of experts was chosen to comprise different higher education stakeholders, whose expertise was already described in the previous subchapter on content validity. All 22 experts from the group of those evaluating content validity also participated in a *Q-sorting* technique; however, students' perceptions were not taken into consideration in this step of ensuring model validity. Evaluations by experts were done for all 110 practices contained within the initial strategic framework, but for purpose of assessing the final strategic framework and maturity model construct validity, only the assessment for 68 practices contained in the reduced model were considered. The *Q-sorting* method is an iterative process which consists of two stages (Nahm et al. 2002): 1) the experts sort the questionnaire items according to different constructs, in this case the key process areas and 2) items recognized as being ambiguous are reworded or deleted in order to improve the agreement between the experts. In this case, the items were already deleted in the process of ensuring the content validity, as described in the previous subchapter, and the construct validity was based on the set of 68 practices. In the second iteration, the researcher used a different approach. Assessments of experts that were inconsistent in comparison to the assessments of all the other experts (so called "outliers") were excluded from calculating the hit ratio and the Fleiss' Kappa in order to see if the proposed model with relatively high CVI for 68 practices can also demonstrate a satisfied construct validity.

The outliers were detected by calculating the *Hamming distance*, a measure that shows the total number of differences between the opinions of one expert and all the other experts with respect to the determined key process area for each practice (in Divjak & Lovrenčić 2005, p. 266). In

addition to the expert opinions, the researcher's opinion on the appropriate key process area for each practice was also taken into consideration as the evaluation of an additional expert in the calculation of the Hamming distance. The Hamming distance for each of the experts was calculated using the following steps:

Let the $x^{(i)}$ be a vector of length 68, where

$$x^{(i)} = [x_1^{(i)} \dots x_{68}^{(i)}] \text{ where}$$

$x_j^{(i)} = k$ means that i -th expert has sorted j -th practice into category k . Let

$$\delta(x, y) = \begin{cases} 0 & \text{if } x = y \\ 1 & \text{if } x \neq y \end{cases}$$

then Hamming distance between experts i and j was calculated as

$$d_{ij} = \sum_{k=1}^{68} \delta(x_k^{(i)}, x_k^{(j)}), 0 \leq d_{ij} \leq 68.$$

The Hamming distances between all experts were calculated, and these are presented in **Table 19**. The column *Differences* shows the sum of the Hamming distances of individual experts compared to all others. Full Hamming distance matrix is provided in **Appendix I**.

Eight experts with at least 42% differences from the others in terms of their sorting of practices were excluded from further analysis. As there is no strict rule for defining the value for excluding the experts' sorting from further analysis, the author decided to put the border line for inclusion of sortings at 37% so only around 2/3 of experts that provided "better" sortings were included in further analysis. Moreover, the included sortings all show differences between 24% and 36%, while the eight excluded sorting are above 42%. After the outliers were removed, the evaluations of 14 experts were taken into consideration.

Table 19. Hamming distances for experts' evaluations

| Expert | Differences | % of differences |
|------------|-------------------|------------------|
| 1 | 795 | 53% |
| 2 | 475 | 32% |
| 3 | 640 | 43% |
| 4 | 635 | 42% |
| 5 | 658 | 44% |
| 6 | 459 | 31% |
| 7 | 827 | 55% |
| 8 | 509 | 34% |
| 9 | 746 | 50% |
| 10 | 428 | 29% |
| 11 | 351 | 23% |
| 12 | 378 | 25% |
| 13 | 480 | 32% |
| 14 | 353 | 24% |
| 15 | 395 | 26% |
| 16 | 527 | 35% |
| 17 | 777 | 52% |
| 18 | 425 | 28% |
| 19 | 636 | 43% |
| 20 | 449 | 30% |
| 21 | 371 | 25% |
| 22 | 533 | 36% |
| 23 | 353 | 24% |
| | | |
| | <i>difference</i> | <i>%</i> |
| <i>Min</i> | 351 | 23,5% |
| <i>Q1</i> | 410 | 27,4% |
| <i>Q2</i> | 480 | 32,1% |
| \bar{X} | 530,4 | 35,5% |
| <i>Q3</i> | 638 | 42,7% |
| <i>Max</i> | 827 | 55,3% |

The sorting of the remaining 14 experts for 68 practices into one of the four key process areas or the category *Other* if, according to their opinion, the practice did not fit any of the pre-defined key process areas, were used for calculating hit ratio and the Fleiss' Kappa value (Gwet 2010). For the purpose of calculating Fleiss' Kappa⁹ and hit ratio, missing values were put in category *Other*. In the existing benchmark scale for Fleiss' Kappa, an agreement < 0.40 is considered poor, an agreement between 0.4 and 0.75 is considered intermediate to good and an agreement > 0.75 is considered excellent (Gwet 2010). The obtained Fleiss' Kappa value of **0.7123** for the 14 experts and 68 practices shows that the model can be considered good,

⁹ The Fleiss' Kappa value was calculated using the resources and support from Dr. Charles Zaiontz, author of the *Real Statistics Using Excel* (<http://www.real-statistics.com/reliability/fleiss-kappa/>)

approximating excellent. This was confirmed by the calculation of a hit ratio of **98%** for the practices within the key process area for *Strategic planning*, **89%** for practices within *Curriculum design and delivery*, **85%** for practices within *Student support*, **77%** for practices within *Extra-curricular activities* and **88%** for the *overall model*, as shown in **Table 20**. Although there is no strict agreement on acceptable measure levels, a *hit ratio above 75%* might be considered acceptable. In the final model, each practice was categorized in the key area indicated by the highest number of the evaluators.

Table 20. Hit ratio calculation for experts' sortings of key practices

| | Actual Categories | | | | | | |
|--------------------------------|------------------------------------|--------------------------------|-----------------|-----------------------------|-------|------------------------|----------------------------------|
| Target Categories | Strategic planning | Curriculum design and delivery | Student support | Extra-curricular activities | Other | Items placements | Hit ratio |
| Strategic planning | 179 | 3 | 0 | 0 | 1 | 182 | 0.9835 |
| Curriculum design and delivery | 10 | 336 | 14 | 0 | 18 | 378 | 0.8889 |
| Student support | 17 | 11 | 202 | 4 | 4 | 238 | 0.8487 |
| Extra-curricular activities | 24 | 1 | 11 | 118 | 0 | 154 | 0.7662 |
| | Total Items Placements: 952 | | | | | Total hits: 835 | Overall Hit ratio: 0.8771 |

6.4.2. Model reliability

Reliability is “a synonym for dependability, consistency and replicability over time, over instruments and over groups of respondents” which consider the accuracy of the research results (Cohen et al. 2011, p. 199). It is important to stress that some interpretation of reliability are not applicable to this research, for example the replicability over time. The last step in the maturity model development 5) *Reflect the evolution* indicates that the model should be updated over the time because higher education systems, as the focus of observance in this research, is not static. Therefore, within this research, the reliability will be observed primarily through the comprehensiveness as the coverage of domain. The comprehensiveness of domain can actually be interpreted as “a fit between what researchers record as data and what actually occurs in the natural setting that is being researched” (Bogdan and Biklen, in Cohen et al. 2011, p. 202). However, this does not mean that some other researcher conducting the same research would come up with the same results, since there are many possible interpretations of what is

happening in the world, and they all might be reliable (Cohen et al. 2011, p. 202; Merriam and Tisdell 2015, pp. 250-251).

In the context of this thesis, reliability of the final strategic framework was already demonstrated through different methods that also served as a basis for assuring the model validity. The literature suggests that some features related to reliability also appear in validity, for example the content validity which also refers to the coverage of domain and comprehensiveness (Cohen et al. 2011, p. 204). The reliability understood as dependability may also be connected to the internal validity as it requires methods such as respondent validation, triangulation or researcher experience in the field (Cohen et al. 2011, p. 202, Merriam and Tisdell 2015, p. 246), all of which were explained within the elaboration of maturity model for supporting higher education graduates' early careers design and evaluation. The reliability of final maturity model, which additionally contains descriptions of maturity levels for practices contained within the strategic framework, was demonstrated by testing the model at four higher HEIs in Croatia.

Before stepping forward from assessing the model content and construct validity to assessing the model reliability, the description of maturity levels for 68 practices was done, as described within *subchapter 6.3.2*. In the context of maturity model design methodology, it is interesting to notice that the *Step 3: Design the model* and *Step 4: Evaluate the design* interwave. This is possible because model validity is based only on the assessment of practices, while model reliability is done based on the maturity level description for each practice.

To ensure the model's reliability, the model was tested at four real cases: HEIs in Croatia that offer study programmes in the field of ICT. These cases were conducted during May and June 2016, through conversations with individuals who could provide good insight into the maturity level of different practices at the focal institutions, including dean, vice-deans for students and study affairs and experts employed in careers services. As those individuals are experts in the field, their role was not only to determine the most adequate maturity level for a certain practice at their institution, but they could also suggest researcher if some descriptions of maturity levels should be reworded. This can be considered as a peer-review method, which is also used for demonstrating both the internal validity and reliability (Cohen et al. 2011, p. 202, Merriam and Tisdell 2015, p. 249). The institutions that were included in the model applications were:

- *Josip Juraj Strossmayer University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology Osijek;*
- *University of Zagreb, Faculty of Electrical Engineering and Computing;*
- *University of Zagreb, Faculty of Organization and Informatics; and*
- *University of Applied Sciences VERN.*

The procedure for testing the model was as follows:

- 1) An invitation letter for the institution to participate in the model's evaluation was prepared (***Appendix J***) and sent to a contact person at each HEI.
- 2) After a positive answer was received from the institution, a date and time for the evaluation were decided. The evaluations were done in person by both the researcher and the relevant persons from each institution, and they were located at the HEI participating in the evaluation. This approach is important for three main reasons:
 - The researcher could explain certain practices or capability descriptions if they were not sufficiently clear;
 - The institution's representative could look for additional documents or ask for help from other relevant persons at the institution if he/she was not sure about the right level of maturity for some of the practices;
 - The institution's representative could also suggest potential changes in the descriptions of maturity levels which would be incorporated in final maturity model.
- 3) A spreadsheet was prepared in Excel for each institution in the form of maturity model tables, as shown in ***subchapter 7.2***. The institution's representative was also given a spreadsheet in a printed form to allow him/her to more easily follow the evaluation process while the researcher was recording answers and additional comments in a digital form of the spreadsheet.

There were two main purposes of testing the model to real cases:

- 1) To detect whether the maturity levels for each practice were sufficiently *comprehensive*; in other words, to determine whether they covered all possible levels of maturity. The indicator for this criteria was whether a given HEI could detect its level of maturity for all practices within the proposed maturity level descriptions.
- 2) To detect whether the maturity levels for each practice were *disjunctive*, meaning that there was no overlap between maturity levels. The indicator for this criteria was

whether a given HEI could determine one - and no more than one - maturity level as being the most adequate for each practice.

In general, the model was shown to be applicable to institutions of different sizes and structures. However, it is important to emphasize several observations from the model application:

- 1) In some cases, respondents preferred to describe how a certain practice is organized at the institution and leave it to the researcher to decide the most adequate maturity level. In this case, the maturity model was used as an instrument for guided self-evaluation. Therefore, the developed model presents a hybrid between the self-evaluation and external evaluation, which are the most common practices of quality assurance in the system of higher education. For the researcher, it was helpful to make short notes about the information collected from the respondent and help them to indicate the most adequate maturity level for a certain practice, as well as to think about the potential improvements.
- 2) Some practices and descriptions of maturity levels were slightly reworded as a result of this evaluation phase.

The model reliability phase also resulted in the need to exclude three practices from the final model, as follows:

- *Professional and generic skills important for employability in the subject area are addressed in learning outcomes from curriculum design and delivery.* Some difficulties were faced with assessing the maturity level for this practice because the professional and generic skills are integrated through a variety of teaching methods or available through some elective courses or extra-curricular activities (and not only within the curriculum as proposed with this practice). However, generic skills and professional skills are recognized to be obtained through different teaching methods which encourage student active learning, as well as work-related activities, and therefore it can be assumed they are contained within the implementation (do) phase of final model. As this practice was recognized as important from the evaluations of experts and students, the step 5) *Reflect the evolution* of the final model should consider the modification of this practice in the planning phase - i.e. separating professional and generic skills in two practices and their inclusion in other key process areas as well.
- *Framework for the provision of student academic development (academic reading, writing, communication etc.) is established.* This maturity level of this practice within

the extra-curricular activities was also difficult to assess for similar reasons as for the previous practice – activities related to the academic development are not planned and implemented only within the area of extra-curricular activities. Some HEIs integrate the activities related to the academic development into the study programs or within elective courses and not as extra-curricular activities. In the further development of model, this practice should also be considered in the context of different key process areas.

- *Student representatives are gathering feedback from students on different issues.* There is an opinion that this practice should be assessed by students and not HEIs. It is also implied within the practice *Students elect their representatives* as well as within the practice *Students representatives participate in different committees within the HEI.*

Therefore, the final strategic framework and maturity model consist of 65 practices: 13 within strategic planning, 26 within curriculum design and delivery, 16 within student support and 10 within extra-curricular activities.

In the context of assessing the model reliability, limitation are recognized as follows:

- 1) Reliability was assessed by the model application on the sample of HEIs only in Croatia. However, HEIs from Croatia did not participate in model design. Moreover, the sample of HEIs included both public and private HEIs.
- 2) The model evaluations at HEIs was guided by a single researcher (PhD candidate), so the lack of experience and expertise might have affected some results in the case when researcher had to decide about the most adequate maturity level of certain practices. On the other hand, this raised a question on the right person(s) that should decide on the most adequate maturity level of each practice within a certain HEI in the process of model application.

6.5. Step 5: Reflect the evolution

As has already been mentioned, the evolution part of maturity model design is important because of the way in which the roles of organizations change over time. In this particular case, as the student support system within HEIs changes and evolves, the maturity model should be redesigned accordingly. Since this doctoral dissertation is time-constrained, it is not able to cover this research part of the maturity model design process in an extended way.

A future development of model could be observed in the context of quality assurance processes within the higher education system. An example of the re-accreditation of HEIs in Croatia shows the four-step procedure: 1) HEIs drafting self-evaluation report, 2) the re-accreditation visit of the expert panel to the HEI, 3) the panel of experts write the report of the re-accreditation process and the Agency's for Science and Higher Education (ASHE) Accreditation Council provides the re-accreditation opinion and 4) follow-up (Agency for Science and Higher Education 2017). In the process of drafting self-evaluation report HEIs are provided guidelines, as well as the criteria for the assessment of quality of HEIs. The guidelines consist of a set of questions HEIs should answer, while the assessment criteria includes a list of HEIs' practices which are then assessed on the scale: *not implemented*, *starting phase of implementation*, *partly implemented*, *mostly implemented* and *fully implemented*. These assessment criteria can be understood at maturity levels. However, textual descriptors for maturity levels provided in the newly-developed maturity model for supporting higher education graduates' early careers can be used as an addition to the self-evaluation guidelines to provide HEIs clear guidance on what is expected within a certain assessment criteria. As this model contains only the practices recognized as important for supporting graduates' employability, it could be further developed so it includes all the practices relevant for the process of HEIs' re-accreditation. In that context, further development of the model for supporting graduates' early careers should also explore and define the procedures of using the model – particularly who is responsible for the interpretation of the capability of certain practices.

The exclusion of three practices within the previous step also indicate a need for the modification of some important practices and their potential inclusion within several key process areas. Another solution could be in adding additional key process area(s) that would contain practices that, in the current version of the model, could be assessed within different key process areas. Additionally, further model development could include description of maturity levels for all 110 practices contained within the initial strategic framework. The assessment of model reliability also raised a question on the right person that could decide on the most adequate maturity level of a certain practice. From the studied cases, it can be concluded that the vice-dean for students and study affairs can provide relevant information on most of the practices. Some suggestions for further development of the maturity model are also provided in *subchapter 8.4*.

6.6. Chapter relevance

Chapter 6 is the most comprehensive since it includes a detailed description of all research steps and methods used in the development of the final strategic framework and maturity model. Research was conducted within five steps, each of which includes both the rigor and the relevance, summarized as follows:

Within **Step 1: Identify a new need or opportunity**, rigor and relevance are ensured via the following:

- *Rigor:*
 - A literature review of papers related to graduate employability, strategic management and quality assurance in higher education
 - A systematic literature review of scientific papers in the fields of the education and career development of future ICT professionals
 - A review of maturity models and methodologies for their development
- *Relevance:*
 - A review of relevant strategic documents at the EU level
 - A review of recent projects in the field of graduate employability and preparation for the world of work within HEIs.

Within **Step 2: Define the scope**, rigor and relevance are ensured through the following:

- *Rigor:*
 - Expert knowledge gathered from the focus groups
- *Relevance:*
 - An initial list of key process areas and practices based on the review of relevant literature, recent projects in the field of graduate employability and preparation for the world of work within HEIs and relevant documents, such as universities' strategies, quality assurance policies, graduate employability strategies, etc.

Within **Step 3: Design the model**, rigor and relevance were ensured through the following:

- *Rigor:*
 - Knowledge gathered from the focus groups with relevant stakeholders
 - Description of capability assessment criteria for each practice
- *Relevance:*
 - Case study research conducted at four HEIs in Europe

Within *Step 4: Evaluate the design*, rigor and relevance were ensured through the following:

- *Rigor:*
 - Experts' and students' knowledge used for model evaluation and calculations used for ensuring models' content and construct validity (CVR, average, hit ratio, Fleiss Kappa)
- *Relevance:*
 - Model testing at four HEIs in Croatia.

The final results of methodology applied in this research are presented in *Chapter 7*, along with the reference to the set research objectives, research questions and research hypotheses.

7. RESEARCH RESULTS

This chapter presents the final results of the research conducted within this thesis in the form of:

- *A strategic framework for supporting higher education graduates' early careers* within HEIs. The initial strategic framework contains 110 practices: 15 within strategic planning, 35 within curriculum design and delivery, 34 within student support and 26 within extra-curricular activities. The initial framework is presented in detail in *subchapter 7.1*. This strategic framework resulted from *Step 3: Design the model*.
- *A maturity model for supporting higher education graduates' early careers* within HEIs. This model contains 65 practices: 13 within strategic planning, 26 within curriculum design and delivery, 16 within student support and 10 within extra-curricular activities. The model is presented in detail in *subchapter 7.2*. The final strategic framework and maturity model resulted from *Step 4: Evaluate the design*.
- *An overview of the current situation of the maturity of HEIs that educate students in the field of ICT in Croatia and recommendations for enhancing the capabilities of their practices* aimed at supporting graduates' early careers and overall institutional maturity in supporting graduates early careers is presented in *subchapter 7.3*. These recommendations resulted from *Step 4: Evaluate the design* and, particularly, *subchapter 6.4.2*.

7.1. Strategic framework for supporting higher education graduates' early careers

This subchapter first presents and discusses an initial strategic framework for supporting graduates' early careers, which contains a total of 110 practices within four key process areas, organized according to the four capability dimensions (plan-do-check-act): 15 within strategic planning, 35 within curriculum design and delivery, 34 within student support and 26 within extra-curricular activities. Further, this chapter elaborates the final strategic framework in relation to the set research questions, research objectives and the hypothesis H1.

The initial strategic framework for supporting higher education graduates' early careers is presented in **Table 21**, **Table 22**, **Table 23** and **Table 24**. Previously, this initial framework was also presented at the EAN conference in May 2016 (Pažur Aničić & Divjak 2016).

Table 21 shows 15 practices within the key process area of *Strategic planning*. It can be perceived that the most practices (6) fall within the planning phase of the Deming cycle, followed by 4 practices in the implementation phase, 2 practices related to monitoring and 3 related to continual improvement. This indicates that, to successfully deliver graduates' employability strategies, the planning phase is very important. One of the reasons this phase is the most comprehensive is that it involves collecting information from all relevant stakeholders, including alumni, students, the business sector and managerial and supporting institutions, as well as different HEI organizational units and policy documents at both the national and international levels. For the implementation phase, it is most important that graduates' employability is addressed in published institutional strategies and supported by action plans containing concrete actions to successfully implement the strategies. Reports on the success of actions plans are the most important assets during the monitoring phase, and feedback from student satisfaction surveys can provide valuable information for better understanding strategy success. Finally, before beginning the new process of strategic planning, it is crucial to analyze the success or failure of the current strategy and determine its compliance with changes in the internal or external environment in order to provide recommendations for necessary changes in strategy for the upcoming period.

Following the evaluation process, one practice was excluded from further analysis and final strategic framework and maturity model (*Inputs from (inter)national policy documents are used in the (re)development of institutional strategies*). Furthermore, the practices *Institutional strategies are accompanied with action plans* and *Initiatives supporting graduates*

employability are addressed in action plans were merged into one practice: *Institutional strategies are accompanied with action plans addressing graduate employability.*

Table 21. 15 practices within the key process area of *Strategic planning*

| Capability dimension | Practices related to <i>Strategic planning</i> |
|----------------------|--|
| Plan | Procedures for (re)development of institutional strategies are defined. |
| | Information from graduate studies is used in the (re)development of institutional strategies. |
| | Inputs from students are included in the (re)development of institutional strategies. |
| | Inputs from relevant stakeholders are included in the (re)development of institutional strategies. |
| | <i>Inputs from (inter)national policy documents are used in the (re)development of institutional strategies.</i> |
| | Inputs from relevant HEI organizational units are included in the (re)development of institutional strategies. |
| Do | Employability of graduates is addressed in institutional strategies. |
| | Institutional strategies are communicated across the HEI. |
| | Institutional strategies are accompanied with action plans. |
| | <i>Initiatives supporting graduates employability are addressed in action plans.</i> |
| Check | Monitoring procedures regarding the implementation of institutional strategies are defined. |
| | Reports on success of action plans are collected from different organizational units. |
| Act | Feedback from student satisfaction survey is used for better understanding of strategy success. |
| | Compliance of strategy with changes in the external and internal environment is checked. |
| | Strategy success is analyzed before starting a new strategic planning process. |

**practices written in italics script were excluded from further analysis, based on the results of model evaluation, or merged with other practices*

Table 22 shows practices within the key process area *Curriculum design and delivery*. This is the most comprehensive process area, with 35 initially recognized practices, most of which (13) fall within the implementation phase. The planning phase follows with 11 practices, while the monitoring phase contains 7 practices and the continual improvement phase contains 4 practices. This is because the planning and implementation phase contains detailed practices that refer to the main curriculum elements: learning outcomes, study content, teaching methods/pedagogic approaches, assessment methods and teachers. Additionally, the practices support relationships with the business sector as the most relevant stakeholder in the process of curriculum design and delivery, indicate the need for the curriculum to be based on relevant national and international frameworks and organize the need for a student-centred approach and the inclusion of employability skills incrementally across the curriculum. Practices within these two cycles are also closely connected. For example, within the planning phase, it is

important that formal procedures for student internships are established, while in the implementation phase, student internships should be included as integral parts of the curriculum. In this process area, practices within the monitoring phase are focused on the assessment of different elements, including not only the curriculum as a whole, but also the assessment of the quality of student work, feedback on student internships and the evaluation of teachers' performance. As in the key process area *Strategic planning*, as a basis for starting a new process of curriculum design, it is necessary to review changes in internal or external environments, ensure communication with the relevant stakeholders and, finally, discuss the strengths and weaknesses of the current study programme in order to provide recommendations for potential improvements.

Of the 35 practices within the *Curriculum design and delivery* process area contained in the strategic framework, 26 were left in the final maturity model. The following practices were excluded based on the results of the model evaluation phase:

- *New pedagogic approaches that contribute to the achievement of learning outcomes are planned within the process of curriculum design.*
- *The provision of elective courses in the curriculum is planned.*
- *Career development content is included in the curriculum.*
- *High levels of student choice and 'self-selected' courses are offered within the curriculum.*
- *Teaching and learning activities are supported with an e-learning system.*
- *Assessment methods include students' self-assessment and peer assessment.*
- *Teachers receive peer feedback for their work.*

The practices *Changes in internal or external environments are triggers for changes in the curriculum* and *Communication with the relevant stakeholders is done in order to ensure regular updates to learning outcomes in line with labour market needs* were recognized as similar based on the qualitative comments during the evaluation; thus, these were integrated into the second practice. Further, the practice *Professional and generic skills important for employability in the subject area are addressed in learning outcomes* was excluded during the model testing.

Table 22. 35 practices within the key process area of *Curriculum design and delivery*

| Capability dimension | Practices related to <i>Curriculum design and delivery</i> |
|----------------------|---|
| Plan | Procedures for curriculum design and development are established at the institutional level. |
| | Curriculum development is guided by a student-centred approach in which employability skills are considered to be inter-related and need to be developed incrementally across the curriculum. |
| | Inputs from employers are included in curriculum design and development process. |
| | Construction of learning outcomes is based on relevant national and international frameworks. |
| | Departments work together on the creation of coherent content for a certain study programme. |
| | <i>New pedagogic approaches that contribute to the achievement of learning outcomes are planned within the process of curriculum design.</i> |
| | Formal procedures for student internship are established. |
| | <i>The provision of elective courses in the curriculum is planned.</i> |
| | Procedures and guidelines for the evaluation of teacher work are established. |
| | Continuous professional development of teachers is encouraged. |
| | Support for teachers to implement new technology (e-learning) in courses is provided. |
| Do | Curriculum is delivered in partnership with industry. |
| | <i>Career development content is included in curriculum.</i> |
| | <i>Professional and generic skills important for employability in the subject area are addressed in learning outcomes.</i> |
| | Interrelation between content of different courses is established. |
| | Teaching methods encourage independent, active learning and engagement with tasks (every student as a researcher/practitioner). |
| | Curriculum contains embedded work-based activities. |
| | Student internship is an integral part of the curriculum. |
| | <i>High levels of student choice and 'self-selected' courses are offered within the curriculum.</i> |
| | Student theses are done in cooperation with the industry. |
| | Teaching and learning activities are taking place in an adequate working environment. |
| | <i>Teaching and learning activities are supported with an e-learning system.</i> |
| | <i>Assessment methods include students' self-assessment and peer assessment.</i> |
| | Students are provided with proper feedback on their course performance. |
| Check | Curriculum relevance, consistency, practicality and effectiveness are monitored. |
| | Student feedback on curriculum implementation is collected. |
| | Quality of the assessment of student work is monitored. |
| | Feedback on internship is collected from students and employers. |
| | Teacher performance is evaluated by students. |
| | <i>Teachers receive peer feedback for their work.</i> |
| Act | Control mechanisms based on the evaluation of teacher performance are established. |
| | <i>Changes in internal or external environments are triggers for changes in the curriculum.</i> |
| | Communication with the relevant stakeholders is done in order to ensure regular updates of learning outcomes in line with labour market needs. |
| | Strengths and weaknesses of the current study programme are discussed prior to new curriculum design and development process. |
| | Results of teacher performances are discussed for potential improvements. |

**practices written in italics script were excluded from further analysis, based on the results of model evaluation, or merged with other practices*

Table 23 contains 34 practices within the area of *Student support*. The implementation phase is the most comprehensive within this key process area, with 19 practices. Next, the monitoring phase comprises 8 practices, the planning phase contains 5 practices and continuous improvement comprises only 2 practices. Practices within this key process area are primarily focused on career services and activities; thus, the planning phase considers the establishment of such services within the HEI and the preparation of an annual action plan. The set of different activities included in such a plan is evident from the implementation phase and covers all aspects of career-related activities described in **Chapter 6**: career information, career counselling, career education and liaisons with the business world. The assessment and evaluation of career service activities are key practices related to monitoring and continuous improvement. In addition to career services, practices within student support also cover the areas of academic development, students' personal development planning, student tutoring and peer support systems and graduate tracking. The previously described two areas, *Strategic planning* and *Curriculum design and delivery*, can be seen to be highly connected to practices related to graduate tracking. Namely, information collected through graduate studies within this key process area are used as valuable inputs for the planning phases of both strategy development and curriculum design and development.

The final strategic framework and maturity model contain 16 practices within the key process area of student support, meaning that more than half of the practices from this initial strategic framework were excluded based on the model evaluation. These are:

- *Institution has signed partnership agreements with employers regarding activities related to employability.*
- *Institution provides assistance to employers in recruiting new employees.*
- *Visits to companies are organized for students.*
- *Employer invited lectures or workshops are organized for students.*
- *Alumni invited lectures are organized for students.*
- *Psychometric testing is available to students.*
- *Student peer support activities regarding academic and social development are provided.*
- *Personal tutoring system for students is organized.*
- *Information on the number of students using career services is collected.*
- *Analytical data are used to monitor the reach of online student engagement with career services information.*

- *Information on the number of students attending career fair is collected.*
- *Students' engagement in career service activities is monitored and regulated.*
- *Student peer support system is monitored.*
- *Personal tutors monitor students' progress.*
- *Personal tutors react to students' progress.*

Based on the comments, the following two sets of practices were connected into single practices: *Information on job opportunities and labour market is available to students* and *Information about alumni employment and careers is available to students*; *An alumni database is established* and *Information about graduate employment is collected*. Furthermore, the practice *A framework for the provision of student academic development is established* was excluded during the model testing.

It can be noted that most of the practices from the monitoring and continuous improvement phase were excluded. The focus within this area is on the implementation of practices. This is not surprising when we consider that most of the practices contained within this process area are not obligatory for either the institution to provide them or the students to use them, as is the case with the formal process of curriculum development. This is in line with the recent findings on the lack of information about the students using the career service European Commission/EACEA/Eurydice (2016).

Table 23. 34 practices within the key process area of *Student support*

| Capability dimension | Practices related to <i>Student support</i> |
|----------------------|--|
| Plan | Careers development service for students is established. |
| | Annual action plan for the careers development service is prepared. |
| | <i>Institution has signed partnership agreements with employers regarding activities related to employability.</i> |
| | Graduate profiles for study programmes are available to students entering the institution. |
| | <i>A framework for the provision of student academic development is established.</i> |
| Do | Information on job opportunities and labour market is available to students. |
| | <i>Information about alumni employment and careers is available to students.</i> |
| | Career information is available to students through an organized career fair. |
| | Service of reviewing and correcting job application is offered to students. |
| | Simulation of job interviews is provided to students. |
| | <i>Institution provides assistance to employers in recruiting new employees.</i> |
| | <i>Visits to companies are organized for students.</i> |
| | <i>Employer invited lectures or workshops are organized for students.</i> |
| | <i>Alumni invited lectures are organized for students.</i> |
| | Individual career counselling is offered to students. |

| | |
|--------------|---|
| | <i>Psychometric testing is available to students.</i> |
| | <i>An alumni database is established.</i> |
| | Information about graduate employment is collected. |
| | Students are encouraged and supported to create their own portfolio (personal development plan). |
| | Support for student academic development is provided. |
| | <i>Student peer support activities regarding academic and social development are provided.</i> |
| | <i>Personal tutoring system for students is organized.</i> |
| | Mentorship for excellent students is provided. |
| | Support for students with disabilities is provided. |
| Check | <i>Information on the number of students using career services is collected.</i> |
| | <i>Analytical data are used to monitor the reach of online student engagement with career services information.</i> |
| | <i>Information on the number of students attending career fair is collected.</i> |
| | Student feedback on the usefulness of career services provided is collected. |
| | <i>Students' engagement in career service activities is monitored and regulated.</i> |
| | Information on graduates' satisfaction with their study and readiness for work is collected. |
| | <i>Student peer support system is monitored.</i> |
| | <i>Personal tutor monitors students' progress.</i> |
| Act | Evaluation of career services activities is conducted. |
| | <i>Personal tutors react to students' progress.</i> |

**practices written in italics script were excluded from further analysis, based on the results of model evaluation, or merged with other practices*

Table 24 shows the 26 practices contained within the key process area *Extra-curricular activities*. Like the area *Student support*, this one also contains mostly activities that are not obligatory for either the institution to provide or the students to participate. Here, more than half of the practices (14) fall within the implementation phase, 6 are related to planning and 6 are related to monitoring and continuous improvement. Within this area, the practices are related to a variety of extra-curricular and co-curricular activities, such as participation in student competitions, students' entrepreneurship initiatives, the work of different student organizations and the organization of the system of student representatives. In the planning phase, it is important that the HEI recognizes the importance of these different activities in contributing to graduates' employability and that it establishes frameworks for their implementation. As with the *Student support* practices, the practices in the implementation phase here consider different activities that could be offered within the HEI, such as the work of different student organizations and support for students to participate in different competitions, engage in sport or volunteering activities, start their own businesses, etc. Such support comprises a variety of aspects, including the provision of adequate working space for extra-curricular activities, financial support, mentorship for additional education, connecting students with relevant experts outside the institution, etc. In addition to monitoring of the provision of different extra-

curricular activities, the monitoring phase also involves recognizing student achievement in extra-curricular activities, which has been acknowledged as an important practice within some of the latest EU strategic documents (European Commission 2016a).

