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(I.P.P.S.) IN INFORMATION SYSTEMS

MSc Dissertation

IMPLEMENTATION OF WEB-BASED APPLICATION FOR SELF ASSESSMENT
OF PROFESSIONAL QUALIFICATIONS

of

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Dedications

To my wife Areti, who keeps me strong with her love.
The best are yet to come!

To my daughter Maria, for all the nights that I was not next to you,
to finish this work.

To my mother, who taught me to work hard and never give up.

To my sister, which I admire.

To my friend Harry, who is always there for a talk.

To my dad, who can see me from up there and knows everything.

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It has been a great opportunity to work with Professor Tambouris, who has also been a source of inspiration to me throughout this journey. I've learned a lot more than what I was expected, and I am thankful to him for this.

I'd also like to thank PhD researcher, Maria Zotou, for her kind advices.

Abstract

This thesis explores self-assessment of professional qualifications in the Information and Communications Technology (*ICT*) sector, aiming to introduce improvements with the implementation of a new web-based application. This need for improvement is identified by conducting a literature review on the constituent parts of self-assessment and the level of coverage provided today by available web applications.

Based on the latest reports from accredited international organizations, such as the European Center for Development of Vocational Training (*CEDEFOP*) and the International Labor Office (*ILO*), the outlook of the employment of ICT professionals indicates strong job creation in ICT intensive services, and high growth demands for ICT professionals. This is the result of digitalism that spreads in the work world, globally, and reflects the development in ICT competency of the workforce.

Based on the above, this thesis scopes to research in the effectiveness of the available methods for online self-assessment, considering the increasing needs from professionals to fit in their selves within this booming sector. The outcome of the research indicates applications' functionality that provide adequacy in skills matching and job matching, however there is a gap in the verification of the employability level, as a unique characteristic that may enable professionals to compare their selves with others.

More specifically, the exact point of interest is to enable professionals matching their potential for employment, against ICT professionals that hold roles that they are interested, per geographic region. This thesis focuses in the utilization of such a functionality within a web application, and has clear benefits and implementation difficulties. This is considered as a major problem solving functionality, as it serves to rate professionals, following a rating method developed similar to the ratings provided by financial organizations that verify creditworthiness.

Another important benefit to the ICT professionals using the web application is embedded big data analytics, synchronizing with LinkedIn, with insightful visuals offered in-app by a business intelligence software, such as Tableau. The implementation is considered feasible by the provision of access to the available RestFul APIs of these 3rd party software.

The requested system verified with a thorough feasibility analysis and followed a detailed functional and non-functional requirements analysis. A functional and structural analysis followed, by representing the available activities to be carried by the user in-app, with supporting mockup screens, and a use case diagram that represent the interaction with the system and the 3rd party systems. Moreover, it is included a detailed class diagram for the representation of system's classes, their attributes, operations, as well as the relationships between objects. Following to this, detailed robustness and sequence diagrams provided, as well as the deployment diagram describing the physical layer. Finally, a Java code implementation generated to demonstrate core Unified Model Language (*UML*) data representations.

On the other hand, there are certain difficulties, both in the technical as well as the business model level. The analysis and design of the web application carried over assuming provisioning of the available APIs, service calls establishment and undisturbed data flows. Specifically with regards to data availability, provision of data from a 3rd party is considered as a single point of failure for our system and business model.

This thesis includes the approach to commercialization of the new web application, serving to provide an end-to-end view, from idea inception to market launch of the actual product. Thus, a business plan structured to support web app implementation and its placement in the market. Based on the model created, it is required an initial capital of €160.000, with projection for profits taking and payback of €100.000 bank loan, in the 3rd fiscal year.

Keywords: Professional qualifications, Employability, Self-assessment Web Application

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1. Introduction

1.1. Problem Statement

According to Gartner ¹, nowadays we are witnessing fundamental cultural, behavioral, market, industry and process changes, in a period which is considered as the Digital Disruption ERA. The rapid technological advancements and specifically the evolution of internet, cloud and web applications, require supply of professionals that assist with their skills and qualifications the organizations to embrace change and anticipate growth.

This thesis explores the characteristics of the Information and Communications Technology (*ICT*) job market, addressing the problem arises from the limitations in the functionality of web applications for self-assessment of professional qualifications by individuals. This affects the job search behavior as well as the processes individuals follow to match their professional qualifications with jobs.

Despite the vast amount of information, it is yet unclear how one can clarify his/her valuation in the ICT job market. The answer to the generic question of “*what is my skillset worth*” while looking to fulfil certain roles in certain geographic regions, is yet matter of consultation or personal judgement with no clear criteria and definitive measurable or comparable outcome. Specifically to the ICT roles job market and notwithstanding the constantly positive global demand, individuals need to anticipate the lack of available benchmarking online tools for self-assessing their qualifications, creating a misinterpretation of their employability.

This misperception of the skillset required for ICT roles by individuals often lead to physical and mental burnout, caused by certifications collection efforts and development of skills that often add no significant value towards eligibility for targeted roles. A step further, this misperception has roots to lack of information for decision and effects the professionals’ personal and family life. While commitment of time and money are key inputs for the acquisition of new skills, effective management of these resources determine to a great extent the living standards of one’s life and his/her family.

It can be said that professionals act often as triathlon athletes, having the mentality of “*you don’t know your wall before you touch it*”. When professionals enter the skillset development battle, similarly to triathlon athletes they rely on stamina reserves, often do not make decisions using appropriate tools and by digging their consciousness.

¹ <https://www.gartner.com/it-glossary/digital-disruption>

While this race of a professional is both physical and mental, there should be an intuition about it feeling wrong. According to triathlete Evan Pardi (2017) ², “*the path to winning isn’t about beating the other people. It’s about challenging yourself.*”

The above statement raises concerns about the appropriate method one should follow with regards to skills development, career planning and professional advancement. Unless decisions are made precisely and determined, a professional can face tremendous waste of resources, life balance and career targets, resulting to burnout.

Inevitably, we reach the over-education problem as a conjugator of the mismatch from one’s willingness to acquire additional skills, so that can become a favorable resource for the fulfilment of ICT roles. With respect to this, Cedefop (2015) European Skills and Jobs survey released evidences regarding the global effect of over-education ². At the figure below is represented the unweighted average share of young adult employees (aged 24–35) with higher qualifications than needed to do their job.

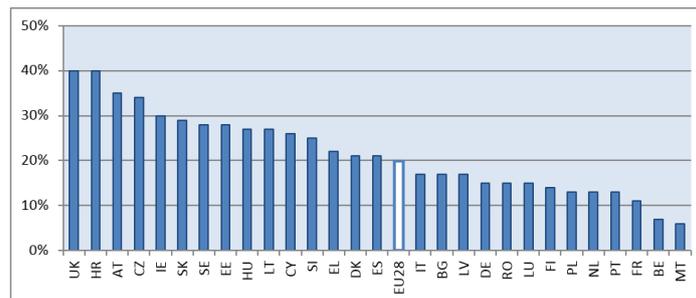


Figure 1. Cedefop European Skills and Jobs (ESJ) survey, 2015

It must be highlighted that about a quarter of the global workforce considered as over-qualified, meaning that their qualifications are higher than required by their occupation. Similarly, under-qualified workers are those whose qualifications are lower than required by their occupation.

² <https://www.cb nuggets.com/blog/2017/07/plan-for-your-it-training-like-you-would-a-triathlon/>

³ <https://www.cedefop.europa.eu/en/events-and-projects/projects/european-skills-and-jobs-esj-survey>

1.2. Research scope and objectives

The main objectives of this thesis are the following three points:

- i. Justification of the need for an online service making available self-assessment of professional qualifications.
- ii. Implementation of such a service with the use of Unified Modeling Language (*UML*) software development tools and techniques.
- iii. Verification of an entrepreneurial initiative, to commercialize the proposed web application as a marketable service.

The scope of this thesis includes

- i. Conduction of a literature review, which will serve to identify what scientists have already pinpointed with regards to skillset standardization and the need of a self-assessment tools for professionals' skills.
- ii. Application of Software Design Life Cycle techniques, with the use of appropriate UML software tools, such as Visual Paradigm, to implement an on-line application that serve to solve the problem
- iii. Development of a business plan, enabling one to take a business initiative such as forming a start-up.

At this point it is deemed necessary to clarify the points that will not be included at the scope of this study, such as:

- i. Detailed design of the front-end of the online service
- ii. Go-live of the online service
- iii. Licensing and funds raising for the start-up

1.3. Structure of the thesis

This thesis consist of 6 chapters:

- The **first chapter** is an introduction to the overall scope and objectives of this dissertation.
- The **second chapter** serves to accommodate the methodology and evidences of the literature review carried over.
- The **third chapter** serves to accommodate the results from the literature review, as well as the results from the current offering in web applications for self-assessment of professional qualifications.

- The **fourth chapter** serves to accommodate the software design and analysis of the web application for self-evaluation of skills
- The **fifth chapter** serves to accommodate the entrepreneurial business plan developed for the utilization of the service to the market.
- The **sixth chapter** serves to accommodate the final conclusions and recommendations of this dissertation

2. Methodology

2.1. Introduction

This section focuses in the analysis of the methodologies followed to allocate and utilize existing knowledge and best practices in our problem domain. Firstly, a literature review is conducted, scoping to identify the key concepts of self-evaluation of professional skills. Secondly, a software analysis and design methodology adapted for the development of a web-based application. Thirdly, a business plan methodology is followed for the introduction of the new web application in the market.

2.2 Literature review methodology

In order to explore the problem domain, the strategy selected to approach existing scientific knowledge focuses, at first, in the understanding of the constituent parts of a self-assessment. As such, it is considered incompatible to follow a literature review methodology that focuses in a certain concept and systematically analyze the literature around a precise, clearly defined core concept.

Therefore, a compendious literature review conducted to decompose the problem domain, splitting into specific scientific interest views that led to research and resulted publications in each niche domain. With this in mind, the primary concern of the literature review is to identify the suitable core elements (research keywords).

This strategy served by conducting research which was limited to scientific search engines only, scoping to identify the appropriate keywords that lead to identification of the core characteristics of self-assessment.

The main sources used for research are the following three scientific search engines:

- Science Direct ⁴
- Semantic Scholar ⁵
- Google Scholar ⁶

With the selection of the engines assuring credibility on the scientific content of the results, the next step followed was to explore the domain by creating composite keywords.

⁴ <https://www.sciencedirect.com/>

⁵ <https://www.semanticscholar.org/>

⁶ <https://scholar.google.gr/>

The process of keywords creation was based in selecting and combining meanings, in the form of:

Variable part (“*keyword*”) + Fixed part (“*self-evaluation*”) = keyword

The following combinations of variable and fixed phrases selected, based on results:

		sciencedirect.com	semanticsscholar.org	scholar.google.gr
A/A	Combined Keyword	Engine 1 results	Engine 2 results	Engine 3 results
1	Employability skills +"self evaluation"	2298	31300	24000
3	Professional certificates +"self evaluation"	3621	20800	26600
2	match skills +"self evaluation"	4245	31900	18100
4	Self-Efficacy +"self evaluation"	9909	20600	52900
5	"Career development self-evaluation"	54526	471000	119000

Table 1. Keywords results on selected scientific search engines

The selected combined **keywords** returned an outcome of the intense in scientific publications, therefore are classified as imperative for the assortment of the key **concepts** around which the literature will be reviewed.

Concluding on the key concepts of self-assessment of professional skills based on the above process, the next step is to examine currently available web applications to professionals for self-assessment of their qualifications. This research conducted using standard nonscientific online search engines, following the same logic applied for the identification of the keywords that will help us to understand what an effective self-assessment is consisted of.

As such, our selected keywords derived on the first step of the literature review, transformed into concepts with the following method:

Variable part (“*keyword*”) + Fixed part (“*web application*”) = concept

Following this process with the combination of keywords, a shortlist of applications created which will later be matter of review and benchmark. The benchmark of web apps is held based on the key concepts identified by examining the intense of the keywords on the publications.

The final step is to process the results generated by the apps benchmark after online review, highlighting points for improvement, having identified the gaps based on the needs of the ICT professionals nowadays.

2.3. Web application analysis and design methodology

While the need for a new web application that serves the scope of this thesis is justified based on the above process, the next step is to select the method that will be used for the analysis and design of the new web app, to bring in life an application that will successfully fulfil the gaps appear in the market today, This stage includes adaption of the software analysis and design best practice recommended by Dennis et al, considered as suitable to serve our needs.

The methodology proposed by Dennis, which is also considered as reference point and market standard in the software development market, consist of the following steps:

- 1. Planning** (“*Why*” the new systems needs to be developed)
 - i.** Project Initiation
 - ii.** Project Management

- 2. Analysis** (“*Who*” will use it, “*What*” will be the functionality, “*Where*”, “*When*” will be used)
 - i.** Activity Diagrams
 - ii.** Use Case Diagrams & mockup screens
 - iii.** Class Diagrams

- 3. Design** (“*How*” will the system operate, H/W, S/W, Network)
 - i.** Robustness Diagrams
 - ii.** Class Diagrams
 - iii.** Activity & State Diagrams
 - iv.** Deployment Diagrams

- 4. Implementation** (“*Creation*”, “*Testing*”, “*Installation*”, “*Maintenance*”)
 - i.** JAVA code preparation

2.4. Business Plan Methodology

The final step of the procedure adopted, is to develop a business plan that will lead the commercialization of the app to the market. This serves to provide to the reader of this thesis a 360' view of the concept, with scientific means related to both IT and business aspects.

Therefore, the need for a business plan that will bind up the output of the software development and transform it to a business concept is utilized by a lean plan that includes the following:

- i. Executive summary
- ii. Company description
- iii. Product & Marketing strategy
- iv. Financial projections

2.5. Conclusions

The end-to-end process followed to approach and decompose the key concepts of self-assessment is considered suitable, for the complexity and broadness of the topic. It is crucial to firstly understand in depth the constituent parts and then, once the expectations are structured for such a service to be provided over the web, to identify and evaluate a sample set of indicative apps, based on the conformance to the highlighted concepts. Finally, following this approach, we are enabled to identify gaps in the current offerings and brainstorm on the generation and launch of a new app.

3. Literature Review

3.1. Introduction

It is considered as rather essential in the beginning of this literature review to scientifically approach and define self-assessment of professional qualifications, as it serves the core concepts identification, based on which the current web apps will be benchmarked. In principal, self-assessment is associated to career decisions, which based on the literature is considered among the most important and sophisticated decisions in a person's life (Jiang, 2014, p.112-124).

Moreover, career paths are surrounded with Nobel Prize awarded human capital theories (Becker, 1993, 30-54), indicating that individuals invest significant amount of their time and effort to improve their skills for advancement, job mobility and gain of power. Literally, it has been pointed the importance of learning outcomes, such as knowledge, skills and competencies acquired during learning that individuals can use as qualifications' evidence (Zotou, Papantoniou, Kremer, Peristeras & Tambouris, 2014, p.18-21).

Focusing in the definition of self-assessment of professional qualifications, we acknowledge the description introduced by Zhou Jiang, 2015, p.450, as "*a basic, fundamental appraisal of one's worthiness, effectiveness, and capability as a person*". Furthermore, it is highlighted that self-evaluating experiences result to influencing professionals psychological states and career decision-making (Zhou Jiang, 2014).

3.2. Qualifications and Skills

Accepting the above definition of self-assessment, it is required to clearly distinguish the difference between skills and qualifications, as well as the join between them. As a general rule, a skill is typically related to a specific ability, is a learned ability and usually matter of development by practice. On the other hand, a qualification is a more general accomplishment, one that requires possession of certain skills.

3.3. Overview of the cases and research profile

With regards to the online research the conducted, accredited only online scientific databases selected using multiple criteria, instead of single key words. This serves to explore closer and deeper the concepts we are interested, also considered necessary for the purpose of shaping a 360' view of the problem domain.

More analytically, the composite keywords selected to consist the basis of the literature review where:

- “Employability Skills”
- “Job match model”
- “Role of professional certificates in the market”
- “Career development self-evaluation”
- “Self-efficacy”

The research of these composite keywords led to identification of high volume of scientific publications. This resulted to a matrix of concepts based upon today’s applications for self-assessment of professional qualifications can be benchmarked. The result of the benchmark is expected to verify the need for improvements which can be utilized by the implementation of a new up with the unavailable today characteristics.

3.4 Matching research keywords with self-assessment concepts

Based on the analysis output, the keywords selected and the relating concepts are summarized on the table below:

Research keyword	Matching concept
Employability skills	Employability
Professional certificates	Training needs
Skills match	Matching skills with jobs
Self-efficacy	Self-assessment of skills
Career development	Employability

Table 2. *Matching research keywords with self-assessment concepts*

The outcome of this mapping between keywords and problem domain concepts will be matter of examination with regards to currently available web applications, generating a list of benchmarked applications relevant to each other, with a focus on ours concepts.

3.4.1. Employability Skills

It is considered that qualifications and accumulated knowledge express an informal valuation of a person capability to fit in the job market, considered as employability. A fair definition for employability (Yorke & Knight, 2004, p.2) is “*the set of achievements (ie. skills, understandings and personal attributes) that make individuals more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy*”. As a set of generic

achievements, employability is not static but something that a person develops throughout his/her life. Despite the theoretical and practical importance of such a figure to be available today, it remains an abstract and subjective estimation rather than a scientifically engineered methodology, available instantly from a web based application.