The final maturity model contains only ten practices within *Extra-curricular activities*, meaning that more than half of the practices were excluded from the initial strategic framework following the model evaluation processes. First, within the planning phase, the practices related planning on the levels of student organizations and student representatives were excluded:

- *Framework for supporting student organizations is established.*
- *Student organizations prepare annual plans of their activities.*
- *Student representatives develop strategic plans.*

This shows that the planning of extra-curricular activities at the level of the institution is more important than that on the level of particular student organizations perceived by stakeholders included in model evaluation. This stresses the role of the institution in ensuring adequate support for these activities. Within the implementation phase, most of the practices referring to particular activities were excluded; however, these are all contained within the overall practice *Students are provided with an adequate working environment for their extra-curricular activities*. The last two excluded practices show that there is a consensus between experts and students concerning the lack of need for the active involvement of teachers and other stakeholders in the provision of extra-curricular activities. Instead, students should be the ones to conduct these activities. The practices excluded from the implementation phase are:

- *Students are given support to work on their own projects.*
- *Students are encouraged to participate in different competitions.*
- *Students are offered different summer programmes.*
- *Students are offered volunteering opportunities.*
- *Students are offered different sports activities.*
- *Institution provides students with entrepreneurship education.*
- *Teachers support the work of student organizations through mentorship programmes.*
- *Collaboration with different HEI stakeholders is established through the work of student organizations.*

Additionally, practice *Student representatives gather feedback from students on different issues* was excluded, following the model testing at real HEIs.

Within both the monitoring and continuous improvement phases, only one practice was left; all others were excluded:

- *Work of student organizations is monitored at the institutional level.*
- *Work of student representatives is guided and monitored by institutional staff.*
- *Reports on student organizations are provided to HEI management.*
- *Potential improvements in the student representatives system are discussed at the institutional level.*

This shows that experts and students agreed that students' extra-curricular activities do not require any monitoring from the institution. However, the recognition of student achievement in extra-curricular activities is important in the monitoring phase. Interestingly, none of the practices within the continuous improvement phase should have been left in the final model following the evaluation phase; however, in order to close the PDCA cycle of strategic planning related to extra-curricular activities, it was decided to keep the practice with the best evaluation among the three practices related to continuous improvement: *Potential improvements in support of student extra-curricular activities are discussed at the institutional level.*

Table 24. 26 practices within the key process area of *Extra-curricular activities*

| Capability dimension | Practices related to <i>Extra-curricular activities</i> |
|----------------------|---|
| Plan | Framework for supporting student extra-curricular activities is established (student organizations, student projects, participation in competitions, etc.). |
| | Framework for supporting student entrepreneurship initiatives is established. |
| | <i>Framework for supporting student organizations is established.</i> |
| | <i>Student organizations prepare annual plans of their activities.</i> |
| | Institution has established system of student representatives. |
| | <i>Student representatives develop strategic plans.</i> |
| Do | Students are provided with an adequate working environment for their extra-curricular activities. |
| | <i>Students are given support to work on their own projects.</i> |
| | <i>Students are encouraged to participate in different competitions.</i> |
| | <i>Students are offered different summer programmes.</i> |
| | <i>Students are offered volunteering opportunities.</i> |
| | <i>Students are offered different sports activities.</i> |
| | <i>Institution provides students with entrepreneurship education.</i> |
| | Institution provides support for student start-ups. |
| | Students are involved in the work of student organizations. |
| | <i>Teachers support the work of student organizations through mentorship programmes.</i> |

| | |
|--------------|--|
| | <i>Collaboration with different HEI stakeholders is established through the work of student organizations.</i> |
| | Students elect their representatives. |
| | <i>Student representatives gather feedback from students on different issues.</i> |
| | Student representatives participate in different committees within the HEI. |
| Check | Student achievement in extra-curricular activities is recognized. |
| | <i>Work of student organizations is monitored at the institutional level.</i> |
| | <i>Work of student representatives is guided and monitored by institutional staff.</i> |
| Act | Potential improvements in support of student extra-curricular activities are discussed at the institutional level. |
| | <i>Reports on student organizations are provided to HEI management.</i> |
| | <i>Potential improvements in the student representatives system are discussed at the institutional level.</i> |

**practices written in italics script were excluded from further analysis, based on the results of model evaluation, or merged with other practices*

As explained in detail, this initial strategic framework was further limited to 65 practices contained within final strategic framework and maturity model, based on the assessment of model validity and reliability: 13 within strategic planning, 26 within curriculum design and delivery, 16 within student support and 10 within extra-curricular activities. This final strategic framework provides answer to the second research question:

Research question 2: *Which are the key higher education institutions' practices having impact to the preparation of higher education graduates for their early careers?*

Key practices of HEIs that have an impact on the preparation of higher education graduates for their early careers within HEIs are presented in the form of a final strategic framework and maturity model within **subchapter 7.2**. The answer to the second research question also contributes to the achievement of the research objective:

Research objective 2: *To develop the strategic framework of supporting higher education graduates' early careers in the field of ICT.*

In addition to answering the research question and contributing to the research goal, the final strategic framework also supports hypotheses H1:

H1: *Developed strategic framework for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will fulfil both relevance and rigor requirements of design science research.*

A summary of the research methods used in the steps of developing the strategic framework are presented in the research hodogram in **Figure 12**, which indicates that the research process

included several different methods related to the principles of both rigour and relevance requirements of design science research. Hypothesis H1 is confirmed and elaborated with detailed descriptions of the research methods used in the process of developing the strategic framework and maturity model, presented in the conclusion within *subchapter 6.6* and summarized below:

Relevance requirements of design science research are fulfilled by the use of the following methods through the four steps of strategic framework and maturity model design:

Step 1: Identify a new need or opportunity

- A review of relevant strategic documents and policies at the EU level
- A review of recent projects in the field of graduate employability and preparation for the world of work within HEIs

Step 2: Define the scope

- An initial list of key process areas and practices based on the review of relevant literature, recent projects in the field of graduate employability and preparation for the world of work within HEIs and relevant documents, such as universities' strategies, quality assurance policies, graduate employability strategies, etc.

Step 3: Design the model

- Case study research conducted at four HEIs in Europe

Step 4: Evaluate the design

- Model testing at four HEIs in Croatia.

Rigor requirements of design science research are fulfilled by the use of the following methods through the four steps of strategic framework and maturity model design:

Step 1: Identify a new need or opportunity

- A literature review of papers related to graduate employability, strategic management and quality assurance in higher education
- A systematic literature review of scientific papers in the field of the education and career development of future ICT professionals
- A review of maturity models and methodologies for their development

Step 2: Define the scope:

- Expert knowledge gathered from the focus groups

Step 3: Design the model:

- Knowledge gathered from the focus groups with relevant stakeholders

- Description of capability assessment criteria for each practice

Step 4: Evaluate the design:

- Experts' and students' knowledge used for model evaluation and calculations used for ensuring models' content and construct validity (CVR, average, hit ratio, Fleiss' Kappa)

Based on the above elaborations, it can be concluded that the final strategic framework fulfils both the relevance and the rigour requirements of design science research. This supports hypothesis **H1**.

7.2. Maturity model for supporting higher education graduates' early careers

The main output of the research within this thesis is a final strategic framework with accompanying maturity model for supporting graduates' early careers within HEIs. This model comprises 65 practices within four key process areas: 13 within strategic planning, 26 within curriculum design and delivery, 16 within student support and 10 within extra-curricular activities. These practices are also divided according to the capability dimensions within each of the four phases in the Deming cycle: plan-do-check-act, which gives a model the strategic dimension. For each key process area, there is at least one practice within each capability dimension.

This comprehensive model contributes to the achievement of the research objective:

Research objective 3: *To develop a maturity model for supporting higher education graduates early careers in the field of ICT.*

The developed maturity model, which is presented in **Table 25, Table 26, Table 27** and **Table 28**, contains the criteria for assessing the capabilities of all 65 relevant practices at five maturity levels and answers the following research question:

Research question 3: *Which are the capability assessment criteria of key higher education institution's practices having impact to the preparation of higher education graduates for their early careers?*

The final step in the design of the maturity model, its testing at four HEIs in Croatia conducting study programmes in the field of ICT, is presented as part of *Step 5) Evaluate the design* in the process of maturity model development. This step supported hypothesis H2:

H2: *Developed maturity model for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will be both comprehensive and reliable.*

As has already been mentioned, the primary purpose of testing the model to real cases was to determine whether the maturity levels for each practice were sufficiently *comprehensive*; in other words, the model's application sought to determine whether the proposed levels covered all possible levels of maturity. The indicator for this criteria was whether a given HEI was able

to identify the most adequate level of maturity for all practices within the proposed maturity level descriptions. This was accomplished in all four cases. Comprehensiveness, as the coverage of domain, can be considered one of the main attributes of reliability, but also as an indicator of internal validity. As explained within the subchapter on model reliability, the reliability of final strategic framework was ensured with the assessment of model validity, while the reliability of final maturity model (which differs from strategic framework only in addition of maturity level for each practice) was ensured by testing the final model at four HEIs. The other attribute of reliability can be understood as trustworthiness or demonstrability, which can be defined as replicability over groups of respondents. In this context, the respondents are HEIs in Croatia performing study programmes in the field of ICT. The model was applied to four institutions educating students in the field of ICT, each of which clearly differs from the others in terms of its content focus (i.e. some study programmes are more focused on the application of IT to business, some to electrical engineering, others to software development, etc.). There are also differences in the sizes of the institutions, the number of students, ownership (private or public), etc. Therefore, even within the field of ICT, there are differences among institutions that could affect the model's application. However, the model showed that most of the practices are sufficiently generic to be applicable to different groups of respondents; this supports the thesis concerning the reliability of the maturity model. Moreover, the application showed that the maturity levels for each practice are *disjunctive*, meaning that there is no overlap among maturity levels and that each HEI can determine one (and no more than one) maturity level that is most adequate for each of the practices. This contributes to the model's reliability.

The tables in the following four subchapters present the final maturity model for supporting graduates' early careers within HEIs, including the capability assessment criteria for all 65 practices. This model is presented within the final report of the project *Development of a model for supporting graduates' early careers* available at the project website¹⁰ and partially within the final project booklet *How to prepare students for the labour market challenges?* The model presented here was proofread after its testing at HEIs.

¹⁰ Webpage of a project *Development of a model for supporting graduates' early careers*: <http://cpsrk.foi.hr/razvoj-modela-za-pruzanje-podrske-diplomantima-u-ranom-razvoju-karijera>

7.2.1. Practices within the key process area of Strategic planning

Table 25. Capability assessment criteria of 13 practices within the area of *Strategic planning*

| STRATEGIC PLANNING | | | | | |
|---|--|---|---|--|---|
| | Not assessed | Initial | Partially adequate | Largely adequate | Fully adequate |
| PLAN | | | | | |
| Procedures for (re)development of institutional strategies are defined. | Procedures for (re)development of institutional strategies are not defined. | Procedures for (re)development of institutional strategies are defined ad hoc as informal guidelines and used inconsistently. | Procedures for (re)development of institutional strategies are formally defined but used inconsistently. | Procedures for (re)development of institutional strategies are formally defined, available to all staff and used consistently in defined timeframes. | Procedures for (re)development of institutional strategies are formally defined, available to all staff, used consistently in defined timeframes and the process of their application is documented for further improvements. |
| Information from graduate studies is used in the (re)development of institutional strategies. | Information from graduate studies is not used in the (re)development of institutional strategies. | Information from graduate studies is used informally and inconsistently in the (re)development of institutional strategies. | Information from graduate studies is used formally, but inconsistently for (re)development of institutional strategies. | Complete information from graduate studies formally guides decisions in the process of strategy (re)development, but without documented reflection. | Complete information from graduate studies explicitly and formally guides decisions in the process of strategy (re)development, with documented reflection on the usage of information from graduate studies. |
| Inputs from students are included in the (re)development of institutional strategies. | Inputs from students are neither collected nor used in the (re)development of institutional strategies. | Inputs from students are collected and used informally and inconsistently in the (re)development of institutional strategies. | Inputs from students are collected formally but used inconsistently in the (re)development of institutional strategies. | Inputs from students are collected formally and used consistently to guide decisions in the process of strategy (re)development, but without documented reflection. | Inputs from students are collected formally and used completely and consistently to guide decisions in the process of strategy (re)development, with documented reflection on the usage of collected inputs. |
| Inputs from relevant stakeholders are included in the (re)development of institutional strategies. | Inputs from relevant stakeholders are neither collected nor used in the (re)development of institutional strategies. | Inputs from some relevant stakeholders are collected and used informally and inconsistently in the (re)development of institutional strategies. | Inputs from some relevant stakeholders are collected formally but used inconsistently in the (re)development of institutional strategies. | Inputs from all relevant stakeholders are collected formally and used consistently to guide decisions in the process of strategy (re)development, but without documented reflection. | Inputs from all relevant stakeholders are collected formally and used completely and consistently to guide decisions in the process of strategy (re)development, with documented reflection on the usage of collected inputs. |

| | | | | | |
|---|--|--|---|---|---|
| Inputs from relevant HEI organizational units are included in the (re)development of institutional strategies. | Inputs from relevant HEI organizational units are neither collected nor used in the (re)development of institutional strategies. | Inputs from some HEI organizational units are collected and used informally and inconsistently in the (re)development of institutional strategies. | Inputs from some HEI organizational units are collected formally but used inconsistently in the (re)development of institutional strategies. | Inputs from all relevant HEI organizational units are collected formally and used consistently to guide decisions in the process of strategy (re)development, but without documented reflection. | Inputs from all relevant HEI organizational units are collected formally and used completely and consistently to guide decisions in the process of strategy (re)development, with documented reflection on usage of collected inputs. |
| DO | | | | | |
| Employability of graduates is addressed in institutional strategies. | Institutional strategies do not address employability of graduates. | Employability of graduates is indirectly addressed in institutional strategies. | Employability of graduates is explicitly addressed in institutional strategies but without defined key performance indicators. | Employability of graduates is explicitly addressed in institutional strategies with defined key performance indicators but is not in the core part of institutional strategies (part of its mission/vision). | Employability of graduates is explicitly addressed with defined key performance indicators and comprises the core of institutional strategies (part of its mission/vision) or there is a separate employability strategy. |
| Institutional strategies are communicated across the HEI. | Institutional strategies are not communicated across the HEI in any form. | Institutional strategies are available via institutional document repository but information about their availability is not distributed across the institution. | Institutional strategies are available through an institutional document repository and information about their availability is distributed across the institution but without instructions on the expected use of strategy by particular organizational units. | Institutional strategies are available through an institutional document repository, information about their availability is distributed across the institution with instructions on the expected use of strategy by particular organizational units. | Institutional strategies are available through an institutional document repository, information about their availability is distributed across the institution with instructions on the expected use of strategy by particular organizational units, supported by guidelines and reporting documentation regarding strategy success. |
| Institutional strategies are accompanied with action plans addressing graduate employability. | Institutional strategies are not accompanied with action plans or the existing actions plans are not connected to strategies. | Institutional strategies are supported by informal and inconsistent action plans created by some organizational units without formal institutional guidelines. | Institutional strategies are supported by formal action plans created by most organizational units according to the formal institutional guidelines but without their approval from management or plans for further actions/reporting. | Institutional strategies are supported by formal action plans approved by management, covering all aspects of strategy, including the strict definition of activities, goals and deadlines. | Institutional strategies are supported by formal action plans approved by management, covering all aspects of strategy, including the strict definition of activities, goals and deadlines, as well as reporting instructions. |

| CHECK | | | | | |
|--|--|---|--|--|--|
| Monitoring procedures regarding the implementation of institutional strategies are defined. | Monitoring procedures regarding the implementation of institutional strategies are not defined. | Monitoring of institutional strategies implementation is done ad hoc, informally and inconsistently. | Monitoring procedures regarding the implementation of institutional strategies are formally defined, based on the reports from action plans, but used inconsistently. | Institution has formally defined procedures based on the reports from action plans, available to the staff and used consistently for monitoring of strategies' implementation. | Institution has formally defined procedures based on the reports from action plans, available to the staff, and used consistently for monitoring of strategy implementation, with the results being documented for further improvements. |
| Reports on success of action plans are collected from different organizational units. | Success reports of action plans are not collected from any of the organizational units. | Success reports of action plans are collected on an ad hoc basis, informally and inconsistently from some organizational units. | Success reports of action plans are collected from most of the organizational units in a free form without formally pre-defined instructions that would cover all the aspects of action plans. | Success reports of action plans are collected annually from all the organizational units, having been prepared according to formal instructions and including information about all activities, goals and deadlines. | Success reports of action plans are collected annually from all organizational units, having been prepared according to formal instructions and including information about all the set activities, goals and deadlines. They are followed by a conclusion about the success of the specific parts of the action plan. |
| ACT | | | | | |
| Feedback from student satisfaction survey is used for better understanding of strategy success. | Feedback from student satisfaction survey is not used for better understanding of strategy success or failure. | Feedback from student satisfaction survey is collected and used informally, partially and inconsistently. | Feedback from student satisfaction survey is collected formally on a regular basis but used inconsistently for better understanding of strategy success. | Feedback from student satisfaction survey is collected formally and used consistently for better understanding of strategy success, but without documented reflection. | Feedback from student satisfaction survey is collected formally and used consistently for better understanding of strategy success, with documented reflection and suggestions for further improvements. |
| Compliance of strategy with changes in the external and internal environment is checked. | Compliance of strategy with changes in the external or internal environment is not checked. | Compliance of strategy with changes in the external or internal environment is checked on an ad hoc basis, informally and inconsistently. | Compliance of strategy with changes in the external or internal environment is formally checked on a regular basis but used inconsistently and informally for suggestions on further improvements. | Compliance of strategy with changes in the external or internal environment is formally checked on a regular basis and used consistently to guide decisions about further improvements, but without documented reflection. | Compliance of strategy with changes in the external or internal environment is formally checked on a regular basis and used consistently to guide decisions about further improvements, with documented reflection. |

| | | | | | |
|---|---|---|--|---|---|
| Strategy success is analyzed before starting a new strategic planning process. | Strategy success or failure is not analyzed before starting new strategic planning process. | Strategy success or failure is analyzed on an ad hoc basis, informally and inconsistently, without using the reports on action plans. | Strategy success or failure is formally analyzed on the basis of reports on action plans, although inconsistently. | Strategy success or failure is analyzed formally, including all the data from reports on action plans, but without any documented suggestions for improvements. | Strategy success is formally analyzed, including all the data from reports on action plans, followed by the documented suggestions for improvements in the next strategic planning cycle. |
|---|---|---|--|---|---|

7.2.2. Practices within the key process area of Curriculum design and delivery

Table 26. Capability assessment criteria of 26 practices within the area of Curriculum design and delivery

| CURRICULUM DESIGN AND DELIVERY | | | | | |
|--|--|---|--|---|--|
| | Not assessed | Initial | Partially adequate | Largely adequate | Fully adequate |
| PLAN | | | | | |
| Procedures for curriculum design and development (CDD) are established at the institutional level. | Institution has no established procedures for curriculum design and development. | Procedures for CDD are defined ad hoc as informal guidelines and used inconsistently. | Procedures for CDD are formally defined but used inconsistently. | Procedures for CDD are formally defined, available to all staff and are used consistently in defined timeframes. | Procedures for curriculum design and development are formally defined, available to all staff, used consistently in defined timeframes and the process of their application is documented for further improvement. |
| Curriculum development is guided by a student-centred approach in which employability skills are considered to be inter-related and need to be developed incrementally across the curriculum. | CDD is not guided by a student-centred approach. | Employability skills are planned in CDD ad hoc, informally and inconsistently. | Employability skills are planned in CDD only partially in some parts of the curriculum. | Employability skills are planned in CDD and inter-related through some parts of the curriculum. | Employability skills are planned in CDD process incrementally across the whole curriculum. |
| Inputs from employers are included in curriculum design and development (CDD) process. | Inputs from employers are not collected and used in the CDD process. | Inputs from employers are collected and used informally and inconsistently for CDD process. | Inputs from employers are collected formally, but used inconsistently for CDD process. | Inputs from employers are collected formally and used consistently to guide decisions in CDD process, but without documented reflection. | Inputs from employers are collected formally and used completely and consistently to guide decisions in the CDD process, with documented reflection on the usage of collected inputs. |
| Construction of learning outcomes is based on relevant national and international frameworks. | Definition of learning outcomes is not based on relevant frameworks. | In some courses, learning outcomes are based on relevant frameworks, but this is done inconsistently and is not coordinated at the study programme level. | In some courses, learning outcomes are based on relevant frameworks consistently but not coordinated at the study programme level. | For most of the courses, learning outcomes are consistently matched with the prescribed areas in relevant frameworks and coordinated with learning outcomes at the study programme level. | Learning outcomes for all courses are consistently matched with the prescribed areas in relevant frameworks, coordinated at study programme level and formally improved at the level of institution. |

| | | | | | |
|---|---|---|--|--|--|
| Departments work together on the creation of coherent content for a certain study programme. | Departments do not work together on the creation of coherent content for a certain study programme. | Content is defined at the level of each individual course but is not discussed at the level of departments. | Content is defined at the level of each individual course and discussed at the level of departments, but it is not coordinated in a way that it constitutes a coherent unit at the department level. | Content of courses is coordinated within departments so it constitutes a coherent unit within a department, but it is not coordinated with the content of courses across other departments. | Study programme content is coordinated both within the departments and between different departments so that it forms a coherent unit, based on the defined learning outcomes. |
| Formal procedures for student internship are established. | Formal procedures for student internship are not established. | Procedures for student internship are defined ad hoc as informal guidelines and used inconsistently. | Procedures for student internship are formally defined but not available to students and employers. | Procedures for student internship are formally defined and available to students and employers. | Formal procedures for student internship are established, available to students and employers, and supported by an online system. |
| Procedures and guidelines for the evaluation of teacher work are established. | Procedures and guidelines for the evaluation of teacher work are not established. | Procedures and guidelines for the evaluation of teacher work are defined ad hoc and informally and used inconsistently. | Procedures and guidelines for the evaluation of teacher work are formally defined but used inconsistently. | Institution has formally defined procedures and guidelines for the evaluation of teacher work available to all staff and they are used consistently in defined timeframes. | Institution has formally defined procedures and guidelines for the evaluation of teacher work available to all staff and which are used consistently in defined timeframes and documented for further improvement. |
| Continuous professional development of teachers is encouraged. | Institution does not encourage any actions for the continuous professional development of teachers. | Institution only informs teachers about courses for their professional development organized by external organizations. | Institution informs teachers about courses for their professional development organized by external organizations and provides some financial support for their participation. | Institution sometimes offers some courses for teachers' professional development covering a wide range of academic skills, implementation of new pedagogical approaches in courses, etc., and provides some financial support for attending extra courses outside the institution. | Institution continuously offers a set of pre-defined courses for teachers' professional development covering a wide range of academic skills, support for implementing new pedagogical approaches in courses, etc., and provides some financial support for attending extra courses outside the institution. |
| Support for teachers to implement new technology (e-learning) in courses is provided. | Institution does not provide any support for teachers to implement new technology in courses. | Institution has technical staff who can provide support for teachers to implement new technology in courses, but it does not provide any education or guidelines. | Institution has developed a strategy for implementation of new technology in courses but does not offer continuous support for teachers to implement new technology in courses. | Institution has developed a strategy for implementation of new technology in courses and offers continuous support for teachers to implement new technology in courses, but without any education for the implementation of new technology in courses. | Institution has developed a strategy for implementation of new technology in courses and offers continuous support and education for teachers to implement new technology in courses, in order to improve teaching processes. |

| DO | | | | | |
|--|--|--|--|--|--|
| Curriculum is delivered in partnership with industry. | There is no evidence of partnership with industry within curriculum delivery. | In some courses, partnership with industry is realized through one-time participation of employers in curriculum delivery (invited lectures etc.). | In most courses, partnership with industry is realized through one-time participation of employers in curriculum delivery (invited lectures etc.). | In most courses, partnership with industry is realized through one-time participation of employers in curriculum delivery (invited lectures, etc.), and in some courses, industry is included in curriculum delivery through extended activities within one course (i.e. series of invited lectures and student projects done in collaboration with industry, etc.). | In most courses, industry is included in curriculum delivery through extended activities within one course (i.e. series of invited lectures and student projects done in collaboration with industry). |
| Interrelation between content of different courses is established. | Interrelation between content of different courses is not established. | In some cases, there is a connection between a course's content and that of other courses to a small extent (usually between courses taught by the same teachers). | Connection between course content is established between some of the courses within the same department. | Connection between course content is established between most of the courses within the same department, and the course descriptions contain their connection with content from other courses that students are expected to know. | Connection between course content is established between most of the courses at the level of the study programme, and the course descriptions contain the connection with content from other courses that students are expected to know. |
| Teaching methods encourage independent, active learning and engagement with tasks (every student as a researcher/practitioner). | Most of the courses are theoretically oriented, without any tasks encouraging students' independent and active learning. | Some courses have integrated one or more small-scale tasks that encourage students' independent and active learning. | Plenty of the courses have integrated one or more tasks that encourage students' independent and active learning. | Plenty of the courses have integrated one or more tasks that encourage students' independent and active learning and some courses have integrated semester-long projects that encourage students' independent and active learning. | Most of the courses have integrated semester-long projects that encourage students' independent and active learning, where teachers have only the role of moderator. |
| Curriculum contains embedded work-based activities. | Curriculum does not contain any embedded work-related activities. | Some courses have integrated one or more small-scale tasks that can be considered work-related activities (some real-world problem-solving task, etc.). | Plenty of the courses have embedded small-scale work-related activities (some real-world problem-solving task, etc.). | Plenty of the courses have embedded one or more work-related activities and some courses have integrated semester-long work-related projects. | Most of the courses have embedded one or more work-related activities and some courses have integrated semester-long work-related projects in collaboration with employers. |

| | | | | | |
|--|---|---|--|--|--|
| Student internship is an integral part of the curriculum. | Student internship is not an integral part of the curriculum for a particular study programme. | Student internship is an elective part of the curriculum, students have to find internship placements on their own and there is no predicted timeslot in the curriculum for student internship. | Student internship is an elective part of the curriculum, the institution ensures some internship placements for students through signed agreements with companies, but there is no predicted timeslot in the curriculum for student internship. | Student internship is an obligatory part of the curriculum but students have to find internship placements on their own and there is no predicted timeslot in the curriculum for continuous internship or students' need to study longer to compensate for the period of internship. | Student internship is an integral part of the curriculum and institution ensures enough internship placements for all students through signed agreements with companies. There is a timeframe in the curriculum dedicated to the internship and students receive credits for it (i.e. ECTS or equivalent). |
| Student theses are done in cooperation with the industry. | Student theses are not done in cooperation with the industry. | Student theses are proposed by professors or students and some of them are done partially in cooperation with the industry (i.e. student conducts a case study within a company, etc.) | Student theses are proposed by professors or students and most of the students conduct a thesis in cooperation with the industry (i.e. student conducts a case study or undergoes an internship in the company related to the thesis topic.) | In some cases, industry proposes a thesis topic and, in agreement with a professor, informally mentors students in the process of thesis development (during informal meetings, internship in the company, etc.). | In most cases, industry proposes thesis topics and industry representatives are formally included in the process of thesis development as co-mentors. |
| Teaching and learning activities are taking place in an adequate working environment. | Working environment is not suitable for the provision of teaching and learning activities. | Working environment is suitable for the provision of basic teaching and learning activities. | Working environment is suitable for the provision of most types of teaching and learning activities, but institution does not provide adequate place for students' individual learning and team projects outside the classes. | Working environment is completely suitable for provision of all types of teaching activities (lectures, seminars, students' individual and team work, projects in collaboration with employers, etc.). Students also have places for their individual learning and team projects outside of class, but not fully equipped. | Working environment is completely suitable for provision of all types of teaching activities (lectures, seminars, students' individual and team work, projects in collaboration with employers, etc.). Students have access to fully equipped places for their individual learning and team projects outside of class. |
| Students are provided with proper feedback on their course performance. | Students are provided with quantitative feedback only and there is no defined deadline for the provision of feedback. | Students are provided with quantitative feedback only and there is a defined deadline for the provision of feedback. | Students receive both quantitative and qualitative feedback in some courses, while in most of them, feedback is only quantitative. There is no defined deadline for the provision of feedback. | Students receive both quantitative and qualitative feedback in some courses, while in most of them, feedback is only quantitative. Feedback is provided in defined time. | Students receive both quantitative and qualitative feedback in most of the courses in appropriate time, which enables them to make further improvements in acquiring new knowledge. |

| CHECK | | | | | |
|---|---|---|--|---|--|
| Curriculum relevance, consistency, practicality and effectiveness are monitored. | Institution has no established procedures for curriculum monitoring. | Procedures for curriculum monitoring are defined ad hoc as informal guidelines (in oral or written form) and used inconsistently. | Procedures for curriculum monitoring are formally defined but used inconsistently. | Institution has formally defined procedures available to all staff and they are used consistently in defined timeframes for curriculum monitoring. | Institution has formally defined procedures available to all staff, they are used consistently in defined timeframes for curriculum monitoring and documented for further improvement. |
| Student feedback on curriculum implementation is collected. | Students do not provide any feedback on curriculum. | Feedback from students on curriculum is collected and used informally, partially and inconsistently. | Feedback from students on curriculum is collected formally, but used partially/ inconsistently for better understanding of potential improvements in curriculum. | Feedback from students on curriculum is collected formally and used consistently for better understanding of potential improvements in curriculum, but without documented reflection. | Feedback from students on curriculum is collected formally and used consistently for better understanding of potential improvements in curriculum, with documented reflection for new process of curriculum design and development. |
| Quality of the assessment of student work is monitored. | There is no mechanism for monitoring the quality of the assessment of student work. | Procedures for monitoring of the quality of the assessment of student work are defined ad hoc as informal guidelines and used inconsistently. | Procedures for monitoring of the quality of the assessment of student work are formally defined but used inconsistently and partially. | Procedures for monitoring of the quality of the assessment of student work are formally defined and used consistently for monitoring of the quality of some types of assessment of student work. | Procedures for monitoring of the quality of the assessment of student work are formally defined and used consistently for monitoring of the majority of the assessment (oral exam, written exam, project work, etc.). |
| Feedback on internship is collected from students and employers. | Institution does not collect feedback on internship, either from students or employers. | Feedback from some students or employers on their satisfaction with internship is collected informally, partially and inconsistently. | Feedback on internship is collected from some students and employers, but only in relation to their satisfaction with a particular student/employer and not with the process of internship in general. | Feedback on internship is collected from all students and employers in writing and in relation to the satisfaction with a particular student/employer but also in relation to the general process of internship. Collected data is used partially for specific improvements, but without any documented reflection. | Feedback on internship is collected from all students and employers in writing and in relation to their satisfaction with a particular student/employer but also in relation to the general process of internship. Collected data is used fully for specific improvements, with documented reflection. |
| Teacher performance is evaluated by students. | Teacher performance is not evaluated by students. | Teacher performance is evaluated by students informally, partially and inconsistently. | Teacher performance is evaluated by students formally in writing, but not consistently for all courses and in each academic year. | Teacher performance is evaluated by students for most of the courses he/she teaches at least every second year, using pre-defined assessment forms. | Teacher performance is evaluated by students annually for all courses, according to pre-defined assessment forms. |

| | | | | | |
|--|--|---|--|---|--|
| Control mechanisms based on the evaluation of teacher performance are established. | There are no control mechanisms established. | Control mechanisms based on the evaluation of teacher performance are defined ad hoc and informally and used inconsistently. | Control mechanisms based on the evaluation of teacher performance are formally defined but used inconsistently. | Control mechanisms based on the evaluation of teacher performance are formally defined, available to all staff and used consistently in defined timeframes. | Control mechanisms based on the evaluation of teacher performance are available to all staff, used consistently in defined timeframes and the process of their application is documented for further improvements. |
| ACT | | | | | |
| Communication with the relevant stakeholders is done to ensure regular updates of learning outcomes in line with labour market needs. | There is no communication with internal or external stakeholders about potential improvements to the curriculum. | Communication with some relevant stakeholders on needed changes to the curriculum is carried out and used informally, partially and inconsistently. | Communication with some relevant stakeholders is carried out formally and on a regular basis but used inconsistently for better understanding of needed changes to the curriculum. | Communication with most of the relevant stakeholders is carried out formally and used consistently for better understanding of needed changes to the curriculum, but without documented reflection. | Communication with all the relevant stakeholders is carried out formally and used consistently for better understanding of needed changes to the curriculum, with documented reflection and suggestions for further improvement. |
| Results of teacher performances are discussed for potential improvements. | Results of teacher performance are not discussed at all at the institutional level. | Results of teacher performance are discussed occasionally and informally with some teachers with lower results, but without any actions for improvements. | Results of teacher performance are discussed with all teachers with lower performance and they are encouraged to take some actions for improvements. | Results of teacher performance are discussed with each teacher and the institution has formally defined actions for improvements in teacher performance, but those actions are not conducted regularly. | Results of teacher performance are communicated with each teacher, the institution has formally defined actions based on the results of teacher performance and those actions are conducted regularly. |
| Strengths and weaknesses of the current study programme are discussed prior to new curriculum design and development (CDD) process. | Strengths and weaknesses of the programme are not discussed prior to new CDD. | Strengths and weaknesses of the programme are discussed informally, partially and inconsistently. | Strengths and weaknesses of the programme are discussed formally on a regular basis but used inconsistently for the process of new CDD. | Strengths and weaknesses of the programme are discussed formally on regular basis and used consistently for the process of new CDD, but without documented reflection. | Strengths and weaknesses of the programme are discussed formally on a regular basis and used consistently for the new process of curriculum design and development, with documented reflection. |

7.2.3. Practices within the key process area of Student support

Table 27. Capability assessment criteria of 16 practices within the area of *Student support*

| STUDENT SUPPORT | | | | | |
|---|--|---|--|---|---|
| | Not assessed | Initial | Partially adequate | Largely adequate | Fully adequate |
| PLAN | | | | | |
| Careers development service for students is established. | Careers development service for students is not established in any form. | There are some initiatives for establishment of careers development service at the institutional level, but not followed with any concrete actions. | Institution is in the process of formal establishment of careers development service. | Institution has formally established careers development service but without employed professionals. | Institution has formally established careers development service with employed professionals for the provision of career-related activities. |
| Annual action plan for the careers development service is prepared. | Annual action plan for the careers development service is not prepared. | Careers development service prepares only an informal list of planned activities for the academic year. | Careers development service prepares action plan of its activities, but without strict definition of goals, key performance indicators and timeframes. | Careers development service prepares annual action plan of activities with defined goals, key performance indicators and timeframes, but the plan is not formally approved at the institutional level. | Career services prepare annual action plan of its activities with defined goals, key performance indicators and timeframes. The plan is formally approved at the institutional level and serves as a basis for financing the careers service. |
| Graduate profiles for study programmes are available to students entering the institution. | Institution does not provide students with any kind of description of graduate profiles. | Institution only provides students with a list of some of the most common graduate profiles for the particular study programme. | Institution provides students with a list of the most common graduate profiles for the particular study programme, including a list of competences for each profile. | Institution provides students with an extensive list of graduate profiles for the particular study programme, including list of competences, working tasks and any related additional information for each profile. | Institution provides students with a complete list of potential graduate profiles for the particular study programme, including the list of competences, working tasks and additional information for each profile, together with the statistics of alumni employment for the particular profile. |
| DO | | | | | |
| Information on job opportunities and labour market is available to students. | Institution does not provide any information on job opportunities and labour market. | Institution allows employers to publish their job opportunities on a physical bulletin board placed at the institution. | Institution periodically publishes job opportunities for students on its website, but there is no dedicated place for that type of information. | Institution has established portal or dedicated place on its webpage where job opportunities for students are published on a regular basis. | Institution has established portal or dedicated a place on its webpages where job opportunities for students are published on a regular basis, with the option for students |

| | | | | | |
|--|---|--|--|---|---|
| | | | | | to filter job opportunities according to their preferences. |
| Career information is available to students through an organized career fair. | Institution does not organize career fair. | Institution does not organize career fair, but some student or partner organizations organize events related to career development and the institution only informs students about it. | Institution organizes smaller events where students can get career-related information. | Institution organizes career fair at least once a year where students can get in touch with employers. | Institution organizes a career fair at least once a year where students can get in touch with potential employers but students can also attend other activities aimed at supporting their career development (workshops, lectures, etc.). |
| Service of reviewing and correcting job application is offered to students. | Institution does not offer any type of service of reviewing and correcting job applications for students. | Some student or partner organizations periodically organize workshops for reviewing and correcting of job applications, but institution only informs students about that possibility. | Institution periodically provides service of reviewing and correcting job applications in collaboration with partner organizations. | Institution provides service of reviewing and correcting job applications for students from its own employers, either in the form of workshops or individual counselling. | Institution continuously provides service of reviewing and correcting job applications for students by its own employees, both in the form of regular workshops and individual counselling. |
| Simulation of job interviews is provided to students. | Institution does not provide any kind of simulation of job interviews for students. | Some student or partner organizations periodically organize preparation for/simulation of job interviews, but institution only informs students about that possibility. | Institution periodically provides preparation for/simulation of job interviews in collaboration with partner organizations. | Institution provides preparation for job interviews/simulation of job interviews by its own employees. | Institution provides preparation for job interviews/simulation of job interviews, by its own employees and in collaboration with employers. |
| Individual career counselling is offered to students. | Institution does not offer individual career counselling for students. | Institution informs students about possibilities for individual career counselling from external partners/services. | Institution periodically provides service of individual career counselling for students in collaboration with partner organizations. | Institution has some of its employees who can, among other things, provide service of individual career counselling for students. | Institution has employed experts to provide individual career counselling for students. |

| | | | | | |
|---|--|--|--|--|--|
| Information about graduate employment is collected. | Institution does not collect any information about the employment and career development of its graduates. | Institution collects information about graduates' employment ad hoc, informally and inconsistently. | Institution collects information from its graduates only immediately after their graduation. | Institution collects information from its graduates immediately after their graduation and for some time after their graduation, but it does not invest additional resources to reach most of the graduates. | Institution invests additional resources in collecting information from most of its graduates immediately upon their graduation and at pre-defined periods for several years after the graduation. The process of collecting information is formally defined at the institutional level, followed by analysis of the collected data. |
| Students are encouraged and supported to create their own portfolio (personal development plan). | Institution does not encourage students nor does it provide them with any support to create their own portfolio. | Institution provides students with information about portfolio and its importance but does not actively encourage or support them to create their own portfolio. | Institution provides students with the opportunity and support to create their own portfolio, but it is not obligatory. | It is obligatory for all students to have their own portfolio, the institution provides them with support to create their portfolio but it does not use it to monitor their progress. | It is obligatory for all students to have their own portfolio, supported by the information system, and the institution provides them with support to create their portfolio as well as tutors to monitor student progress. |
| Support for student academic development is provided. | Institution does not offer any type of support for student academic development. | Some student or partner organizations periodically organize workshops or other activities related to student academic development, but the institution only informs students about that possibility. | Institution periodically provides activities for students' academic development in collaboration with partner organizations. | Institution provides activities for student academic development from its own employees, but it is not obligatory for students. | Institution provides activities for student academic development from its own employees, and some of the activities are obligatory for some groups of students (e.g. freshmen). |
| Mentorship for excellent students is provided. | Institution does not provide any mentorship for excellent students. | Some of the (non)teaching staff informally provide support for excellent students in some aspects (preparation for student competitions, etc.). | Institution has organized some informal activities to support excellent students in some aspects (preparation for student competitions, different projects, etc.). | Institution has formally established system for supporting excellent students in some aspects (preparation for student competitions, different projects, etc.) | Institution has formally established system for supporting excellent students in a range of different aspects, providing them with individual mentorship from its own employees or external partners. |

| | | | | | |
|---|--|---|---|--|--|
| Support for students with disabilities is provided. | Institution does not offer any type of support for students with disabilities. | Some student or partner organizations provide support for students with disabilities, but the institution only informs students about that possibility. | Institution provides support for students with disabilities in collaboration with partner organizations. | Institution has some of its employees who are, among other things, dedicated to providing support for students with disabilities. | Institution has established office(s) or employed experts to provide support for students with disabilities. |
| CHECK | | | | | |
| Student feedback on the usefulness of career services provided is collected. | Institution does not collect any feedback from students on the usefulness of career services. | Feedback from students on the usefulness of career services is collected and used informally, partially and inconsistently. | Feedback from students on the usefulness of career services is collected systematically but used informally, partially and inconsistently for potential improvements. | Feedback from students on the usefulness of career services is collected systematically in writing and used for improvements, but without documented conclusions/reflection. | Feedback from students on the usefulness of career services is collected systematically in writing, analyzed and used for improvements, with documented suggestions for further improvements. |
| Information on graduates' satisfaction with their study and readiness for work is collected. | Institution does not collect any information from graduates about their satisfaction and readiness for work. | Feedback from graduates about their satisfaction and readiness for work is collected and used informally, partially and inconsistently. | Feedback from graduates about their satisfaction and readiness for work is collected systematically but used informally, partially and inconsistently for potential improvements. | Feedback from graduates about their satisfaction and readiness for work is collected systematically in writing and used for some improvements, but without documented conclusions/reflection. | Feedback from graduates about their satisfaction and readiness for work is collected systematically in writing, analyzed and used for some improvements, with documented suggestions for further improvements. |
| ACT | | | | | |
| Evaluation of career services activities is conducted. | Institution does not conduct any actions for the evaluation of career services activities. | Evaluation of career services activities is conducted ad hoc, informally and inconsistently, without using the feedback from students and alumni. | Evaluation of career services activities is conducted systematically, based on the feedback from students and alumni, but only from the careers service employees. | Evaluation of career services activities is conducted systematically, based on the complete feedback from students and alumni, both from the careers service employees and institutional management, but without documented conclusions. | Evaluation of career service activities is conducted formally, based on the complete feedback from students and alumni, both from the career service employees and institutional management, with documented suggestions for further improvements. |

7.2.4. Practices within the key process area of Extra-curricular activities

Table 28. Capability assessment criteria of 10 practices within the area of *Extra-curricular activities*

| EXTRA-CURRICULAR ACTIVITIES | | | | | |
|--|---|--|---|--|---|
| Practice | Not assessed | Initial | Partially adequate | Largely adequate | Fully adequate |
| PLAN | | | | | |
| Framework for supporting student extra-curricular activities is established (student organizations, student projects, participation in competitions, etc.). | Framework for support of student extra-curricular activities is neither established nor planned. | Support for student extra-curricular activities is planned ad hoc, informally and inconsistently. | Institution makes only partial plans for supporting some student extra-curricular activities but most of the students are not familiar with the available support. | Institution makes plans for supporting most student extra-curricular activities and takes action to inform students about the available support. | Institution makes formal plans for complete support (financial, mentorship, etc.) of a wide range of student extra-curricular activities, based on previous results and plans for new academic year, followed by action to encourage students to use the available support. |
| Framework for supporting student entrepreneurship initiatives is established. | Framework for supporting student entrepreneurship initiatives is neither established nor planned. | Support for student entrepreneurship initiatives is planned ad hoc, informally and inconsistently. | Institution makes only partial plans for supporting some student entrepreneurship initiatives but most of the students are not familiar with the available support. | Institution makes plans for supporting most student entrepreneurship initiatives and takes action to inform students about the available support. | Institution makes formal plans for complete (financial, mentorship, etc.) support of a wide range of student entrepreneurship initiatives within the institution and in connection with relevant partners, followed by action to encourage students to use the available support. |
| Institution has established system of student representatives. | Institution does not have established system of student representatives. | There are some initiatives for the establishment of a student representative system, but not followed by any concrete actions. | System of student representatives is established at the institution according to regulations at university/national level. | System of student representatives is established according to the regulations at university/national level, but institution also has its own, additional informal regulations for student representative system. | System of student representatives is established according to the regulations at university/national level, but institution also has its own, additional formal regulations for student representative system. |

| DO | | | | | |
|--|---|--|---|--|---|
| Students are provided with an adequate working environment for their extra-curricular activities. | Students are not provided with any working environment for their extra-curricular activities. | Institution provides some space for student extra-curricular activities upon their request. | Institution provides spaces with basic equipment adequate for the provision of some extra-curricular activities (i.e. offices for student organizations). | Institution provides students with working environment equipped for the provision of most of the extra-curricular activities (i.e. labs equipped with different technology). | Institution provides students with working environment fully equipped for the provision of most of the extra-curricular activities and continuously invests in additional financial and material resources for its improvement. |
| Institution provides support for student start-ups. | Institution does not provide any support for student start-ups. | Institution provides support for student start-ups ad hoc, informally and inconsistently. | Institution provides support for student start-ups only in some aspects (education, accountancy, offices, etc.). | Institution provides formal support for the establishment of student start-ups in most aspects (education, accountancy, offices etc.). | Institution provides formal support for the establishment of student start-ups, including all the necessary infrastructure (education, accountancy, offices, etc.). |
| Students are involved in the work of student organizations. | There are no student organizations at the institution. | There are only one or two student organizations at the institution, and they are not very active and do not involve many students in their work. | There are a few student organizations at the institution, with a small number of students actively involved in their work. | There are several student organizations active at the institution, with a moderate number of students involved in their work. | There are many active student organizations at the institution and many students are actively involved in their activities. |
| Students elect their representatives. | Students do not have an opportunity to elect their representatives. | Students elect their representatives ad hoc, informally and inconsistently. | Students elect their representatives on a regular basis, but only at the level of the entire institution. | Students elect their representatives on a regular basis for each study programme. | Students elect their representatives on a regular basis for each study programme and each study year. |
| Student representatives participate in different committees within the HEI. | Student representatives do not participate in any institutional committees. | Student representatives participate in a few institutional committees. | Student representatives participate in several institutional committees. | Student representatives participate in several institutional committees and some decision-making bodies. | Student representatives participate in most of the institutional committees as well as the institutional decision-making bodies. |
| CHECK | | | | | |
| Student achievement in extra-curricular activities is recognized. | Student achievement in extra-curricular activities is not recognized. | There are some initiatives for recognition of student achievement in extra-curricular activities, but they are not followed with any concrete actions. | Institution has informal procedures for the recognition of student achievement in some extra-curricular activities, but they are used inconsistently. | Student achievement in some extra-curricular activities, both within and outside the institution, is formally recognized in number of ECTS credits (or equivalent), as an addition to diploma supplement, etc. | Student achievement in most extra-curricular activities, both within and outside the institution, is formally recognized in number of ECTS credits (or equivalent), as an |

| | | | | | |
|---|--|---|---|---|---|
| | | | | | addition to diploma supplement, etc. |
| ACT | | | | | |
| Potential improvements in support of student extra-curricular activities are discussed at the institutional level. | Institution does not conduct any actions for potential improvements in support of student extra-curricular activities. | Potential improvements in support of student extra-curricular activities are discussed ad hoc, informally and inconsistently. | Potential improvements in support of student extra-curricular activities are discussed systematically but separately for different extra-curricular activities. | Potential improvements in support of all student extra-curricular activities are discussed systematically at the level of institutional management, but without documented conclusions. | Potential improvements in support of all student extra-curricular activities are discussed systematically at the level of institutional management, with documented suggestions for further improvements. |

7.3. Model's testing at HEIs in the field of ICT in Croatia

This last subchapter related to the research results discusses the implications of the model testing at four HEIs in Croatia that provide study programmes in the field of ICT. In addition to confirming the reliability of the maturity model, this applied part of the research contributes insight into the current maturity level of HEIs in one of their main roles: preparing graduates for their early careers. This insight into HEIs current capabilities related to certain practices also serves as a basis for providing recommendations for the improvement and enhancement of the maturity level of HEIs in Croatia in the field of ICT in general. As mentioned in *subchapter 6.4.2*, the maturity model was tested at the following HEIs:

- *Josip Juraj Strossmayer University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology Osijek*
- *University of Zagreb, Faculty of Electrical Engineering and Computing*
- *University of Zagreb, Faculty of Organization and Informatics*
- *University of Applied Sciences VERN.*

Here, it is important to emphasize that the idea behind the model testing was not to assess the maturity of four HEIs that participated in the model evaluation. Instead, the model testing provided the insight into the capability of different practices at Croatian HEIs and served as a basis to provide general conclusion and recommendations for enhancing the capability of practices within HEIs providing study programmes in the field of ICT in the Croatia.

7.3.1. Maturity of HEIs in the field of ICT in Croatia

This subchapter answers the following research question:

Research question 4a: *What is the current level of maturity of HEIs in Republic of Croatia regarding the preparation of ICT graduates for their early careers?*

The following is a summary of the results of the applied research. The average values presented in this chapter were calculated based on quantifying the qualitative descriptors of maturity levels as follows: “Not assessed – 1, Initial – 2, Partially adequate – 3, Largely adequate – 4 and Fully adequate – 5”.

The graphical representation in **Figure 16** shows that the overall level of maturity of the four HEIs is the highest for the areas of *Extra-curricular activities* ($M = 3.75$) and *Curriculum design and delivery* ($M = 3.71$) and is only slightly lower in the area of *Strategic planning* ($M = 3.48$). The lowest level of maturity was observed for the area of *Student support* ($M = 2.88$).

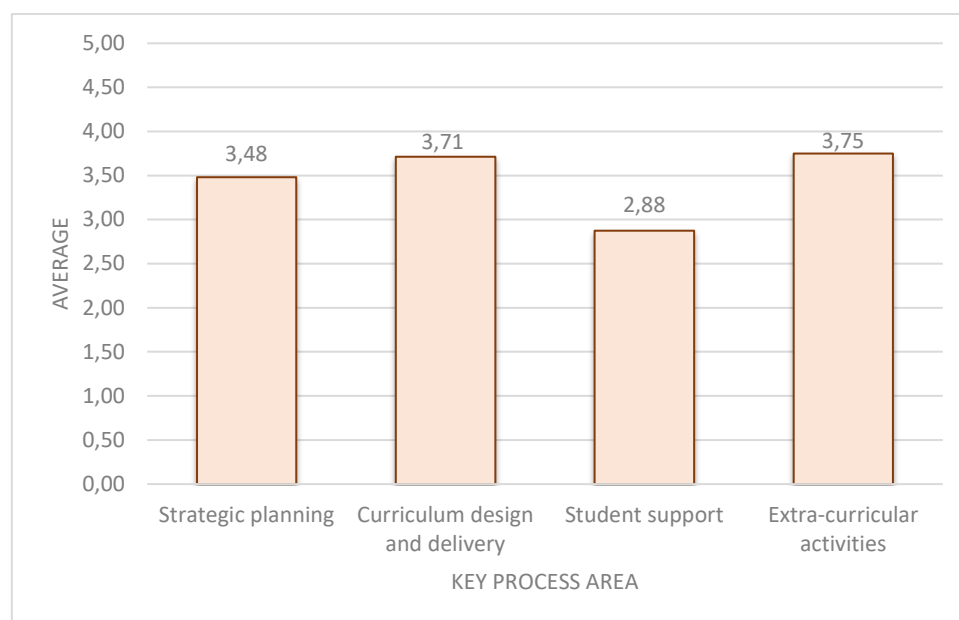


Figure 16. Maturity levels of HEIs in Croatia educating students in the field of ICT according to key process areas in general

These results are consistent with the results of research conducted by the Croatian Agency for Science and Higher Education (ASHE) and the national Euroguidance (Agency for Mobility and the European Union) on the work of guidance services and career counselling at HEIs, published in April 2016 (Agency for Science and Higher Education 2016). This survey aims to encourage capacity building in HEI career centres, as described in the Strategy for Lifelong Guidance and Career Development 2016–2020 (Croatian Government 2015). The most recent survey showed that fewer than half of the surveyed HEIs had established units for student career guidance and development. Most recently, Croatia is recognized among only two countries at the European level without career guidance available at HEIs (European Commission/EACEA/Eurydice 2016). Since the maturity model practices in the area of *Student support* focused mainly on the activities of such services, their absence within HEIs resulted in a very low capacity of HEIs regarding related practices, which affected the overall lower maturity of this process area.

In terms of the level of implementation (capability dimension) of certain practices, the highest level of maturity was recorded in the planning phase ($M = 3.74$), and a slightly lower level of

maturity was recorded at the levels of the verification of achievement of certain practices (*check*; $M = 3.52$) and their implementation ($M = 3.32$). In line with the results of some previous research (Divjak 2016), institutions show the lowest levels of maturity in the Deming cycle for strategic planning (Plan-Do-Check-Act) within activities directed towards continuous improvement (*act*; $M = 3.19$) (**Figure 17**).

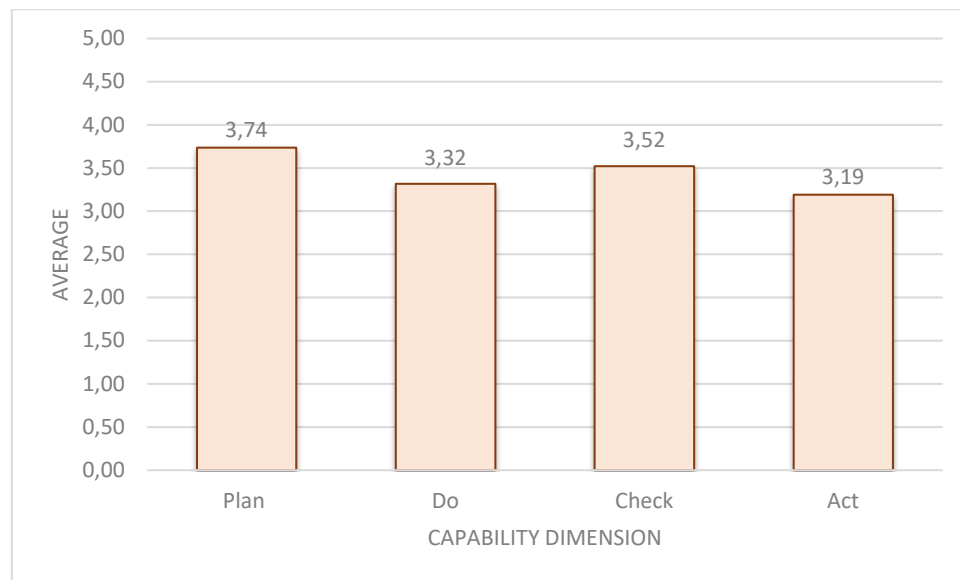


Figure 17. Maturity level of HEIs in Croatia educating students in the field of ICT according to capability dimensions in general

Individual observations of each institution suggest that there are certain trends, but that each individual institution shows better or worse performance in a particular process area. For example, there is an HEI with an average level of maturity in the area of strategic planning of $M > 4.6$ and an HEI with an average level of maturity in the area of strategic planning of $M = 3.0$. The institutions also exhibited differences in terms of their capabilities within key process areas.

For further analysis and recommendations about potential improvements, it is also interesting to analyze the practices with the highest (**Table 29**) and lowest (**Table 30**) average values. It is interesting to note that, of the practices with the highest capabilities ($M > 4.5$), there are no practices related to *Student support*; instead, *Student support* practices represent the highest number of practices among the group of practices with the lowest capabilities ($M < 3.0$). Although the average values provides a certain information about the overall maturity level of institutions according to the key process areas, for the detailed examination and provision of

appropriate recommendations for enhancing the current level of maturity, it is more convenient to observe key process areas by the appearance of their practices at certain maturity level.

Table 29. Practices with the highest capability within HEIs in Croatia

| Key process area | Practice | Average |
|-----------------------------|--|---------|
| Strategic planning | Procedures for (re)development of institutional strategies are defined. | 4.5 |
| | Inputs from relevant HEI organizational units are included in the (re)development of institutional strategies. | 4.5 |
| Curriculum | Departments work together on the creation of coherent content for a certain study programme. | 5.0 |
| | Formal procedures for student internship are established. | 4.75 |
| | Procedures and guidelines for the evaluation of teacher work are established. | 4.75 |
| | Feedback on internship is collected from students and employers. | 4.75 |
| | Teacher performance is evaluated by students. | 4.5 |
| Extra-curricular activities | Students representatives participate in different committees within the HEI. | 4.5 |

Table 30. Practices with the lowest capability within HEIs in Croatia

| Key process area | Practice | Average |
|-----------------------------|--|---------|
| Strategic planning | Information from graduate studies is used in the (re)development of institutional strategies. | 2.75 |
| | Institutional strategies are accompanied with action plans addressing the employability. | 2.5 |
| Curriculum | Continuous professional development of teachers is encouraged. | 3.0 |
| | Student theses are done in cooperation with the industry. | 3.0 |
| | Support for teachers to implement new technology (e-learning) in courses is provided. | 2.25 |
| Student support | Annual action plan for the careers development service is prepared. | 2.5 |
| | Simulation of job interviews is provided to students. | 2.25 |
| | Information about graduate employment is collected. | 2.5 |
| | Students are encouraged and supported to create their own portfolio (personal development plan). | 1.75 |
| | Student feedback on the usefulness of career services provided is collected. | 1.5 |
| | Evaluation of career service activities is conducted. | 1.75 |
| Extra-curricular activities | Students are involved in the work of student organizations. | 3.0 |

In general, it can be concluded that, among the HEIs in Croatia that conduct study programmes in the field of ICT, there is room for improvement in certain practices and for increased levels of maturity in all process areas and across all dimensions of organizational capacity, depending on the individual institution. To accomplish these objectives, the created maturity model can

serve as a good guideline for developing a comprehensive and integrated approach to improving practices aimed to better prepare students for their transitions to the labour market.

7.3.2. Recommendations for enhancing the maturity of HEIs in Croatia in the field of ICT

The analysis of the maturity of HEIs in Croatia in the field of ICT according to key process areas and capability dimensions is provided within *subchapter 7.3.1*. Maturity of HEIs in the field of ICT in Croatia provides a basis for answering the following research question:

Research question 4b: *What are the possible improvements in preparation of ICT graduates for their early careers in the Republic of Croatia?*

This subchapter refers to the findings presented within the previous subchapter and provides recommendations according to the key process areas and capability dimensions.

7.3.2.1. Recommendations for the area of Strategic planning

Figure 18 shows the number of practices at a certain capability dimension for all four HEIs within the key process area of *Strategic planning*. The practices within this key process area are spread almost equally accros the all maturity levels, except the first one (*not assessed*). This indicate that most of the practices related to strategic planning are, to some extend, organized within HEIs. The average values according to capability dimensions are M=3.85 for *plan*, M=3.0 for *do*, M=3.38 for *check* and M=3.42 for *act*.

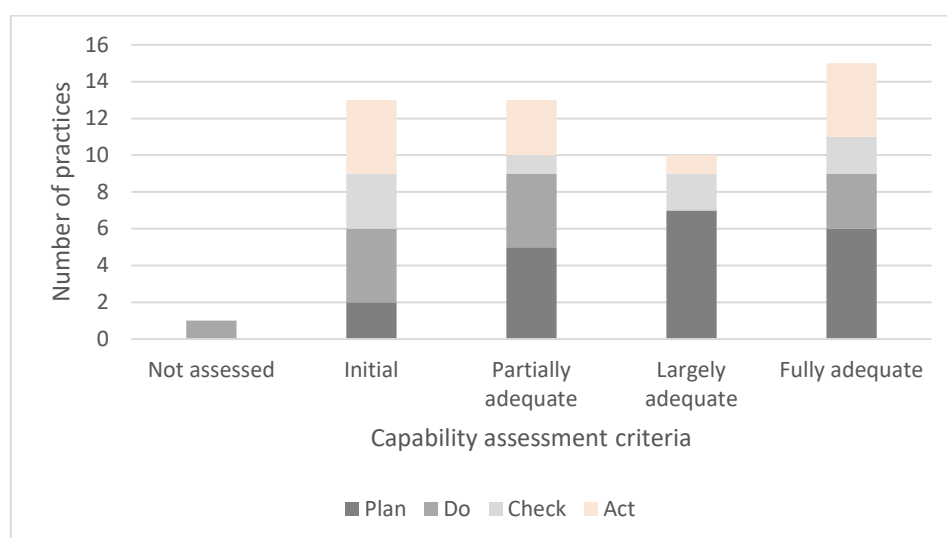


Figure 18. Number of practices at a certain capability dimension within the key process area Strategic planning for HEIs in Croatia

Plan

The first positive finding within the planning phase of institutional strategy development is that most of the institutions have very well defined procedures for the (re)development of institutional strategies. Although inputs from students and different organizational units within HEIs are used in the (re)development of new strategies, institutions show low performance in the usage of external data sources, such as different stakeholders and alumni. The first suggestion, therefore, is to formally include more external stakeholders in the process of strategy development, as well as to collect data from alumni via graduate studies and to use these data consistently to guide decisions when developing new strategies.

Do

Unlike in the results for all key process areas in general, within the process area of *Strategic planning*, institutions show lower capabilities in the implementation (*do*) phase. The reason is primarily that most of the studied institutions do not address employability in their institutional strategies. This practice needs to be changed if the institutions seek to provide comprehensive support for their graduates' career development. Employability needs to be addressed either explicitly within the core of the institutional strategy (its mission/vision/strategic goals) or via a separate employability strategy. Addressing employability as a main strategy will also positively affect all other practices if the institution is consistent in implementing its own strategic plans. In this context, HEIs should accompany their strategies with action plans and communicate them across the institution; however, currently, such an approach is extremely rare.

Check

The monitoring phase directly relates to the implementation phase. Therefore, the lower performance within the implementation phase also affects some practices in this phase. The absence of action plans for success is the first area that should be monitored in this phase. Therefore, if an institution does not have action plans, these will not be available for monitoring. The obtained results are in line with the findings from Divjak (2016) who reported that the monitoring of the strategy implementation at Croatian HEIs is not conducted.

Act

Since the *act* phase is directly connected to the planning phase within the new cycle of strategic planning, the two phases involve similar recommendations. If an institution wishes to make improvements in the next strategic planning cycle, it must collect information from graduates

regarding their satisfaction with their studies in order to gain an impression of how actual strategies affect their employability potential. Since HEIs are not closed systems and since the purpose of their employability strategy is to provide students with adequate support in developing their employability capacity and to ensure their smooth transition to the labour market, the compliance of strategy with changes in the internal and external environment should be checked through communication with relevant stakeholders. This could be accomplished through the organization of different kinds of events, such as conferences, round tables, career days, etc., at which the suggestions of different groups of stakeholders can be collected.

7.3.2.2. Recommendations for the area of Curriculum design and delivery

Figure 19 shows number of practices at a certain capability dimension for all four HEIs within the key process area of *Curriculum design and delivery*. Comparing to other key process areas, this one contains most of the practices showing the highest level of capability. The reason for this situation very likely lies in curriculum being the central element of each study programmes, with very well defined procedures for its design and delivery. The average values according to capability dimensions are $M=3.83$ for *Plan*, $M=3.53$ for *Do*, $M=3.92$ for *Check* and $M=3.42$ for *Act*.

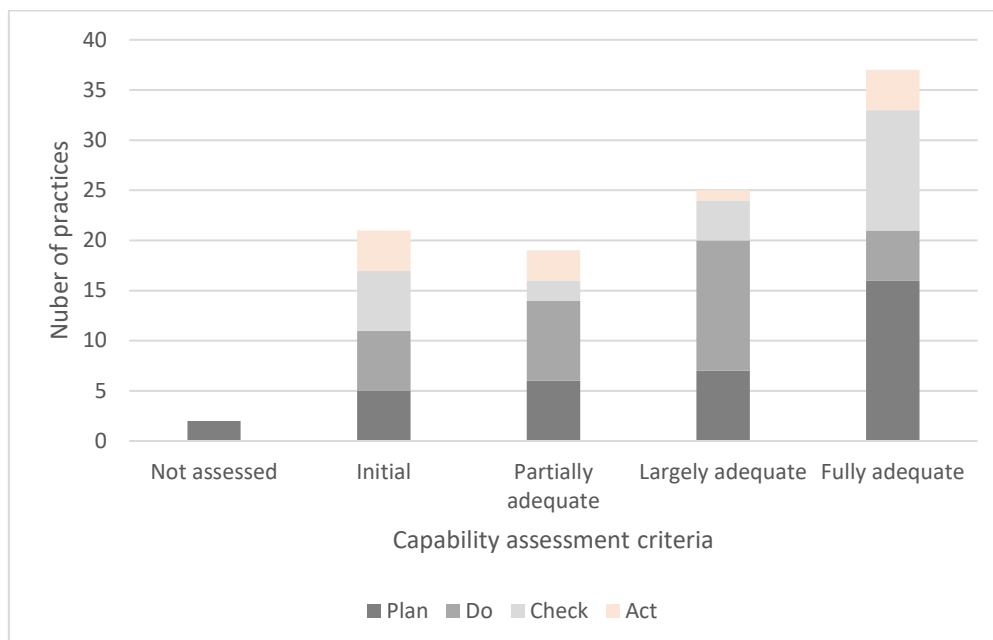


Figure 19. Number of practices at a certain capability dimension within the key process area Curriculum design and delivery for HEIs in Croatia

Plan

The biggest disadvantage in the planning phase of curriculum development is that curriculum development is not guided by a student-centred approach in which employability skills are considered to be inter-related and need to be developed incrementally across the curriculum. This also affects the construction of learning outcomes, which set the basis for the other elements of the curriculum. Institutions should place more emphasis on the planning of employability skills in these first steps of curriculum design, since this affects further curriculum development. Within this process, it is also important to include employers' suggestions, since employers are the main consumers of the outputs of the higher education system. This can be done either through actively involving employers in different curriculum development groups at the institution or through different types of workshops, focus groups, etc. Another area for improvement concerns the professional development of the teachers who implement the curriculum in practice. Institutions should offer their teaching staff opportunities for continuous training related not only to the pedagogical aspects of teaching, but also their professional knowledge. Such systematic continuous updating of professional knowledge is particularly important in the area of ICT, which is changing rapidly. Teachers must remain up-to-date with the latest research trends and technologies in order to be able to prepare their students for their future careers in this dynamic labour market.

Do

Curriculum implementation depends largely on the curriculum planning and preparation phase, during which all aspects of the curriculum are defined. In the particular area of ICT within Croatia, students would benefit from the more active involvement of employers within curriculum delivery through, for example, invited lectures, collaborative projects involving both institutions and companies, case studies on real cases, real-world problem-solving tasks, more internships as integral and obligatory parts of the curriculum, mentorship of students' theses etc. More intensive collaboration with employers in the framework of curriculum delivery also contribute to the introduction of different innovative methods of teaching and learning that encourage students' independent and active learning, such as work-based learning, project-based learning, problem-based learning, etc. It is essential for institutions to move away from the traditional *ex-cathedra* teaching methods to the more creative teaching and learning methods that require students to be actively involved in the processes of teaching and learning. This also requires adequate working environments for students, such as laboratories equipped with the latest computer programmes adapted for teamwork and fully

equipped areas for students' individual learning and team projects outside of regular classes. Finally, it is very important for students to receive both quantitative and qualitative feedback on their achievements within appropriate timeframes, since this will enable them to further improve their acquisition of new knowledge.