3.4.2. Professional certificates

In the labor market, if an individual holds a job then this person is considered to have the required education, knowledge and skills, to be a qualified person for this particular job. Furthermore, if a person demonstrates proven ability to achieve the desired results, then this person can be considered as competent (Lapina, Sceulovs, 2014, p.404-408). Thus, it is derived that the terms knowledgeable, qualified and competent are not actually synonyms in the job market.

Qualified and knowledgeable professionals may be unable to deliver the results required for a job, since a person may have the necessary knowledge and skills but may not apply these properly. Based on this, competency should be understood as a proven ability to apply knowledge and skills in practice.

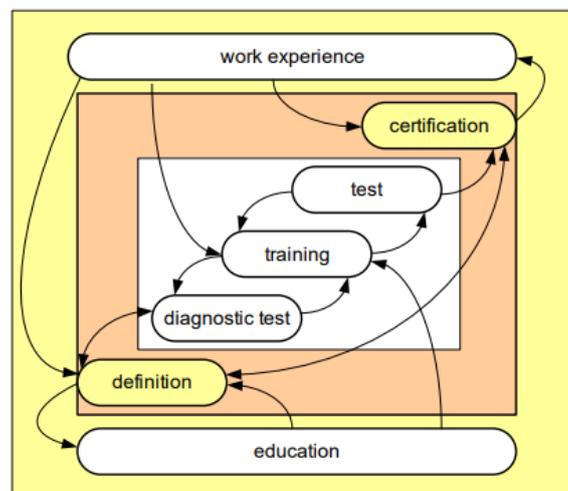


Figure 2. Learning and certification: Acquiring of relevant qualifications

Based on the Pearson Vue’s survey “Value of IT Certification”, 2016 ⁷, processing results from 26.000 completed responses from individuals worldwide, 3 out of 4 would like to earn additional certifications considering the positive impact on their professional image. Moreover, 20% received a salary increase and 19% found a job after gaining a certificate, while 14% managed also to get a promotion due to this.

⁷ <https://home.pearsonvue.com/Documents/Marketing/2016-Pearson-VUE-Value-of-IT-Certification-Survey.aspx>

However, the certificates gaining model to underpin potential may be indicative for a person's capabilities, his/her capability though remains unproven in the job field as applicable knowledge. As a proof to this, and based on the same data pool, 68% of the respondents highlight the need to explore new ways of assessing and validating their knowledge and technical skills.

3.4.3. Skills match

The research focusses in three major skillset standardization frameworks, acknowledged by the scientific community. These frameworks are:

- i. The European e-Competence Framework (*e-CF*)
- ii. The European Skills, Competences, Qualifications and Occupations framework (*ESCO*)
- iii. The Enterprise IT Body of Knowledge (EITBOK) Skills Dictionary

More analytically, the **European e-Competence Framework (*e-CF*)**⁸ is considered ICT focused, providing a reference point of 40 competences that are practiced in the ICT workplace, making available a common context for competences, skills, knowledge and proficiency levels in Europe.

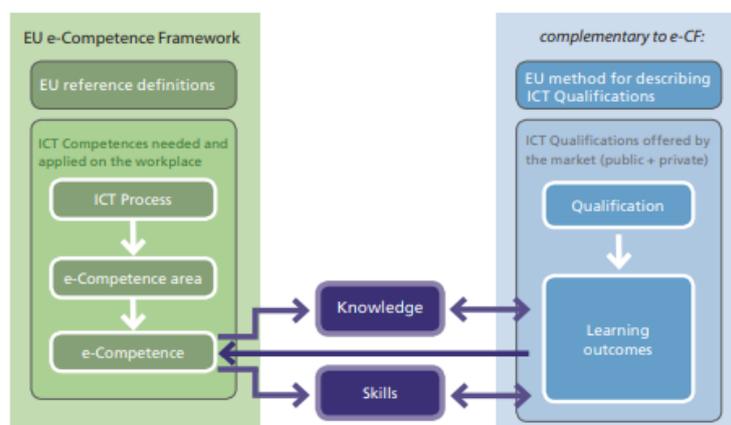


Figure 3. User guide for the application of the European e-Competence Framework

The e-CF framework is considered as a key component of the European Union's strategy for digital skills in the 21st century, and it is supported by the European Commission.

The **European Skills, Competences, Qualifications and Occupations framework (*ESCO*)** is the European multilingual classification of Skills, Competences, Qualifications and Occupations. ESCO stands as a glossary, allocating, explaining and classifying relevant job roles, skills, and qualifications for the European labor market, education and training.

⁸ <http://www.ecompetences.eu/>

Finally, the **Enterprise IT Body of Knowledge (EITBOK) Skills Dictionary** ⁹, accredited by IEEE and the Association for Computing Machinery, introduces a model where skills are divided into five categories: methodology, technology, related knowledge, EIT human skills and specific skills.

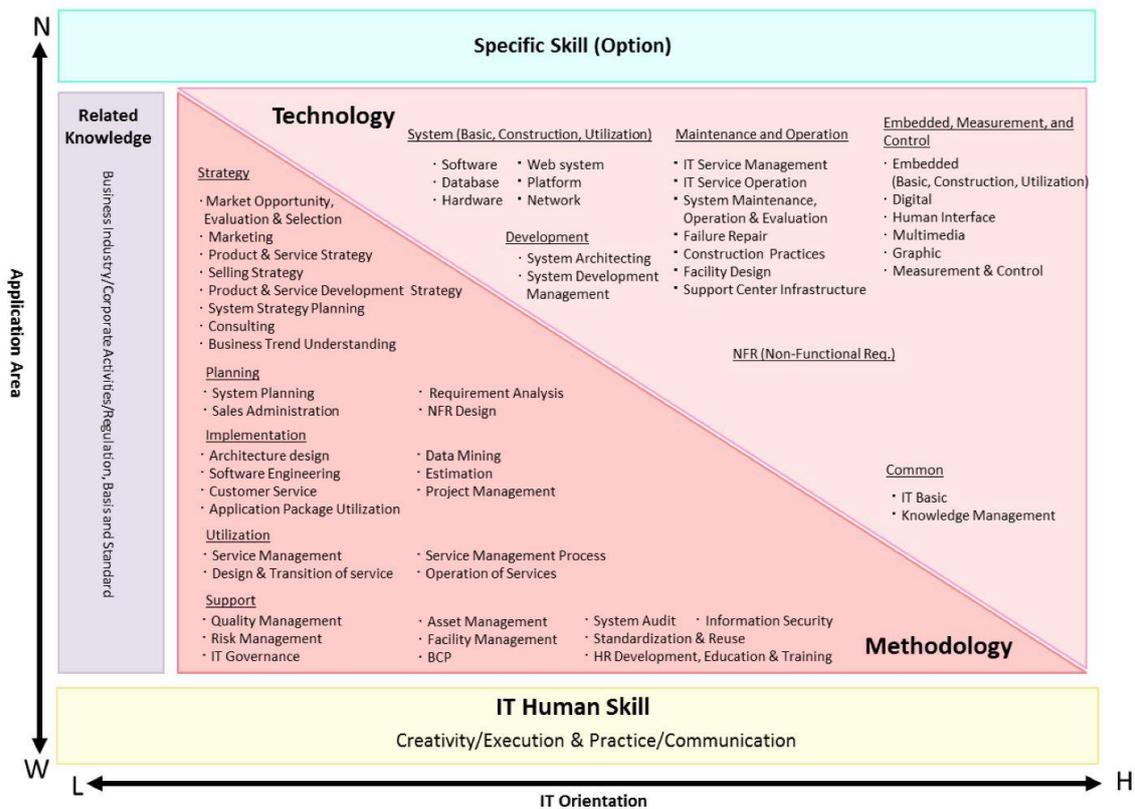


Figure 4. The iCD Skill Dictionary Chart

3.4.4. Self-efficacy

Self-efficacy is an individual's judgment about how one can perform in a particular task or situation. It is can be considered as “*the highly valuable faith in one's competence to mobilize his/her motivation, intellectual reserves, and behavior needed to meet expected situational demands*”, (Wood, R., Bandura, A., 1989, p.805-810). The four key factors that impact self-efficacy of a professional, are the following (Bandura, 1994, p.2-3):

- i. Mastery experience: referring to direct experience and successful accomplishment of the task in the past
- ii. Vicarious learning: referring to observing people and comparing one's competencies in relation to competencies of others.

⁹ http://eitbokwiki.org/Enterprise_IT_Skill_Frameworks

- iii. Verbal persuasion: referring to encouragement, constructive feedback and education.
- iv. Psychological/ emotional state: referring to anxiety, fear of failure and depression

3.4.5. Career development

Investigating further on the sources of the self-efficacy and the outcome expectations for career exploitation and decision making, a model for career self-management developed to assist in explaining the process which people contribute to their educational and career development (Lent R., Ezeofor I., Morisson A., Penn L. & Ireland G., 2015, p.48)

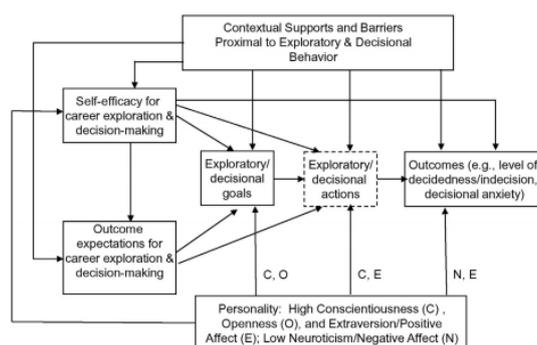


Figure 5. Career Self-Management model

This model serves to explain several process aspects of career behavior, including key issues such as how individuals manage normative tasks and cope with challenges involved in career planning, entry to market, adjustment to conditions, and change, regardless to their educational and occupational fields.

3.5 List of available web application for self-assessment

The outcome of the online search, based on standard search engines with key entries the focus concepts, summarizes in the following working sample of web-based apps.

	Application	Description (as appear on each website)
1	careeronestop.org	It serves to deliver integrated, easy-to-understand workforce information that helps job seekers, students, workers, workforce intermediaries, and employers develop their capacity and make sound economic decisions in the new economy.
2	myskillsmyfuture.org	It helps laid-off workers and other career changers explore new careers that may use the skills and experience gained in previous jobs.
3	life-pilot.org.uk	It aims to increase the progression of adults and young people to higher level study through providing online, impartial information and support about all progression routes
4	onetonline.org	It offers a variety of search options and occupational data. It is an application that was created for the general public to provide broad access to the O*NET database of occupational information.

5	Skillsmatch	It is an online resource that allows an exploration of the dynamic between skills supply and employer demand in London. It brings skills data and labour market data together to enable users to take an intelligence-led, geographically specific approach to addressing youth unemployment in London
6	hr-survey.com	It offers a survey platform that serves as a diagnostic tool for determining what training needs to take place. This survey gathers data to determine what training needs to be developed to help individuals and the organization accomplish their goals and objectives
7	preftrain.com	It is a training network, offering instant access to referred trainers, facilitators and instructional designers in Australia. Preferred Training Networks aims to be the most flexible learning organization in Australia.
8	Linkedin	It is among the world's largest professional networks, with more than 645 million users in more than 200 countries worldwide. It serves to connect professionals to make them more productive and successful.
9	Glassdoor	It is one of the world's largest job and recruiting sites. It offers millions of the latest job listings, combined with a growing database of company reviews, CEO approval ratings, salary reports, interview reviews and questions, benefits reviews, and office photos.
10	CareerBuilder	Its mission is empowering employment. It is a platform aiming to help individuals to find jobs and equip employers with the talents needed.

Table 3. Selected self-assessment web applications for benchmarking

3.5.1. Benchmarking results

In order to structure a benchmark table for the selected web applications, it is required to establish the metric method and the logic to apply the metrics. Therefore, a rating scale is firstly introduced, ranking from 1 (minimum) to 10 (maximum). The logic to apply the rating is based on marking after online review and personal judgement in the relative coverage of the examined concept of each web app.

As such, the following table is structured by applying the above scaling factors and the review logic for each web app and key concept.

	Web app	Focusing Concept			
		Skills match	Training needs	Self-assessment of skills	Employability
1	careeronestop.org	9	3	3	0
2	myskillsmyfuture.org	7	5	7	0
3	careerpilot.org.uk	8	0	2	0
4	onetonline.org	9	4	8	7
5	skillsmatch	0	3	0	0
6	hr-survey.com	0	10	7	0
7	preftrain.com	1	1	1	0
8	Linkedin	9	4	7	6
9	Glassdoor	6	3	1	0
10	CareerBuilder	7	1	3	3

Table 4. Selected self-assessment web applications for benchmarking

By collecting the data generated on the benchmark table, we process these data to derive useful information, by structuring the following results table.

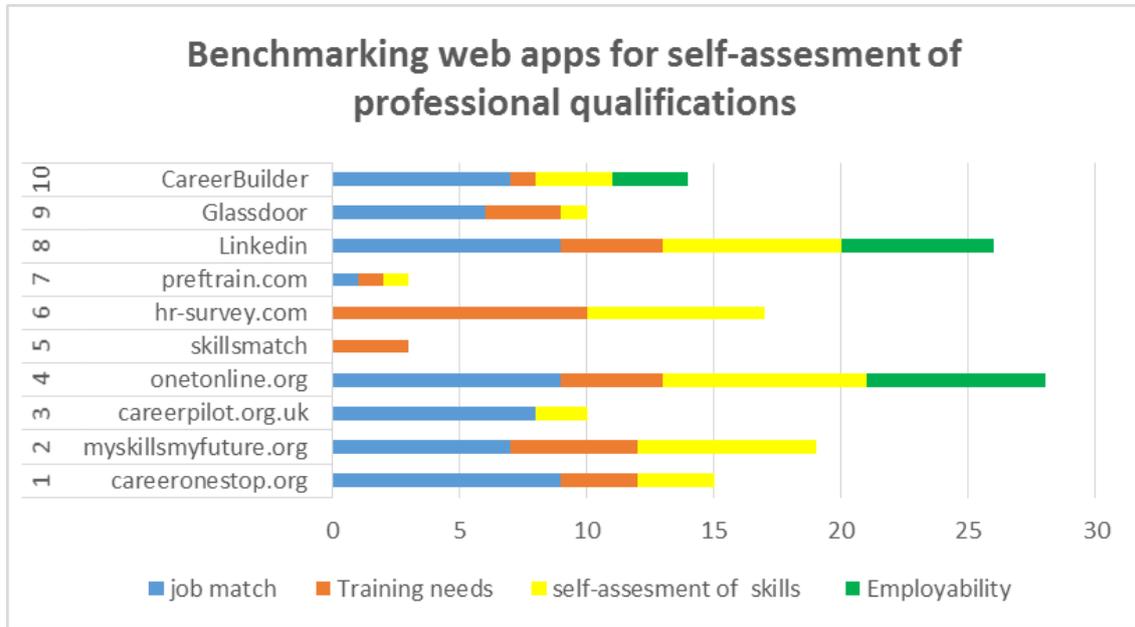


Figure 6. Benchmarking of web apps for self-assessment

3.5.2. Discussion of results

Interpolating the benchmarked data, it can be noticed that in the indicative sample of ten applications there are characteristic similarities, as well as points for improvement. More specifically, the key information arises is:

- i. 80% of the apps offer job matching with skills, also considered as the core among the characteristics for them in all except one app
- ii. 90% of the apps offer evaluation of training needs, this is only predominant in only one app.
- iii. 70% of the apps provide functionality in at least 3 out of the 4 concepts
- iv. 30% of the apps cover employability, and in none of these apps this is the core characteristic.
- v. 30% of the apps cover employability, and in none of these apps this is the core characteristic.
- vi. 30% of the apps provide functionality in the examined concepts

Based on the above, the following table is derived, indicating the importance of each concept in the current market situation, based on the apps' functionality coverage, followed by the level of relevant impact, availability and room for improvement on the concepts' current offering:

	Impact	Availability	Gap
job match	High	High	No
Training needs	High	High	No
self-assessment of skills	High	High	No
Employability	High	Low	Yes

Table 5. Concepts' impact, availability and gap identification

From the above table it is concluded that current offerings are lacking in provision of functionality in the “employability” concept, rather than the other 3 constituent concepts of self-assessment of qualifications. Moreover, it is also important to mark this limited offering not as a stand-alone concept, but as an improvement within an app that covers all the four concepts, since the cross-combination noticed to be offered only in the 30% of the available apps.

3.6. Conclusions

This literature review identifies a lack of theoretical progress and application implementation, towards the creation of a self-evaluation environment where individuals can explore online their employability towards acquiring ICT roles. The results indicate the existence of certain room for improvement, with employability being pin-pointed as the reference point for innovation. This innovation should not be limited in the context of technical capabilities, but is considered as a domain where business logic should and must be applied, transferring best practices from other sectors where rating is crucial for the justification of conformance. This key conclusion consist the basis for ideation of an in-app rating schema for ICT employability, similarly to the financial rating scores, that can be self-served to professionals.