Check

Within the monitoring phase, institutions should pay more attention to the quality of the assessment of student work, especially in relation to innovative teaching and learning methods. Institutions perform well in general with respect to students' evaluations of teacher work; however, it is also important to collect student information on other aspects of curriculum delivery beyond teacher characteristics. This is especially important in the area of ICT, where students have numerous opportunities to get in touch with potential employers and receive information on the desired knowledge and skills for certain ICT jobs, and can suggest potential improvements.

Act

Although most of the studied institutions had established procedures for monitoring teacher work at a high level of maturity, they typically failed to react when the results of the monitoring required further initiatives. Institutions should have clear rules for actions based on the results of the monitoring of teacher work. With respect to the area of strategic planning, to achieve continuous improvement in curriculum design and delivery, it is also important to reflect on the latest version of the curriculum and consult professional organizations' curriculum models (i.e. ACM and IEEE) when communicating with relevant stakeholders, such as students, alumni, employers, etc.

7.3.2.3. Recommendations for the area of Student support

Figure 20 shows number of practices at a certain capability dimension for all four HEIs within the key process area of *Student support*. Most of the practices here are in the initial stage, with a significant number of those that are still not assessed, especially related to the monitoring and evaluation of certain activities and their continuous improvement. This supports previous elaborations on the lack of career services within HEIs and the need for their development. The average values according to capability dimensions are $M=3.17$ for *plan*, $M=3.00$ for *do*, $M=2.38$ for *check* and $M=1.75$ for *act*.

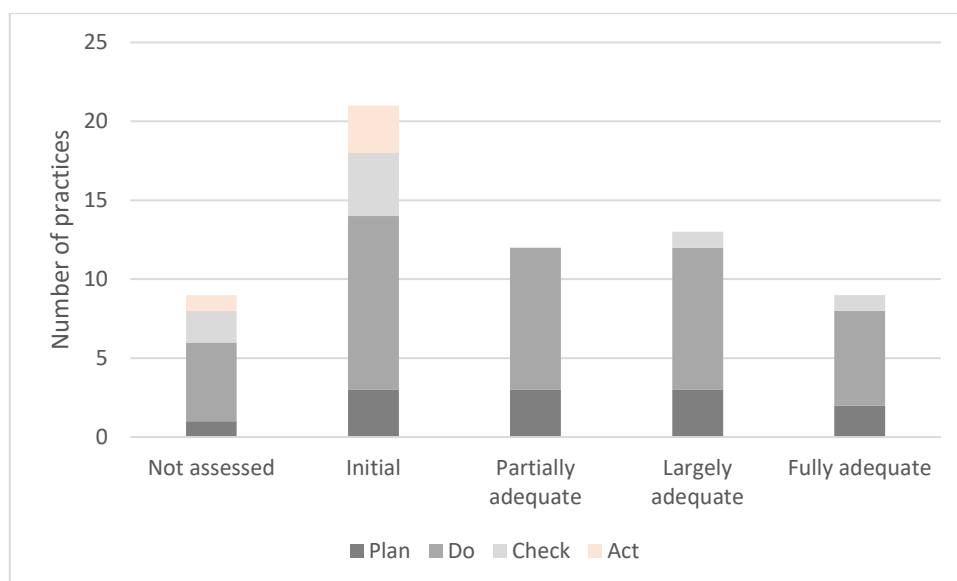


Figure 20. Number of practices at a certain capability dimension within the key process area Student support for HEIs in Croatia

Plan

Since the area of *Student support* focuses primarily on practices contained within the work of career services, it is essential for each HEI to formally establish an organizational unit for the provision of career services. This unit must have its own annual action plan of activities with defined goals, key performance indicators and timeframes. Although there is evidence that some of the studied institutions provide some career-related activities within different organizational units and by different staff members, the effects are not the same as those achieved by institutions that have established dedicated career services units and employed professionals for the provision of planned activities.

Do

Once they are formally established, career services units should provide a wide range of activities that contribute to the development of students' employability skills and connect them with potential employers. For example, career services centres can publish job opportunities on institutional web pages; organize annual (or more frequent) careers fairs, at which students can not only connect with employers but also attend other activities aimed to support their career development (e.g. workshops, lectures, etc); provide reviewing and correcting services for students' job applications; prepare students for job interviews by simulating job interviews both with the institution's own employees and in collaboration with employers; provide students opportunities for individual career counselling; etc. Institutions should also encourage students to create their own digital portfolios. In the area of ICT, in which graduates are

expected to demonstrate not only high levels of digital skills, but also good soft skills such as communication and presentation skills, graduates will benefit from presenting employers with digital portfolios. As **Chapter 4** shows, today's labour market expects ICT graduates to be skilled in both hard and soft skills. In addition to developing these skills within their curricula, institutions should develop academic soft skills within their student support services.

The areas of *Strategic planning* and *Curriculum design and delivery* indicated the need to use data collected from graduates and alumni within institutional practices. However, a clear problem within most institutions is that such data do not exist. This is not a case only with the four studied institutions, but the recent studies at the European level reported that Croatia is among seven countries for which graduate studies could not be identified (European Commission/EACEA/Eurydice 2016; Mühleck et al. 2016). In the proposed maturity model for supporting graduates' early careers, collecting information about graduate employment is one of the practices within the area of student support. Since this also affects the success of other process areas, the following presents a more detailed elaboration of why institutions should pay special attention to this practice.

As already elaborated before, graduate studies are powerful tool for getting insight into the relationship between study programmes and graduate success in their early careers. This kind of data collection is widely considered a good practice and is common among universities; however, EUROGRADUATE report indicated that, in many of the studied countries, it is also implemented at a national level (Mühleck et al. 2016). Different types of tracer studies exist; however, in general, all of them collect data from graduates organized around the following several areas: 1) study programme, 2) other educational and related experiences, 3) transition from study to work, 4) first job after graduation, 5) employment history and current situation, 6) current work, 7) work organization, 8) competencies and knowledge management, 9) evaluation of study programme, 10) values and orientations and 11) personal information (HEGESCO 2007). Most recently, the EUROGRADUATE feasibility study indicated four main topics that should be covered within the European Graduate Survey: 1) transition into the labour market; 2) generating and sustaining employability; 3) quality of HE, skills and competencies acquired in HE, and skills mismatch and 4) mobility of graduates (Mühleck et al. 2016, p. 82).

Thus, tracer studies provide valuable information that can be used to improve curricula and study programmes and to contribute to the improvement of the quality of HEIs and the higher

education system in general. However, some researchers (Pavlin & Svetlik 2014) have noted that these benefits typically do not manifest because tracer studies tend to be conducted randomly and because the decisions made within HEIs are usually ad hoc and based on academics' personalized and random experiences, rather than on systematically collected data on the relationship between HEIs practices and the world of work. The European Commission confirmed the importance of graduate tracking in its plans to propose an initiative on tertiary graduate tracking as a first step in 2017 in order to support Member States in improving their access to and understanding of information on graduates' progress in the labour market (European Commission 2016a). The greatest contribution to this area is given recently through the EUROGRADUATE project which not only elaborated a need for the European Graduate Study, but provided recommendations for the design and operationalization of such a comprehensive study at the European level (Mühleck et al. 2016).

Check

The monitoring phase within the area of *Student support* supports the thesis concerning the importance of collecting data from graduates, since these data contain information not only on graduates' employment, but also their satisfaction (with their study experiences) and their readiness for work. In addition to data from graduates, feedback from all students on the usefulness of career services should be collected systematically in a written form, analyzed and used to improve the provision of activities within career services.

Act

As in most cases in which career services are not established, evaluations of career services based on data collected from students, graduates, alumni and employers are lacking. As within every other strategic planning process, in this case, this information is important for enabling further improvements in the provision of student support services and activities.

7.3.2.3. Recommendations for the area of Extra-curricular activities

Figure 21 shows the number of practices at a certain capability dimension for all four HEIs within the key process area of *Extra-curricular activities*. Activities within this area are mostly connected to the work of student organizations, student participation in different competitions and student entrepreneurship initiatives. Another aspect of student extra-curricular activities is more formal and considers the system of student representatives. Since the studied institutions show good performance in this last practice and since the procedure for student representatives

is established at the national level, recommendations for this area are directed primarily toward support systems for all other types of student extra-curricular activities. The average values according to capability dimensions are $M=3.83$ for *Plan*, $M=3.80$ for *Do*, $M=3.75$ for *Check* and $M=3.25$ for *Act*.

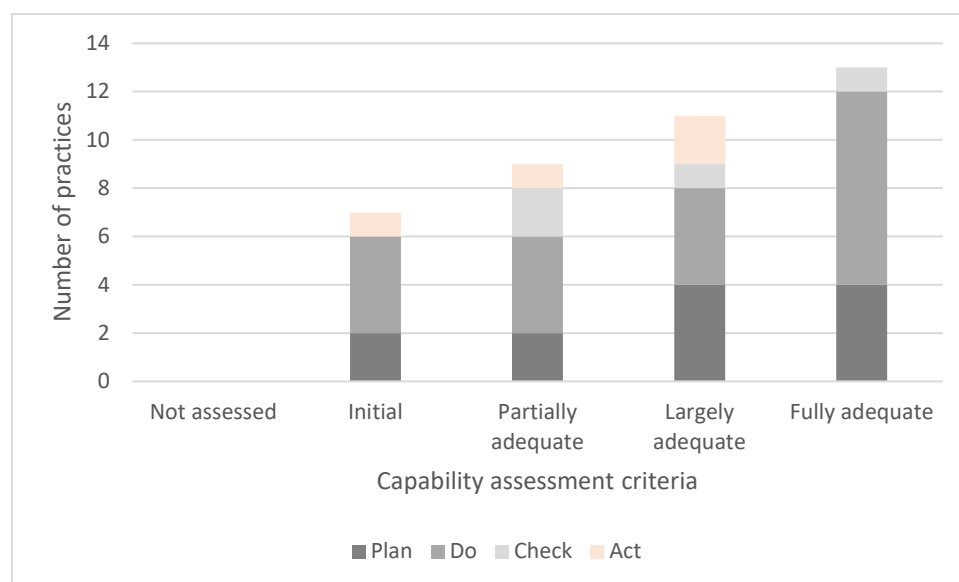


Figure 21. Number of practices at a certain capability dimension within the key process area of Extra-curricular activities for HEIs in Croatia

Plan

The planning phase within *Extra-curricular activities* refers to the establishment of a framework for supporting a wide range of student extra-curricular activities, such as the work of student organizations, student projects, participation in competitions, student entrepreneurship initiatives, etc. In general, institutions show an awareness of the importance of extra-curricular activities for student career development; however, there is still room to improve in the processes of planning that support. Institutions should devote effort to moving from ad hoc and partial support for student extra-curricular activities to integrative planning for the complete support (financial, mentorship-based, etc.) of a wide range of student extra-curricular activities, based on the previous results and plans for new academic years and followed by actions designed to encourage students to use the available support.

Do

It is very positive that most institutions have recognized the need to support students' start-ups and similar entrepreneurship initiatives, since self-employment is among the popular approaches to career development in the field of ICT. Institutions should continue to provide

full support (labs equipped with different technologies, additional education, financial support for participation in student competitions, etc.) to student activities that are important for the development of entrepreneurship skills, such as projects in collaboration with employers outside of regular classes or participation in competitions. Students benefit from actively participating in the work of different student organization; therefore, institutional support for the work of student organizations is important for encouraging more active student participation.

Check

Since students' extra-curricular activities are important for their professional development within HEIs and since they encourage the development of students' employment capacities, institutions should not only provide support for these types of activities, but also monitor and evaluate students' performance in extra-curricular activities. To accomplish these objectives, institutions should consider formally recognizing students' achievements in extra-curricular activities, both within and outside the institution, through The European Credit Transfer and Accumulation System (ECTS) credits, as additions or supplements to students' diplomas or in some other way.

Act

In the evaluation model phase, this capability dimension is the only one for which all the practices were evaluated as unimportant according to all the criteria applied. However, to close the cycle of the strategic planning of *Extracurricular activities*, the author decided to leave one practice related to continuous improvement in the model. As for all the other process areas, potential improvements in support of all student extra-curricular activities should be discussed systematically at the level of institutional management, with documented suggestions for further improvements, in order to provide valuable inputs for new processes of strategic planning.

7.4. Chapter relevance

It could be argued that *Chapter 7* is the most relevant chapter in this thesis because it presents the results of the conducted research. To summarize the relevance of this chapter, a short summary of research results is provided according to the set research objectives, research questions and research hypotheses.

Before starting the research, four **research objectives** were set. Furthermore, since this research had an exploratory character, applied mostly qualitative research methods and was oriented towards the development of theory, it was guided by five **research questions**.

The answer to the first research question also refers to the first research objective:

***Research objective 1:** To explore and identify key higher education system determinants aimed at supporting graduates' early careers.*

***Research question 1:** Which are the key higher education systems' determinants having a major impact on the preparation of higher education graduates for their early careers?*

The answer to this research question was provided in *Step 2) Define the scope* of the maturity model development. Based on the literature review and the focus groups with experts, four main higher education system determinants aimed at supporting graduates' early careers were identified. These were recognized as *four key process areas* within the strategic framework and the maturity model, as follows: *Strategic planning, Curriculum design and delivery, Student support* and *Extra-curricular activities*. Those four determinants served as a basis for the further development of the strategic framework for supporting graduates' early careers, which was set as the second research objective and also provides an answer to the second research question:

***Research objective 2:** To develop the strategic framework for supporting higher education graduates' early careers in the field of ICT.*

***Research question 2:** Which are the key higher education institutions' practices having impact to the preparation of higher education graduates for their early careers?*

The answer to the second research question was first provided in *Step 3) Design the model* of the development of the strategic framework and maturity model. Within this step, four case

studies were conducted at different HEIs in Europe providing study programmes in the field of ICT. The analyses of the data collected within the case studies and the focus groups with different stakeholders resulted in an initial strategic framework for supporting graduates' early careers within HEIs, which is presented in **subchapter 7.1**. The resulting strategic framework contains 110 practices within four key process areas, organized according to the four capability dimensions (plan-do-check-act): 15 within strategic planning, 35 within curriculum design and delivery, 34 within student support and 26 within extra-curricular activities. The strategic framework was further evaluated within *Step 4) Evaluate the design* and improved using capability assessment criteria within *Step 3) Design the model*, for 65 practices recognized as the most important. The amended strategic framework, enhanced using the capability assessment criteria in the form of five maturity levels for each practice, represents the final maturity model for supporting graduates' early careers within HEIs and provides an answer to the third research question, which is also related to the third research objective:

Research question 3: *Which are the capability assessment criteria of key higher education institution's practices having impact to the preparation of higher education graduates for their early careers?*

Research objective 3: *To develop a maturity model for supporting higher education graduates' early careers in the field of ICT.*

The final strategic framework and maturity model is presented in **subchapter 7.2**. It contains 65 practices within four key process areas: 13 within strategic planning, 26 within curriculum design and delivery, 16 within student support and 10 within extra-curricular activities. Once the maturity model was evaluated on a theoretical basis (content and construct validity), it was also tested in practice in order to ensure its reliability. The testing of the final model at four HEIs in Croatia in the field of ICT represented only one of the methods used to evaluate the model and also provided an answer to the research questions related to the fourth research objective:

Research question 4a: *What is the current level of maturity of HEIs in Republic of Croatia regarding the preparation of ICT graduates for their early careers?*

Research question 4b: *What are the possible improvements in preparation of ICT graduates for their early careers in the Republic of Croatia?*

Research objective 4: *To determine the current maturity level of higher education institutions in the Republic of Croatia in supporting graduates' early careers in the field of ICT, and provide recommendations about further strategic development.*

Although organizational maturity varies from institution to institution, some general recommendation for HEIs providing education for future ICT professionals in Croatia could be provided. **Subchapter 7.3** provides the initial detailed results of the application of the model to four HEIs. Then, recommendations for potential improvements according to key process areas and capability dimensions are outlined in detail.

Finally, in addition to the research objectives and research questions, the author proposed two research hypotheses related to the development of the final strategic framework and maturity model and conducted research steps that supported both hypotheses. The research hodogram in **Figure 12** briefly presents all of the research methods used in the five-step process of the design of the strategic framework and the maturity model: 1) *Identify a need or new opportunity*, 2) *Define the scope*, 3) *Design the model*, 4) *Evaluate the design* and 5) *Reflect the evolution*. It can be perceived that, within each step, research methods related to both rigor and relevance were used. The detailed elaboration of the methods used in the development of the model, presented in **Chapter 6**, explains the usage of the methods in detail and supports the first hypothesis:

H1: *Developed strategic framework for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will fulfil both relevance and rigor requirements of design science research.*

The first hypothesis is supported within different research steps, but this process of support ends within the phase of the model's evaluation. This phase also supports the second research hypothesis with the testing of the final maturity model to real cases. The model is shown to be applicable to HEIs of different sizes and structure and, therefore, supports the second hypothesis:

H2: *Developed maturity model for supporting early careers of graduates in the field of information and communication technologies within higher education institutions will be both comprehensive and reliable.*

8. CONCLUSION

This last chapter continues the previous one by summarizing the research results and concluding this research by positioning the results within the frame of their scientific and social contributions. In addition to discussing the contributions of the research, this chapter considers some of the research limitations and also presents implications for further research.

8.1. Scientific contribution

In accordance with the set research objectives and hypotheses, the achieved scientific contribution, which is evident as a result of the rigor cycle of design science research, is as follows:

- 1) *Contribution to the systematization and increasing knowledge in the field of education and career development of future ICT professionals.*

The comprehensive systematic literature review presented in **Chapter 4** included a review of 7179 papers on the level of the title, 761 papers on the level of the summary and 155 papers that were analyzed in depth. The papers were collected from five databases: the ACM Digital Library, the IEEE Xplore Digital Library, SCOPUS, ScienceDirect, and the Web of Science. This comprehensive research results in the form of clusters of research topics represents a kind of repository of the accumulated knowledge that indicates the need for more integrative and strategic further research on the education of ICT professionals.

Findings of the systematic literature review presented in **Chapter 4** indicated the need for a strategic approach within HEIs to connect all the relevant determinants of education and employability and to include relevant stakeholders through the process of strategic planning. From the obtained results, it is evident that a comprehensive theoretical framework should be developed to enable more structured further research, as well as to guide HEIs in designing curricula, services and strategies to support the employability of ICT graduates. In this respect, the developed maturity model, that summarizes most important HEIs practices and describe in detail their possible maturity levels, also contributes to the systematization and increasing the knowledge related to education and career development within the ICT domain.

2) *Development of a comprehensive strategic framework for supporting higher education graduates' early careers within higher education institutions, in the field of ICT.*

The development of a comprehensive strategic framework is another important scientific contribution of this research. According to the definitions of different terms related to *strategy*, a *strategic framework* can be explained as an outline of primary objectives and initiatives that follow *strategic guidelines*, which are broad principles that set general directions (Rademakers, 2014, p. 22). In the context of this research, the main objectives within the strategic framework are presented in the form of four key process areas, and the initiatives are represented in the form of higher education practices. The initial strategic framework for supporting higher education graduates' early careers is presented within **subchapter 7.1**. This framework contains a total of 110 practices within four key process areas, organized according to the four capability dimensions (plan-do-check-act): 15 within strategic planning, 35 within curriculum design and delivery, 34 within student support and 26 within extra-curricular activities. This full list of relevant practices can help HEIs develop strategic roadmaps with general plans for targets, actions and roles and prepare strategic blueprints with comprehensive plans detailing most activities. The focus on ICT domain in model development is evident in several areas: 1) a need for such a model is indicated from the systematic literature review on the education and career development of future ICT professionals; 2) practices contained within the model were researched at four HEIs in Europe that provide study programmes in the ICT domain; 3) model evaluation included stakeholders (teaching and non-teaching staff, students, alumni, employers) from the ICT-related domain and 4) model was tested at four HEIs in Croatia that conduct study programmes in ICT. Within this research, the initial strategic framework served as a basis for developing an accompanying maturity model for supporting graduates' early careers within HEIs. The final strategic framework contains 65 practices that are also contained within the final maturity model, as explained below. This final maturity model represents another scientific contribution:

3) *Development of accompanying maturity model for supporting higher education graduates' early careers within higher education institutions, in the field of ICT.*

The final and most important scientific contribution of this research lies in its development of a maturity model for supporting higher education graduates' early careers. The maturity model presented in **subchapter 7.2** contains the 65 most relevant practices from the list of 110 contained within the initial strategic framework: 13 within strategic planning, 26 within

curriculum design and delivery, 16 within student support and 10 within extra-curricular activities. All of these practices are also divided according to the capability dimensions within each of the four phases in Deming cycle: plan-do-check-act. For each key process area, there is at least one practice within each capability dimension, and the capability assessment criteria for each is described at five maturity levels.

The overview of the representation of maturity models within existing scientific literature presented in **Chapter 5** showed that there are no significant maturity models related to higher education in terms of graduates' employability. Therefore, the model developed within this thesis contributes to the scientific literature on the application of maturity models in the field of higher education. Since the content of the maturity model is related to graduates' employability in the context of higher education, its development also contributes to both of the focal scientific fields, with a special emphasis on the field of the education and career development of future ICT professionals.

Last, but not least, this research contributes to the general methodology for the design of maturity models by combining different research methods within the rigor and relevance cycles of design science paradigm in a way that has not yet been proposed in previous researches. In the current literature on maturity model development, there are a few examples of maturity model design methodologies; thus, this research can provide guidance for other researchers striving to develop maturity models that are applicable in practice.

8.2. Societal contribution

In addition to the above-mentioned scientific contributions, the results of the proposed research offer significant social contributions with respect to their applicability for solving the current problems and challenges facing in higher education in the form of guidelines for the design of practices for supporting graduates in their early careers.

The concrete societal contributions of this research are evident in the fourth step of the maturity model design: *4) Evaluate the design*. In order to ensure the model's reliability, the model was tested at four HEIs in Croatia providing study programmes in the field of ICT. During the model's testing, these HEIs had the opportunity to evaluate their current levels of maturity for all 65 practices contained within the final maturity model and to determine their strengths and weaknesses, in a form of guided self-evaluation. For the practices evaluated as exhibiting lower capabilities on the five maturity levels, the institutions could immediately see the potential for

improvement in the form of the descriptors for their relevant certain maturity levels. Additionally, the studied institutions have received anonymized aggregated results for all four HEIs that participated in model testing, which they could use for the purpose of benchmarking.

Based on the general results for all four institutions, the author provided guidelines for enhancing the maturity of the higher education system in Croatia for study programmes in the field of ICT within *subchapter 7.3.2*. These guidelines can be used by all institutions, not only those participating in the evaluation of the model. Moreover, most of the practices contained within the final maturity model are generic enough to be applicable to HEIs in general, regardless of the field of education. Therefore, the model can potentially be used by HEIs providing study programmes in different study fields than ICT.

Finally, in a broad sense, the results of this research affect its end users - students, alumni, employers, HEIs and other relevant stakeholders - which can use the research outcomes both as tools for problem-solving regarding graduates' employment issues and as guidelines for creating stimulating policies on the individual, institutional and national levels.

8.3. Limitations of the study

Although this research has clear and significant scientific and societal contributions, it also has some limitations that should be taken into consideration. Some limitations related to the research topic this thesis covers were already stressed in the *Introduction* and the limitations related to certain parts of empirical research were explained within the description of maturity model design steps, especially within the step 4) *Evaluate the model*; therefore, this subchapter brings general limitations of the entire empirical research.

One of the limitations of this research may be its focus on HEIs educating students in the field of ICT. On one hand, it was necessary to limit the scope for this research to a single study field; on the other hand, this could pose limitations related to the testing of the final model. However, in the final maturity model presented in *subchapter 7.2*, most of the practices are clearly generic enough to be applicable to HEIs in general, regardless of the field of education. Moreover, even among the institutions educating students in the field of ICT, there are certain differences: some study programmes are more focused on the application of ICT to business, some are focused on electrical engineering and computing, still others focus on software development, etc. Therefore, even within the field of ICT, there are differences that could affect the model's application. Finally, the existing literature has already shown that careers do not

depend to a great extent on an individual's specific field of study (Teichler 2009, p. 17); thus, it is likely that the maturity model developed in the frame of this research could be, with minor modifications, applicable to other study fields as well.

Another limitation lies in the number of institutions used for the case study research within the phases of both the model design and the model application. The reason for using four cases within the design phase was due primarily to the financial and time limitations of the thesis. Each of the case studies was conducted at one of four HEIs in different European countries. Each lasted approximately five days and required intensive preparation related to both the case study protocol and the arrangements related to meeting with potential interviewees and planning the trip. The mitigating consideration for the researcher was that the research was competitive enough to be financed by the EU via the European Social Fund. This grant covered the full expenses for all four case studies. In the methodological context, prior research has shown that between 4 and 10 cases usually works well, while fewer than 4 cases makes it difficult to generate theory (Eisenhardt 1989; Stake 2006, p. 22). Therefore, it can be said that the four cases conducted within this research are in accordance with the expected research methodology. However, the results of this case study research were amended in light of other appropriate research methods, such as focus groups with different HEI stakeholders and expert evaluations. Through the application of these several methods, different stakeholders were given the opportunity to contribute to expanding the initial list of practices recognized through the case study research. The idea of model application to four HEIs in Croatia was not in assessing the maturity of the concrete institutions but rather in getting an insight into the capability of HEIs practices in supporting graduates employability within the Croatian higher education system, with a main purpose to provide general recommendations for increasing their capability.

As for all qualitative research, the constraint for this one is also that the data collection and analysis is to some point subjective and affected by the researcher's skills and knowledge (Twining et al. 2017). Moreover, a large amount of qualitative and quantitative data that were analyzed in the scope of this research increases the possibility of errors in their manipulation and interpretation. To minimize these negative effects of a comprehensive qualitative research conducted by a single young researcher and ensure the high quality of research results, different method were applied. Although this research included different stakeholders, their characteristics (expertise, experiences etc.) certainly affected the research results to some point.

8.4. Implications for further research

Within this thesis, a strategic framework and a maturity model for supporting higher education graduates' employability were developed using the five-step methodology for the design of maturity models. As the final step in the design of maturity models, 5) *Reflect the evolution*, indicates, it is important to redesign the maturity model according to the changing nature of HEIs. This is one of the main implications for further research. Since the higher education system is highly dynamic and complex, it will be important to periodically evaluate the importance of current practices in the model in order to exclude practices that appear to no longer be relevant and to add new practices that have gained relevance over time. Additionally, the *Step 5) Reflect evolution* indicates a need to improve the model deficiencies recognized through its testing at real HEIs.

Secondly, it has been indicated that the developed model could also be applicable to other study fields besides ICT. Most of the practices contained within the final model are general and not related particularly to the field of ICT and can potentially be used for assessing the maturity of HEIs in other study fields as well. This is the case because the practices do not include the particularities of ICT domain, such as the curriculum content or specific professional competences required from the ICT graduates. Therefore, it would be interesting to apply the developed maturity model to HEIs in different fields, but also in different countries on the global level that are characterized by different educational systems. This would provide a good basis for a comparative study and could yield indications for the creation of policies at the national and international levels.

Finally, further research could include a more detailed examination and scientific elaboration of certain practices. For example, the effects of different teaching methods could be researched, and the model could be extended through a more detailed description of the maturity levels of certain practices, as well as description of all 110 practices contained within the initial strategic framework. In this way, the developed maturity model could become even more applicable to practice. The potential for more extended model application in practice is also in recognition of graduate employability as an important element in the internal and external quality assurance processes within higher education system, as well as in the implementation of national qualification frameworks.

REFERENCES

- Aarrevaara, T. & Dobson, I.R., 2013. Movers or Shakers: Do Academics Control Their Own Work? In U. Teichler & E. A. Höhle, eds. *The Work Situation of the Academic Profession in Europe: Findings of a Survey in Twelve Countries*. Springer, pp. 159–181.
- Agency for Science and Higher Education, 2016. *Osnutak, rad i potrebe službi za profesionalno usmjeravanje (karijerno savjetovanje) studenata i zaposlenika na visokim učilištima*. Available at: https://www.azvo.hr/images/stories/novosti/Izvjestaj_o_provedenoj_anketi_Karijerni_centri.pdf [Accessed April 21, 2017].
- Agency for Science and Higher Education, 2017. *Re-accreditation of higher education institutions*. Available at: <https://www.azvo.hr/en/evaluations/evaluations-in-higher-education/re-accreditation-of-higher-education-institutions> [Accessed April 21, 2017].
- Al-Hosaini, F.F. & Sofian, S., 2015. A Review of Balanced Scorecard Framework in Higher Education Institution (HEIs). *International Review of Management and Marketing*, 5(1), pp.26–35.
- Ali, A. & Aliyar, L., 2012. Re-engineering of ICT engineering education. In *2012 IEEE International Conference on Engineering Education: Innovative Practices and Future Trends (AICERA)*. IEEE.
- Allen, J., Coenen, J. & Humburg, M., 2011. The Transition and Early Career. In J. Allen, S. Pavlin, & R. van der Velden, eds. *Competencies and Early Labour Market Careers of Higher Education Graduates in Europe*. University of Ljubljana, Faculty of Social Sciences
- Allinson, R. et al., 2015. 6th University Business Forum 2015, Brussels, 5-6 March 2015, Forum report. *European Commission*. Available at: http://ec.europa.eu/education/tools/docs/university-business-forum-brussels_en.pdf [Accessed February 6, 2016].
- Alves, H., Wagner Mainardesa, E. & Raposo, M., 2010. A Relationship Approach to Higher Education Institution Stakeholder Management. *Tertiary Education and Management*, 16(3), pp.159–181.
- Andersen, E.S. & Jessen, S.A., 2003. Project maturity in organisations. *International Journal*

- of Project Management*, 21(6), pp.457–461.
- Arjomandi, M., Kestell, C. & Grimshaw, P., 2009. An EFQM Excellence Model for higher education quality assessment. In *20th Australasian Association for Engineering Education Conference*. pp. 1015–1020.
- Arjona Perez, E., Kozovska, K. & Garrouste, C., 2010. *Towards a benchmark on the contribution of Education and Training to Employability: a discussion note*, European Commission. Joint Research Centre. JRC Scientific and Technical Reports JRC 57362
- Asif, M. et al., 2013. A model for total quality management in higher education. *Quality & Quantity*, 47, pp.1883–1904.
- Association for Computing Machinery (ACM), 2017. ACM Curricula Recommendations. Available at: <http://www.acm.org/education/curricula-recommendations> [Accessed April 18, 2017].
- Australian Government, 2015a. *Budget 2016 - Jobs & Growth. Supporting Small Business*. Available at: http://budget.gov.au/2016-17/content/glossies/jobs-growth/downloads/FS/Small_Business.pdf [Accessed February 21, 2017].
- Australian Government, 2015b. *Budget 2016 - Jobs & Growth. Youth Employment Package*. Available at: http://budget.gov.au/2016-17/content/glossies/jobs-growth/downloads/FS/Youth_Employment.pdf [Accessed October 3, 2016].
- Ayre, C. & Scally, Andrew John, 2014. Critical Values for Lawshe's Content Validity Ratio: Revisiting the Original Methods of Calculation. *Measurement and Evaluation in Counseling and Development*, 47(1), pp. 79–86
- Bach, T. et al., 2014. *Transparency of European Higher Education through Public Quality Assurance Reports (EQAreps), Final report of the project*. Ocasional papers 21. M. Kelo & L. Kerber, eds., European Association for Quality Assurance in Higher Education (ENQA), Brussels, Belgium.
- Balaban, I., 2011. *Development of an ePortfolio system success model: an information system approach*. PhD. University of Zagreb, Faculty of Organization and Informatics Varaždin.
- Baldrige Performance Excellence Program, 2016. *2015–2016 Baldrige Excellence Framework (Education)*. Available at: <https://www.nist.gov/baldrige/publications/baldrige-excellence-framework/education>

[Accessed October 7, 2016].

- Becker, J., Knackstedt, R. & Pöppelbuß, J., 2009. Developing Maturity Models for IT Management - A Procedure Model and its Application. *Business & Information Systems Engineering*, 1, pp.213–222.
- Becket, N. & Brookes, M., 2008. Quality Management Practice in Higher Education - What Quality Are We Actually Enhancing? *The Journal of Hospitality, Leisure, Sport and Tourism Education*, 7(1), pp.40–54.
- Beljo Lučić, R. et al., 2011. *Croatian Qualifications Framework - Introduction to Qualifications* M. Dželalija, ed., Government of the Republic of Croatia Ministry of Science, Education and Sports. Available at: public.mzos.hr/lgs.axd?t=16&id=17399 [Accessed July 29, 2015]
- Bennett, N., Dunne, E. & Carré, C., 1999. Patterns of core and generic skills provision in higher education. *Higher Education*, 37, pp.71–93.
- Borys, M., Milosz, M. & Plechawska-Wojcik, M., 2012. Using Deming cycle for strengthening cooperation between industry and university in IT engineering education program. In *2012 15th International Conference on Interactive Collaborative Learning (ICL)*. IEEE.
- Braun, H. & Bily, C., 2013. *Assessment of Higher Education Learning Outcomes (AHELO), Feasibility Study Report, Volume 3 - Further Insights*, OECD
- Brenders, D. a, Hope, P. & Ninnan, A., 1999. A Systemic, Student-Centered Study of University Service. *Research in Higher Education*, 40(6), pp.665–685.
- Brinkmann, S. & Kvale, S., 2015. *InterViews: Learning the Craft of Qualitative Research Interviewing* 3rd ed., Sage Publications, Inc.
- Brookes, M. & Becket, N., 2007. Quality Management in Higher Education: A Review of International Issues and Practice. *International Journal for Quality and Standards*, 1(1), pp.1–37.
- Brusoni, M. et al., 2014. *The concept of excellence in higher education*, Z. Olcen, ed. Ocasional papers 20 European Association for Quality Assurance in Higher Education (ENQA), Brussels, Belgium
- Bryson, J.M., 2004. *Strategic planning for public and nonprofit organizations: A guide to*

Strengthening and Sustaining Organizational Achievement, Jossey-Bass.

- Byars, L.L., Rue, L.W. & Zahra, S.A., 1996. *Strategic Management*, Times Mirror, Higher Education Group.
- Cai, Y., 2013. Graduate employability: a conceptual framework for understanding employers' perceptions. *Higher Education*, 65(4), pp.457–469.
- Calitz, A.P., Greyling, J.H. & Cullen, M.D.M., 2011. ICT career track awareness amongst ICT graduates. In *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment (SAICSIT)*. New York, USA: ACM Press, pp. 59–68.
- Calvo-Mora, A., Leal, A. & Roldán, J.L., 2006. Using enablers of the EFQM model to manage institutions of higher education. *Quality Assurance in Education*, 14(2), pp.99–122.
- Carbone, A. & Sheard, J., 2002. A studio-based Teaching and Learning Model in IT: What do First Year Students Think? In *Proceedings of the 7th annual conference on Innovation and technology in computer science education (ITiCSE)*. New York, USA: ACM Press, pp. 213–217.
- Carcary, M., 2011. Design Science Research: The Case of the IT Capability Maturity Framework (IT CMF). *The Electronic Journal of Business Research Methods*, 9(2), pp.109–118.
- Çerri, S., 2012. Assessing the Quality of Higher Education Services Using a Modified SERVQUAL Scale. *Annales Universitatis Apulensis Series Oeconomica*, 14(2), pp.664–679.
- Chalaris, I.E. & Poustourli, C., 2012. Total Quality Management in Higher Education with Balanced Scorecard Technique. In *Proceedings of Management of Innovative Business, Education & Support systems (MIBES) 2012*. pp. 85–99.
- Chen, C., 2010. The implementation and evaluation of a mobile self- and peer-assessment system. *Computers & Education*, 55(1), pp.229–236.
- Cheney, P.H., Hale, D.P. & Kasper, G.M., 1990. Knowledge, skills and abilities of information systems professionals: past, present, and future. *Information & Management*, 19(4), pp.237–247.

- Clark, G. et al., 2015. “It’s everything else you do...’: Alumni views on extracurricular activities and employability. *Active Learning in Higher Education*, 16(2), pp.133–147.
- Clewes, D., 2003. A Student-centred Conceptual Model of Service Quality in Higher Education. *Quality in Higher Education*, 9(1), pp.69–85.
- Cohen, L., Manion, L. & Morrison, K., 2011. *Research Methods in Education* 7th ed., Routledge.
- Coll, R.K., Zegward, K. & Hodges, D., 2002. Science and Technology Stakeholders’ Ranking of Graduate Competencies Part 2: Students Perspective. *Asia-Pacific Journal of Cooperative Education*, 3(2), pp.35–44.
- Confederation of British Industry (CBI), 2007. *Embedding employability in work experience*, Available at: <http://www.educationandemployers.org/wp-content/uploads/2014/06/time-well-spent-cbi.pdf> [Accessed March 6, 2017]
- Costley, C. & Dikerdem, M., 2012. *Work Based Learning Pedagogies and Academic Development*, A Research Project funded by the HEA Subject Centre for Education, ESCalate 2011. Institute for Work Based Learning, Middlesex University
- Council of the European Union, 2013. Council Conclusions on investing in education and training — a response to “Rethinking Education: Investing in skills for better socio-economic outcomes” and the “2013 Annual Growth Survey.” *Official Journal of the European Union*. Available at: [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013XG0305\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013XG0305(01)&from=EN) [Accessed February 6, 2016].
- Council of the European Union, 2012. Council conclusions on the employability of graduates from education and training. *3164th Education, Youth, Culture and Sport Council meeting Brussels, 10 and 11 May 2012*. Available at: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/educ/130142.pdf [Accessed February 7, 2016].
- Creswell, J.W., 2009. *Research Design: Qualitative, Quantitative, and Mixed Method Approaches* 3rd ed., Sage Publications.
- Croatian Government, 2015. *Strategy for lifelong learning career guidance in the Republic of Croatia 2016-2020*. Available at: https://ec.europa.eu/epale/sites/epale/files/strategija_cpu_eng_kon.pdf [Accessed

February 22, 2017].

- Ćulum, B., Rončević, N. & Ledić, J., 2013. Facing New Expectations - Integrating Third Mission Activities into the University. In B. M. Kehm & U. Teichler, eds. *The Academic Profession in Europe: New Tasks and New Challenges*. Springer, pp. 163–195.
- Dacre Pool, L. & Sewell, P., 2007. The key to employability: developing a practical model of graduate employability. *Education + Training*, 49(4), pp.277–289.
- Davey, T. et al., 2011. *The State of European University - Business Cooperation*, Final Report - Study on the cooperation between Higher Education Institutions and public and private organisations in Europe. Science-to-Business Marketing Research Centre, Münster University of Applied Sciences, Germany
- Demir, C. & Kocabaş, İ., 2010. Project Management Maturity Model (PMMM) in educational organizations. *Procedia - Social and Behavioral Sciences*, 9, pp.1641–1645.
- Divjak, B., 2016. Challenges of Strategic Decision-Making within Higher Education and Evaluation of the Strategic Decisions. In *Proceedings of Central European Conference on Information and Intelligent Systems (CECIIS)*.
- Divjak, B., 2008. *Ishodi učenja u visokom školstvu* B. Divjak, ed., TIVA Tiskara Varaždin.
- Divjak, B., 2014. Preduvjeti za osnivanje, autonomija i odgovornost suvremenih sveučilišta – globalna i Hrvatska perspektiva. In L. Budin & M. Klačmer Čalopa, eds. *Strategija visokog obrazovanja u sjeverozapadnoj Hrvatskoj*. Hrvatska akademija znanosti i umjetnosti, Zavod za znanstveni rad u Varaždinu i Sveučilište u Zagrebu, Fakultet organizacije i informatike.
- Divjak, B. & Begičević Ređep, N., 2016. Preporuke za sistemske i strateške inovacije studijskih programa iz područja Ekonomije i Poslovne ekonomije. In A. Host & N. Alfirević, eds. *Preporuke za inovaciju studijskih programa iz ekonomije i poslovne ekonomije na temelju ishoda učenja*. Ekonomski fakultet Sveučilišta u Rijeci, Ekonomski fakultet Sveučilišta u Splitu, pp. 69–102.
- Divjak, B. & Begičević Ređep, N., 2015. Strategic Decision Making Cycle in Higher Education: Case Study of E-learning. In *Proceeding of the International Conference E-learning 2015*.
- Divjak, B. & Lovrenčić, A., 2005. *Diskretna matematika s teorijom grafova*, TIVA Tiskara Varaždin.

- Doboli, S. et al., 2010. A model of entrepreneurship education for computer science and computer engineering students. In *IEEE Frontiers in Education Conference (FIE)*. IEEE, pp. T4D-1-T4D-6.
- Douglass, J.A., Thomson, G. & Zhao, C.-M., 2012. The learning outcomes race: the value of self-reported gains in large research universities. *Higher Education*, 64, pp.317-335.
- Duarte, D. & Martins, P.V., 2013. A Maturity Model for Higher Education Institutions. *Jornal of Spatial and Organizational Dynamics*, I(I), pp.25-45.
- Edge Hill University, 2013. *Employability strategy 2013 -2018*. Available at: <https://www.edgehill.ac.uk/documents/files/employability-strategy.pdf> [Accessed July 29, 2015].
- Education and Training Inspectorate of Northern Ireland (ETINI), 2015. *Improving Quality: Raising Standards, Further Education and Work-based Learning (2015/2016)*. Available at: <http://dera.ioe.ac.uk/25705/1/improving-quality-raising-standards-iqrs-further-education-2010.pdf> [Accessed February 18, 2016].
- Eisenhardt, K.M., 1989. Building Theories from Case Study Research. *The Academy of Management Review*, 14(4), pp.532-550.
- Etzkowitz, H. et al., 2000. The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. *Research Policy*, 29(2), pp.313-330.
- European Association for Quality Assurance in Higher Education (ENQA) et al., 2015. *Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)*, Brussels, Belgium
- European Centre for the Development of Vocational Training (Cedefop), 2008. *Terminology of European education and training policy: A selection of 100 key terms*, Luxembourg: Office for Official Publications of the European Communities
- European Commission, 2010a. *A Digital Agenda for Europe*. Available at: [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245R\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245R(01)&from=EN) [Accessed July 1, 2014].
- European Commission, 2016a. *A New Skills Agenda for Europe - Working together to strengthen human capital, employability and competitiveness*. Available at: <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-381-EN-F1-1.PDF>

[Accessed September 11, 2016].

European Commission, 2010b. *An Agenda for new skills and jobs: A European contribution towards full employment*. Available at: http://eur-lex.europa.eu/resource.html?uri=cellar:776df18f-542f-48b8-9627-88aac6d3ede0.0003.03/DOC_1&format=PDF [Accessed December 27, 2014].

European Commission, 2011. *Commission Staff Working Paper on the development of benchmarks on education and training for employability and on learning mobility*,

European Commission, 2016b. *Digital Skills and Jobs Coalition*. Available at: <https://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs-0> [Accessed October 11, 2016].

European Commission, 2016c. *Employability and social inclusion*. Available at: <https://ec.europa.eu/jrc/en/research-topic/employability-and-social-inclusion> [Accessed February 21, 2016].

European Commission, 2004. *E-Skills for Europe: Towards 2010 and Beyond*, The European e-Skills Forum Synthesis Report

European Commission, 2010c. *Europe 2020 - A European strategy for smart, sustainable and inclusive growth*. Available at: [http://ec.europa.eu/eu2020/pdf/COMPLET EN BARROSO 007 - Europe 2020 - EN version.pdf](http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%2007%20Europe%2020%20-%20EN%20version.pdf) [Accessed December 27, 2014].

European Commission, 2012a. *Exploiting the employment potential of ICTs*, Commission staff working document. Available at: ec.europa.eu/social/BlobServlet?docId=7628&langId=en [Accessed July 1, 2014]

European Commission, 2016d. *Highlights from the Working Groups 2014-2015 - Education and Training 2020*. Available at: http://ec.europa.eu/education/policy/strategic-framework/expert-groups/2014-2015/group-highlights_en.pdf [Accessed February 6, 2016].

European Commission, 2012b. *New skills and jobs in Europe: Pathways towards full employment*, Directorate-General for Research and Innovation Socio-economic Sciences and Humanities, Luxembourg: Publications Office of the European Union.

European Commission, 2015. *Novi prioriteti za europsku suradnju u području obrazovanja i osposobljavanja. Službeni list Europske Unije*. Available at: [http://eur-lex.europa.eu/legal-content/HR/TXT/PDF/?uri=CELEX:52015XG1215\(02\)&from=HR](http://eur-lex.europa.eu/legal-content/HR/TXT/PDF/?uri=CELEX:52015XG1215(02)&from=HR)

[Accessed September 6, 2015].

European Commission, 2016e. *Strategic framework – Education & Training 2020*. Available at: http://ec.europa.eu/education/policy/strategic-framework/index_en.htm [Accessed October 4, 2016].

European Commission, 2014. *The EU ICT Sector and its R&D performance. Digital Agenda Scoreboard*. Available at: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=5806 [Accessed February 21, 2016].

European Commission, 2010d. *Youth on the Move*. Luxembourg: Publications Office of the European Union. Available at: http://europa.eu/youthonthemove/docs/communication/youth-on-the-move_EN.pdf [Accessed December 27, 2014].

European Commission/EACEA/Eurydice, 2014. *Modernisation of Higher Education in Europe: Access, Retention and Employability 2014* Eurydice Report. Luxembourg: Publications Office of the European Union.

European Commission/EACEA/Eurydice, 2016. *Structural Indicators on Graduate Employability in Europe – 2016*, Eurydice Report. Luxembourg: Publications Office of the European Union.

European Committee for Standardization (CEN), 2014. European e-Competence Framework 3.0. , pp.1–53. Available at: <http://www.ecompetences.eu/> [Accessed July 1, 2014].

European Foundation for Quality Management, 2015. EFQM. Available at: <http://www.efqm.org/> [Accessed June 3, 2015].

European Higher Education Area, 2010. Budapest-Vienna Declaration on the European Higher Education Area. *EHEA*. Available at: https://media.ehea.info/file/2010_Budapest_Vienna/64/0/Budapest-Vienna_Declaration_598640.pdf [Accessed June 11, 2015].

European Indicators and Ranking Methodology for University Third Mission, 2008. *Needs and constraints analysis of the three dimensions of third mission activities*. Project result. Available at: <http://e3mproject.eu/Three-dim-third-mission-act.pdf> [Accessed July 17, 2017].

European Union, 2015a. *ECTS Users' Guide 2015*. Available at:

- http://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf. [Accessed April 11, 2017]
- European Union, 2015b. *The Bologna process: setting up the European higher education area*. Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:c11088&from=EN> [Accessed March 9, 2017].
- Eurostat, 2016. Almost 8 million ICT specialists employed in the EU in 2014. *Eurostat newsrelease*, (15). Available at: <http://ec.europa.eu/eurostat/documents/2995521/7141198/4-21012016-AP-EN.pdf> [Accessed February 21, 2016].
- Eurostat, 2015. Eurostat regional yearbook 2015 M. Kotzeva, ed. *European Union*. Available at: <http://ec.europa.eu/eurostat/en/web/products-statistical-books/-/KS-HA-14-001>. [Accessed February 21, 2016]
- Faculty of Organisational Sciences (FOS), 2016. *Faculty of Organisational Sciences*. Available at: <http://www.fon.bg.ac.rs/eng/> [Accessed August 1, 2016].
- Fincher, S. & Petre, M., 1998. Project-based learning practices in computer science education. In *Proceedings of 28th Annual Frontiers in Education Conference (FIE)*. IEEE, pp. 1185–1191.
- Finn, D., 2000. From full employment to employability: a new deal for Britain's unemployed? *International Journal of Manpower*, 21(5), pp.384–399.
- Firdaus, A., 2006a. Measuring service quality in higher education: HEdPERF versus SERVPERF. *Marketing Intelligence & Planning*, 24(1), pp.31–47.
- Firdaus, A., 2006b. The development of HEdPERF: a new measuring instrument of service quality for the higher education sector. *International Journal of Consumer Studies*, 30(6), pp.569–581.
- Fitzsimmons, J.A. & Fitzsimmons, M.J., 2008. *The role of services in an economy. Service management: Operations, strategy, and information technology* 6th ed., McGraw-Hill/Irwin.
- Fleiss, J.L., 1971. Measuring nominal scale agreement among many raters. *Psychological Bulletin*, 76(5), pp.378–382.

- Fugate, M., Kinicki, A.J. & Ashforth, B.E., 2004. Employability: A psycho-social construct, its dimensions, and applications. *Journal of Vocational Behavior*, 65(1), pp.14–38.
- Gaebel, M. et al., 2012. *Tracking Learners' and Graduates' Progression Paths (TRACKIT)*, European University Association
- Gareis, K. et al., 2014. *E-skills for jobs in Europe: Measuring progress and moving ahead*, Final report, Empirica Gesellschaft für Kommunikations- und Technologieforschung mbHm, Bonn, Germany.
- Gartner, 2017. *Gartner Hype Cycle*. Available at:
<http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp> [Accessed April 18, 2017].
- Glushko, R.J., 2008. Designing a service science discipline with discipline. *IBM Systems Journal*, 47(1), pp.15–27.
- González, N., Marle, F. & Bocquet, J.-C., 2007. Measuring project maturity: Example in a french automotive organization. In *International Conference on Engineering Design (ICED)*.
- Gorgone, J.T. et al., 2002. *IS 2002: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems*, Association for Computing Machinery (ACM), Association for Information Systems (AIS), Association of Information Technology Professionals (AITP)
- Government of Canada, 2016. Youth Employment Strategy. Available at:
<https://www.canada.ca/en/employment-social-development/services/funding/youth-employment-strategy.html>.
- Grabher, A., Litofcenko, J. & Unger, M., 2015. EUROGRADUATE Research digest: Stakeholders' requirements for a European graduate study. *German Centre for Higher Education Research and Science Studies (DZHW)*. Available at:
http://www.eurograduate.eu/download_files/documents/Research-digest_WP2_150319.pdf [Accessed February 6, 2016].
- Graham, M., Milanowski, A. & Miller, J., 2012. *Measuring and Promoting Inter-Rater Agreement of Teacher and Principal Performance Ratings*, Center for Educator Compensation and Reform (CECR)
- Green, A. et al., 2013. *Literature Review on Employability, Inclusion and ICT, Report 1: The*

- Concept of Employability with a Specific Focus on Young People , Older Workers and Migrants* C. Centeno & J. Stewart, eds., JRC Technical Report Series, EUR 25794 EN. Institute for Prospective Technological Studies, Joint Research Centre, European Commission (2013). Available at:
<http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6059> [Accessed August 12, 2015]
- Grotkowska, G., Wincenciak, L. & Gajderowicz, T., 2011. Determinants of graduates' labour market success across domains: a comparative analysis. In M. Melink & S. Pavlin, eds. *Employability of Graduates and Higher Education Management Systems (Final report of DEHEMS project)*. University of Ljubljana, Faculty of Social Sciences.
- Gudeva, L.K. et al., 2012. Designing descriptors of learning outcomes for Higher Education qualification. *Procedia - Social and Behavioral Sciences*, 46, pp.1306–1311.
- Gwet, K.L., 2010. *Handbook of inter-rater reliability, Second Edition, The Definitive Guide to Measuring the Extent of Agreement Among Raters*, Advanced Analytics, LLC
- Harvey, L. & Knight, P., 1997. *Transforming Higher Education*, Open University Press, Taylor & Francis
- Hasan, M. & Al-Kassem, A.H., 2014. Total Quality Management in Higher Education: A Review. *International Journal of Human Resources Studies*, 4(3), pp.294–307.
- HEGESCO, 2007. Findings from the European Project “Higher Education as a Generator of Strategic Competences” (HEGESCO). Available at:
http://www.decowe.org/static/uploaded/htmlarea/finalreportshegesco/HEGESCO_Summary.pdf [Accessed October 3, 2016].
- Helgesson, Y.Y.L., Höst, M. & Weyns, K., 2012. A review of methods for evaluation of maturity models for process improvement. *Journal of Software Maintenance and Evolution: Research and Practice*, 24(4), pp.436–454.
- Hennemann, S. & Liefner, I., 2010. Employability of German Geography Graduates: The Mismatch between Knowledge Acquired and Competences Required. *Journal of Geography in Higher Education*, 34(2), pp.215–230.
- Hevner, A.R., 2007. A Three Cycle View of Design Science Research. *Scandinavian Journal of Information Systems*, 19(2), pp.87–92.
- Hevner, A.R. et al., 2004. Design Science in Information System Research. *MIS Quarterly*, 28(1), pp.75–105.

- Higher Education Funding Council for England (HEFCE), 2000. Strategic planning in higher education: A guide for heads of institutions, senior managers and members of governing bodies. *Good practice (Higher Education Funding Council for England)* Available at: http://dera.ioe.ac.uk/4547/1/00_24.pdf [Accessed February 18, 2016].
- Hinton, K.E., 2012. *A Practical Guide to Strategic Planning in Higher Education*, Society for College and University Planning.
- Ho, S.K. & Wearn, K., 1996. A higher education TQM excellence model: HETQMEX. *Quality Assurance in Education*, 4(2), pp.35–42.
- Holmes, L., 2013. Competing perspectives on graduate employability: possession, position or process? *Studies in Higher Education*, 38(4), pp.538–554.
- Humburg, M., Velden, R. van der & Verhagen, A., 2013. *The Employability of Higher Education Graduates: The Employers' Perspective*, Final report, Research Centre for Education and the Labour Market, School of Business and Economics, Maastricht University. Publications Office of the European Union
- Hussain, A. et al., 2011. Evaluation of Curriculum Development Process. *International Journal of Humanities and Social Science*, 1(14), pp.263–271.
- Hynes, B., Costin, Y. & Birdthistle, N., 2011. Practice-based learning in entrepreneurship education: A means of connecting knowledge producers and users. *Higher Education, Skills and Work-based Learning*, 1(1), pp.16–28.
- Intayoad, W., 2014. PBL Framework for Enhancing Software Development Skills: An Empirical Study for Information Technology Students. *Wireless Personal Communications*, 76(3), pp.419–433.
- Internationales Zentrum für Hochschulforschung Kassel (INCHER-Kassel), 2000. *Careers after Higher Education: a European Research Study*. Available at: <https://www.uni-kassel.de/einrichtungen/en/incher/research/projects-completed-up-to-2010/cheers-i.html> [Accessed October 3, 2016].
- Jain, R. & Jain, S., 2013. Conceptualization, Measure Development and Empirical Assessment of Career Oriented Attitudes and Employability of Technology Graduates. *Vision: The Journal of Business Perspective*, 17(2), pp.143–157.
- Johnston, B., 2003. The Shape of Research in the Field of Higher Education and Graduate Employment: Some issues. *Studies in Higher Education*, 28(4), pp.413–426.

- Kahveci, T.C. et al., 2012. Evaluation of Public Strategic Planning Models for Turkish Universities. *Procedia - Social and Behavioral Sciences*, 58, pp.138–148.
- Kalali, N.S. et al., 2011. Why does strategic plans implementation fail? A study in the health service sector of Iran. *African Journal of Business Management*, 5(23), pp.9831–9837.
- Kaplan, R.S. & Norton, D.P., 1992 The Balanced Scorecard – Measures that Drive Performance. *Harvard Business Review*. January-February 1992
- Kasperaviciute, R., 2013. Application Of ISO 9001 and EFQM Excellence Model Within Higher Education Institutions: Practical Experiences Analysis. *Social Transformations in Contemporary Society*, 1, pp.81–92.
- Kinash, S. et al., 2014. *Global graduate employability research: A report to the Business20 Human Capital Taskforce (Draft)*, Gold Coast, QLD Australia: Bond University
- Kinash, S. et al., 2015. *Supporting graduate employability from generalist disciplines through employer and private institution collaboration, final report prepared for the Australian Government, Office for Learning and Teaching*, final report prepared for the Australian Government, Office for Learning and Teaching
- Kinash, S. & Crane, L., 2015. Enhancing graduate employability of the 21st century learner. In *Proceedings of the International Mobile Learning Festival*. Hong Kong.
- Kinash, S., Crane, L. & Judd, M.-M., 2016. Good practice report: Nurturing graduate employability in higher education. *Learning and Teaching papers. Paper 136*.
<http://epublications.bond.edu.au/tls/136>
- Kitchenham, B., 2004. *Procedures for Performing Systematic Reviews*, Joint Technical Report - Keele University Technical Report TR/SE-0401 and NICTA Technical Report 0400011T.1
- Knight, P.T. & Yorke, M., 2002. Employability through the curriculum. *Tertiary Education and Management*, 8(4), pp.261–276.
- Kulkarni, U. & Freeze, R., 2004. Development and Validation of a Knowledge Management Capability Assessment Model. In *Proceedings of the 25th International Conference on Information Systems (ICIS)*. pp. 657–670.
- Lawshe, C.W., 1975. A Quantitative Approach to Content Validity. *Personnel Psychology*, 28(4), pp.563–575.

- Lazić, D., 2012. Career guidance at university level - European perspective and situation in Serbia. In D. Lazić, ed. *University Centres For Career Development and Student Counselling: Career Guidance at Universities in Serbia*. Tempus project “Development of Career Guidance aimed at Improving Higher Education in Serbia – CareerS”
- Lazić, D. & Janković Barović, A., 2012. Centres for career development and student counselling at Serbian universities - basic services. In L. Dejana, ed. *University Centres For Career Development and Student Counselling: Career Guidance at Universities in Serbia*. Tempus project “Development of Career Guidance aimed at Improving Higher Education in Serbia – CareerS.”
- Lee, D.M.S., Trauth, E.M. & Farwell, D., 1995. Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation. *MIS Quarterly: Management Information Systems*, 19(3), pp.313–340.
- Lella, G. et al., 2012. Universities as complex service systems: External and Internal perspectives. *Proceedings of 2012 IEEE International Conference on Service Operations and Logistics, and Informatics (SOLI)*, pp.422–427.
- Leoni, R., 2014. Graduate employability and the development of competencies. The incomplete reform of the “Bologna Process.” *International Journal of Manpower*, 35(4), pp.448–469.
- Leydesdorff, L., 2013. The Triple Helix of University-Industry-Government Relations. *Encyclopedia of Creativity, Innovation, and Entrepreneurship*, pp.1844–1851.
- Li, T., 2005. A general model for clustering binary data. *Proceeding of the eleventh ACM SIGKDD international conference on Knowledge discovery in data mining - KDD '05*, pp.188–197.
- Lokhoff, J. et al., 2010. *A Guide to Formulating Degree Programme Profiles (Including Programme Competences and Programme Learning Outcomes)*, Bilbao, Groningen and The Hague.
- London Metropolitan University, N/A. *Staff Guide to Embedding Employability in the Curriculum*, Available at:
https://metranet.londonmet.ac.uk/fms/MRSite/psd/StudServ/CDES/Employability_Quick_Guide.pdf [Accessed July 30, 2015]
- Ludeman, R.B. et al., 2009. *Student affairs and services in higher education: Global*

foundations, issues and best practices, United Nations Educational, Scientific and Cultural Organization

Luhanga, M., 2010. Strategic Planning of Higher Education Institutions in Africa: A Case Study of the University of Dar-es-Salaam. *Procedia - Social and Behavioral Sciences*, 2(5), pp.7071–7085.

Macdonald, R., 2009. Academic Development. In M. Tight et al., eds. *The Routledge International Handbook of Higher Education*. Routledge, pp. 427–439.

Maglio, P.P. et al., 2009. The service system is the basic abstraction of service science. *Information Systems and e-Business Management*, 7(4), pp.395–406.

ManpowerGroup, 2015. 2015 Talent Shortage Survey. Available at: <http://www.manpowergroup.com/talent-shortage-2015/talent+shortage+results> [Accessed February 22, 2016].

March, S.T. & Smith, G.F., 1995. Design and natural science research on information technology. *Decision Support Systems*, 15(4), pp.251–266.

Markkula, M. et al., 2011. *A Self-Assessment Model for Quality Management and Organisational Development for Continuing and Professional Education*, DAETE [2] Project

Marshall, S., 2006a. *E – learning Maturity Model Version 2.2.: Process Assessment Workbook*, Victoria University of Wellington, New Zealand. Available from <http://www.utdc.vuw.ac.nz/research/emm/Publications.shtml>.

Marshall, S., 2006b. *New Zealand Tertiary Institution E-Learning Capability: Informing and Guiding E- Learning Architectural Change and Development Project Report*. Report to the New Zealand Ministry of Education. Victoria University of Wellington, New Zealand. Available from <http://www.utdc.vuw.ac.nz/research/emm/Publications.shtml>

Marshall, S., 2007. *E-Learning Maturity Model Version 2.3. Process Descriptions*, Victoria University of Wellington, New Zealand. Available from <http://www.utdc.vuw.ac.nz/research/emm/Publications.shtml>

Marshall, S. & Mitchell, G., 2002. An E-Learning Maturity Model? *Proceedings of the 19th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education*.

- Martínez-González, M.M. & Duffing, G., 2007. Teaching databases in compliance with the European dimension of higher education: Best practices for better competences. *Education and Information Technologies*, 12, pp.211–228.
- Matsuo, M., Wong, C.W.Y. & Lai, K., 2008. Experience-based learning of Japanese IT professionals: A qualitative research. *The Journal of Strategic Information Systems*, 17(3), pp.202–213.
- McCaffery, P., 2010. *The Higher Education Manager's Handbook: Effective leadership & management in universities & colleges* 2nd ed., Routledge.
- Mcquaid, R.W. & Lindsay, C., 2005. The Concept of Employability. *Urban Studies*, 42(2), pp.197–219.
- Melink, M. & Pavlin, S., 2011. *Employability of Graduates and Higher Education Management Systems (Final report of DEHEMS project)*, University of Ljubljana, Faculty of Social Sciences
- Melink, M., Pušnik, T. & Pavlin, S., 2014. *Emerging Modes of Cooperation between Private Enterprises and Universities – Insights of European Enterprises and Employers Organisations*, EMCOSU project report, University of Ljubljana, Faculty of Social Sciences
- Merriam, S.B. & Tisdell, E.J., 2015. *Qualitative Research: A Guide to Design and Implementation* 4th ed., Jossey-Bass, A Wiley Brand.
- Mettler, T., 2010. Thinking in terms of design decisions when developing maturity models. *International Journal of Strategic Decision Sciences*, 1(4), pp.76–87.
- Mettler, T. & Rohner, P., 2009. Situational Maturity Models as Instrumental Artifacts for Organizational Design. In *Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology (DESRIST)*. Philadelphia, Pennsylvania, USA: ACM Press, New York, USA.
- Miller, K. et al., 2011. *A toolkit for enhancing personal development planning strategy, policy and practice in higher education institutions (Second edition)*, The Quality Assurance Agency for Higher Education (QAA) Scotland.
- Ministarstvo znanosti obrazovanja i sporta, 2014. *Nove boje znanja - Strategija obrazovanja, znanosti i tehnologije*, Available at:
http://novebojeznanja.hr/UserDocsImages/datoteke/KB_web.pdf [Accessed October 3,

2016]

Ministry of Science Education and Sports of the Republic of Croatia, 2013. *Croatian Qualifications Framework (CROQF)*. Available at: <http://www.kvalifikacije.hr/hko-en> [Accessed February 24, 2016].

Moldovan, L., 2012. Integration of Strategic Management and Quality Assurance in the Romanian Higher Education. *Procedia - Social and Behavioral Sciences*, 58, pp.1458–1465.

Mühleck, K. et al., 2016. *Testing the Feasibility of a European Graduate Study*, Final report of the EUROGRADUATE feasibility study, German Center for Higher Education Research and Science Studies (DZHW). Available at: http://www.eurograduate.eu/download_files/eurograduate_feasibility_report.pdf [Accessed October 3, 2016]

Mühleck, K. & Hauschildt, K., 2015. EUROGRADUATE Research digest: National-level capacities for studying HE graduates in Europe. *Deutsches Zentrum für Hochschul- und Wissenschaftsforschung (DZHW)*, p.4. Available at: http://www.eurograduate.eu/download_files/documents/Research-digest_WP4_150317.pdf [Accessed February 6, 2016].

Nahm, A.Y. et al., 2002. The Q-Sort Method : Assessing Reliability And Construct Validity Of Questionnaire Items At A Pre-Testing Stage. *Journal of Modern Applied Statistical Methods*, 1(1), pp.114–125.

National Commission for Further and Higher Education (NCFHE), February 2013. *Implementation of quality assurance programmes in vocational education & training (VET) institutions, A manual for VET providers*, EQAVET Malta Project “Quality Assurance Tool for Vocational Education and Training”

Neff, A. a. et al., 2014. Developing a maturity model for service systems in heavy equipment manufacturing enterprises. *Information & Management*, 51(7), pp.895–911.

Nelles, J. & Vorley, T., 2010. Constructing an Entrepreneurial Architecture: An Emergent Framework for Studying the Contemporary University Beyond the Entrepreneurial Turn. *Innovative Higher Education*, 35(3), pp.161–176.

Nelson, R.R., 1991. Educational Needs as Perceived by IS and End-User Personnel: A Survey of Knowledge and Skill Requirements. *MIS Quarterly*, 15(4), pp.503–525.