Moreover, it is marked the importance for any professional seeking to self-assess their qualifications, to access data that can be fast and accurately converted to information, extracting a measurable output of the skillset with comparison to current ICT job holders of the position and location of interest.

4. Web application analysis & design

4.1. Introduction

In this chapter we interpret the outcome of the literature review, by developing a web application for self-assessment of professional qualifications. With regards to the software analysis and design methodology followed, as noted on chapter 2, we chose the latest market standards for software lifecycle management, as recommended by Dennis at all. In the next paragraphs it follows a step-by-step representation of the app's development stages, from start (*planning*) to finish (*implementation*).

4.2. Planning

4.2.1. System Request

The basis for the design of the application is the market gap identified, scoping to fulfil the needs of ICT professionals, that except from a skills matching tool it provides the capability to identify and verify their employability level. This will be utilized in the form of a rating similarly to the ratings provided by the financial credit rating organizations and their approach on private and public sector bonds.

Moreover, while the required features to fulfil the market gap are represented on the requirements of the new web app, the pool data for profile ratings will be available via LinkedIn API calls. The skills matching schema will be based on the Enterprise IT Body of Knowledge Skills Dictionary skills matching model mentioned on chapter 3.4.3. Finally, the matching results will be represented in the form of embedded analytics via API calls with a BI tool, such as Tableau.

The first step of the software design and analysis is to structure the System Request, which clarifies the following:

Project name:	Implementation of web-based application for self-assessment of professional qualifications
Project sponsor:	Ioannis Kirpitsas
Business need or opportunity:	<ul style="list-style-type: none">– Limited functionality of current web services for self-assessment of professional qualifications.– Occurrence of extreme specialization, raising the need for self-distinguish and benchmarking.

	<ul style="list-style-type: none"> – The ICT qualifications holders encounter high competition. – Availability of ICT professional’s data online. – Use of the latest web technologies for big data analytics and visualization techniques.
Business requirement:	<ul style="list-style-type: none"> – The key business requirement is to enable self-assessment of professional qualifications online, providing a measurable element of ICT employability, based on skill characteristics: methodology, technology, related knowledge, EIT human skills and specific skills, after benchmark with LinkedIn profiles. – To serve the provision of an ICT employability metric, a rating schema is introduced based on the sum of the above elements, similarly to the ratings schemas followed by the financial rating organizations. – The required data of ICT professionals for benchmarking are provided by LinkedIn API. – The required big data, in-app visualization, is enabled with Tableau Embedded analytics. – The system provides the options for getting a rating score, getting embedded analytics and getting detailed employability rating report.
Business value:	<ul style="list-style-type: none"> – Register 4.000 users in the 1st year (Y1) of operation. – Anticipate positive EBITDA from Y1, profits from Y3.
Special issues:	<ul style="list-style-type: none"> – Integration responsiveness of 3rd party systems. – Personal data handling with QDPR compliance.

Table 6. System Request

4.2.2. Feasibility Study

In this chapter we investigate the needs for development of the web application, and by the end it will be completed:

- i. Technical feasibility, serve to answer “*can it be developed?*”
- ii. Economic feasibility, serve to answer “*will it be financially beneficial?*”
- iii. Organizational feasibility, serve to answer “*will it be used?*”

- iv. Legal feasibility, serve to satisfy legal and other compliance

The result of the above set of analysis assists to verify the purpose of developing the web application, scoping to fulfil needs for self-assessment of professional qualifications.

4.2.2.1. Technical Feasibility

Technical feasibility serves to help the development team identifying the technical challenges arising from the idea utilization of the web application. For this purpose, it is verified that it is technically viable to proceed with the new web application, as:

- We have available the required theoretical experience in software analysis and design
- We have access to required software tools to implement the idea
- We have access to data regarding qualifications of current ICT jobholders
- The field is of our primary interest, deploying transferrable skills
- We have access to the global developers' community, which may assist at any point upon request and arrangement.
- The size of the project is controllable and scalable, considering the benefits from adopting cloud solutions.
- The web application will be compatible with the latest software and database development techniques.

The following risks can be traced, with regards to the technical feasibility:

- The solution relies on to data being available from 3rd parties, such as LinkedIn data. Provision of full access to r_fullprofile API requires LinkedIn Developers Network members' permission.
- Solution integration is approached theoretically
- Coding capabilities of the author are limited to basic, thus there is strong dependency to contractors
- Solution scale up for fast success of the business model

4.2.2.2. Economic Feasibility

Economic feasibility, as expected, serves to justify the purpose of engaging financial resources for the development of a new web application for self-assessment of professional qualification. The sustainability of such an investment arises by the occurrence of the following key factors:

Costs:

- Estimated direct/ indirect cost for development of the application: €70.000
- Estimated total cost to commercialize the application: €160.000

Benefits:**- Tangible:**

- Net profit of €15.500 on the 3rd year of operations
- Estimated bank loan payoff on the 3rd year of operations

- Intangible:

- Positioning as the primary professional service for self-assessment of qualifications.
- Formation of a global database with ICT professional's ratings.

4.2.2.3. Organizational Feasibility

Organizational feasibility assists in the justification of the solution acceptance by the organization developing the service. This is rather self-evident, given that the purpose of the organization forming is to develop and market the service. Unless the solution will be adopted by an existing organization, already operational with its own business units and services, there is no conflict or question whether the solution will be accepted by the organization.

4.2.2.4. Legal Feasibility

The scope of legal feasibility is to verify that no conflict will appear with regards to the processing of personal data of the ICT jobholders. This will be secured by fully adopting GDPR legislative directions, as well as by adopting ISO 27001 for compliance with information security management global standards.

4.3. Analysis

This chapter focuses in the web application analysis which is consist of the following elements:

- i. Activity diagrams
- ii. Use case diagrams
- iii. Use case descriptions
- iv. OO and class diagrams

Following the best practices in the Software analysis and design, this phase starts with business process modeling, of the organizational operations to be carried for utilizing the

service. Considering that the concept will be brought to life by a newly formed company, there is no existing business processes in place, thus it is invalid to explore Business Process Automation, Business Process Improvement or Business Process Re-engineering.

4.3.1. Business Modeling

To simulate the commercial service model offered by the web application, it is required to list in details the core activities that will be taking place.

The list of activities consist of the following core activities:

- i. Registration
- ii. Renewal
- iii. Payment
- iv. Self-assessment
- v. Obtain rating for qualifications

4.3.1.1. Activity Diagrams

- i. User Registration

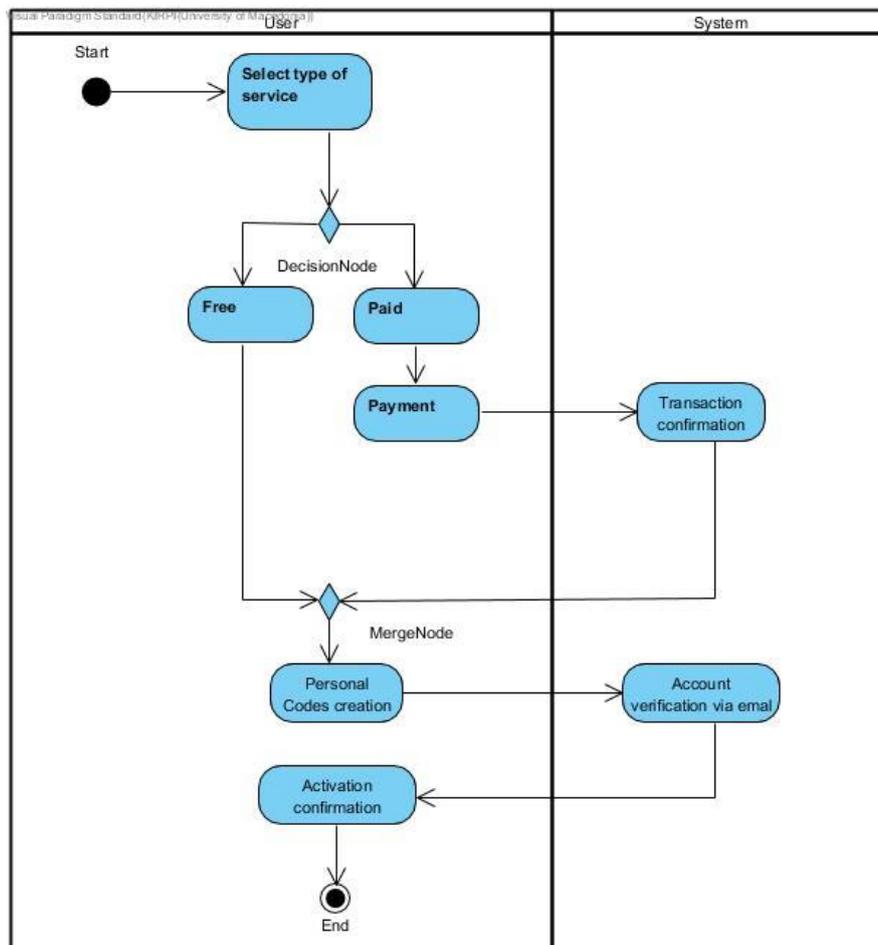


Figure 7. User registration, Activity diagram

ii. User renewal (paid services only)

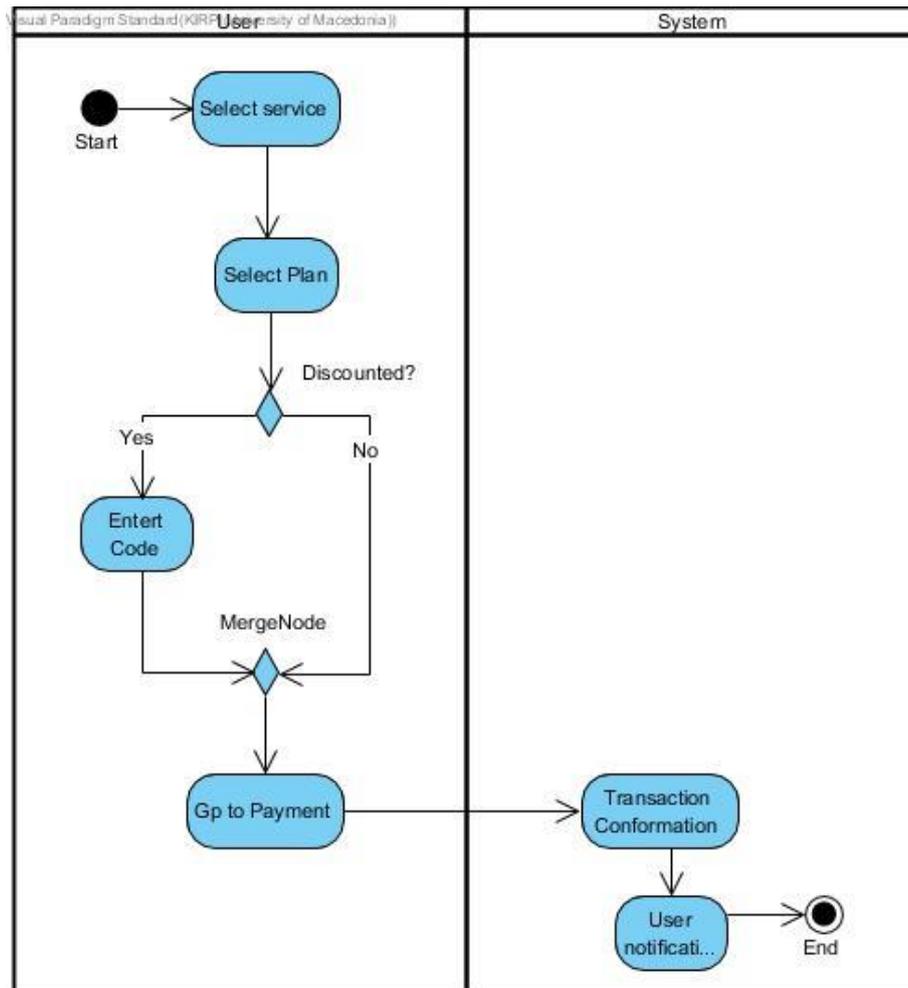


Figure 8. User renewal, Activity diagram

iii. Payment

Visual Paradigm Standard (KIRPI(University of Macedonia))

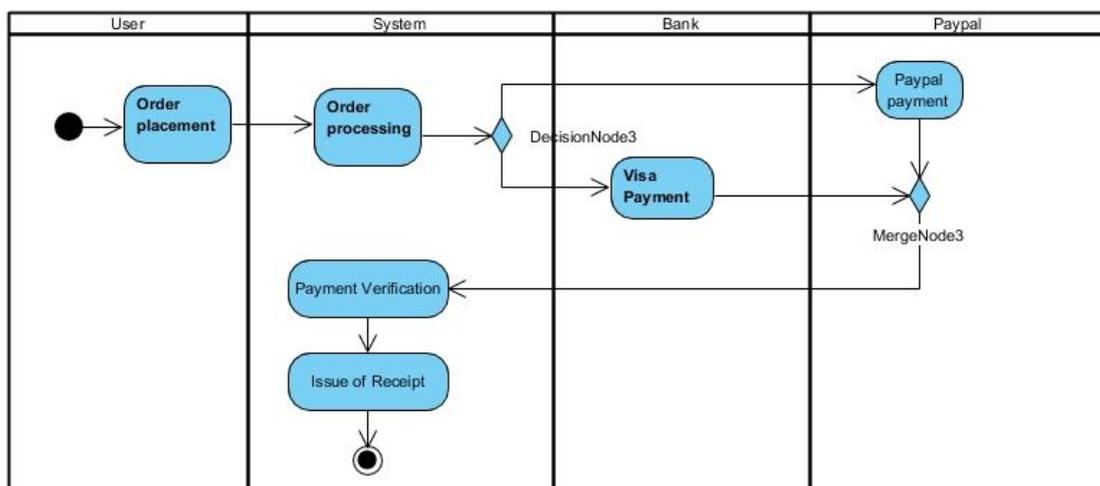


Figure 9. Payment, Activity diagram

iv. Self-Assessment

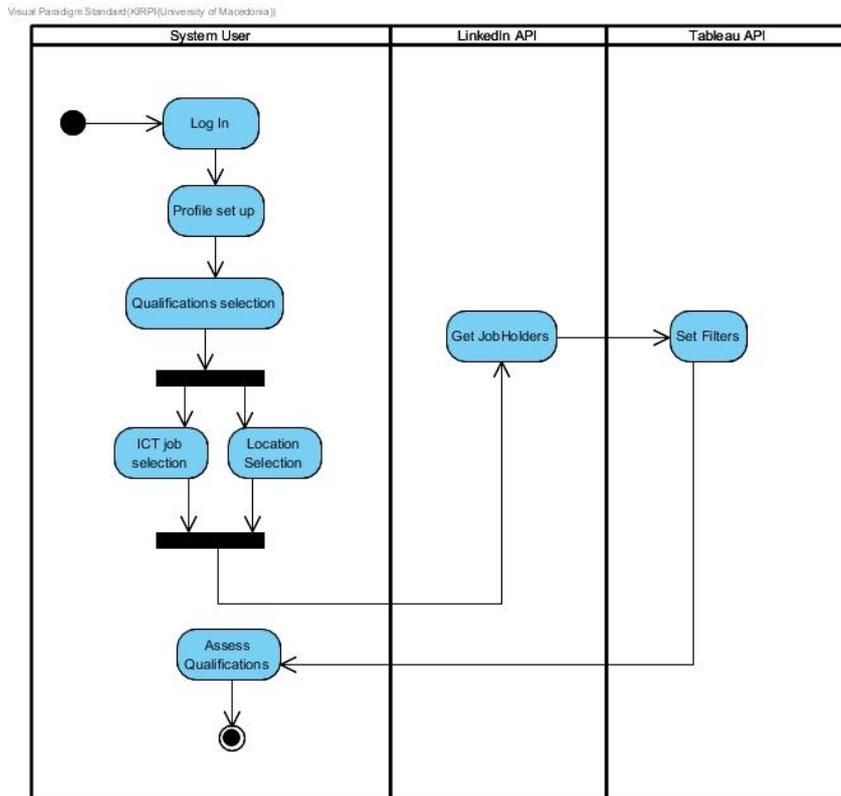


Figure 10. Self-Assessment, Activity diagram

v. Obtain Qualifications Rating

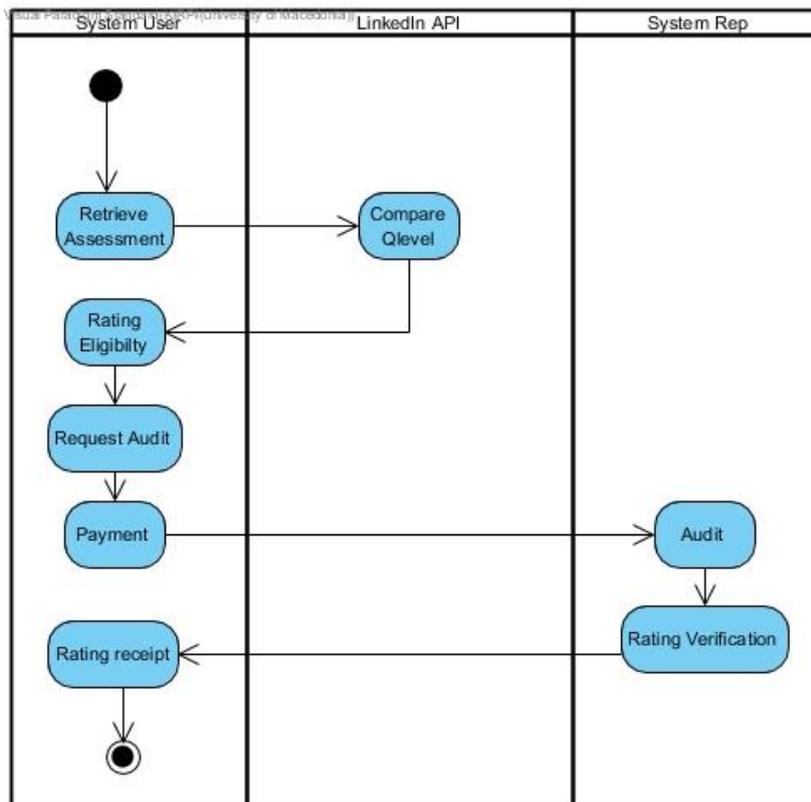


Figure 11. Obtain Rating, Activity diagram

4.3.2. Requirements Analysis

Once the objectives of the new web application for self-assessment of professional qualifications have been clearly defined during the phases of Planning and Concept development, the next goal is to precisely outline system requirements. This includes the following:

- i. Definition of Functional Requirements
- ii. Definition of Non-Functional requirements
- iii. Definition of User Stories
- iv. Creation of system requirements documents & requirements tractability matrix
- v. Development of planned test activities

4.3.2.1 Functional Requirements

In principal, functional requirements describe what the system can do, as well as the information should be providing to its users. In more detail functional requirements serve to define.