- Neufeld, D.J. & Haggerty, N., 2001. Collaborative Team Learning in Information Systems: A Pedagogy for Developing Team Skills and High Performance. *Journal of Computer Information Systems*, 42(1), pp.37–43.
- Noaman, A.Y. et al., 2013. HEQAM: A Developed Higher Education Quality Assessment Model. In *Proceedings of the 2013 Federated Conference on Computer Science and Information Systems*. pp. 739–746.
- OECD, 2016. *Key ICT Indicators, Employment of ICT specialists across the economy, as share of total employment - Last updated July 2015*. Available at: <http://www.oecd.org/internet/broadband/oecdkeyictindicators.htm> [Accessed February 21, 2016].
- OECD, 2015. *OECD Science, Technology and Industry Scoreboard 2015: Innovation for growth and society*, OECD Publishing, Paris. Available at: http://dx.doi.org/10.1787/sti_scoreboard-2015-en [Accessed February 21, 2016]
- Pardede, E. & Lyons, J., 2012. Redesigning the Assessment of an Entrepreneurship Course in an Information Technology Degree Program: Embedding Assessment for Learning Practices. *IEEE Transactions on Education*, 55(4), pp.566–572.
- Paulk, M.C. et al., 1993. *Capability Maturity ModelSM for Software, Version 1.1*, Technical Report: CMU/SEI-93-TR-024 and ESC-TR-93-177, Software Engineering Institute Carnegie Mellon University Pittsburgh, Pennsylvania
- Paulk, M.C. et al., 1993. *Key Practices of the Capability Maturity ModelSM Version 1.1*, Technical Report CMU/SEI-93-TR-025 and ESC-TR-93-178, Software Engineering Institute Carnegie Mellon University Pittsburgh, Pennsylvania
- Pavlin, S. et al., 2011. Addressing graduates' career success from the higher education perspective – theoretical and conceptual frameworks. In M. Melink & S. Pavlin, eds. *Employability of Graduates and Higher Education Management Systems (Final report of DEHEMS project)*. University of Ljubljana, Faculty of Social Sciences.
- Pavlin, S., 2011. Conclusions and implications for higher education management systems. In M. Melink & S. Pavlin, eds. *Employability of Graduates and Higher Education Management Systems (Final report of DEHEMS project)*. University of Ljubljana, Faculty of Social Sciences.
- Pavlin, S., Deželan, T. & Svetlik, I., 2013. *Challenges of Citizenship in Higher Education*,

- Pavlin, S. & Svetlik, I., 2014. Employability of higher education graduates in Europe. *International Journal of Manpower*, 35(4), pp.418–424.
- Pažur Aničić, K. & Arbanas, K., 2015. Right Competencies for the right ICT Jobs – case study of the Croatian Labor Market. *TEM Journal*, 4(3), pp.236–243.
- Pažur Aničić, K. & Divjak, B., 2015. Development of Strategic Framework for Supporting Higher Education Graduates Early Careers. In *8th International Conference of Education, Research and Innovation Proceedings (ICERI 2015)*. Seville, Spain: IATED, pp. 3722–3731.
- Pažur Aničić, K. & Divjak, B., 2016. Supporting student retention and employment capabilities within higher education institution: four case studies research. In *25th European Access Network (EAN) conference: Retrospective for Perspective: Access and Widening Participation 1991-2041*.
- Pažur Aničić, K., Divjak, B. & Arbanas, K., 2017a. Preparing ICT Graduates for Real-World Challenges: Results of a Meta-Analysis. *IEEE Transactions on Education*, 60(3), pp.191–197 Copyright © 2017 IEEE
- Pažur Aničić, K., Divjak, B. & Arbanas, K., 2017b. Prestige and collaboration among researchers in the field of education and career development of ICT graduates: Is there a cross-fertilization of research and knowledge? accepted for publishing in *Journal of Information and Organizational Sciences*.
- Pažur Aničić, K. & Mekovec, R., 2016. Introducing Problem-Based Learning to Undergraduate IT Service Management Course: Student Satisfaction and Work Performance. *Journal of Problem Based Learning in Higher Education*, 4(1), pp.16–37.
- Pegg, A. et al., 2012. *Pedagogy For Employability*, The Higher Education Academy.
- Pigford, D. V., 2001. Designing and implementing active learning in the computer science curriculum: an interactive tutorial. *Journal of Computing Sciences in Colleges*, 17(2), pp.199–204.
- Pöppelbuß, J. & Röglinger, M., 2011. What makes a useful maturity model? A framework of general design principles for maturity models and its demonstration in business process management. In *European Conference on Information Systems Proceedings (ECIS 2011)*.

- Potgieter, C., 2012. Linking learning activities and assessment activities to learning outcomes and assessment standards when teaching technology: a case study. *International Journal of Technology and Design Education*, 23(4), pp.969–986.
- Pournader, M., Tabassi, A.A. & Baloh, P., 2015. A three-step design science approach to develop a novel human resource-planning framework in projects: the cases of construction projects in USA, Europe, and Iran. *International Journal of Project Management*, 33(2), pp.419–434.
- Prasad, R.K. & Jha, M.K., 2013. Quality Measures in Higher Education: A Review and Conceptual Model. *Journal of Research in Business and Management*, 1(3), pp.23–40.
- Prøitz, T.S., 2010. Learning outcomes: What are they? Who defines them? When and where are they defined? *Educational Assessment, Evaluation and Accountability*, 22(2), pp.119–137.
- Rademakers, M.F., 2014. *Corporate Universities: Drivers of the learning organization*, Routledge.
- Research Centre for Education and the Labour Market (ROA), Maastricht University, The Netherlands. 2008. *REFLEX - international survey higher education graduates*. Available at: <http://www.reflexproject.org> [Accessed December 27, 2014].
- Rice, W.R. et al., 1999. New pedagogical approaches to computer science education: a case study in peer learning. In *Proceedings of 29th Annual Frontiers in Education Conference (FIE)*. San Juan, Puerto Rico, USA: IEEE.
- Röglinger, M., Pöppelbuß, J. & Becker, J., 2012. Maturity models in business process management. *Business Process Management Journal*, 18(2), pp.328–346.
- Rosa, M.J., Sarrico, C.S. & Amaral, A., 2012. Implementing Quality Management Systems in Higher Education Institutions. In M. Savsar, ed. *Quality Assurance and Management*. InTech, pp. 129–146. Available from: <http://www.intechopen.com/books/quality-assurance-and-management/implementing-quality-management-systems-in-higher-education-institutions> [Accessed June 6, 2015]
- Ryška, R. & Zelenka, M., 2015. *EUROGRADUATE Research digest: Mapping international data capacities for studying HE graduates*. Available at: http://www.eurograduate.eu/download_files/documents/Research-digest_WP3_150319.pdf [Accessed February 6, 2016].

- Salah, D., Paige, R. & Cairns, P., 2014. An Evaluation Template for Expert Review of Maturity Models. In M. Jedlitschka A., Kuvaja P., Kuhrmann M., Männistö T., Münch J., Raatikainen, ed. *Product-Focused Software Process Improvement. PROFES 2014. Lecture Notes in Computer Science vol. 8892*. Springer, Cham, pp. 318–321.
- Saldaña, J., 2013. *The Coding Manual for Qualitative Researchers* 2nd ed., Sage Publications.
- Schindler, L. et al., 2015. Definitions of Quality in Higher Education: A Synthesis of the Literature. *Higher Learning Research Communications*, 5(3), pp.3–13.
- Shah, M. & Sid Nair, C., 2014. Turning the ship around: Rethinking strategy development and implementation in universities. *Quality Assurance in Education*, 22(2), pp.145–157.
- Silverman, D., 2013. *Doing Qualitative Research* 4th ed., Sage Publications.
- Silverman, D., 2014. *Interpreting qualitative data* 5th ed., SAGE Publications.
- Simpson, M. et al., 2003. Successful Studio-Based Real-World Projects in IT Education. In *Proceedings of the fifth Australasian conference on Computing education (ACE)*. Australian Computer Society, Inc., pp. 41–51.
- Spasos, S. et al., 2008. Implementation Of Efqm Model In A Greek Engineering Higher Education Institute : A Framework And A Case Study. *International Journal for Quality research*, 2(1), pp.43–50.
- Spohrer, J. et al., 2007. Steps Toward a Science of Service Systems. *Computer*, 40(1), pp.71–77.
- Spohrer, J. & Maglio, P.P., 2008. The Emergence of Service Science: Toward Systematic Service Innovations to Accelerate Co-Creation of Value. *Production and Operations Management*, 17(3), pp.238–246.
- Stabback, P., 2016. What Makes a Quality Curriculum? *In-Progress Reflection No.2 on Current and Critical Issues in Curriculum and Learning*, UNESCO. Available at: <http://unesdoc.unesco.org/images/0024/002439/243975E.pdf>. [Accessed April 30, 2017]
- Stake, R.E., 2006. *Multiple Case Study Analysis*, The Guilford Press.
- Straub, D., Boudreau, M.-C. & Gefen, D., 2004. Validation Guidelines for IS Positivist Research. *Communications of the Association for Information Systems*, 13, pp.380–427 (Article 24).

- Sumanasiri, E.G.T., Yajid, M.S.A. & Khatibi, A., 2015. Review of Literature on Graduate Employability. *Journal of Studies in Education*, 5(3), pp.75–88.
- Sveučilište u Zagrebu, 2014. Strategija studija i studiranja Sveučilišta u Zagrebu (2014. - 2025.).
- Tangworakitthaworn, P., Gilbert, L. & Wills, G.B., 2013. A Conceptual Model of Intended Learning Outcomes Supporting Curriculum Development. In J. C. Ng W., Storey V.C., Trujillo, ed. *Conceptual Modeling. ER 2013. Lecture Notes in Computer Science vol. 8217*. Springer, Berlin, Heidelberg, pp. 161–173.
- Tari, J.J. & Madeleine, C., 2010. The EFQM self-assessment processes in HEIs in Spain and in Jordan. *US-China Education Review*, 7(7), pp.65–74.
- Taylor, J. & De Lourdes Machado, M., 2006. Higher Education Leadership and Management: From Conflict to Interdependence through Strategic Planning. *Tertiary Education and Management*, 12(2), pp.137–160.
- Teichler, U., 2009. *Higher Education and The World of Work: Conceptual Frameworks, Comparative Perspectives, Empirical Findings*, Sense Publishers.
- The International Graduate Insight Group Ltd. (i-graduate), 2011. *Supporting Graduate Employability: HEI Practice in Other Countries*, Department for Business, Innovation & Skills (BIS) research paper number 40
- The Quality Assurance Agency for Higher Education, 2009. *Personal development planning: guidance for institutional policy and practice in higher education*, The Quality Assurance Agency for Higher Education (QAA)
- The University of Edinburgh, 2016. The University of Edinburgh. Available at: <http://www.ed.ac.uk/> [Accessed August 1, 2016].
- Timmerman, B. & Lingard, R., 2003. Assessment of active learning with upper division computer science students. In *33rd Annual Frontiers in Education Conference (FIE)*. IEEE, pp. S1D–7 – S1D–12.
- Todd, P.A., McKeen, J.D. & Gallupe, R.B., 1995. The Evolution of IS Job Skills: A Content Analysis of IS Job Advertisements from 1970 to 1990. *MIS Quarterly: Management Information Systems*, 19(1), pp.1–27.
- Tohidi, H., Jafari, A. & Afshar, A.A., 2010. Strategic planning in Iranian educational

- organizations. *Procedia - Social and Behavioral Sciences*, 2(2), pp.3904–3908.
- Tremblay, K. et al, 2013. *Assessment of Higher Education Learning Outcomes (AHELO), Feasibility Study Report, Volume 2 - Data Analysis and National Experiences*, OECD
- Tremblay, K., Lalancette, D. & Roseveare, D., 2012. *Assessment of Higher Education Learning Outcomes (AHELO) Feasibility Study Report, Volume 1 - Design and Implementation*, OECD
- Twining, P. et al., 2017. Some guidance on conducting and reporting qualitative studies. *Computers & Education*, 106, pp.A1–A9.
- Udam, M., Lauri, L. & Bach, T., 2014. Understanding the stakeholders' perspective on the use and usefulness of external quality assurance reports. In M. Kelo & L. Kerber, eds. *Transparency of European Higher Education through Public Quality Assurance Reports (EQAreps), Final report of the project*. Occasional papers 21. European Association for Quality Assurance in Higher Education (ENQA), Brussels, Belgium.
- United Nations Educational, Scientific and Cultural Organization (UNESCO), 2002a. *Handbook on career counselling: A practical manual for developing, implementing and assessing career counselling services in higher education settings*, Follow-up to the World Conference on Higher Education (Paris 5-9 October 1998)
- United Nations Educational, Scientific and Cultural Organization (UNESCO), 2002b. *The role of student affairs and services in higher education: A practical manual for developing, implementing and assessing student affairs programmes and services*, Follow-up to the World Conference on Higher Education (Paris 5-9 October 1998)
- University of Bradford, 2012a. *Employability Strategy 2012-2015*. Available at: [http://www.bradford.ac.uk/student-experience/media/academicdevelopment/documents/Employability-Strategy-\(Revised-September-2014\).pdf](http://www.bradford.ac.uk/student-experience/media/academicdevelopment/documents/Employability-Strategy-(Revised-September-2014).pdf) [Accessed July 29, 2015].
- University of Bradford, 2012b. *University of Bradford Curriculum Framework*. Available at: <http://www.bradford.ac.uk/educational-development/media/academicdevelopment/documents/curriculum-framework.pdf> [Accessed July 29, 2015].
- University of Cambridge, 2012. *Learning and Teaching Strategy, 2012-15*. Available at: <http://www.educationalpolicy.admin.cam.ac.uk/files/strategy.pdf> [Accessed July 29,

2015].

University of Edinburgh, 2014a. *College of Science and Engineering Learning and Teaching Strategy 2014-2016*. Available at:

http://www.ed.ac.uk/files/atoms/files/college_of_science_and_engineering_learning_and_teaching_strategy_2014-2016.pdf [Accessed July 29, 2015].

University of Edinburgh, 2014b. *Developing and Supporting the Curriculum: final report*.

The Quality Assurance Agency for Higher Education, Scotland (QAA): Developing and Supporting the Curriculum (DSC) Enhancement Theme. Available at:

<http://www.enhancementthemes.ac.uk/pages/docdetail/docs/report/dsc-final-report---university-of-edinburgh>.

University of Edinburgh, 2012. *Strategic Plan 2012-2016*. Available at:

<http://www.docs.sasg.ed.ac.uk/gasp/strategicplanning/201216/StrategicPlan201216.pdf> [Accessed July 29, 2015].

University of Hull, 2011. *Employability Strategy 2011-2015*. Available at:

<http://www2.hull.ac.uk/student/pdf/00EmployabilityStrategy.pdf> [Accessed July 29, 2015].

University of Kent, 2013. *Employability Strategy*. Available at:

<https://www.kent.ac.uk/ces/staff/EmployabilityStrategy.pdf> [Accessed July 29, 2015].

University of Oxford, 2013. *Strategic Plan 2013–18*. Available at:

https://www.ox.ac.uk/sites/files/oxford/field/field_document/StrategicPlan2013-18.pdf [Accessed July 29, 2015].

University West, 2016. *University West*. Available at: <https://www.hv.se/en/> [Accessed August 1, 2016].

Vaishnavi, V.K. & Kuechler Jr., W., 2007. *Design Science Research Methods and Patterns: Innovating Information and Communication Technology*, Auerbach Publications, Taylor & Francis Group.

van den Akker, J. et al., 2009. *Curriculum in development* A. Thijs & J. van den Akker, eds., Netherlands Institute for Curriculum Development (SLO)

Vlada Republike Hrvatske, 2014. *Smjernice za razvoj i provedbu aktivne politike zapošljavanja u Republici Hrvatskoj za razdoblje od 2015.-2017. godine*. Available at: <http://www.mrms.hr/wp-content/uploads/2015/02/smjernica-apz.pdf> [Accessed

September 6, 2015].

Webster, J. & Watson, R.T., 2002. Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26(2), pp.xiii–xxiii.

Wirtschaftsuniversität Wien (WU), 2016. *Vienna University of Economics and Business*. Available at: <https://www.wu.ac.at/en/> [Accessed August 1, 2016].

Wright, G.B., 2011. Student-Centered Learning in Higher Education. *International Journal of Teaching and Learning in Higher Education*, 23(3), pp.92–97.

Yin, R. k., 2014. *Case Study Research: design and method* 5th ed., Sage Publications.

Yorke, M. & Knight, P.T., 2006. *Embedding employability into the curriculum*, Series one, The Higher Education Academy

Yousapronpaiboon, K., 2014. SERVQUAL: Measuring Higher Education Service Quality in Thailand. *Procedia - Social and Behavioral Sciences*, 116, pp.1088–1095.

Yu, F.Y. & Wu, C.-P., 2011. Different identity revelation modes in an online peer-assessment learning environment: Effects on perceptions toward assessors, classroom climate and learning activities. *Computers & Education*, 57(3), pp.2167–2177.

APPENDIX

Appendix A: Systematic literature review search procedure

| Table A1. Limitations to the database query | | | |
|--|---|---|--------------------------|
| Database | Limitation 1 | Limitation 2 | Limitation 3 |
| ACM | Journal, Proceedings | | |
| IEEE | Conference Publications, Journals & Magazines | | |
| ScienceDirect | Journals | AND LIMIT-TO(cids, "277811,271849,271756,271751,273219","Procedia - Social and Behavioural Sciences, Computers & Education, International Journal of Educational Development..., Economics of Education Review, Education and Computing") | |
| Scopus | Article, Conference paper | AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "cp")) AND (LIMIT-TO(SUBJAREA, "SOCI") OR LIMIT-TO(SUBJAREA, "COMP") OR LIMIT-TO(SUBJAREA, "ENGI")) | 500 most relevant papers |
| WOS | Article, Proceedings paper | Refined by: DOCUMENT TYPES: (ARTICLE OR PROCEEDINGS PAPER) AND RESEARCH AREAS: (EDUCATION EDUCATIONAL RESEARCH OR COMPUTER SCIENCE OR ENGINEERING OR SOCIAL SCIENCES OTHER TOPICS OR INFORMATION SCIENCE LIBRARY SCIENCE) | 500 most relevant papers |

| Table A2. Initial search results | | | | | |
|---|----------------------|-----------------------|--|---------------------------|----------------|
| | | Initial number | After limitation 1 and limitation 2 | After limitation 3 | Date |
| ICT Education | ACM | 3362 | 2560 | 2560 | 24.-28.7.2014. |
| | IEEE | 1080 | 1050 | 1050 | 23.7.2014. |
| | ScienceDirect | 3011 | 287 | 287 | 29.7.2014. |
| | Scopus | 16952 | 7464 | 500 | 29.7.2014. |
| | WOS | 11215 | 3054 | 500 | 29.7.2014. |
| | ICT Education | 35620 | 14415 | 4897 | |
| | | | | | |
| ICT Career | ACM | 1170 | 799 | 799 | 30.7.2014. |
| | IEEE | 386 | 381 | 381 | 30.7.2014. |
| | ScienceDirect | 1403 | 102 | 102 | 30.7.2014. |
| | Scopus | 9372 | 2923 | 500 | 30.7.2014. |
| | WOS | 5625 | 926 | 500 | 30.7.2014. |
| | ICT Career | 17956 | 5131 | 2282 | |
| | | | | | |
| | Sum | 53576 | 19546 | 7179 | |

Appendix B: List of papers within *ICT Education* dataset

1. Abraham, Aju Thomas, and Jayasankar Prasad. 2009. "Industry Institute Interaction for Capability Building in Engineering Education in India a Study on the Indian Information Technology Companies." In 2009 ITI 7th International Conference on Communications and Information Technology (ICICT), pp. 17–22.
2. Adrion, W.R., W. Burleson, W. Cooper, W.L. Israel, J. Kurose, and K. Watts. 2003. "Excite: Enabling X-Campus Information Technology Education." In 33rd Annual Frontiers in Education, 2003. pp. S4F_18–S4F_23.
3. Agayev, Firudin, and Gulara Mamedova. 2012. "Development of an Educational Standard of Higher Education for ICT Sphere." In 2012 IV International Conference "Problems of Cybernetics and Informatics" (PCI), pp. 1–3.
4. Ahlan, Abdul Rahman, Yusri Arshad, Mohd Adam Suhaimi, and Husnayati Hussin. 2010. "The Malaysia IT Outsourcing Industry Skill-Sets Requirements of Future IT Graduates." WSEAS Transactions on Computers 9(7): 738–747.
5. Alford, K.L., C.A. Carver, E.K. Ressler, and C.W. Reynolds. 2004. "A Curriculum Framework for Evolving an Information Technology Program." In 34th Annual Frontiers in Education, 2004., pp. 882–887.
6. Alford, Kenneth L., Curtis A. Carter, Daniel J. Ragsdale, Eugene K. Ressler, and Charles W. Reynolds. 2004. "Specification and Managed Development of Information Technology Curricula." In Proceedings of the 5th Conference on Information Technology Education - CITC5 '04, pp. 261–266.
7. Ali, Asha, and Liyamol Aliyar. 2012. "Re-Engineering of ICT Engineering Education." In 2012 IEEE International Conference on Engineering Education: Innovative Practices and Future Trends (AICERA), pp. 1–6.
8. Alkazemi, Basem Y., Mohammed K. Nour, Abdulqader Q. Sahrawi, Anas M. Basalamah, Saleh M. Basalamah, Hassan F. Lahza, and Grami M.A Grami. 2014. "A Framework for Designing a Market-Oriented Curriculum for the Degree of Information System Engineering." In 2014 IEEE Global Engineering Education Conference (EDUCON), pp. 695–700.
9. Barbosa, Fernanda, Helga Guincho, Francisco B. Leite, Jose Luis Nunes, and Carlos Pereira. 2011. "European Computer Science Master Curriculum Development Methodology: Management and Research." In 2011 7th International Conference on Next Generation Web Services Practices, pp. 487–92.
10. Blum, Thomas E., and Margaret M. McCoey. 2007. "Incorporating Business Concepts into a Computer Science Curriculum: A Multi-Tiered Approach." Journal of Computing Sciences in Colleges 22(3): 175–182.
11. Borys, Magdalena, Marek Milosz, and Malgorzata Plechawska-Wojcik. 2012. "Using Deming Cycle for Strengthening Cooperation between Industry and University in IT Engineering Education Program." In 2012 15th International Conference on Interactive Collaborative Learning (ICL), pp. 1–4.
12. Buckley, Michael, Helene Kershner, Kris Schindler, Carl Alphonse, and Jennifer Braswell. 2004. "Benefits of Using Socially-Relevant Projects in Computer Science and Engineering Education." In Proceedings of the 35th SIGCSE Technical Symposium on Computer Science Education - SIGCSE '04, pp. 482–486.
13. Calitz, Andre P., Jean H. Greyling, and Margaret D. M. Cullen. 2011. "ICT Career Track Awareness amongst ICT Graduates." In Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment - SAICSIT '11, pp. 59–68.
14. Carbone, Angela, and Judy Sheard. 2002. "A Studio-Based Teaching and Learning Model in IT: What do First Year Students Think?." In Proceedings of the 7th Annual Conference on Innovation and Technology in Computer Science Education ITiCSE'02, pp. 213–217.
15. Cardoso, João M. P. 2005. "New Challenges in Computer Science Education." Proceedings of the 10th annual SIGCSE conference on Innovation and technology in computer science education - ITiCSE '05, pp. 203–207.
16. Chen, Dan, and Nian-feng Fu. 2010. "On Computer Science Reform of Curriculum Structure." In 2010 Third International Symposium on Electronic Commerce and Security, pp. 21–24.
17. Chengxia, Liu, Cai Ying, and Shen Meie. 2011. "Using Cooperation between University and Enterprise to Improve the Comprehensive Competitiveness of Student in Computer Science." In 2011 6th International Conference on Computer Science & Education (ICCSE), pp. 772–775.
18. Chin, Kum Leng, and E. Chang. 2009. "Sustainable ICT Education Ecosystem." In 2009 3rd IEEE International Conference on Digital Ecosystems and Technologies, pp. 271–277.
19. Chin, Kum Leng, and Elizabeth Chang. 2011. "A Sustainable ICT Education Ontology." In 5th IEEE International Conference on Digital Ecosystems and Technologies (IEEE DEST 2011), pp. 350–354.
20. Chin, Kum Leng, Elizabeth Chang, and Doug Atkinson. 2008. "A Digital Ecosystem for ICT Educators, ICT Industry and ICT Students." In 2008 2nd IEEE International Conference on Digital Ecosystems and Technologies, pp. 660–673.

21. Chookittikul, Jaruek, and Wajee Chookittikul. 2008. "Six Sigma Quality Improvement Methods for Creating and Revising Computer Science Degree Programs and Curricula." In 2008 38th Annual Frontiers in Education Conference, pp. F2E – 15–F2E – 20.
22. Collings, P., D. Sharma, and D. Walker. 2005. "IT Education and the Knowledge Society: an Australian Perspective." In 3rd International Conference on Information and Communication Technology, pp. 57–73.
23. Couger, J. Daniel, Gordon B. Davis, Dorothy G. Dologite, David L. Feinstein, John T. Gorgone, A. Milton Jenkins, George M. Kasper, Joyce Currie Little, Herbert E. Longenecker, and Joseph S. Valacich. 1995. "IS'95: Guideline for Undergraduate IS Curriculum." *MIS Quarterly: Management Information Systems* 19 (3): 341–359.
24. Darrah, Marjorie, Rebecca Giorcelli, and Tracie Dodson. 2007. "A Comprehensive Program for Expanding Pathways to IT Careers." In Proceedings of the 8th ACM SIGITE Conference on Information Technology Education - SIGITE '07, pp. 195–200.
25. Doboli, Simona, Gerda L. Kamberova, John Impagliazzo, Xiang Fu, and Edward H. Currie. 2010. "A Model of Entrepreneurship Education for Computer Science and Computer Engineering Students." In 2010 IEEE Frontiers in Education Conference (FIE), pp. T4D – 1–T4D – 6.
26. Domingo-Ferrer, J. 2003. "Networking in the New ICT Curricula." In Proceedings of the International Conference on Information Technology: Computers and Communications (ITCC'03), pp. 20–24.
27. Falkner, Nickolas J.G., Rebecca Jade Vivian, and Katrina Elizabeth Falkner. 2013. "Computer Science Education: The First Threshold Concept." In Learning and Teaching in Computing and Engineering (LaTiCE) 2013, pp. 39–46.
28. Fellers, Jack W. 1996. "Teaching Teamwork: Exploring the Use of Cooperative Learning Teams in Information Systems Education." *Data Base for Advances in Information Systems* 27 (2): 44–59.
29. Floyd, Ronald C. 2004. "A Model for Information Technology Curriculum." In Proceedings of the 5th Conference on Information Technology Education - CITC5 '04, pp. 83–89.
30. Fossum, T. V., and S. M. Haller. 2005. "A New Quantitative Assessment Tool for Computer Science Programs." In Proceedings of the 10th annual SIGCSE conference on Innovation and technology in computer science education ITiCSE '05, pp. 153–157.
31. Fulbright, Ron. 2011. "Teaching Innovation-on-Demand in an Undergraduate Information Technology Program." In Proceedings of the 2011 Conference on Information Technology Education - SIGITE '11, pp. 233–238.
32. Furst, Merrick, Charles Isbell, and Mark Guzdial. 2007. "ThreadsTM: How to Restructure a Computer Science Curriculum for a Flat World." Proceedings of the 38th SIGCSE technical symposium on Computer science education SIGCSE '07, pp. 420–424.
33. Ghosh, S. 1998. "A New Metric for Assessing Quality in Advanced Graduate Courses in Computer Science & Engineering." In FIE '98. 28th Annual Frontiers in Education Conference, pp. 628–633.
34. Gorgone, John T., and Paul Gray. 1999. "Graduate IS Curriculum for the 21st Century." In Proceedings of the 32nd Hawaii International Conference on System Sciences, pp. 1–7.
35. Guo, Weibin, Jianhua Li, Jianguo Yang, Gaoqi He, and Hong Zheng. 2011. "Practical Education for Computer Science Undergraduates at East China University of Science and Technology." In 2011 International Conference on Control, Automation and Systems Engineering (CASE), pp. 1–4.
36. Gupta, Gopal K. 2007. "Computer Science Curriculum Developments in the 1960s." *IEEE Annals of the History of Computing* 29(2): 40–54.
37. Hagan, Dianne. 2004. "Employer Satisfaction with ICT Graduates," In Proceedings of the Sixth Australasian Conference on Computing Education ACE '04, pp. 119–123.
38. Hazzan, Orit, and Gadi Har-Shai. 2014. "Teaching and Learning Computer Science Soft Skills Using Soft Skills: The Students' Perspective." In Proceedings of the 45th ACM Technical Symposium on Computer Science Education - SIGCSE '14, pp. 567–572.
39. He, Xiao-Qi, Yi-Gang Wang, Zhuo-Yuan Wang, Sheng-Li Fan, and Jia-Lin Cui. 2010. "Illuminations from the Experience in Computer Science Education at Foreign Universities." In 2010 5th International Conference on Computer Science & Education, pp. 806–808.
40. Helps, C. Richard G. 2006. "Instructional Design Theory Provides Insights into Evolving Information Technology Technical Curricula." In Proceedings of the 7th Conference on Information Technology Education - SIGITE '06, pp. 129–134.
41. Henno, J., H. Jaakkola, and J. Makela. 2012. "Quo Vadis, IT Education?" In Proceedings of the 35th International Convention MIPRO 2012, pp. 1232–1238.
42. Hoganson, Kenneth. 2004. "Computer Science Curricula in a Global Competitive Environment." *Journal of Computing Sciences in Colleges* 20(1): 168–177.
43. Hoganson, Kenneth. 2005. "A Strategic Approach to Computer Science Curriculum." In Proceedings of the 43rd Annual Southeast Regional Conference on ACM-SE, pp. 365–370.

44. Intayoad, Wacharawan. 2014. "PBL Framework for Enhancing Software Development Skills: An Empirical Study for Information Technology Students." *Wireless Personal Communications* 76(3):419–33.
45. Jaakkola, Hannu, Jaak Henno, and Imre Rudas. 2006. "IT Curriculum as a Complex Emerging Process." In 2006 IEEE International Conference on Computational Cybernetics, pp. 1–5.
46. Jamaludin, Zulikha, and Ariffin Abdul Mutalib. 2005. "IT-Graduate Abilities: Performance Gap as an Input for Curriculum Improvement." In ITRE 2005. 3rd International Conference on Information Technology: Research and Education, 2005., pp. 348–51.
47. Jiangyu Li. 2009. "Theoretical Study and Practice on Training Model of Information Technology Competency for College Students." In 2009 4th International Conference on Computer Science & Education, pp. 1820–1824.
48. Kabicher, Sonja, Michael Derntl, and Renate Motschnig. 2008. "Approaching Inclusive Universal Access on the Computer Science Curriculum Level." In 2008 38th Annual Frontiers in Education Conference, pp. F2H – 14–F2H – 19.
49. Kabicher, Sonja, Renate Motschnig-Pitrik, and Kathrin Figl. 2009. "What Competences Do Employers, Staff and Students Expect from a Computer Science Graduate?" In 2009 39th IEEE Frontiers in Education Conference, pp. W1E-1 – W1E-6.
50. Knight, John C., Jane C. Prey, and William A. Wulf. 1997. "A Look Back: Undergraduate Computer Science Education: A New Curriculum Philosophy and Overview." In Proceedings Frontiers in Education 27th Annual Conference. Teaching and Learning in an Era of Change, pp. 722–27.
51. Koh, Christine Siew Kuan, and Damien Joseph. 2011. "Occupational Commitment of IT Students: A Social Cognitive Career Theory Perspective." In Proceedings of the 49th SIGMIS Annual Conference on Computer Personnel Research - SIGMIS-CPR '11, pp. 62–64.
52. Koppi, Tony, Sylvia L. Edwards, Judy Sheard, Fazel Naghdy, and Wayne Brookes. 2010. "The Case for ICT Work-Integrated Learning from Graduates in the Workplace." In 12th Australasian Computing Education Conference (ACE 2010), pp. 107–116.
53. Koppi, Tony, Judy Sheard, Fazel Naghdy, Joe Chicharo, Sylvia L. Edwards, Wayne Brookes, and David Wilson. 2009. "What Our ICT Graduates Really Need from Us: A Perspective from the Workplace," 09 Proceedings of the Eleventh Australasian Conference on Computing Education, pp. 101–110.
54. Kruus, Helena, Peeter Ellervee, Tarmo Robal, Priit Ruberg, and Margus Kruus. 2013. "Involving Students in Teaching Process — Encouraging Student-Generated Content in ICT Studies." In 2013 Proceedings of the 24th EAEEIE Annual Conference (EAEEIE 2013), pp. 76–81.
55. Kulkarni, Vidya, Christelle Scharff, and Olly Gotel. 2010. "From Student to Software Engineer in the Indian IT Industry: A Survey of Training." In 2010 23rd IEEE Conference on Software Engineering Education and Training (CSEE&T), pp. 57–64.
56. Lee, J. A. N. 2002. "The Emporium Approach to Computer Science Education." Proceedings of the 7th annual conference on Innovation and technology in computer science education ITiCSE '02, pp. 203–207.
57. Leon, Gonzalo. 2008. "Public-Private Partnerships in ICT Education from the Open Innovation Perspective." In 2008 ITI 6th International Conference on Information & Communications Technology, pp. 19–25.
58. Lethbridge, Timothy C. 1998. "A Survey of the Relevance of Computer Science and Software Engineering Education." In Proceedings 11th Conference on Software Engineering Education, pp. 56–66.
59. Levano, Marcos A., and Oriel A. Herrera. 2012. "Validation Strategies of Competences in a Computer Science Curriculum." In 2012 31st International Conference of the Chilean Computer Science Society, pp. 9–11.
60. Li, Minjie. 2010. "A Model for Information Technology Education for Undergraduates of Engineering." In 2010 2nd International Conference on Education Technology and Computer, pp. V3–94 – V3–98.
61. Li, Weibin, Shunli Zhang, and Zongling Li. 2009. "Open Source Movement and Computer Science Education Innovation." In 2009 International Conference on Information Engineering and Computer Science, pp. 1–4.
62. Machanick, Philip. 2003. "Principles versus Artifacts in Computer Science Curriculum Design." *Computers & Education* 41(2):191–201.
63. Shao, Kun and Peter Maher. 2009. "Populating the Global Software Talent Pool: An Effective Approach to Computer Science Education in China." In Proceedings of 2009 4th International Conference on Computer Science & Education, pp. 1539–1544.
64. Manacero, Aleardo, Rildo R. dos Santos, Norian Marranghello, Aledir S. Pereira, Adriano M. Cansian, and Jose C.L. Ralha. 2001. "A Flexible Curriculum for Computer Science Undergraduate Major." In 31st Annual Frontiers in Education Conference. pp. F3D-20 – F3D-25.
65. Mansour, Samah S., and John Reynolds. 2009. "Development of a Baccalaureate Major in Information Technology: Adding a Third Dimension to a Comprehensive Computing Program." In Proceedings of the 10th ACM Conference on SIG-Information Technology Education - SIGITE '09, pp. 108–114.

66. Marshall, Linda. 2012. "A Comparison of the Core Aspects of the ACM/IEEE Computer Science Curriculum 2013 Strawman Report with the Specified Core of CC2001 and CS2008 Review." In *Proceedings of Second Computer Science Education Research Conference - CSERC '12*, pp. 29–34.
67. Maryska, Milos, Petr Doucek, and Renata Kunstova. 2012. "The Importance of ICT Sector and ICT University Education for the Economic Development." *Procedia - Social and Behavioral Sciences* 55:1060–1068.
68. Nai-xiang, Li. 2009. "Innovating IT Education and Accelerating IT Service Outsourcing Talent Training." In *2009 International Conference on Computer Technology and Development*, pp. 443–447.
69. Nelson, R. Ryan. 1991. "Educational Needs as Perceived by IS and End-User Personnel: A Survey of Knowledge and Skill Requirements." *MIS Quarterly* 15 (4):503–525.
70. Orr, Jo, and Liisa von Hellens. 2000. "Skill Requirements of IT&T Professionals and Graduates: An Australian Study Research-in-Progress." In *Proceedings of the 2000 ACM SIGCPR Conference on Computer Personnel Research - SIGCPR '00*, pp. 167–170.
71. Owen, William. 2003. "Focus Tracks: Specializing in IT Education." In *Proceeding of the 4th Conference on Information Technology Education - CITC '03*, pp. 135–138.
72. Pardas, Montse, and Antonio Bonafonte. 2011. "Work in Progress — Cooperative and Competitive Projects for Engaging Students in Advanced ICT Subjects." In *2011 Frontiers in Education Conference (FIE)*, pp. F2G – 1–F2G – 3.
73. Pardede, Eric, and Judith Lyons. 2012. "Redesigning the Assessment of an Entrepreneurship Course in an Information Technology Degree Program: Embedding Assessment for Learning Practices." *IEEE Transactions on Education* 55(4):566–72.
74. Philippovich, A.Yu. 2013. "Integrating Vendors Educational Content and Official Courses into Russian Technical Universities' IT Curriculums." In *2013 IEEE 11th International Conference on Emerging eLearning Technologies and Applications (ICETA)*, pp. 315–319.
75. Pigford, Darleen V. 2001. "Designing and Implementing Active Learning in the Computer Science Curriculum: An Interactive Tutorial." *Journal of Computing Sciences in Colleges* 17(2) :199–204.
76. Pilgrim, Chris J. 2013. "Industry Involvement in ICT Curriculum: A Comparative Survey." In *2013 35th International Conference on Software Engineering (ICSE)*, 1148–53.
77. Pirker, Johanna, Maria Riffnaller-Schiefer, and Christian Gütl. 2014. "Motivational Active Learning - Engaging University Students in Computer Science Education." In *Proceedings of the 2014 Conference on Innovation & Technology in Computer Science Education - ITiCSE '14*, pp. 297–302.
78. Plice, Robert K., and Bruce A. Reinig. 2007. "Aligning the Information Systems Curriculum with the Needs of Industry and Graduates." *Journal of Computer Information Systems* 48 (1): 22–30.
79. Poulouva, Petra, and Ivana Simonova. 2013. "IT and Management from Graduates' View: 20-Year Evaluation of the Study Programme." In *2013 12th International Conference on Information Technology Based Higher Education and Training (ITHET)*, pp. 1–5.
80. Ren, Xiang-min, and Xue-yan Zhou. 2009. "Research and Practice on Cultivation of IT Talents in Applied Undergraduate Education through Business- Education Partnership." In *2009 4th International Conference on Computer Science & Education*, pp. 1469–1472.
81. Said, Hazem, Louise Chaytor, Daniel Humpert, John Nyland, Robert Schlemmer, Mark Stockman, et al. 2004. "An Implementation of a Core Curriculum in an Information Technology Degree Program." In *Proceedings of the 5th Conference on Information Technology Education - CITC5 '04*, pp. 94–100.
82. Shi, Hao. 2008. "Maximising Computer Science Student Career Opportunity through ICT Industry Placements." In *2008 International Multi-Symposiums on Computer and Computational Sciences*, pp. 228–31.
83. Simmons, Chris B., and Lakisha L. Simmons. 2010. "Gaps in the Computer Science Curriculum: An Exploratory Study of Industry Professionals." *Journal of Computing Sciences in Colleges* 25(5): 60–65.
84. Simpson, Matthew, Jay Burmeister, Alan Boykiw, and Jihan Zhu. 2003. "Successful Studio-Based Real-World Projects in IT Education." In *Proceedings of the Fifth Australasian Conference on Computing Education ACE*, pp. 41–51.
85. Sobiesk, Edward J., Jean R.S. Blair, James D. Cook, John C. Giordano, Bryan S. Goda, and Charles W. Reynolds. 2006. "Designing an Interdisciplinary Information Technology Program." In *Proceedings of the 7th Conference on Information Technology Education - SIGITE '06*, pp. 71–76.
86. Sweeney, Robert B. 2003. "Creativity in the Information Technology Curriculum Proposal." In *Proceeding of the 4th Conference on Information Technology Curriculum - CITC '03*, pp. 139–141.
87. Tatnall, Arthur. 2008. "Factors Affecting the Adoption of ICT Curriculum Innovations and Educational Technology." In *2008 ITI 6th International Conference on Information & Communications Technology*, pp. 11–16.

88. Tatnall, Arthur, and Bill Davey. 2002. "Understanding the Process of Information Systems and ICT Curriculum Development: Three Models," Proceedings of the IFIP 17th World Computer Congress - TC3 Stream on Tele-Learning: the Challenge for the Third Millennium, pp. 225-232
89. Tharp, Alan L. 2007. "Innovating: The Importance of Right Brain Skills for Computer Science Graduates." In Proceedings of the 12th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education - ITiCSE '07, pp. 126-130.
90. Timmerman, B., and R. Lingard. 2003. "Assessment of Active Learning with Upper Division Computer Science Students." In 33rd Annual Frontiers in Education Conference (FIE). pp. S1D-7 - S1D-12
91. Topi, Heikki, Joseph S. Valacich, Ryan T. Wright, Kate Kaiser, Jay F. Nunamaker, Janice C. Sipior, and Gert Jan de Vreede. 2010. "IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems." Association for Computing Machinery (ACM) and Association for Information Systems (AIS)
92. van Veen, Maarten, Fred Mulder, and Karel Lemmen. 2004. "What Is Lacking in Curriculum Schemes for Computing/informatics?" Proceedings of the 9th annual SIGCSE conference on Innovation and technology in computer science education, pp. 186-190.
93. Xiangmin, Ren. 2009. "Difffluence Cultivation of IT Talents in Applied Undergraduate Education through College-Enterprise Cooperation." In 2009 International Forum on Computer Science-Technology and Applications, pp. 168-71.
94. Xue, Jiwei, and Lifeng Zhang. 2011. "Application of Task-Driven Approach in Information Technology Education." In 2011 International Conference on Electrical and Control Engineering, pp. 2024-2026.
95. Ying, Lin, Zhang Yan, and Li Tong. 2010. "Strategies for Promoting Better Interaction between Higher Education and IT Industry." In 2010 International Conference on E-Business and E-Government, pp. 5520-22.
96. Yuan, Dongqing, and Jiling Zhong. 2010. "Design and Implement a Networking Curriculum in Light of ACM IT Curriculum Recommendations and Bloom's Taxonomy." In Proceedings of the 2010 ACM Conference on Information Technology Education - SIGITE '10, pp. 155-156.
97. Zamyatina, Oxana M., and Polina I. Mozgaleva. 2013. "IT Implementation in the Educational Process of Future Engineers by Means of Project Activities and Competences Assessment." In 2013 IEEE Global Engineering Education Conference (EDUCON), pp. 1170-1176.
98. Zendler, Andreas, and Christian Spannagel. 2008. "Empirical Foundation of Central Concepts for Computer Science Education." Journal on Educational Resources in Computing 8(2): 1-15.
99. Zhang, Qianfan. 2010. "An Ability Demand-Oriented Curriculum Design for IM & IS Degree Program." In 2010 International Conference on Electrical and Control Engineering, pp. 2655-2658.
100. Zhu, Duan, Wu Di, and Zhao DanTing. 2010. "The Interaction between IT Corporations and Education: Exploration on Talents Cultivating Modes of Higher Education." In 2010 5th International Conference on Computer Science & Education, pp. 1547-1549.
101. Zhu, Nanli, Suling Yang, and Wumei Ye. 2009. "Research on the Student-Oriented Role-Shift Teaching Model in the Computer Information Technology Course." In 2009 First International Workshop on Education Technology and Computer Science, pp. 256-260.

Appendix C: List of papers within *ICT Career* dataset

1. Aasheim, Cheryl L., Susan Williams, and E. Sonny Butler. 2009. "Knowledge and Skill Requirements for it Graduates." *Journal of Computer Information Systems* 42(3): 48–53.
2. Ahlan, Abdul Rahman, Yusri Arshad, Mohd Adam Suhaimi, and Husnayati Hussin. 2010. "The Malaysia IT Outsourcing Industry Skill-Sets Requirements of Future IT Graduates." *WSEAS Transactions on Computers* 9(7):738–747.
3. Archibald, J. A., and M. Katzper. 1974. "On the Preparation of Computer Science Professionals in Academic Institutions." In *Proceedings of the National Computer Conference and Exposition - AFIPS '74*, 313–319.
4. Azahar, Dayana, Norehan Abdul Manaf, Nalini Dharmarajan, and Wan Adilah Wan Adnan. 2010. "Malaysia IT Career Opportunity Analysis Based on Classified Advertisement in the New Straits Times (2000–2008)." In *2010 International Conference on Information Retrieval & Knowledge Management (CAMP)*, 348–52.
5. Bakar, Azuraini Abu and Choo-Yee Ting. 2011. "Soft Skills Recommendation Systems for IT Jobs: A Bayesian Network Approach." In *2011 3rd Conference on Data Mining and Optimization (DMO)*, pp. 82–87.
6. Boyeena, Manoy, and Prakash Goteti. 2011. "A Blended Approach to Course Design and Pedagogy to Impart Soft Skills: An IT Company's Experiences from Software Engineering Course." In *IEEE Technology Students' Symposium*, pp. 6–10.
7. Braught, Grant, Craig S. Miller, and David Reed. 2004. "Core Empirical Concepts and Skills for Computer Science." In *Proceedings of the 35th SIGCSE technical symposium on Computer science education SIGCSE '04*, pp. 245–249.
8. Calitz, Andre P., Jean H. Greyling, and Margaret D. M. Cullen. 2011. "ICT Career Track Awareness amongst ICT Graduates." In *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment - SAICSIT '11*, pp. 59–68.
9. Cappel, James J. 2001. "Entry-Level IS Job Skills: A Survey of Employers." *Journal of Computer Information Systems* 42(2): 76–82.
10. Carter, Lori. 2011. "Ideas for Adding Soft Skills Education to Service Learning and Capstone Courses for Computer Science Students." In *Proceedings of the 42nd ACM Technical Symposium on Computer Science Education - SIGCSE '11*, pp. 517–522.
11. Cheney, Paul H., David P. Hale, and George M. Kasper. 1990. "Knowledge, Skills and Abilities of Information Systems Professionals: Past, Present, and Future." *Information & Management* 19(4): 237–247.
12. Darrah, Marjorie, Rebecca Giorcelli, and Tracie Dodson. 2007. "A Comprehensive Program for Expanding Pathways to IT Careers." In *Proceedings of the 8th ACM SIGITE Conference on Information Technology Education - SIGITE '07*, pp. 195–200.
13. Deng, Changshou, Yuan Mei, and Qing Xie. 2009. "Job Position Oriented Experiment Courses of Computer Science." In *International Conference on Information Engineering and Computer Science ICIECS 2009*, pp. 1–4.
14. Donohue, Patrick, and Norah Power. 2012. "Legacy Job Titles in IT: The Search for Clarity." In *Proceedings of the 50th Annual Conference on Computers and People Research - SIGMIS-CPR '12*, pp. 5–10.
15. Fan, Jianbo, Liangxu Liu, Rina Su, Hua Yu, and Qingfeng Li. 2011. "Reform and Practice of Training Engineering Professionals in 2C+E Computer Science." In *2011 IEEE 10th International Conference on Trust, Security and Privacy in Computing and Communications*, pp. 1308–1312.
16. Fang, Xiang, Sooun Lee, and Seokha Koh. 2005. "Transition of Knowledge/skills Requirement for Entry-Level Is Professionals: An Exploratory Study Based on Recruiters' Perception." *Journal of Computer Information Systems* 46(1): 58–70.
17. Fernandez-Sanz, L. 2010. "Analysis of Non Technical Skills for ICT Profiles." In *2010 5th Iberian Conference on Information Systems and Technologies (CISTI)*, pp. 1–5.
18. Figl, Kathrin, and Renate Motschnig. 2008. "Researching the Development of Team Competencies in Computer Science Courses." In *2008 38th Annual Frontiers in Education Conference*, pp. S3F – 1–S3F – 6.
19. Gallagher, Kevin P, Tim Goles, Stephen Hawk, Judith C. Simon, Kate M. Kaiser, Cynthia M. Beath, and Wm Benjamin Martz Jr. 2011. "A Typology of Requisite Skills for Information Technology Professionals." In *2011 44th Hawaii International Conference on System Sciences*, pp. 1–10.

20. Gallivan, Michael J., Duane P. Truex III, and Lynette Kvasny. 2004. "Changing Patterns in IT Skill Sets 1988-2003: A Content Analysis of Classified Advertising." *Data Base for Advances in Information Systems* 35(3): 64–87.
21. Gardiner, Adrian, Vladan Jovanovic, and Han Reichgelt. 2004. "Second Thoughts about a Career in IT?" In *Proceedings of the 5th Conference on Information Technology Education - CITC5 '04*, pp. 194–201.
22. Goles, Tim, Stephen Hawk, and Kate M. Kaiser. 2008. "Information Technology Workforce Skills: The Software and IT Services Provider Perspective." *Information Systems Frontiers* 10 (2): 179–194.
23. Hagan, Dianne. 2004. "Employer Satisfaction with ICT Graduates," In *Proceedings of the Sixth Australasian Conference on Computing Education ACE '04*, Australian Computer Society. pp. 119–123
24. Hazzan, Orit, and Gadi Har-Shai. 2013. "Teaching Computer Science Soft Skills as Soft Concepts." In *Proceeding of the 44th ACM Technical Symposium on Computer Science Education - SIGCSE '13*, pp. 59–64.
25. Hazzan, Orit, and Gadi Har-Shai. 2014. "Teaching and Learning Computer Science Soft Skills Using Soft Skills: The Students' Perspective." In *Proceedings of the 45th ACM Technical Symposium on Computer Science Education - SIGCSE '14*, pp. 567–572.
26. Huang, Haiyan, Lynette Kvasny, K. D. Joshi, Eileen Trauth, and Jan Mahar. 2009. "Synthesizing IT Job Skills Identified in Academic Studies, Practitioner Publications and Job Ads." In *Proceedings of the Special Interest Group on Management Information System's 47th Annual Conference on Computer Personnel Research - SIGMIS-CPR '09*, pp. 121–128.
27. Intayoad, Wacharawan. 2014. "PBL Framework for Enhancing Software Development Skills: An Empirical Study for Information Technology Students." *Wireless Personal Communications* 76(3):419–433.
28. Janz, Brian D., and Ernest L. Nichols. 2010. "Meeting the Demand for IT Employees: Can Career Choice be Managed?." In *Proceedings of the 2010 Special Interest Group on Management Information System's 48th Annual Conference on Computer Personnel Research - SIGMIS-CPR '10*, pp. 8–14.
29. Jiangyu Li. 2009. "Theoretical Study and Practice on Training Model of Information Technology Competency for College Students." In *2009 4th International Conference on Computer Science & Education*, pp. 1820–1824.
30. Joseph, Damien, Soon Ang, and Sandra Slaughter. 1999. "Soft Skills and Creativity in IS Professionals," *Proceedings of the 32nd Hawaii International Conference on System Sciences*, pp 1–5.
31. Kabicher, Sonja, Renate Motschnig-Pitrik, and Kathrin Figl. 2009. "What Competences Do Employers, Staff and Students Expect from a Computer Science Graduate?" In *2009 39th IEEE Frontiers in Education Conference*, pp. W1E-1 – W1E-6.
32. Lee, Choong Kwon. 2005. "Transferability of Skills over the IT Career Path." In *SIGMIS CPR'05 - Proceedings of the 2005 ACM SIGMIS CPR Conference on Computer personnel research*, pp. 85–93.
33. Lee, Denis M.S., Eileen M. Trauth, and Douglas Farwell. 1995. "Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/industry Investigation." *MIS Quarterly: Management Information Systems* 19(3): 313–40.
34. Lee, Kyootai, and Dinesh Mirchandani. 2010. "Dynamics of the Importance of IS/IT Skills." *Journal of Computer Information Systems* 50(4): 67–78.
35. Levano, Marcos A., and Oriel A. Herrera. 2012. "Validation Strategies of Competences in a Computer Science Curriculum." In *2012 31st International Conference of the Chilean Computer Science Society*, pp. 9–11.
36. Litecky, Charles R., Kirk P. Arnett, and Bipin Prabhakar. 2004. "The Paradox of Soft Skills versus Technical Skills in Is Hiring." *Journal of Computer Information Systems* 45(1): 69–76.
37. Litecky, Chuck, Bipin Prabhakar, and Kirk Arnett. 2006. "The IT/IS Job Market: A Longitudinal Perspective." In *Proceedings of the 2006 ACM SIGMIS CPR Conference on Computer Personnel Research Forty Four Years of Computer Personnel Research: Achievements, Challenges & the Future - SIGMIS CPR '06*, pp. 50–52.
38. Mammadova, Masuma, and Faig Mammadzadeh. 2012. "Formation of Supply and Demand for IT Specialists on the Base of Competency Model." In *2012 IV International Conference Problems of Cybernetics and Informatics (PCI)*, pp. 1–3.
39. Miller, Craig S., and Lucia Dettori. 2008. "Employers' Perspectives on It Learning Outcomes." In *Proceedings of the 9th ACM SIGITE Conference on Information Technology Education - SIGITE '08*, pp. 213–218.
40. Moe, Carl Erik, and Maung Kyaw Sein. 2001. "Meeting the IT-Skill Shortage in Europe Head-On: Approaching in Unison from Practice and Academia." In *Proceedings of the 2001 ACM SIGCPR Conference on Computer Personnel Research - SIGCPR '01*, pp. 29–36.
41. Nelson, H. James, Altaf Ahmad, Nancy L. Martin, and Charles R. Litecky. 2007. "A Comparative Study of IT/IS Job Skills and Job Definitions." In *Proceedings of the 2007 ACM SIGMIS CPR Conference on 2007*

- Computer Personnel Research: The Global Information Technology Workforce - SIGMIS-CPR '07, pp. 168-170.
42. Nelson, R. Ryan. 1991. "Educational Needs as Perceived by IS and End-User Personnel: A Survey of Knowledge and Skill Requirements." *MIS Quarterly* 15 (4):503-525.
 43. Orr, Jo, and Liisa von Hellens. 2000. "Skill Requirements of IT&T Professionals and Graduates: An Australian Study Research-in-Progress." In *Proceedings of the 2000 ACM SIGCPR Conference on Computer Personnel Research - SIGCPR '00*, pp. 167-170.
 44. Peng, Xu. 2011. "Exploration and Practice of Training Practical IT Professionals by the Cooperation of the University and Enterprises." In *2011 IEEE 3rd International Conference on Communication Software and Networks (ICCSN)*, 268-271.
 45. Prabhakar, Bipin, Charles R. Litecky, and Kirk Arnett. 2005. "IT Skills in a Tough Job Market." *Communications of the ACM* 48(10): 91-94.
 46. Ross, Jeanne, and Karen Ruhleder. 1993. "Preparing IS Professionals for a Rapidly Changing World: The challenge for IS educators." In *Proceedings of the 1993 Conference on Computer Personnel Research - SIGCPR '93*, pp. 379-384.
 47. Shi, Hao. 2008. "Maximising Computer Science Student Career Opportunity through ICT Industry Placements." In *2008 International Multi-Symposiums on Computer and Computational Sciences*, pp. 228-231.
 48. Simmons, Chris B., and Lakisha L. Simmons. 2010. "Gaps in the Computer Science Curriculum: An Exploratory Study of Industry Professionals." *Journal of Computing Sciences in Colleges* 25(5): 60-65.
 49. Smits, Stanley J., Ephraim R. Mclean, and John R. Tanner. 1992. "Managing High-Achieving Information Systems Professionals." In *Proceedings of the 1992 ACM SIGCPR conference on Computer personnel research SIGCPR '92*, pp. 314-327.
 50. Tharp, Alan L. 2007. "Innovating: The Importance of Right Brain Skills for Computer Science Graduates." In *Proceedings of the 12th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education - ITiCSE '07*, pp. 126-30.
 51. Todd, Peter A., James D. McKeen, and R. Brent Gallupe. 1995. "The Evolution of IS Job Skills: A Content Analysis of IS Job Advertisements from 1970 to 1990." *MIS Quarterly: Management Information Systems* 19(1): 1-27.
 52. Tye, Eugenia M.W.Ng, Ray S.K. Poon, and Janice M. Burn. 1995. "Information Systems Skills: Achieving Alignment between the Curriculum and the Needs of the IS Professionals in the Future." *DATABASE for Advances in Information Systems* 26(4): 47-61.
 53. Vesisenaho, Mikko, Helena Puhakka, Jussi Silvonen, Erkki Sutinen, Marjatta Vanhalakka-Ruoho, Pirkko Voutilainen, and Leena Penttinen. 2009. "Need for Study and Career Counselling in Computer Science." In *2009 39th IEEE Frontiers in Education Conference*, pp. W2B-1 - W2B-6.
 54. Yen, David C., Houn-Gee Chen, Sooun Lee, and Seokha Koh. 2003. "Differences in Perception of IS Knowledge and Skills between Academia and Industry: Findings from Taiwan." *International Journal of Information Management* 23(6): 507-522.

Appendix D: Request for permission to conduct case study research



European Union
Investing in future
Project co-financed by the European Union from the European Social Fund



*Research fellowships for professional development of young researchers and postdoc
HR.3.2.01-0154 Development of a model for supporting graduates early careers*

[Institution name]

In Varaždin, 21st August 2015

REQUEST FOR PERMISSION TO CONDUCT CASE STUDY RESEARCH

Dear *[the name of Institution representative the request was addressed to]*,

My name is Katarina Pažur Aničić and I'm working as a research & teaching assistant and PhD candidate at the University of Zagreb, Faculty of Organization and Informatics, Croatia. As a young researcher I am a beneficiary of project financed by European Social Fund that deals with *Development of a model for supporting graduates early careers* and is closely connected with my PhD research that is currently in the middle stage. My research supervisor is prof. Blaženka Divjak, PhD, from the University of Zagreb, Faculty of Organization and Informatics, Croatia.

The aim of research is to develop strategic framework with accompanying maturity model for higher education institutions that will help them to support early career development of their graduates.

Research proposal includes conducting several case study researches at higher education institutions in Europe, in order to determine all the relevant elements of higher education institutions in supporting graduates' early careers. Case study research itself consider semi-structured interviews with key players, including vice-rector (or equivalent) for students and study programmes, directors/heads of career support and student counselling centers and counselors in such centers, quality assurance experts/advisors and other key persons that can provide relevant information on processes in higher education institutions concerning career development of graduates.

I have recognized *[Institution name]* as a prominent research case study, as it is one of the leading universities in Europe and worldwide, and hereby I am seeking your consent to conduct case study research at your institution.

All the travel and accommodation costs for one week study visit are covered within the project for young researchers financed by European Social Fund.

If you are interested, upon the completion of the study I can provide *[Institution name]* with a copy of research report as well as instruments and models developed in the scope of the research.

I sincerely hope you will find some time to help me with my research.

Thank you in advance.

Sincerely,

Katarina Pažur Aničić
Young researcher
kpazur@foi.hr

Prof. Blaženka Divjak
Supervisor
bdivjak@foi.hr

Appendix E: Informed Consent form



European Union
Investing in Future
Project co-financed by the European Union from the European Social Fund



INFORMED CONSENT

This Informed Consent Form has two parts:

- Information Sheet (to share information about the research)
 - Certificate of Consent (for signatures if you choose to participate)
- You will be given a copy of the full Consent Form.

PART I: INFORMATION SHEET

PROJECT.

Research fellowships for professional development of young researchers and postdoc - HR.3.2.01-0154 "Development of a model for supporting graduates early careers"

PRINCIPLE INVESTIGATOR.

Katarina Pažur Aničić, M.Inf.

Faculty of Organization and Informatics, Pavlinska 2, HR-42000 Varaždin, Croatia; E: kpazur@foi.hr; T: +385 99 3990714

MENTOR.

Prof. Blaženka Divjak, PhD

ORGANIZATION.

Faculty of Organization and Informatics, University of Zagreb
Pavlinska 2, HR-42000 Varaždin, Croatia

ABOUT THE RESEARCH.

The project *Development of a model for supporting graduates early careers* is conducted within the research fellowship for young researchers funded by the European Social Fund at the Faculty of Organization and Informatics, University of Zagreb. The project will result with the theoretical strategic framework for supporting graduates in their career development within higher education institutions (HEI) including the application of accompanying maturity model within the education of future ICT professionals. The research includes several case study researches at HEI in Europe, in order to determine all the relevant elements of higher education institutions in supporting graduates' early careers. Case study research itself includes semi-structured interview with key players, including vice-rectors (or equivalent) for students and study programmes, directors/heads of career support and student counselling centres and councillors in such centres, quality assurance experts/advisors and other key persons that can provide relevant information on processes on a higher education institution concerning career development of graduates.

BENEFITS.

In a broad sense the project will affect project stakeholders – students, alumni, employers and higher education institutions that will use the project outputs as a tool for the problem resolving regarding some graduates' employment issues but also as a guidelines for creating stimulating policies on individual, institutional and national level.

More specifically, since the research results will be available to the institution and participants in the form of strategic framework with accompanying maturity model including guidelines for HEIs, they will be able to use them to improve the maturity of their processes.

PROCEDURES.

Although the research includes the participation of individuals the

subject/case of the research are higher education institutions and not individuals that will be interviewed within the project. It is expected from the participating individuals to provide objective information about some processes and practices related to their role at the institution, not about their personal opinions, attitudes, values etc.

During the interview the interviewer will sit down with a participant in a comfortable place at the Faculty. The interview will be semi-structured including the possibility for the participants to amend the questions according to their positions, knowledge and experience. If a participant does not wish to answer any of the questions during the interview, he/she may say so and the interviewer will move on to the next question.

The entire interview will be tape-recorded. Since the information recorded is considered confidential we will make all legal and necessary actions to protect the confidentiality of the data provided and to deny the access to any third party. However, the interview transcripts will be presented/published as integrated materials in the final model of this research.

The list of questions will be available to the participants in written form prior to the interview date.

PUBLISHING.

Research results will be published in the form of PhD dissertation, scientific papers, on project webpage, in the project booklet and within project reports submitted to the funding organization.

Furthermore, any quotations of participants will not be published without being checked with each participant before the publication. The participants will be provided with the case study research results and will be invited to check, comment or add anything else they will consider necessary.

The identification of the participants will appear only as a list of persons involved and their positions at the institution.

DURATION.

The research takes place over 15 months in total. During that time, we will interview each participant on one occasions and each interview will last for about one hour. All the participants will be also invited to conduct the evaluation of the model resulting from the research. The participation in the evaluation will be also on voluntary basis and will occur a few months after the interviews.

PARTICIPATION AND PARTICIPANT SELECTION.

The participation in this research is on the voluntary basis and participants hold the rights to refuse or withdraw. Please note that an individual does not have to take part in this research if he/she does not wish to do so. The participant may stop participating in the interview at any time that he/she wishes.

The selection of the participating institution is based on the set of different criteria among which the development of comprehensive institutional support for their graduates' employability is the most significant.

REIMBURSEMENTS.

The participants will not be provided any reimbursement to take part in the research but will receive the Certificate of Participation together with the booklet of research results.

WHO TO CONTACT.

If you have any questions, please ask immediately or contact the principle investigator later.



European Union
Investing in future
Project co-financed by the European Union from the European Social Fund



INFORMED CONSENT

PART II: CERTIFICATE OF CONSENT

STATEMENT BY THE PARTICIPANT

I have been invited to participate in research *Development of a model for supporting graduates early careers* and to provide, within the interview, objective information about some processes and practices related to my role at the institution, not about my personal opinions, attitudes, values etc.

The project will result with the theoretical strategic framework for supporting graduates in their career development within higher education institutions (HEI) including the application of accompanying maturity model within the education of future ICT professionals.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

PRINT NAME OF PARTICIPANT

FUNCTION

SIGNATURE OF PARTICIPANT

DATE _____

DAY/MONTH/YEAR

STATEMENT BY THE RESEARCHER/PERSON TAKING CONSENT

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the procedure that will be done.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Consent has been provided to the participant.

PRINT NAME OF RESEARCHER/
PERSON TAKING THE CONSENT

SIGNATURE OF RESEARCHER /
PERSON TAKING THE CONSENT

DATE _____

DAY/MONTH/YEAR

Appendix F: Case study protocol



European Union
Investing in future
Project co-financed by the European Union from the European Social Fund



*Research fellowships for professional development of young researchers and postdoc
HR.3.2.01-0154 Development of a model for supporting graduates early careers*

PART I. INFORMATION SHEET

RESEARCH OBJECTIVES

1. To develop strategic framework for supporting higher education graduates' early careers
2. To create accompanying maturity model for study programmes in information and communication technologies (ICT)

PURPOSE OF CONDUCTING CASE STUDY RESEARCH

To explore and analyse all relevant practices of higher education system that contribute to the better employability of graduates, through interviews with key persons at higher education institutions.

PRINCIPLE INVESTIGATOR

Katarina Pažur Aničić, M.Inf.

Faculty of Organization and Informatics, Pavlinska 2, HR-42000 Varaždin, Croatia;

E: kpazur@foi.hr; T: +385 99 3990714

MENTOR

Prof. Blaženka Divjak, PhD

Faculty of Organization and Informatics, Pavlinska 2, HR-42000 Varaždin, Croatia;

PART II. DATA COLLECTION PROCEDURES

Data collection procedures are described in detail in the *Informed Consent* form available to all participants prior to the interview.

PART III. CASE STUDY QUESTIONS

During the interview, each participant will be answering only the questions related to his/her area of work/expertize, but is as well welcome to contribute to other questions if he/she wants. General questions available in this document may also be amended with the related sub-questions during the interview.

III.a. Strategic planning

1. Can you tell me something about the strategic planning process at your institution?
2. Do the strategies at your institution include employability of students and to which extent (separate strategy, part of another strategy)?
3. Which stakeholders are included in the process of strategic planning/strategy design (students, employers, alumni...), and to which extent (informal, semi-formal, formal)?
4. Does your institution, and on which basis, do the evaluation of strategy?
5. On which basis does your institution do the revision of strategy? Which information do you use in that process and how do you collect them?
6. How do you evaluate a success of your strategy regarding the employability of graduates?
7. Is your strategy accompanied with action plans at the level of different organizational units?

III.b. Curriculum

1. Can you tell me something about the curriculum development process at your institution?
2. How is the employability of graduates included in the curriculum development process?
3. Which stakeholders are included in the process of curriculum development (students, employers, alumni...), and to which extent (informal, semi-formal, formal)?
4. On which basis does your institution do the revision of curriculum for a certain study programme?
5. Are there some specifics in curriculum development process for study programmes in information and communication technologies?
6. How do you evaluate a success of curriculum for a certain study programme regarding the employability of graduates? Do you use feedback from students within curriculum revision?
7. What is the role of learning outcomes in curriculum design and delivery? How are they connected to the European Qualifications Framework and National Qualifications Framework?
8. How are the employability and employability competences (generic and transferable) included in curriculum content?
9. Is there an institutional support for students in continuous development of their personal planning (*Personal Development Planning*) within curriculum or in the form of extra-curricular activities? Is there any online support for this kind of activities, such as an e-portfolio?
10. How is the mentorship program organized, does each student have a personal mentor? What is the profile of mentors (teachers, senior students...)?
11. Can you describe some teaching methods that are popular as a way to improve students' employability? Are there some examples of work-based learning, problem-based learning, project-based learning etc.?

12. How is the students' assessment performed, do you use methods like *self-assessment* and *peer-assessment*?
13. What kind of support activities are available for teachers that help them in preparing their students for employment?
14. How is the teachers' performance measured?

III.c. Student Support

1. Can you tell me what kind of student services are available at your institution?
2. Can you briefly describe the structure and main purpose of your career centre (or any other centre/service), how the centre's management is organized, who makes and approves yearly action plan, how is the centre financed?
3. Who are the main clients/customers of your services (students, employers, teaching staff, alumni..)?
4. Can you describe the main activities the centre provides for its main customers/target groups?