- i. User authentication
- ii. Access to data
- iii. Operations performed by each screen
- iv. Interfaces required
- v. Workflows performed by the system
- vi. Expected output reports generation
- vii. Compliance with regulations

Based on the above expectations, the following list represents the functional requirements (note as “FR”) of the to-be web application under analysis:

FR 1 – Entering the system, user login

FR 1.1. The system will be supporting the following type of users: non authenticated users (guests), authenticated users, support users.

FR 1.2. Non authenticated users may be eligible for authentication to free or paid users.

FR 1.3. Support users can be 1st line user support agents, content creators (CMs), developers and administrators.

FR 1.4. All users will have a unique log in credentials (username and password).

FR 1.5. All users, paid or free, may be able to permanently delete their account.

FR 2 – Access to data

FR 2.1. The system will be using cookies enablement, for sessions' information storage, upon verification with the guests/users.

FR 2.2. Authenticated users may login to their personal accounts and preferences.

FR 2.3. Registered users may retrieve/ change their password online, via email verification.

FR 2.4. Database administrators may process personal data under full GDPR compliance, and the supervision of Data Processing Officer.

FR 2.5. All users shall be enabled to create pdf/print their profile summary.

FR 2.6. All users shall be enabled to share their profile summary on Facebook, LinkedIn, Twitter, as well as to create a link of their profile summary.

FR 3 – User payments management

FR 3.1. The quest user may proceed to online purchase of commercial package offered by the system (switch to paid user).

FR 3.2. The paid users may upgrade his services bundle, enabled to proceed with online payment via VISA or PayPal.

FR 3.3. The paid users may renew their services, enabled to proceed with online payment via VISA or PayPal.

FR 3.4. The system should generate invoices for every financial transaction.

FR 3.5. The system shall provide full history record of payments and invoices.

FR 4 – Qualifications profile build

FR 4.1. The user shall be able to select among the available ICT skills, from available lists.

FR 4.2. The skills categories are as per the Enterprise IT Body of Knowledge (EITBOK) Skills Dictionary: methodology, technology, related knowledge, human skills and specific skills.

FR 4.3. The user shall be able to access a dashboard with all the selected qualifications.

FR 4.4. The user shall be able to select among the available ICT qualifications, from available lists..

FR 4.5. The qualifications categories are divided into ICT trainings, certificates, diplomas, undergraduate/ postgraduate studies, years of professional experience, recommendations, publications, patents ownership.

FR 5 – Obtain Rating

FR 4.1. The system shall accumulate the data entered by the user, and benchmark against current ICT jobholders, in the selected geographical areas.

FR 5.2. The rating should be provided, according the following schema:

ICT Employability grade

AAA: the best quality of ICT profile, within the top 5%

AA: high quality ICT profile, within the top 15%

A: above average quality ICT profile, within top 25%

BBB: average class ICT profile, satisfactory for employment, top 30%

BB: below average ICT profile, top 40%

B: base scoring ICT profile, top 50%

CCC: below base scoring ICT profile, below 50%

CC: moderate scoring ICT profile, below 60%

C: weak scoring ICT profile, below 75%

D: limited scoring ICT profile, below 85%

NR: not meeting the ICT profile prerequisites

FR 6 – Visitor/ user support

FR 6.1. The user shall be able to contact support via email or via chat.

FR 6.2. Chatting agents can be robots, human, or both.

FR 6.3. Support cannot be provided via telephone.

4.3.2.2 Non-Functional Requirements

While the functional requirements provide a description of what a new system can do and what information shall provide to users, the non-functional requirements serve to describe the new system's usability. The ability of a system to perform its defined tasks its performance while doing defined tasks is related to the following major categories of non-functional requirement (noted as "NR") categories.

NFR 1 – Business Requirements

NFR 1.1. The application must be available on the web.

NFR 1.2. The application requires web integration with other systems and databases.

NFR 1.3. The application must be branded and identifiable on the web.

NFR 1.4. The application must not limit the number of online users.

NFR 1.5. Users may visit the application via a web browser or mobile app.

NFR 1.6. All UI elements shall be in English.

NFR 1.7. The application shall allow personal preference settings, advertisements appearance, privacy and communications

NFR 2 – Performance Requirements

NFR 2.1. Monthly uptime $\geq 99,8\%$.

NFR 2.2. 1st page loading via browser and App ≤ 2 seconds.

NFR 2.3. User login via browser and App ≤ 3 seconds.

NFR 2.4. User login via browser and App ≤ 3 seconds.

NFR 2.5. User login via browser and App ≤ 3 seconds.

NFR 2.6. Platform should be rebootable ≤ 1 minutes.

NFR 2.7. Platform should be restorable on last working version in ≤ 5 minutes.

NFR 2.8. Application database should be 2x to 4x compressible.

NFR 2.9 Database queries should represent data ≤ 3 seconds.

NFR 2.10 API calls to LinkedIn should be executable ≤ 1 second for rendering users with qualifications match.

NFR 2.11 API calls to LinkedIn should be executable ≤ 1 second for rendering users with qualifications match.

NFR 3 – Security Requirements

NFR 3.1. Daily backup, restorable via web interface.

NFR 3.2. Full GDPR compatibility.

NFR 3.3. Use of cookies and sessions upon user prompting.

NFR 3.4. Secure payments environment, including fraud mitigation.

NFR 4 – Political Requirements

NFR 4.1. No applicable political requirements.

4.3.2.3 Use Case Diagram

While the functional requirements provide a description of what a new system can do and what information.

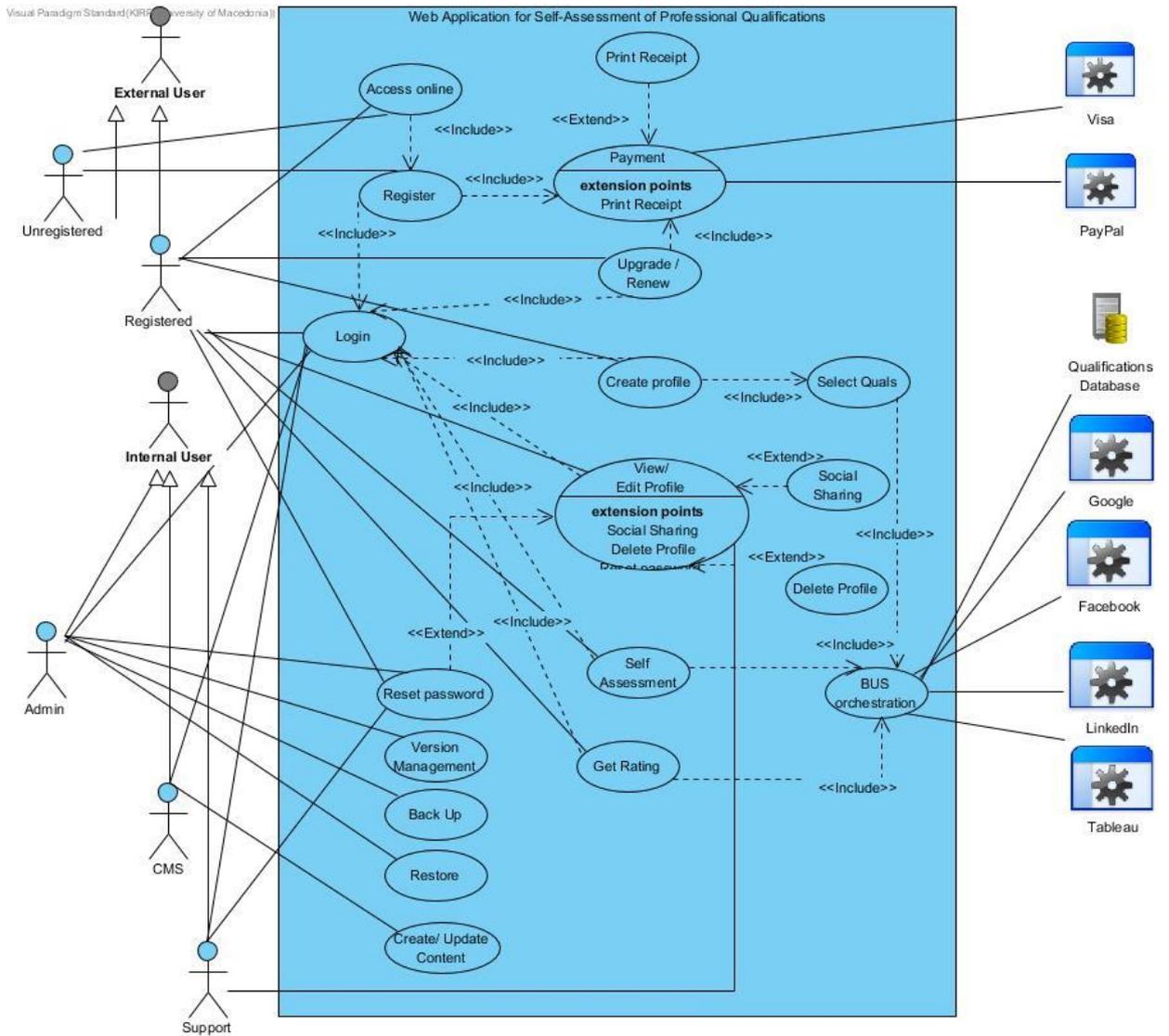


Figure 12. Use Case diagram

4.3.3. Functional Model

4.3.3.1. Textual descriptions & UI design

i. User Registration

Basic flow:

1. The user selects option to register to the service.
2. The system shows the registration form, providing options to select free trial or premium license.
3. The user selects the license type and fulfils the fields with the data required.
4. The system verifies that the login credentials are valid and authorizes the user to login.

Alternative flow 1:

1. The user enters his login credentials.
2. The system identifies that the email provided is already registered to the service and prompts to use another email.
3. The user repeats the registration process.

Alternative flow 2:

1. The user enters his login credentials.
2. The password provided does not match with the password security policy and prompts the user to select another password.
3. The user repeats the registration process.

The figure displays two side-by-side mockups of a user registration form. The left mockup is titled "Registration Form / Free Trial" and shows the "30 days trial" option selected. The right mockup is titled "Registration Form / Premium" and shows the "Premium" option selected. Both forms contain the following fields: Name (John), Surname (Smith), Email (John), Username (jsmith), Password (masked with asterisks), Retype Password (masked with asterisks), and a CAPTCHA question "What's 6+2?" with the answer "8". At the bottom of each form, there are social media icons for Facebook and LinkedIn, a "Concent" checkbox, and "Submit" and "Clear" buttons.

Figure 13. User registration, mockup

ii. User Payment

Basic flow:

1. The user selects register to service option on the first page.
2. The system shows the registration form.
3. The user selects between paying with credit card details or with Paypal.
4. The system provides upon user selection the method to either proceed payment via credit card or connect with Paypal account transferring the corresponding amount.
5. The user submits the registration form.
6. The system confirms transaction success and registration.

Alternative flow:

1. When the payment method cannot proceed due to lack of credit card authorization or Paypal account connectivity, the system prompts the user to try again.
2. The user fills in again either the credit card details for verification, or his/her Paypal account credentials.
3. If the problem persists, the system prompts the user to contact his/her bank or Paypal for support, for verification.

The figure displays two side-by-side mockups of a web form titled "Registration Form / Payment".

The left mockup shows the "Credit Card" payment method selected (radio button checked). It includes the following fields and options:

- Radio buttons for "Visa/Mastercard" (checked) and "Paypal".
- Radio buttons for "Card type": "Visa" and "Mastercard".
- Text input fields for "Card No", "Expiration date", and "CSC code".
- Radio buttons for "Pay monthly" and "Annual Fee".
- Text input field for "Amount".
- Text input fields for "Cardholder name", "Street", "City", and "Zipcode".
- Buttons for "Proceed Payment" and "Clear".

The right mockup shows the "Paypal" payment method selected (radio button checked). It includes the following fields and options:

- Radio buttons for "Visa/Mastercard" and "Paypal" (checked).
- Text input fields for "License fee", "Subtotal", "Processing fee", and "AMOUNT DUE".
- A yellow button with the text "Check out with PayPal".

Figure 14. User payment, mockup

iii. Profile Setup

Basic flow:

1. The user logs in to his/her account.
2. The system provides the form for account creation.
3. The user selects either to fill in manually the required fields, or create his/her profile by his/her LinkedIn profile information.
4. The system creates the user account, showing a success completion message.

Alternative flow:

1. The user selects Create from LinkedIn and his/her login credential are incorrect.
2. The system prompts the user to try again.
3. The user selects the option to reset his/her LinkedIn password,
4. The system connects with LinkedIn and auto fills the fields on the create profile form.
5. The user selects to save the form.
6. The system verifies account creation.

The screenshot shows a web browser window titled "Frame" containing a "Create Profile" form. The form is organized into several sections:

- Personal Details:** Includes input fields for "Name" (containing "jsmith") and "Surname" (containing "*****"). To the right is a "Create From:" section with a LinkedIn logo.
- ICT Experience:** Features a "Job Type" dropdown menu (set to "Project Manag...") and a "Years" dropdown menu (set to "2"). Below these is an "Add Experience" button.
- Certificates:** A grid of checkboxes for various certifications. The first column includes PMP, CCDA, CCNP, ITIL, and CEH. The second column includes CISSP, CISA, CCDA, MSCE, and Prince2. The third column includes CompTIA, AWS developer, CRISK, CGEIT, and CEH. A "Show more.." button is located below the grid.
- Education:** Includes "Area" and "Level" dropdown menus (set to "Engineering" and "Masters" respectively) and an "Add Education" button.
- Skills:** A single input field for skills.
- Buttons:** "Save" and "Cancel" buttons are located at the bottom right of the form.

Figure 15. Profile setup, mockup

iv. Self-Assessment

Basic flow:

1. The user logs in to his/her account
2. The system shows the option to user to fill in the self-assessing form for professional skills.
3. The user fulfills the data fields.
4. The system benchmarks the data with the volume of available ICT professionals for the selected role, target market, location, based on the A1 to A3 role.
5. The user creates the self-assessment.
6. The system returns the user's rating score and the options to view embedded analytics and request a detailed rating report.

The image shows a software mockup of a 'Self-Assessment Form' window. The window has a title bar with the text 'Self-Assessment Form' and a close button. Below the title bar is a 'Menu' button. The main content area is divided into several sections:

- Target ICT Role:** A dropdown menu with the selected option 'Project Manag...'.
- Target Market:** Three columns of checkboxes, each with an 'X' in a box. The first column includes Telcos, Finance (highlighted), Consulting, Engineering, and Utilities. The second column includes IT, Manufacturing, Logistics, Energy, and Pharmaceuticals. The third column includes Media, Retail, Supply Chain, Government, and Academia.
- Target Location:** Two dropdown menus. The first is labeled 'Country:' and has 'Greece' selected. The second is labeled 'City:' and has 'Brussels' selected.
- Language Level:** A dropdown menu with 'Working Proficien...' selected.
- Work Permitted:** Two radio buttons. The 'Yes' button is checked, and the 'No' button is unchecked.

At the bottom right of the form are two buttons: 'Save' and 'Cancel'.

Figure 16. Self-Assessment, mockup

v. Accessing Embedded analytics

Basic flow:

1. The user selects the option to view benchmark results of his profile over the LinkedIn matching profiles.
2. The system returns a profile summary and a technology skills benchmark, as radial bar or graph view type diagrams.
3. The user selects among the benchmarked ICT skills.
4. The system returns the benchmarked for the selected category.



Figure 17. Rating, mockup

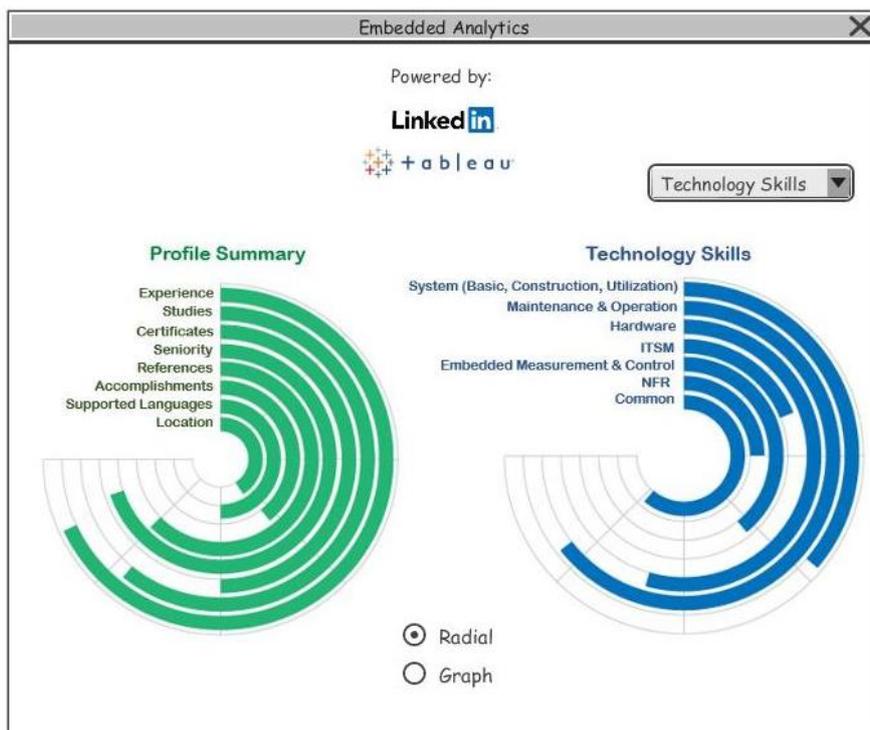


Figure 18. Profile Summary, mockup



Figure 19. Technology skills analysis, mockup

4.3.4. Structural Model

4.3.4.1. Class Diagram

The following diagram indicates the object-oriented representation of the analysis and design of the self-assessment web application. It serves to map the structure of the information system, while classes are the building blocks of objects, representing its interactions.

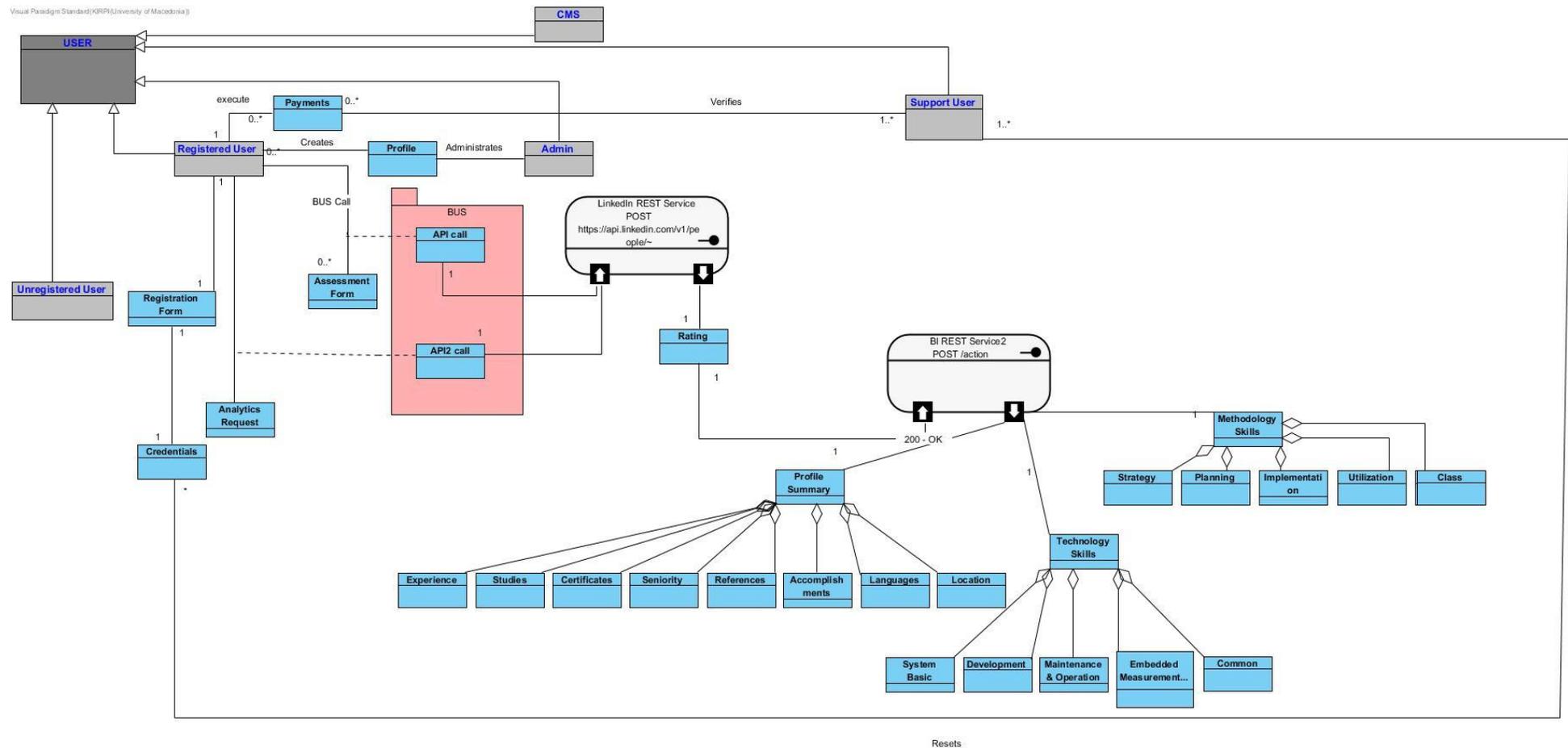


Figure 20. Class Diagram

4.4. Design

4.4.1. Robustness Diagrams

i. User Registration

Basic flow:

1. The user selects at the main page the registration option.
2. The system returns the registration form page.
3. The user fills in the data for registration.
4. The system is checking the database to verify if user exists.
5. The user accepts to finalize registration.
6. The system stores the registration details and creates the user account.

Alternative flow 1:

1. The user enters his registration credentials.
2. The system identifies that the email provided is already registered to the service and prompts to use another email.
3. The user repeats the registration process.

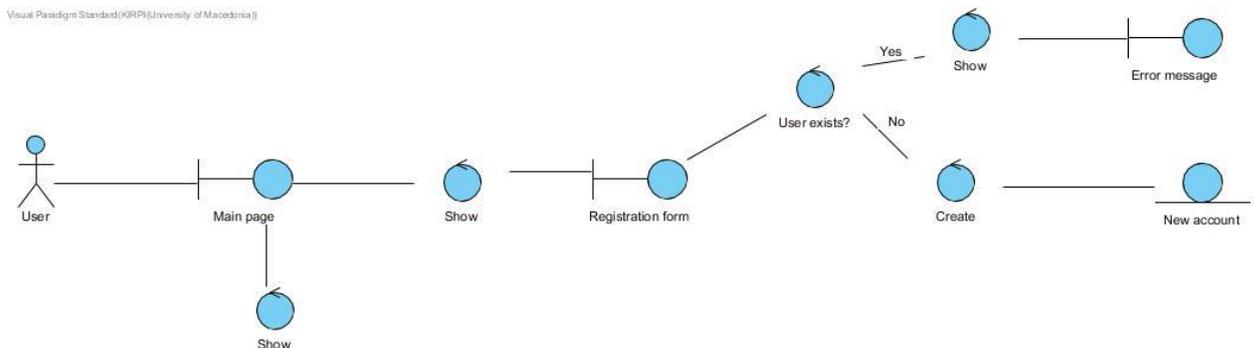


Figure 21. User Registration, Robustness diagram

ii. User Payment

Basic flow:

1. The user selects on the main page to login.
2. The system requests log in credentials.
3. The user provides the log in credentials.
4. The system verifies access.
5. The user selects to pay for premium service.
6. The system prompts to pay providing the options for using credit card or a Paypal account.
7. The user executes the payment.
8. The system verifies the payment.

Alternative flow 1:

1. The user selects on the main page to login.
2. The system requests log in credentials.
3. The user provides the log in credentials.
4. The system does not verify the login credentials and prompts the user to try again.

Alternative flow 2:

1. The user selects Paypal account for payment.
2. The requests Paypal login credentials.
3. The user provides the login credentials.
4. The system does not verify the login credentials and prompts the user to try again.

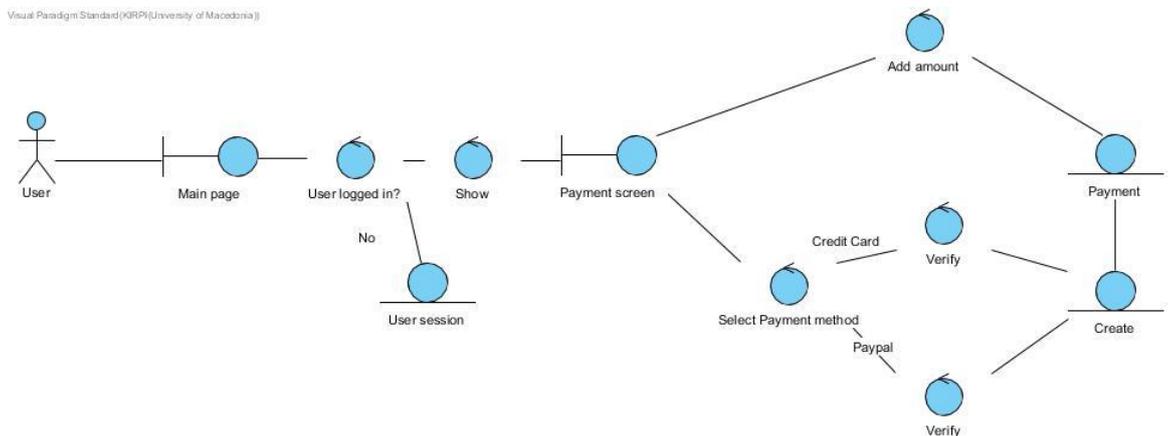


Figure 22. User payment, Robustness diagram

iii. Profile Setup

Basic flow:

1. The user selects the login from main page.
2. The system provides the login form.
3. The user enters his credentials.
4. The system verifies the existence on its database.
5. The user selects to create/edit his profile.
6. The system returns the create profile web form.
7. The user fulfils the data required to complete the form and creates the profile.
8. The system stores the profile on its database with authorized users.

Alternative flow 1:

1. The user selects on the main page to login.
2. The system requests log in credentials.
3. The user provides the log in credentials.
4. The system does not verify the login credentials and prompts the user to try again.

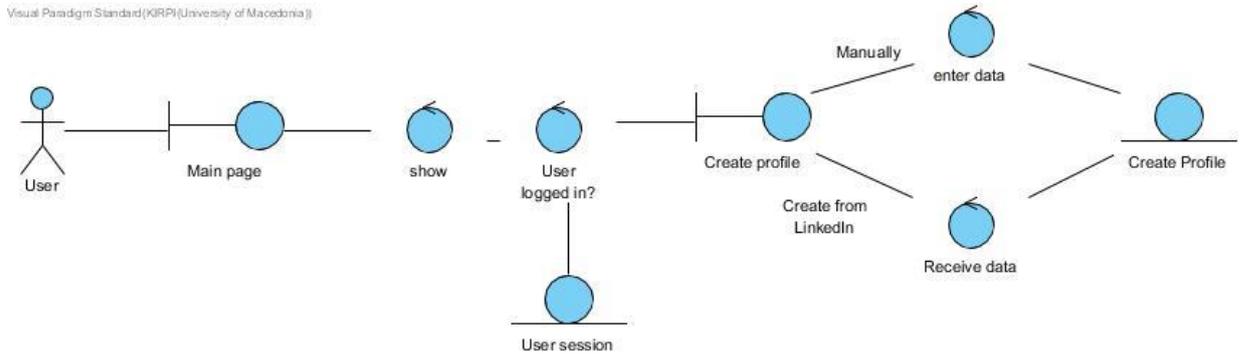


Figure 23. Profile Setup, Robustness diagram

iv. Self-Assessment

Basic flow:

1. The user selects the login from main page.
2. The system provides the login form.
3. The user enters his credentials.
4. The system verifies existence on its database.
5. The user selects to start a self-assessment session.
6. The system returns the self-assessment web form.
7. The user fulfils the data required to complete the form.
8. The system restores information from LinkedIn regarding current ICT jobholders with the user's skillset, for the selected geographical area.
9. The user is notified for his rating score.
10. The system stores the user's rating on his profile.

Alternative flow 1:

1. The user selects on the main page to login.
2. The system requests log in credentials.
3. The user provides the log in credentials.
4. The system does not verify the login credentials and prompts the user to try again.