III.d. Extra-curricular activities

1. Can you tell me what kind of extra-curricular activities are organized/exist at your institution (different kind of student competitions, summer schools, workshops in collaboration with employers, volunteering etc.)?
2. How is the recognition system of extra-curricular activities organized at the level of university or particular school/programme?
3. How does your institution support and foster students to take part in different extra-curricular activities?
4. Which student organizations are active at your university, related to students in ICT, but also in general?
5. Do you support students' entrepreneurship initiatives, for example student start-ups?

III.e. Collaboration with industry

1. Could you describe the collaboration of your institution with industry?
2. Could you describe some of the main activities in collaboration with industry focused to better employability of graduates?
3. Are the industry representatives formally involved in different decision-making bodies or committees (for strategic planning, curriculum development etc.) at your institution?
4. How is the collaboration with industry organized within different study programmes, particularly within School of Informatics?
5. Are there some invited lectures, visits to companies, project task, internships etc. in collaboration with industry as a formal part of curriculum?

6. Could you describe the collaboration of your institution with local community?

III.g. Alumni

1. Could you describe how is the alumni office organized at your institution?
2. Are there some formal procedures of graduates tracking and their career development upon graduation?
3. Are the alumni formally involved in different decision-making bodies or committees (for strategic planning, curriculum development etc.) at your institution?
4. Are there some data collection procedures about alumni satisfaction with their study at your university, is there a practice of using these data for the improvement of certain processes?

Appendix G: Invitation letter to participate in model evaluation



European Union
Investing in future
Project co-financed by the European Union from the European Social Fund



*Research fellowships for professional development of young researchers and postdoc
HR.3.2.01-0154 Development of a model for supporting graduates early careers*

In Varaždin, 8th April 2016

INVITATION LETTER TO PARTICIPATE IN MODEL EVALUATION

Dear Sir/Madam,

My name is Katarina Pažur Aničić and I'm working as a research & teaching assistant and PhD candidate at the University of Zagreb, Faculty of Organization and Informatics, Croatia. As a young researcher I am a beneficiary of a project financed by European Social Fund that deals with the *Development of a model for supporting graduates early careers* and is closely connected with my PhD research that is currently in the middle stage. My research supervisors are prof. Blaženka Divjak, PhD, from the University of Zagreb, Faculty of Organization and Informatics, Croatia, and Assoc. prof. Samo Pavlin, PhD, from the University of Ljubljana, Faculty of Social Sciences.

The aim of the research is to develop **strategic framework with accompanying maturity model** for higher education institutions (HEI) that will help them to support early career development of their graduates.

For the purpose of model design, I have conducted four case study researches at different HEIs in Europe, in order to determine all the relevant elements of HEI in supporting graduates' early careers. The mentioned case study researches were conducted at: 1) University of Belgrade, Faculty of Organizational Sciences, Republic of Serbia, 2) University of Edinburgh, UK, 3) Faculty of Economics and Business Vienna, Austria and 4) University West, Sweden.

In order to define the final model, it needs to be evaluated by different HEI stakeholders. The evaluation shall include the assessment of the importance of recognized practices according to four key process areas: *strategy development, curriculum design and delivery, student support and extra-curricular activities*. It is of vital importance that the model evaluation is done correctly because it provides a basis for the development of final maturity model.

This pool of different HEI stakeholders includes altogether **around 30 carefully chosen experts** so your feedback will be highly appreciated. The estimated time needed for the evaluation is **approximately 1 hour**. For that purpose, I have prepared the Excel spreadsheets together with short guidelines, attached to this letter. Since the study is conducted within the EU funded project this evaluation is part of the strict project activity plan so I would need your valuable feedback as soon as possible and, if possible, **before April 22nd 2016**.

Upon the completion of the study I will provide you with the Certificate of Participation together with the booklet of research results with instruments and models developed in the scope of the research.

I sincerely hope you will find some time to help me with my research and thank you in advance for your time and effort.

Sincerely,

Katarina Pažur Aničić
Young researcher
kpazur@foi.hr

Full Prof. Blaženka Divjak
Project supervisor
bdivjak@foi.hr



European Union
Investing in future
Project co-financed by the European Union from the European Social Fund



*Research fellowships for professional development of young researchers and postdoc
HR.3.2.01-0154 Development of a model for supporting graduates early careers*

INSTRUCTIONS FOR EVALUATING THE INITIAL STRATEGIC FRAMEWORK

1) The goal of this phase of research is to ensure validity of the strategic framework in the following aspects:

- Strategic framework contains **only necessary** higher education practices by rating the importance of each practice
- Strategic framework contains **all the relevant** practices related to supporting graduates employability, for which you are invited to add practices that you find are missing or necessary.
- Each practice is assigned to **only one category** (key process area)
- All the practices are **clear enough** for the potential respondents, for which you are invited to add comments and propose reformulated statements.

2) Document is structured as follows:

- User data** – please fill in the information about yourself
- Evaluation form** – please evaluate practices according to the following instructions:

Column C - please evaluate each practice as following:

- 0 = put zero if you believe you are not the right person to rank a specific statement
- 1 = not important
- 2 = important (but not essential)
- 3 = essential

Column D – please indicate why you cannot respond to the practice OR explain the reason(s) if you think this practice should be modified/reworded

Column E - if you think this practice should be reworded, do it here

Columns F-J - please assign each practice to one of the four main key process areas*:

Strategic planning – practices related to strategic planning in HEI, with the focus on planning related to graduates employability

Curriculum design and delivery – practices related to curriculum design and delivery, including curriculum aims, learning outcomes, teaching and assessment methods etc.

Student support – practices related to different student support services within HEI, such as career services, academic services and related activities

Extra-curricular activities – Practices related to organization and recognition of student participation in extra-curricular activities such as student competitions, different student organizations etc.

Other - If you think that a certain practice belongs to another key process area, outside the four mentioned, please indicate the name of that key process area.

** Practices within each key process area cover four steps of strategic planning cycle: plan, do (implementation), check (monitoring), act (continuous improvement).*

Rows 115 onward - If you find some statements missing but necessary for supporting graduates early career development within HEI, please: 1) add them at the end of the Evaluation form (Column B, Row 115 and below); 2) rank them (Column C) and 3) assign them to the corresponding category (Columns F-J).

Model evaluation template

| HIGHER EDUCATION INSTITUTION PRACTICES | | Importance of <i>practice</i> for supporting students career development within higher education institutions (0 - 3) 1 - Not relevant 2 - Important (but not essential) 3 - Essential 0 - Can not answer | If you can not respond to the practice OR you think this practice should be modified/ reworded, please explain it here; OTHERWISE leave it blank | If you think this practice should be modified/ reworded, please do it here (if you agree with the practice or if you could not rank the practice leave it blank) | Which <i>key process area</i> do you think the practice belongs to? (Mark field with X: only one possible answer for each item) | | | | |
|--|---|---|--|--|---|---|--|---|---|
| | | | | | Strategic planning | Curriculum design and delivery | Student support | Extra-curricular activities | Other |
| | | | | | <i>Strategic planning in HEI, with the focus on planning related to graduates employability</i> | <i>Curriculum aims, learning outcomes, teaching and assessment methods etc.</i> | <i>Career services, academic services and related activities</i> | <i>Student competitions, different student organizations etc.</i> | <i>Please indicate the name of another key process area</i> |
| 1 | Procedures for re(development) of institutional strategies and policies are defined. | | | | | | | | |
| 2 | Information from tracer studies are used in the re(development) of institutional strategies and policies. | | | | | | | | |
| | ... | | | | | | | | |
| | ... | | | | | | | | |
| | ... | | | | | | | | |
| 109 | Work of student representatives is guided and monitored by institutional staff. | | | | | | | | |
| 110 | Potential improvements in the student representatives system are discussed at the institutional level. | | | | | | | | |
| If you think some additional statement(s) is needed, please: 1. add it below, 2. rate it and 3. indicate which construct it belongs to | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | HIGHER EDUCATION INSTITUTION PRACTICES |
|----|---|
| 1 | Procedures for re(development) of institutional strategies and policies are defined. |
| 2 | Information from tracer studies are used in the re(development) of institutional strategies and policies. |
| 3 | Inputs from students are included in the re(development) of institutional strategies and policies. |
| 4 | Inputs from relevant stakeholders are included in the re(development) of institutional strategies and policies. |
| 5 | Inputs from (inter)national policy documents are used in the re(development) of institutional strategies and policies. |
| 6 | Inputs from relevant higher education institution (HEI) organizational units are included in the re(development) of institutional strategies and policies. |
| 7 | Employability of graduates is addressed in institutional strategies and policies. |
| 8 | Institutional strategies and policies are communicated across the higher education institution. |
| 9 | Institutional strategies and policies are accompanied with action plans. |
| 10 | Initiatives supporting graduates employability are addressed in action plans. |
| 11 | Procedures for monitoring of institutional strategies and policies are defined. |
| 12 | Reports on success of action plans are collected from different organizational units within HEI. |
| 13 | Feedback from student satisfaction survey is used for better understanding of institutional strategy success. |
| 14 | Strategy success or failure is analysed before starting with new strategic planning process within HEI. |
| 15 | Compliance of strategy with changes in the external or internal environment is checked. |
| 16 | Procedures for curriculum design and development are established at the institutional level. |
| 17 | Curriculum development is guided with student centred approach in which employability skills are considered to be inter-related and need to be developed incrementally across the curriculum. |
| 18 | Inputs from employers are included in curriculum design and development process. |
| 19 | Construction of learning outcomes is based on relevant national and international frameworks. |
| 20 | Departments work together on creation of coherent content for a certain study programme. |
| 21 | New pedagogic approaches that contribute to the achievement of learning outcomes are planned within the process of curriculum design. |
| 22 | Formal procedures for student internship are established. |
| 23 | Provision of elective courses in curriculum is planned. |
| 24 | Curriculum is delivered in partnership with industry. |
| 25 | Career development content is included in curriculum. |
| 26 | Professional and generic skills important for employability in the subject area are addressed in learning outcomes. |
| 27 | Interrelation between content of different courses is established. |
| 28 | Teaching methods encourage independent, active learning and engagement with tasks (every student as a researcher/practitioner). |
| 29 | Curriculum contains embedded work related activities. |
| 30 | Student internship is an integral part of curriculum. |
| 31 | High-levels of student choice and 'self-selected' courses are offered within curriculum. |
| 32 | Student theses are done in cooperation with the industry. |
| 33 | Teaching and learning activities are taking place in adequate working environment. |
| 34 | Teaching and learning activities are supported with e-learning system. |
| 35 | Assessment methods include students self-assessment and peer assessment. |
| 36 | Students are provided proper feedback on the achievement of learning outcomes. |
| 37 | Curriculum relevance, consistency, practicality and effectiveness are monitored. |
| 38 | Student feedback on curriculum implementation is collected. |

| | |
|----|---|
| 39 | Quality of the assessment of student work is monitored. |
| 40 | Feedback on internship is collected from students and employers. |
| 41 | Changes in internal or external environments are trigger for changes in curriculum. |
| 42 | Communication with the relevant stakeholders is done in order to ensure regular update of learning outcomes in line with the labour market needs. |
| 43 | Strengths and weaknesses of current study programme are discussed prior to new curriculum design and development. |
| 44 | Procedures and guidelines for the evaluation of teacher work are established. |
| 45 | Continuous professional development of teachers is encouraged. |
| 46 | Support for teachers to implement new technology in courses is provided. |
| 47 | Teacher performance is evaluated by students. |
| 48 | Teachers receive peer feedback for their work. |
| 49 | Control mechanism based on the evaluation of teacher performance are established. |
| 50 | Results of teacher performance are discussed for the potential improvement. |
| 51 | Careers development service for students is established. |
| 52 | Annual action plan for the careers development service is prepared. |
| 53 | Institution has signed partnership agreements with employers regarding the activities related to employability. |
| 54 | Information on job opportunities and labour market is available to students. |
| 55 | Information about alumni employment and career is available to students. |
| 56 | Career information is available to student through the organized career fair. |
| 57 | Service of reviewing and correcting job application is offered to students. |
| 58 | Simulation of job interviews is provided to students in collaboration with employers. |
| 59 | Institution provides assistance to employers in recruiting new employees. |
| 60 | Visits to companies are organized for students. |
| 61 | Employer invited lectures or workshops are organized for students. |
| 62 | Alumni invited lectures are organized for students. |
| 63 | Individual career counselling is offered to students. |
| 64 | Psychometric testing is available to students. |
| 65 | Alumni database is established. |
| 66 | Information on the number of students using career services is collected. |
| 67 | Analytical data is used for monitoring of the reach of online student engagement with careers service information. |
| 68 | Information on the number of students attending career fair is collected. |
| 69 | Students feedback on the usefulness of career services provided is collected. |
| 70 | Students engagement in career services activities is monitored and regulated. |
| 71 | Information about the graduates employment are collected. |
| 72 | Information on graduates satisfaction and readiness for work are collected. |
| 73 | Evaluation of careers service activities is done. |
| 74 | Graduate profiles for study programmes are available to students entering the university. |
| 75 | Framework for the provision of student academic development is established. |
| 76 | Students are encouraged and supported to conduct their own portfolio. |
| 77 | Support for student academic development is provided. |
| 78 | Student peer support activities regarding academic and social development are provided. |
| 79 | Personal tutoring system for students is organized. |
| 80 | Mentorship for excellent students is provided. |
| 81 | Support for students with disabilities is provided. |
| 82 | Student peer support system is monitored. |
| 83 | Personal tutor monitors student progress. |
| 84 | Personal tutor reacts on student progress. |
| 85 | Framework for support of student extra-curricular activities is established. |
| 86 | Framework for supporting student entrepreneurship initiatives is established. |
| 87 | Students are provided with adequate working environment for their extra-curricular activities. |

| | |
|-----|--|
| 88 | Students are given support to work on their own projects. |
| 89 | Students are encouraged to participate in different competitions. |
| 90 | Students are offered different summer programmes. |
| 91 | Students are offered volunteering opportunities. |
| 92 | Students are offered different sports activities. |
| 93 | Institution provides students with entrepreneurship education. |
| 94 | Institution provides support for student start-ups. |
| 95 | Student achievement in extra-curricular activities is recognized. |
| 96 | Potential improvements in support of student extra-curricular activities are discussed at the institutional level. |
| 97 | Framework for support of student organizations is established. |
| 98 | Student organizations prepare annual plans of their activities. |
| 99 | Students are involved in the work of student organizations. |
| 100 | Teachers support work of student organizations through mentorship programme. |
| 101 | Collaboration with different HEI stakeholders is established through the work of student organizations. |
| 102 | Work of student organizations is monitored at the institutional level. |
| 103 | Report on students organization is provided to HEI management. |
| 104 | Institution has established system of student representatives. |
| 105 | Student representatives develop strategic plan. |
| 106 | Students elect their representatives. |
| 107 | Student representatives are gathering feedback from students on different issues. |
| 108 | Student representatives participate in different committees within HEI. |
| 109 | Work of student representatives is guided and monitored by institutional staff. |
| 110 | Potential improvements in the student representatives system are discussed at the institutional level. |

Appendix H: List of experts who participated in the model evaluation

| | Stakeholder group | Position/Function |
|-----|--|--|
| 1. | Higher education manager Teaching staff | Associate professor at the Department of Software Engineering, previous Vice-dean for scientific research |
| 2. | Higher education manager Teaching staff | Associate professor, Vice-dean for education and student affairs |
| 3. | Teaching staff Higher education manager | Assistant professor, previous Vice-dean for academic affairs |
| 4. | Higher education manager Teaching staff | Vice-rector, previous Head of school of research, chairman of the board of education |
| 5. | Higher education manager Teaching staff | Vice-dean for education |
| 6. | Teaching staff | Director of Teaching, previous Lecturer and Personal Tutor |
| 7. | Teaching staff | Lecturer at Department of Applied Mathematics and Computer Science, Deputy Head of Graduate Studies |
| 8. | Teaching staff | Associate professor |
| 9. | Teaching staff | Associate professor, Managing director of Business International Case Competition |
| 10. | Teaching staff Non-teaching staff | Senior Lecturer, Career Centre Counselor with 26 years experience in ICT industry |
| 11. | Teaching staff Non-teaching staff | Assistant professor, Career Centre Leader |
| 12. | Teaching staff Supporting institution | Assistant professor, previous Assistant director general in national Employment Service |
| 13. | Non-teaching staff | Intern at Career Development Centre |
| 14. | Alumni Employer representative | Risk Assurance Associate, previous Student Advisor |
| 15. | Alumni Employer representative | IT consultant and PhD Student in Information sciences |
| 16. | Alumni Employer representative | Senior Information Security Consultant, previous Student Assistant |
| 17. | Supporting institution | Assistant Director in national Agency for science and higher education |
| 18. | Supporting institution | Educational Advising Coordinator |
| 19. | Supporting institution | Expert Adviser in Department for Higher Education |
| 20. | Supporting institution | Senior adviser in career guidance centre, previous Head of the Department of vocational guidance and education |
| 21. | Government | Head of Department for Quality of Higher Education, previous Head of Section for national Qualifications Framework |
| 22. | Government | Head of Sector for Quality of HE, International Cooperation and European Affaires, Directorate for HE and Deputy Head of Forum for lifelong career development |

Appendix I: Full Hamming distance matrix

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | differences | % of differences |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------|------------------|
| 1 | 0 | 42 | 37 | 36 | 42 | 39 | 39 | 37 | 26 | 36 | 35 | 36 | 36 | 36 | 33 | 25 | 43 | 37 | 41 | 37 | 34 | 32 | 36 | 795 | 53% |
| 2 | 42 | 0 | 30 | 30 | 28 | 17 | 39 | 23 | 40 | 15 | 9 | 10 | 13 | 8 | 13 | 23 | 37 | 12 | 26 | 17 | 11 | 24 | 8 | 475 | 32% |
| 3 | 37 | 30 | 0 | 29 | 37 | 28 | 35 | 24 | 33 | 26 | 24 | 27 | 26 | 25 | 26 | 29 | 38 | 28 | 32 | 28 | 24 | 29 | 25 | 640 | 43% |
| 4 | 36 | 30 | 29 | 0 | 34 | 25 | 39 | 21 | 29 | 29 | 27 | 26 | 31 | 26 | 26 | 24 | 41 | 25 | 32 | 26 | 28 | 25 | 26 | 635 | 42% |
| 5 | 42 | 28 | 37 | 34 | 0 | 27 | 42 | 30 | 43 | 28 | 23 | 23 | 25 | 23 | 22 | 32 | 38 | 23 | 39 | 23 | 25 | 28 | 23 | 658 | 44% |
| 6 | 39 | 17 | 28 | 25 | 27 | 0 | 36 | 18 | 33 | 16 | 9 | 9 | 18 | 9 | 13 | 23 | 37 | 13 | 25 | 18 | 11 | 26 | 9 | 459 | 31% |
| 7 | 39 | 39 | 35 | 39 | 42 | 36 | 0 | 37 | 40 | 38 | 36 | 39 | 37 | 37 | 36 | 35 | 40 | 34 | 42 | 38 | 35 | 36 | 37 | 827 | 55% |
| 8 | 37 | 23 | 24 | 21 | 30 | 18 | 37 | 0 | 29 | 18 | 16 | 16 | 25 | 17 | 17 | 25 | 37 | 20 | 24 | 22 | 16 | 20 | 17 | 509 | 34% |
| 9 | 26 | 40 | 33 | 29 | 43 | 33 | 40 | 29 | 0 | 32 | 33 | 34 | 37 | 34 | 31 | 30 | 36 | 38 | 37 | 35 | 32 | 30 | 34 | 746 | 50% |
| 10 | 36 | 15 | 26 | 29 | 28 | 16 | 38 | 18 | 32 | 0 | 8 | 9 | 16 | 7 | 10 | 20 | 31 | 14 | 25 | 14 | 8 | 21 | 7 | 428 | 29% |
| 11 | 35 | 9 | 24 | 27 | 23 | 9 | 36 | 16 | 33 | 8 | 0 | 3 | 10 | 1 | 5 | 19 | 31 | 8 | 22 | 10 | 2 | 19 | 1 | 351 | 23% |
| 12 | 36 | 10 | 27 | 26 | 23 | 9 | 39 | 16 | 34 | 9 | 3 | 0 | 11 | 2 | 6 | 20 | 34 | 9 | 25 | 11 | 5 | 21 | 2 | 378 | 25% |
| 13 | 36 | 13 | 26 | 31 | 25 | 18 | 37 | 25 | 37 | 16 | 10 | 11 | 0 | 9 | 13 | 26 | 37 | 14 | 31 | 18 | 12 | 26 | 9 | 480 | 32% |
| 14 | 36 | 8 | 25 | 26 | 23 | 9 | 37 | 17 | 34 | 7 | 1 | 2 | 9 | 0 | 6 | 19 | 32 | 7 | 23 | 9 | 3 | 20 | 0 | 353 | 24% |
| 15 | 33 | 13 | 26 | 26 | 22 | 13 | 36 | 17 | 31 | 10 | 5 | 6 | 13 | 6 | 0 | 22 | 32 | 13 | 25 | 13 | 7 | 20 | 6 | 395 | 26% |
| 16 | 25 | 23 | 29 | 24 | 32 | 23 | 35 | 25 | 30 | 20 | 19 | 20 | 26 | 19 | 22 | 0 | 34 | 18 | 29 | 20 | 19 | 16 | 19 | 527 | 35% |
| 17 | 43 | 37 | 38 | 41 | 38 | 37 | 40 | 37 | 36 | 31 | 31 | 34 | 37 | 32 | 32 | 34 | 0 | 33 | 34 | 34 | 32 | 34 | 32 | 777 | 52% |
| 18 | 37 | 12 | 28 | 25 | 23 | 13 | 34 | 20 | 38 | 14 | 8 | 9 | 14 | 7 | 13 | 18 | 33 | 0 | 27 | 15 | 10 | 20 | 7 | 425 | 28% |
| 19 | 41 | 26 | 32 | 32 | 39 | 25 | 42 | 24 | 37 | 25 | 22 | 25 | 31 | 23 | 25 | 29 | 34 | 27 | 0 | 22 | 23 | 29 | 23 | 636 | 43% |
| 20 | 37 | 17 | 28 | 26 | 23 | 18 | 38 | 22 | 35 | 14 | 10 | 11 | 18 | 9 | 13 | 20 | 34 | 15 | 22 | 0 | 12 | 18 | 9 | 449 | 30% |
| 21 | 34 | 11 | 24 | 28 | 25 | 11 | 35 | 16 | 32 | 8 | 2 | 5 | 12 | 3 | 7 | 19 | 32 | 10 | 23 | 12 | 0 | 19 | 3 | 371 | 25% |
| 22 | 32 | 24 | 29 | 25 | 28 | 26 | 36 | 20 | 30 | 21 | 19 | 21 | 26 | 20 | 20 | 16 | 34 | 20 | 29 | 18 | 19 | 0 | 20 | 533 | 36% |
| 23 | 36 | 8 | 25 | 26 | 23 | 9 | 37 | 17 | 34 | 7 | 1 | 2 | 9 | 0 | 6 | 19 | 32 | 7 | 23 | 9 | 3 | 20 | 0 | 353 | 24% |

Appendix J: Request for permission to model application



Europska Unija
Ulaganje u budućnost
Projekt je sufinancirala Europska unija iz Europskog socijalnog fonda



Varaždin, 18. svibnja 2016. godine

ZAMOLBA ZA PROVOĐENJE ISTRAŽIVANJA

Poštovani,

moje ime je Katarina Pažur Aničić, radim kao asistentica na Fakultetu organizacije i informatike u Varaždinu te ujedno kao istraživačica na projektu **Razvoj modela za pružanje podrške diplomantima u ranom razvoju karijera** sufinanciranom od strane Europskog socijalnog fonda iz programa Razvoj ljudskih potencijala 2007.-2013. u okviru poziva *Istraživačke stipendije za profesionalni razvoj mladih istraživača i poslijedoktoranada*. Navedeni projekt traje od 30. lipnja 2015. do 30. rujna 2016. godine, a proračun iznosi 260.924,70 kn (udio Europske Unije u financiranju je 100%). Projekt je usko vezan uz istraživanje koje provodim u okviru izrade doktorske disertacije pod mentorstvom **prof.dr.sc Blaženke Divjak** s Fakulteta organizacije i informatike Sveučilišta u Zagrebu te **izv.prof.dr.sc. Same Pavlina** s Fakulteta za društvene znanosti Sveučilišta u Ljubljani.

Cilj ovog projekta jest razviti strateški okvir i model zrelosti za pružanje podrške diplomantima u ranom razvoju karijera, s primjenom na obrazovanje studenata u području informacijsko-komunikacijskih tehnologija (ICT). U dosadašnjem tijeku projekta provedena su istraživanja studije slučaja na četiri europska sveučilišta: 1) University of Belgrade, Faculty of Organizational Sciences, Republic of Serbia, 2) University of Edinburgh, UK, 3) Faculty of Economics and Business Vienna, Austria i 4) University West, Sweden. Kroz provođenje studija slučaja identificirani su primjeri dobrih praksi koji utječu na bolju pripremu studenata za rani razvoj karijera u sustavu visokog obrazovanja (VO) te je kreiran preliminarni strateški okvir i pripadajući model zrelosti koji sadrži primjere dobrih praksi u četiri identificirana ključna procesna područja: **strateško planiranje zapošljivosti diplomanata, razvoj i provođenje kurikuluma, podrška studentima, izvannastavne aktivnosti**.

Kako bih mogla uspješno završiti istraživanje, potrebno je provesti validaciju modela na nekoliko institucija visokog obrazovanja u području ICT-a u Republici Hrvatskoj, temeljem čega će se kreirati smjernice za povećanje razine zrelosti institucija VO o RH koje obrazuju studente u području ICT-a. **Stoga Vam se obraćam sa zamolbom za primjenu modela na Vašoj instituciji**. Primjena modela obuhvaća procjenu razina zrelosti za prakse u četiri ključna procesna područja, kroz razgovor s osobama na instituciji koje mogu pružiti odgovore. Finalni model sadrži ukupno 70-ak praksi te je procijenjeno vrijeme za primjenu oko 1 sat i 30 min.

Rezultati istraživanja u okviru doktorske disertacije i ostalih vezanih publikacija objavljuivat će se bez povezivanja individualnih rezultata s pojedinom institucijom, no kao institucija ćete dobiti izvještaj o razinama zrelosti po pojedinim praksama koji će Vam ujedno pružiti smjernice za povećanje njihove razine zrelosti. Također, po završetku projekta ustupit ću Vam knjižicu s finalnim rezultatima projekta.

Nadam se da ćete mi izaći u susret i podržati me u uspješnom završetku istraživanja te Vam unaprijed najljepše zahvaljujem!

Srdačno,

Katarina Pažur Aničić
Istraživačica
kpazur@foi.hr

Prof.dr.sc. Blaženka Divjak
Mentorica projekta
bdivjak@foi.hr

Curriculum Vitae

Katarina Pažur Aničić was born on December 2nd 1987. She graduated from the University of Zagreb, Faculty of Organization and Informatics (FOI) in 2011 and enrolled Postgraduate Doctoral Study in Information Sciences at FOI in 2012. As a students, she received *Dean's award* for best student in her generation in 2007, 2008, 2009, 2010. For her achievements in both the Bachelor and Master studies, she received honour *Summa cum laude*. She was also awarded *Rector's award* at the University of Zagreb in 2010 and *Top scholarship for top students* in 2011. She works as a Teaching assistant and a Head of Student Support and Career Development Centre at FOI.

Scientific papers in journals:

1. Pažur Aničić, Katarina; Divjak, Blaženka; Arbanas, Krunoslav. ***Prestige and collaboration among researchers in the field of education and career development of ICT graduates: Is there a cross-fertilization of research and knowledge?*** // accepted for publishing in Journal of Information and Organizational Sciences (2017).
2. Pažur Aničić, Katarina; Divjak, Blaženka; Arbanas, Krunoslav. ***Preparing ICT Graduates for Real-World Challenges: Results of a Meta-Analysis.*** // IEEE transactions on education. 60(3) (2017); 191–197
3. Pažur Aničić, Katarina; Mekovec, Renata. ***Introducing problem-based learning to undergraduate IT service management course: student satisfaction and work performance.*** // Journal of Problem Based Learning in Higher Education (JPBLHE). 4 (2016), 1; 16-37.
4. Pažur Aničić, Katarina; Arbanas, Krunoslav. ***Right Competencies for the right ICT Jobs – case study of the Croatian Labor Market.*** // TEM JOURNAL - Technology, Education, Management, Informatics. 4 (2015), 3; 236-243.
5. Vidaček-Hainš, Violeta; , Bushati, Jozef; Appatova, Victoria; Prats, Harry; Berger, Norbert; Pažur, Katarina. ***Effective Learning Environments in Higher Education: Case Studies of Albanian, Austrian, Japanese And Croatian Universities.*** // International Journal of Ecosystems and Ecology Sciences (IJEES). 3 (2013), 2; 267-272.
6. Hajdin, Goran; Pažur, Katarina. ***Differentiating Between Student Evaluation of Teacher and Teaching Effectiveness.*** // Journal of Information and Organizational Sciences. 36 (2012), 2; 123-134.

Conference proceedings

1. K.Pažur Aničić, B.Divjak. ***Development of Strategic Framework for Supporting Higher Education Graduates' Early Careers***, 8th annual International Conference of Education, Research and Innovation, 16th - 18th of November, 2015, Seville
2. K. Pažur Aničić, R. Mekovec. ***Case study of implementing work based learning in IT management service course***, E-learning at Work and the Workplace – From Education to Employment and Meaningful Work with ICTs, EDEN, Zagreb, June 2014
3. Fabac, R., Pažur, K., Jugović, A., ***Job Analysis and Design: The Frequency and Importance of Key Activities of Participants in Higher Education Process***, Economic and Social Development, 1st International Scientific Conference, Frankfurt am Main, April 2012
4. Delić, A., Pažur, K., Vidaček-Hainš, V., ***Students' Perception of Institutional Affect towards Minorities: Case-Study of European, American and Australian Universities***, Mipro 2012, Jubilee 35th international Convention, May 21st-25th 2012, Opatija, Croatia
5. Fabac R., Vidaček-Hainš V., Pažur K., ***Attitudes of Undergraduate Students with Regards to the Information and Communication Aspects of Study***, 33rd International Conference on Information Technology Interfaces ITI 2011, Dubrovnik, Croatia
6. Vidaček-Hainš V., Bushaty J., Appatova V., Prats H., Berger N., Pažur K., ***Analysis of some aspects of student support services in higher education: Comparison of American, Albanian, Austrian and Croatian students***, International Conference Universities and the integration process into the European Knowledge Society, 7th -8th May, Vlora, Albanija
7. Vidaček-Hainš, V., Appatova, V., Prats, H., Takemura, K, An, L., Bushati, J., Berger, N., Pažur, K., ***Learning styles and cultural differences: Case studies of American, Albanian, Austrian, Japanese, Chinese and Croatian students***, EAN Conference “From Access to Success: Closing the Knowledge Divide (Higher education for under-represented groups in the market economy)”, 14th -16th June 2010, Stockholm, Sweden.
8. Vidaček-Hains, V., Appatova, V., Prats, H., Takemura, K., An, L., Bushaty,J., Berger. ,N. i Pažur, K. ***Implementation of information and communication technology in higher education: Comparative research in Asian, American and European universities***, 21th CECIIS, 22th -24th September 2010, Varaždin, Croatia
9. Klačmer-Čalopa M., Horvat J., Pažur K., ***Human resource function in organization: case study of companies of Croatia***, Economic Development Perspectives of SEE Region in the global Recession Context ICES 2010, Sarajevo, BiH

10. Brčić R., Vidaček-Hainš V., Pažur K., *A model of professional development as a part of individual value system*, International conference “Management, izobraževanje in turizem”, Univerza na Primorskem Fakulteta za management Koper, 22th-23th October 2009

Conference presentations:

1. Pažur Aničić, K, 2016. *Supporting graduates' early careers: strategic framework and maturity model*, HKO kvalifikacije – za tržište, društvo ili pojedinca?, The National Council for the Development of Human Potential, Zagreb, October 27-28, 2016, (poster and oral presentation – received award for the best research work of young scientists)
2. Pažur Aničić, Katarina; Divjak, Blaženka. *Supporting student retention and employment capabilities within higher education institution: four case studies research*. In *25th European Access Network (EAN) conference: Retrospective for Perspective: Access and Widening Participation 1991-2041*, May 2016, Dublin, Ireland
3. Pažur Aničić, Katarina: *Strategic Framework and Maturity Model for supporting higher education graduates early careers*, Croatian Qualifications Framework conference: Knowledge and Creativity, The National Council for the Development of Human Potential, Zagreb, October 22-23, 2015

Projects:

1. July 2015 – September 2016 - European Social Fund: *Development of a maturity model for supporting graduates early careers*, project manager and main researcher, mentor: Prof. Blaženka Divjak, PhD
2. June 2015 – June 2016 - Croatian Science Foundation: *Development of a methodological framework for strategic decision-making in higher education – a case of open and distance learning (ODL) implementation (HigherDecision)*, researcher, project manager: Prof. Blaženka Divjak, PhD
3. 2014 – associate at FP7 project *Sis Catalyst (Children as Change Agents for Science in Society)*
4. 2013 – February 2015 coordinator of IPA project *StuDiSupport (Enhancing the quality of higher education for disadvantaged groups through the provision of student counselling services)* at FOI, project lead: UNIZG