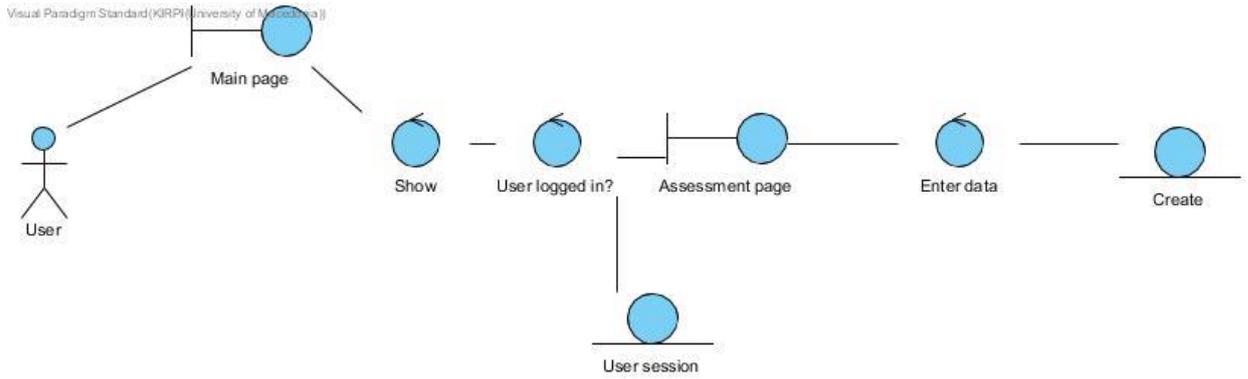


Figure 24. Self-Assessment, Robustness diagram

4.4.2. Sequence Diagrams

i. Registration diagram

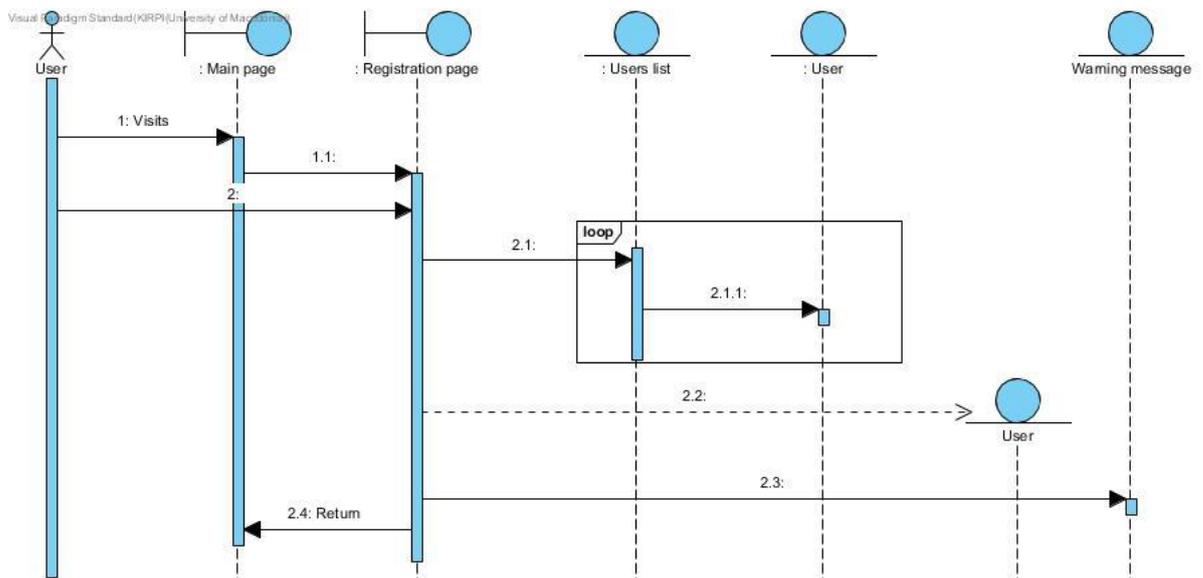


Figure 25. Registration, Sequence diagram

ii. Payment diagram

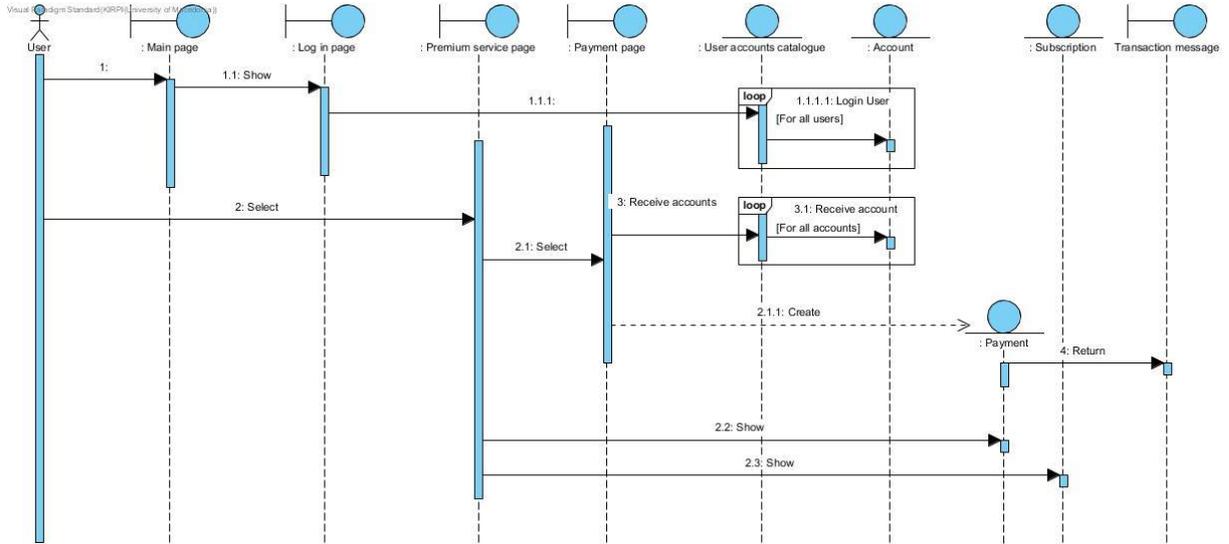


Figure 26. Payment, Sequence diagram

iii. Profile setup

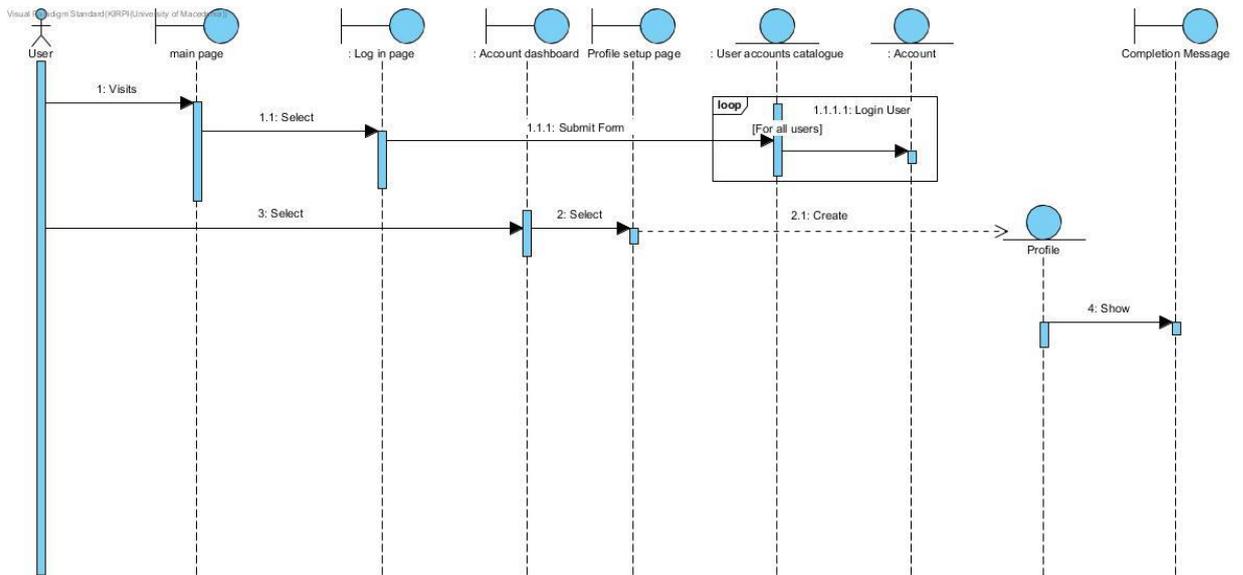


Figure 27. Profile setup, Sequence diagram

iv. Self-Assessment

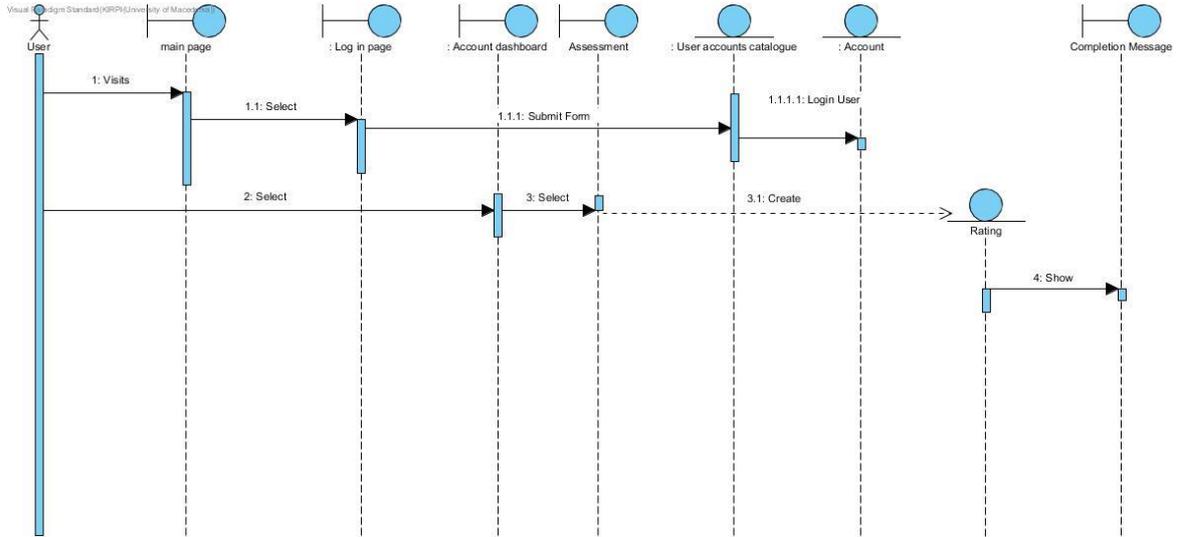


Figure 28. Self-Assessment, Sequence diagram

4.4.3. Detailed Class Diagrams

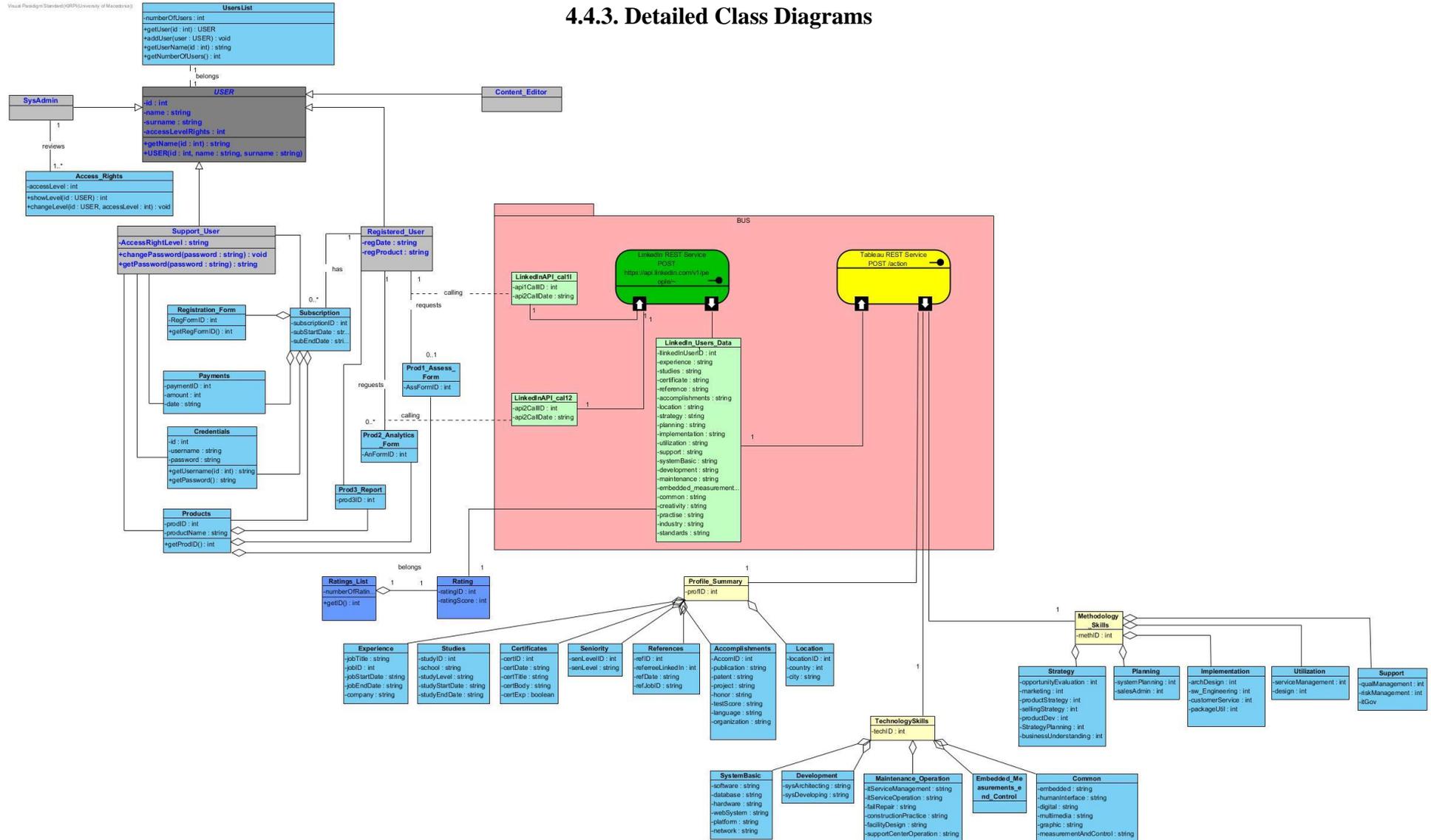


Figure 29. Detailed Class diagram

4.4.4. Deployment Diagram

On the model below is represented the structure of the run-time system, capturing the physical hardware elements and the communication lines between them

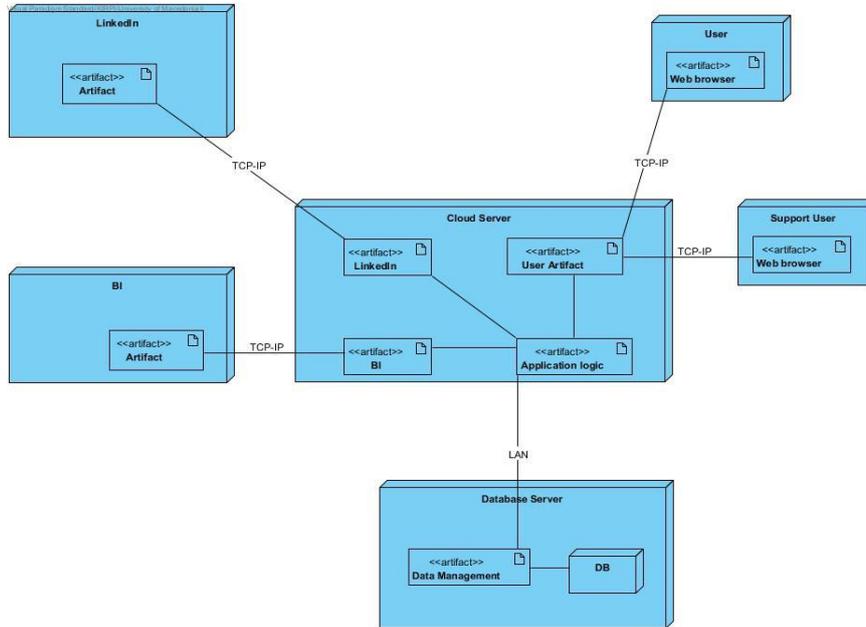


Figure 30. Deployment diagram

4.5. Implementation

4.5.1. Java Code

Having completed the detailed class diagram, following schema is generated as shown in the below graph. The detailed code for each class is available on Appendix III.



Figure 31. JAVA classes

4.6. Conclusions

The design and analysis of the web application carried on based on the market standards, as well as the intuitive Visual Paradigm v15 software. The level of detail of the design outcome is considered analytical, except the part where connection with the APIs of LinkedIn and Tableau is established. The Java code generated automatically, after the design of each class, including attributes and methods.

5. Business Plan

5.1. Executive Summary

Today, as the need for ICT professionals is constantly increasing in the global market, there is high demand by professionals in information with regards to their employability. The creation of “ICT-Q” serves to fulfil the current market gap, offering a web application that provides fast, rich and self-service big data analytics visualization, enabling professionals to acquire a rating for their qualifications as an indicative mark for their employability, by comparison of their profile with current ICT job holders.

The venture is a fully on-line business which requires start-up capital of €160.000, with projected profit taking and bank loan payback in the 3rd fiscal year. The operating plan focuses in the in-house development of the core architecture and outsourcing the needs in coding, web design, infrastructure and marketing, following a lean management method.

5.2. Company Description

5.2.1. Mission Statement

The reason of establishing the venture ICT-Q is to offer a web application that assists ICT professionals to self-assess their skills, benchmarking their profile with current ICT job holders of targeted roles and locations.

5.2.2. Business Objectives

The main objective of the venture is exploitation of SaaS, IaaS, PaaS technology, becoming the first web application that verifies employability status against targeted ICT roles in the form of scaled rating, as a self-service product.

5.2.3. Business Goals

To become a recognizable and trustful online house that supports ICT professionals in self-assessing their professional qualifications, providing unbiased and distinguishable skills rating services.

5.2.4. Organization & Management

The structure of the company is lean, following the example of single person start-ups with potential to scale up with regards to roles and responsibilities, based on growth. This model is depicted with numerous of outsourcing contracts for online services that cover application development, hosting, maintenance and marketing of company.

5.2.5. Establishment costs

The company will be established by co-funding from the business owner and a bank, providing a loan which will be paid in three years. The start-up capital required for the first year of operations is structured as following:

Business owner	Bank loan	Total
€60.000	€100.000	160.000

Table 7. Establishment costs

The company establishment and forecasted expenses for the first year of operations is summarized in the table below:

Cost Item	Cost
Business set up	
registration	1,500 €
Office set up	
rent	7,000 €
PCs	2,000 €
server room	4,000 €
utilities	2,000 €
Personnel (1 person)	
wedges	22,000 €
Suppliers	
Tableau embedded analytics	1,000 €
MS Suite	500 €
Outsource Dev	70,000 €
Web Design	10,000 €
AWS Cloud hosting service	10,000 €
Marketing Agency	30,000 €
TOTAL	160,000 €

Table 8. Start-up cost structure

5.2.6. Development timetable



Figure 32. Development time-plan

5.2.7. Development risks

The business concept of ICT-Q has certain development risks, with data availability feed from a third party to be considered as the most critical, also acknowledged as a single point of failure. The business model relies on the alliance with LinkedIn and provision of *r_fullprofile* access rights of their API. In order to anticipate the risks arising, alliance with LinkedIn should be established in advance, assuring also avoidance of interest conflicts. This risk can be avoided by offering to LinkedIn the capability to retain its Professional membership user basis.

The second most important risk is the lack of dedicated development team, however this is a challenge for the business owner to align with the parties and service outsourcing agencies that will add value to the organization, due to their ad hoc and on-demand expertise.

5.3. Products & Marketing

5.3.1 Description of products

The nature of the product is purely an offering of self-assessment of professional skills as a web service, available for subscription online. The service provides value to ICT professionals that are interested for their career development, being enabled to benchmark their skillset, acquire a rating certificate and boost as such their employability.

- **Product 1:** Standard SaaS self-assessment of professional skills service. This includes benchmarking of skills against all similar job holders at the selected country/ city which are registered on LinkedIn.
Price: €29, 99 monthly (or)
€299, 99 annually
- **Product 2:** Embedded analytics
Price: €29, 99 monthly (or)
€299, 99 annually
- **Product 3:** Personal detailed skills analysis and employability report
Price: €600, 00 per report

5.3.2. Marketing strategy

This section describes how ICT-Q will accomplish its mission and goals. In more details, this includes which campaigns, content, channels, and tools we'll use to execute the mission and track our success.

5.3.2.1. Target market:

The core services are targeted to the ICT professionals worldwide, without any limitation on the age and gender. While the basic SaaS service of rating score provision is addressed to potentially every ICT professional, the Rating Report is a premium service, thus is focused to an audience that have already career credits, working experience, and past achievements in the sector. Typically the category of middle management executives fall in with preciseness.

5.3.2.2. Market trends

According to the US Bureau of Labor Statistics, there is a clear signal for both grow of the demand for IT professionals, and change on the job search methods followed worldwide by professionals. With the rise of AI and Machine Learning assisted job matching, there is room for leveraging technology and big data, towards the provision of tailor made recommendations and self-assessment capabilities.

5.3.2.3. Porter 5-Forces Analysis

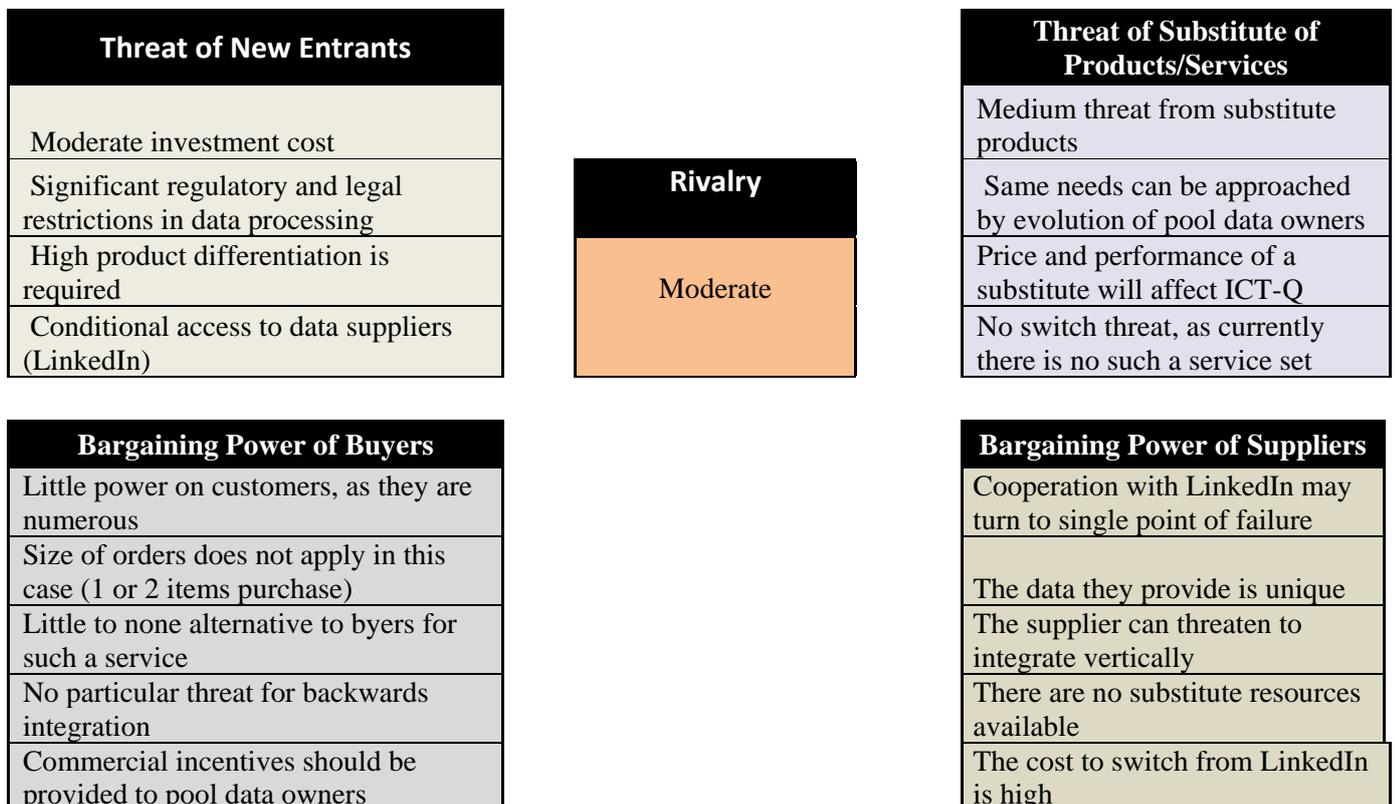


Figure 33. Porters' five forces diagram

5.3.2.4. Value proposition

The value proposition of the venture is related to the expected benefits arising end target to separate the company from the competition. This summarizes in the following characteristics:

- i. Un-paralleled functionality with regards to self-assessment of qualifications on-line, enabling users to benchmark their skillset with current ICT job holders for positions and geographic locations worldwide.
- ii. Rich qualifications insights with real time embedded analytics, enabling the user to create custom screens with an interactive BI tool for results representation.
- iii. Obtaining of a credible employability rating score.
- iv. Obtaining of a detailed personal ICT skills rating and employability report.
- v. Acquisition of CV strengthening qualifications evidences.

5.3.2.5. Marketing goals

The milestones that will be indicative of the success of the marketing strategy will be the following:

- i. Number of registered users: 2750 registrations in year 1.
- ii. Number of registrations for embedded analytics: 1380 registrations in year 1.
- iii. Number of personal rating reports: 60 in year 1.
- iv. The website conversion rate, from visitor to payed user: 0,5% in year 1.

5.3.2.6. Communication strategy

The company plans to communicate its message to the target market is based in the following:

- i. Search engine optimization (SEO) based on the self-assessment keywords
- ii. Social media campaigns, both free and paid
- iii. Paid advertising (Google AdWords)
- iv. Re-targeting and display advertising
- v. Content marketing
- vi. Free product trials with limited functionality/ duration.
- vii. Referral marketing, by creating links to popular blogs and marker places.
- viii. Co-marketing, focusing in LinkedIn alliance, providing the incentive to LinkedIn for increasing their professional account upgrade.
- ix. Viral marketing, creating viral videos and messages to be spread on social media.

5.3.2.7. Competition

The expected competition has been identified in the literature review, emphasizing in the ten most popular currently web applications that offer self-evaluation of professional qualification services. The following SWOT analysis diagram has been created to map the pros and cons with comparison to the competitors.

Strengths	Weaknesses
<ul style="list-style-type: none"> - Use of the latest SaaS, IaaS and PaaS technologies - Unique business proposition - Scale fast/ fail fast business model - 360' business view of the management tea 	<ul style="list-style-type: none"> - Limited technical expertise of the management team in systems integration. - High IS complexity - Reliance to funding schemes for scale up
Opportunities	Threats
<ul style="list-style-type: none"> - Decreasing costs of cloud services - Global IT labor availability for outsourcing - Increasing demand for ICT professionals - Market creation for employability rating services 	<ul style="list-style-type: none"> - Dependency on LinkedIn data, under the r_fullprofile member permission and the API policy - Data processing limitations under GDPR - Selection of Greece as primary business address, due to country risk (taxation, legislation, finance, alliances creation)

Figure 34. SWOT analysis diagram

5.4. Financial Plan

5.4.1. 12-Month Profit and Loss Projection

PROFIT & LOSS ACCOUNT

		EUR					
ICT-Q		2020		2021		2022	
Non audited non consolidated B/S			%		%		%
Number of months		12	struct.	12	struct.	12	struct.
Local inflation rate		3.5%		3.6%		3.7%	
TURNOVER (SALES)		150,000	100%	250,000	100%	420,000	100%
- Cost of goods sold		(93,500)	-62%	(125,000)	-50%	(140,000)	-33%
GROSS PROFIT		56,500	38%	125,000	50%	280,000	67%
- Selling, adm. & general expenses		(30,000)	-20%	(40,000)	-16%	(55,000)	-13%
+ Associated company profits			0%		0%		0%
+ Other operating revenue			0%		0%		0%
EBITDA		26,500	18%	85,000	34%	225,000	54%
- Non operating expenses			0%	(3,500)	-1%	(4,500)	-1%
+ Non operating revenues			0%		0%		0%
EBIT		26,500	18%	81,500	33%	220,500	53%
+ Interest income			0%		0%	0	0%
- Interest expense		(35,000)	-23%	(20,000)	-8%	(45,000)	-11%
PROFIT BEFORE TAXES		(8,500)	-6%	61,500	25%	175,500	42%
+ Extraordinary items			0%		0%		0%
- Taxation		(40,000)	-27%	(70,000)	-28%	(160,000)	-38%
NET PROFITp		(48,500)	-32%	(8,500)	-3%	15,500	4%
+/- Profit attributable to minorities			0%		0%		0%
PROFIT attributable to Shareholders		(48,500)	-32%	(8,500)	-3%	15,500	4%

Table 9. Profit & Loss projection (3 years projection)

5.4.2. Balance Sheet

ASSETS

		EUR					
ICT-Q		2020		2021		2022	
Non audited non consolidated B/S			%		%		%
Number of months		12	struct.	12	struct.	12	struct.
Local inflation rate		3.5%		3.6%		3.7%	
INTANGIBLE ASSETS		1,000	0%	1,000	0%	1,000	0%
Goodwill			0%		0%		0%
Trademarks			0%		0%		0%
* Intangibles		1,000	0%	1,000	0%	1,000	0%
FIXED ASSETS		26,500	9%	30,500	9%	37,500	7%
Land & buildings		8,000	3%	8,000	2%	8,000	2%
Plant & machinery		8,500	3%	14,000	4%	20,000	4%
Other fixed assets		10,000	3%	12,000	3%	14,000	3%
- Depreciation		0	0%	(3,500)	-1%	(4,500)	-1%
OTHER LONG TERM ASSETS		0	0%	0	0%	0	0%
Related company invest. at equity		0	0%	0	0%	0	0%
Other investments			0%	0	0%		0%
Debtors			0%		0%		0%
TOTAL NON CURRENT ASSETS		27,500	9%	31,500	9%	38,500	8%
INVENTORIES		130,000	42%	159,500	45%	158,000	31%
Raw materials			0%		0%		0%
Work-in-progress		40,000	13%	45,000	13%	40,000	8%
Finished goods		90,000	29%	114,500	32%	118,000	23%
Goods for resale			0%		0%		0%
* Inventories			0%		0%		0%
RECEIVABLES		20,000	7%	80,500	23%	100,000	20%
Advances & prepayments			0%		0%		0%
Trade debtors (Net receivables)		20,000	7%	80,500	23%	100,000	20%
Owed by Group companies			0%		0%		0%
Other debtors			0%		0%	0	0%
CASH EQ. & CURRENT INVESTMENTS		130,000	42%	81,500	23%	216,000	42%
Current investments			0%		0%		0%
Cash and equivalents		130,000	42%	81,500	23%	216,000	42%
PREPAID EXPENSES			0%		0%		0%
OTHER CURRENT ASSETS			0%		0%		0%
TOTAL ASSETS		307,500	100%	353,000	100%	512,500	100%
WORKING CAPITAL		32,500	11%	(23,500)	-7%	37,000	7%
WORKING CAPITAL REQUIREMENT		2,500	1%	(40,000)	-11%	(179,000)	-35%
NET CASH SURPLUS (DEFICIT)		30,000	10%	16,500	5%	216,000	42%

Table 10. Balance Sheet, Assets (3 years projection)

LIABILITIES & SHAREHOLDERS' EQUITY

ICT-Q

EUR

Non audited non consolidated B/S	2020	%	2021	%	2022	%
Number of months	12	struct.	12	struct.	12	struct.
Local inflation rate :	3.5%		3.6%		3.7%	
SHAREHOLDERS' FUNDS	60,000	20%	8,000	2%	75,500	15%
<i>Share capital & premium</i>	60,000	20%	60,000	17%	60,000	12%
<i>Revaluation reserve</i>	0	0%	0	0%	0	0%
<i>Other reserves</i>	0	0%	0	0%	0	0%
<i>Retained earnings</i>	0	0%	(52,000)	-15%	15,500	3%
* <i>Non equity reserves</i>	0	0%	0	0%	0	0%
<i>Consolidation differences</i>	0	0%	0	0%	0	0%
<i>PROFIT after dividends / LOSS</i>	0	0%	0	0%	0	0%
<i>MINORITY INTERESTS / Δικαιώματα τριτων</i>	0	0%	0	0%	0	0%
QUASI EQUITY	0	0%	0	0%	0	0%
<i>Capital due</i>	0	0%	0	0%	0	0%
EQUITY & MINORITY INTERESTS	60,000	20%	8,000	2%	75,500	15%
DEFERRED LIABILITIES		0%		0%		0%
DEFERRED TAXATION		0%		0%		0%
LONG TERM DEBT		0%		0%		0%
<i>Bonds</i>		0%		0%		0%
<i>Bank loans</i>		0%		0%		0%
<i>Intercompany debt</i>		0%		0%		0%
<i>Other creditors & liabilities(> 1 year)</i>		0%	15,000	4%	25,000	5%
TOTAL LONG TERM RESOURCES	60,000	20%	8,000	2%	75,500	15%
OPERATING LIABILITIES	147,500	48%	280,000	79%	437,000	85%
<i>Customers' advances & prepayments</i>		0%		0%		0%
<i>Trade creditors Accounts payable</i>	93,000	30%	146,500	42%	230,000	45%
<i>Other creditors (other current liabilities)</i>	54,500	18%	133,500	38%	207,000	40%
SHORT TERM DEBT / ΒΡΑΧΥΠ. ΔΑΝΕΙΑ	100,000	33%	65,000	18%	0	0%
<i>Long term debt (due within 1 year)</i>	100,000	33%	65,000	18%	0	0%
<i>Bank loans & overdrafts</i>		0%		0%		0%
<i>UNREALIZED INCOME</i>		0%		0%		0%
OTHER CURRENT LIABILITIES	0	0%	0	0%	0	0%
TOTAL LIABILITIES & EQUITY /	307,500	100%	353,000	100%	512,500	100%
CONTINGENT LIABILITIES	0	0%	0	0%	0	0%
<i>Guarantees</i>	0	0%	0	0%	0	0%
<i>Other commitments</i>	0	0%	0	0%	0	0%
NET WORTH	59,000	19%	7,000	2%	74,500	15%

Table 11. Balance Sheet, Liabilities (3 years projection)

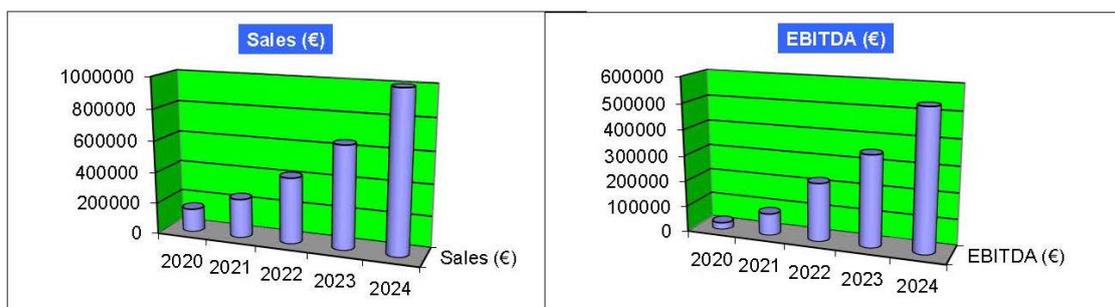


Figure 35. Sales and EBITDA forecasts

5.4.3. Financial Ratios

RATIOS

ICT-Q

Non audited non consolidated B/S		2020	2021	2022
	Number of months	12	12	12
	Local inflation rate	3.5%	3.6%	3.7%
PROFIT attributable to SHAREHOLDERS		(48,500)	(8,500)	15,500
- Dividends		0	0	0
PROFIT after dividends		(48,500)	(8,500)	15,500
DIVIDENDS in % of Profit attr. to shareholders		0.0%	0.0%	0.0%
Number of shares		10,000	10,000	10,000
Number of employees		1	1	1

RATIOS				
EBITDA / Interest expense		0.8	4.3	5.0
EBIT / Interest expense (EQC)		0.8	4.1	4.9
Interest expense / Turnover		23.3%	8.0%	10.7%
Profit before tax / Employee		(8,500.0)	61,500.0	175,500.0
Net profit per share (units)		(4.9)	(0.9)	1.6
Return on capital employed *		NA	NA	NA

Inventories / Turnover (days)		316	233	137
Trade debtors / Turnover (days)		49	118	87
Inventories + receivables / Turnover (days)		365	350	224
W/C requirement / Turnover (days)		6	(58)	(156)
Working capital / Turnover (days)		79	(34)	32
Short term debt / Turnover (days)		243	95	0

Net Worth / Total assets		19.2%	2.0%	14.5%
Pay back period * (EQC)		NA	NA	NA
Gross gearing * (LT debt+ST debt+Leasing/NW)		NA	NA	NA
Net gearing *		NA	NA	NA
Leverage *		NA	NA	NA
Leverage (SG)		4.19	49.29	5.87
Current ratio		1.1	0.9	1.1
Liquid ratio (acid test) (EQC)		0.6	0.5	0.7

DATA FOR EQC				
Structure (ratio)		2.8	4.9	NA
Inventories + Receivables + Liquid assets		280,000	321,500	474,000
Net profit + Interest expense		(13,500)	11,500	60,500

Table 12. Forecasted financial ratios

5.5. Conclusions

The business plan structured to serve the launch of ICT-Q, as a venture that will commercialize the web application for self-evaluation of professional skills in the global market. It appears as a considerable challenging business model, highlighting the strategic alliance that has to be established with LinkedIn, as it is the sole provider of data to serve the design of the application. This risk can be anticipated with the development of marketing alliance strategy, providing to LinkedIn the incentives to sell premium account upgrade services to the web-app users.

With regards to the operational model, a lean approach with full outsourcing strategy of IT development, infrastructure management and marketing execution is adopted. The key to success is the business owner to emphasize in the establishment of the architectural

design of the web application, and the allocation of the appropriate partners for the selected outsourced partners

With regards to the financial model, there is a need for a total start-up capital of €160.000. The business modelled with the provision of bank loan of €100.000, supplied in the form of working capital, fully payable in the 3rd fiscal year. The mode utilizes 100% of the sales targets of the 3 products, as set on the marketing success factors. This is translated to registration of 2750 for the simple “get rating” service, 1380 registrations to “get analytics” and 60 detailed employability rating reports. These numbers are considered achievable for an online service, addressed globally, and it is matter of precise product management and marketing.

Considering the financial forecasts, the venture assuming 100% realization of the sales targets for the 1st year, shall present positive earnings before taxes from its first fiscal year. Moreover, it is expected to fully pay back the bank loan and present net profits of €15.500 on its 3rd fiscal year.

6. Conclusions & Recommendations

This thesis explores the concept of online self-assessment of professional qualifications, as an initiative from personal exposure of the author to the ICT market, acknowledging the difficulties arising in judging the employability potential of his profile in the market. Nowadays, despite the vast amount of information being available from different online and offline sources, it is yet not available a toolset that can enable a professional to objectively define his/her employability level against specific ICT roles, in specific geographic regions.

The outcome of this thesis underlines this gap in the current web applications' offerings, as a result from a literature review conducted to approach the problem domain. More specifically, it has been identified that nowadays the web applications serve to offer functionality that can be used for the purpose of self-assessment, although they offer rich functionality in skills matching and job matching, these services are not offered on the basis of self-evaluation and benchmarking with current job holders and geolocation criteria.

This outcome triggered innovative thinking which led to the creation of a rating model that allows professionals to acquire a rating score of their employability. In order to establish this rating schema, similar methodologies studied that apply in the financial sector, and specifically by the financial credit rating organizations which are able to justify the financial status of a national or private bond.

The next challenge of this thesis was to incorporate this functionality within a new web application. In order to impose employability rating features within the new app, a thorough study of ICT skills matching models studied. Among the available frameworks, the structure recommended by the Enterprise IT Body of Knowledge (EITBOK) chosen as the most appropriate, to be used as a benchmark basis with ICT jobholders' data available online by LinkedIn.

The process of software design analysis followed, includes additional capabilities for big data analytics, as an embedded add-on. As such, with the creation of this new web application, an ICT professional may not only compare his/ her technology, methodology, related knowledge, EIT human and specific skills within the app, but can also use the latest technology for big data analytics and visualization offered by Tableau.

There are certain assumptions made in this work and the key assumption, which is rather critical for decision making and taking entrepreneurial act, is the availability of pool data. More specifically, the source that holds the data and provides API connectivity, in our case LinkedIn, should allow access to the *r_fullprofile* version, offered publically and free of commercial charge, but under review of an application. As such, the communication strategy should precisely consider to assure alliance with the data owner, and also secure GDPR compliance.

With regards to the web app launch in the market, a business plan created to structure the operations, products, marketing and finance strategy. Based on the plan, within the period of the first three years, a total working capital of €160.000 required. The forecasted figures for sales, earnings before interests and taxes, net profits, liquidity are highly promising and the start-up capital is considered relatively low.

This thesis provides great room for additional research in both the application design part, as well as with regards to the entrepreneurial business plan. Firstly, it is recommended for future research to investigate further in the communications protocols and API architecture compatibility between the data providing vendor and the BI vendor. The latest version of Visual Paradigm v15 used in this thesis offers rich UML functionality for Restful API calls modeling, and is associated with the built-in Java code generator.

Another field that is recommended to be further explored is the scaling needs of the system, with regards to precise infrastructure needs and costs over both the period of the first three years, as well as in the longer run, to verify operational efficiency, sustainability and business continuity. An approach of applying the ITIL v3 framework for service strategy, service design, service transition, operation and continuous improvement shall be highly effective in this case.

With regards to the skillset taken into consideration based on iCD framework, it is recommended further research into soft skills frameworks, to be incorporated also on the employability rating schema. The benefits arise from this coupling of soft skills, with the already considered factors of skills, experience, certificates, education, linguistics, recommendations and accomplishments received from LinkedIn profiles, shall create a highly differentiated product.

Finally regards to financial performance modeling, except the use of greater than three years' time spam, it is recommended the use of Altman Z-score for bankruptcy, which is

indicative for a company's profitability, leverage, liquidity and solvency, predicting the probability of company being insolvent. Moreover, it is recommended to explore additional sales utilization scenarios, in order to explore financial performance under different theoretical conditions.

Conclusively, assuring *r_fullprofile* version of LinkedIn API provision, the new web application can turn into a favorable investment initiative.

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List of appendices

I) LinkedIn r_fullprofile data fields

FIELD NAME	DESCRIPTION
last-modified-timestamp	The timestamp, in milliseconds, when the member's profile was last edited.
proposal-comments	A short-form text area describing how the member approaches proposals.
associations	A short-form text area listing the various associations the member is a part of.
interests	A short-form text area describing the member's interests.
publications	An object representing the various publications associated with the member. See Publication Fields for a description of the fields available within this object.
patents	An object representing the various patents associated with the member. See Patent Fields for a description of the fields available within this object.
languages	An object representing the languages that the member knows. See Language Fields for a description of the fields available within this object.
skills	An object representing the skills that the member holds. See Skill Fields for a description of the fields available within this object.
certifications	An object representing the certifications that the member holds. See Certification Fields for a description of the fields available within this object.
educations	An object representing the user's educational background. See Education Fields for a description of the fields available within this object.
courses	An object representing courses the member has taken.

	See Course Fields for a description of the fields available within this object.
volunteer	An object representing the member's volunteer experience. See Volunteer Fields for a description of the fields available within this object.
three-current-positions	A collection of current positions that the member holds, capped at three. See Position Fields for a description of the fields available within this object.
three-past-positions	A collection of the most recent past positions that the member held, capped at three. See Position Fields for a description of the fields available within this object.
num-recommenders	The number of recommendations that the member has.
recommendations-received	An object representing the recommendations that the member has received. See Recommendation Fields for a description of the fields available within this object.
following	A collection of people, company and industries that the member is following.
job-bookmarks	A collection of jobs that the member is following.
suggestions	A collection of people, companies and industries suggested for the member to follow.
date-of-birth	The member's date of birth. This field may not return the year as part of the date, if the member has not provided it.
member-url-resources	An object representing the URLs the member has shared on their LinkedIn profile.
related-profile-views	An object listing related member profiles that were viewed before or after the member's profile.
honors-awards	An object representing the various honors and awards the member has received.

II) ICT employability rating schema

RATING	DESCRIPTION
AAA	The best quality of ICT profile, within the top 5%.
AA	high quality ICT profile, within the top 15%
A	Above average quality ICT profile, within top 25%
BBB	Average class ICT profile, satisfactory for employment, top 30%
BB	Below average ICT profile, top 40%.
B	Base scoring ICT profile, top 50%
CCC	Below base scoring ICT profile, below 50%
CC	Moderate scoring ICT profile, below 60%.
C	weak scoring ICT profile, below 75%
D	Limited scoring ICT profile, below 85%
NR	Not meeting the ICT profile prerequisites

III) Jave code

```
public class Access_Rights {  
  
    private int accessLevel;  
  
    /**  
     *  
     * @param id  
     */  
    public int showLevel(USER id) {  
        // TODO - implement Access_Rights.showLevel  
        throw new UnsupportedOperationException();  
    }  
  
    /**  
     *  
     * @param id  
     * @param accessLevel  
     */  
    public void changeLevel(USER id, int accessLevel) {  
        // TODO - implement Access_Rights.changeLevel  
        throw new UnsupportedOperationException();  
    }  
}
```

```
public class Accomplishments extends Profile_Summary {
```

```
    private int AccomID;  
    private string publication;  
    private string patent;  
    private string project;  
    private string honor;  
    private string testScore;  
    private string language;  
    private string organization;
```

```
    public int getAccomID() {  
        return this.AccomID;  
    }  
}
```

```
    public string getPublication() {  
        return this.publication;  
    }  
}
```

```
    public string getPatent() {  
        return this.patent;  
    }  
}
```

```
    public string getProject() {  
        return this.project;  
    }  
}
```

```

    public string getHonor() {
        return this.honor;
    }

    public string getTestScore() {
        return this.testScore;
    }

    public string getLanguage() {
        return this.language;
    }

    public string getOrganization() {
        return this.organization;
    }
}

public class Certificates extends Profile_Summary {

    private int certID;
    private string certDate;
    private string certTitle;
    private string certBody;
    private boolean certExp;

    public int getCertID() {
        return this.certID;
    }

    public void setCertID(int certID) {
        this.certID = certID;
    }

    public string getCertDate() {
        return this.certDate;
    }

    public string getCertTitle() {
        return this.certTitle;
    }

    public string getCertBody() {
        return this.certBody;
    }

    public boolean isCertExp() {
        return this.certExp;
    }
}

```

```

public class Common extends TechnologySkills {

```

```

private string embedded;
private string humanInterface;
private string digital;
private string multimedia;
private string graphic;
private string measurementAndControl;

public string getEmbedded() {
    return this.embedded;
}

public void setEmbedded(string embedded) {
    this.embedded = embedded;
}

public string getHumanInterface() {
    return this.humanInterface;
}

public void setHumanInterface(string humanInterface) {
    this.humanInterface = humanInterface;
}

public string getDigital() {
    return this.digital;
}

public void setDigital(string digital) {
    this.digital = digital;
}

public string getMultimedia() {
    return this.multimedia;
}

public void setMultimedia(string multimedia) {
    this.multimedia = multimedia;
}

public string getGraphic() {
    return this.graphic;
}

public void setGraphic(string graphic) {
    this.graphic = graphic;
}

public string getMeasurementAndControl() {
    return this.measurementAndControl;
}

```

```

        public void setMeasurementAndControl(string measurementAndControl) {
            this.measurementAndControl = measurementAndControl;
        }
    }

public class Content_Editor extends USER {
}

public class Credentials {

    private int id;
    private string username;
    private string password;

    /**
     *
     * @param id
     */
    public string getUsername(int id) {
        return this.username;
    }

    public string getPassword() {
        return this.password;
    }
}

public class Development extends TechnologySkills {

    private string sysArchitecting;
    private string sysDeveloping;

    public string getSysArchitecting() {
        return this.sysArchitecting;
    }

    public void setSysArchitecting(string sysArchitecting) {
        this.sysArchitecting = sysArchitecting;
    }

    public string getSysDeveloping() {
        return this.sysDeveloping;
    }

    public void setSysDeveloping(string sysDeveloping) {
        this.sysDeveloping = sysDeveloping;
    }
}

public class Embedded_Measurements_end_Control extends TechnologySkills {
}

public class Experience extends Profile_Summary {

    private string jobTitle;

```

```

private int jobID;
private string jobStartDate;
private string jobEndDate;
private string company;

public string getJobTitle() {
    return this.jobTitle;
}

public void setJobTitle(string jobTitle) {
    this.jobTitle = jobTitle;
}

public int getJobID() {
    return this.jobID;
}

public void setJobID(int jobID) {
    this.jobID = jobID;
}

public string getJobStartDate() {
    return this.jobStartDate;
}

public void setJobStartDate(string jobStartDate) {
    this.jobStartDate = jobStartDate;
}

public string getJobEndDate() {
    return this.jobEndDate;
}

public void setJobEndDate(string jobEndDate) {
    this.jobEndDate = jobEndDate;
}

public string getCompany() {
    return this.company;
}

public void setCompany(string company) {
    this.company = company;
}
}

```

```

public class LinkedIn_Users_Data {

```

```

    private int llinkedInUserID;
    private string experience;
    private string studies;
    private int certificate;

```

```

private string reference;
private int accomplishments;
private int location;
private string strategy;
private string planning;
private string implementation;
private string utilization;
private string support;
private string systemBasic;
private string development;
private string maintenance;
private int embedded_measurements;
private string common;
private string practise;
private string industry;
private string standards;

public int getLlinkedInUserID() {
    return this.llinkedInUserID;
}

public void setLlinkedInUserID(int llinkedInUserID) {
    this.llinkedInUserID = llinkedInUserID;
}

public string getExperience() {
    return this.experience;
}

public string getStudies() {
    return this.studies;
}

public int getCertificate() {
    return this.certificate;
}

public string getReference() {
    return this.reference;
}

public int getAccomplishments() {
    return this.accomplishments;
}

public int getLocation() {
    return this.location;
}

public string isStrategy() {
    return this.strategy;
}

```

```

public string isPlanning() {
    return this.planning;
}

public string isImplementation() {
    return this.implementation;
}

public string isUtilization() {
    return this.utilization;
}

public string isSupport() {
    return this.support;
}

public string isSystemBasic() {
    return this.systemBasic;
}

public string isDevelopment() {
    return this.development;
}

public string isMaintenance() {
    return this.maintenance;
}

public int getEmbedded_measurements() {
    return this.embedded_measurements;
}

public string isCommon() {
    return this.common;
}

public string getCreativity() {
    return this.creativity;
}

public string getPractice() {
    return this.practice;
}

public string getIndustry() {
    return this.industry;
}

public string getStandard() {
    return this.standard;
}

}

```

```

public class LinkedInAPI_cal11 {

    private int api1CallID;
    private string api2CallDate;

    public int getApi1CallID() {
        return this.api1CallID;
    }

    public void setApi1CallID(int api1CallID) {
        this.api1CallID = api1CallID;
    }

    public string getApi2CallDate() {
        return this.api2CallDate;
    }
}

```

```

public class LinkedInAPI_cal12 {

    private int api2CallID;
    private string api2CallDate;

    public int getApi2CallID() {
        return this.api2CallID;
    }

    public void setApi2CallID(int api2CallID) {
        this.api2CallID = api2CallID;
    }

    public string getApi2CallDate() {
        return this.api2CallDate;
    }
}

public class Implementation extends Methodology_Skills {

    private int archDesign;
    private int sw_Engineering;
    private int customerService;
    private int packageUtil;

    public int getArchDesign() {
        return this.archDesign;
    }

    public int getSw_Engineering() {
        return this.sw_Engineering;
    }

    public int getCustomerService() {

```

```

        return this.customerService;
    }

    public int getPackageUtil() {
        return this.packageUtil;
    }
}

public class Location extends Profile_Summary {

    private int locationID;
    private int country;
    private string city;

    public int getLocationID() {
        return this.locationID;
    }

    public int getCountry() {
        return this.country;
    }

    public string getCity() {
        return this.city;
    }
}

public class Maintenance_Operation extends TechnologySkills {

    private string itServiceManagement;
    private string itServiceOperation;
    private string failRepair;
    private string constructionPractice;
    private string facilityDesign;
    private string supportCenterOperation;

    public string getItServiceManagement() {
        return this.itServiceManagement;
    }

    public void setItServiceManagement(string itServiceManagement) {
        this.itServiceManagement = itServiceManagement;
    }

    public string getItServiceOperation() {
        return this.itServiceOperation;
    }

    public void setItServiceOperation(string itServiceOperation) {
        this.itServiceOperation = itServiceOperation;
    }

    public string getFailRepair() {

```

```

        return this.failRepair;
    }

    public void setFailRepair(string failRepair) {
        this.failRepair = failRepair;
    }

    public string getConstructionPractice() {
        return this.constructionPractice;
    }

    public void setConstructionPractice(string constructionPractice) {
        this.constructionPractice = constructionPractice;
    }

    public string getFacilityDesign() {
        return this.facilityDesign;
    }

    public void setFacilityDesign(string facilityDesign) {
        this.facilityDesign = facilityDesign;
    }

    public string getSupportCenterOperation() {
        return this.supportCenterOperation;
    }

    public void setSupportCenterOperation(string supportCenterOperation) {
        this.supportCenterOperation = supportCenterOperation;
    }
}

public class Methodology_Skills {
}

public class Payments {

    private int paymentID;
    private int amount;
    private string date;
}

public class Planning extends Methodology_Skills {

    private int systemPlanning;
    private int salesAdmin;

    public int getSystemPlanning() {
        return this.systemPlanning;
    }

    public void setSystemPlanning(int systemPlanning) {
        this.systemPlanning = systemPlanning;
    }
}

```

```

        public int getSalesAdmin() {
            return this.salesAdmin;
        }

        public void setSalesAdmin(int salesAdmin) {
            this.salesAdmin = salesAdmin;
        }
    }

    public class Prod1_Assess_Form {

        private int AssFormID;
    }

    public class Prod2_Analytics_Form {

        private int AnFormID;

        public int getAnFormID() {
            return this.AnFormID;
        }
    }

    public class Prod3_Report {

        private int prod3ID;

        public int getProd3ID() {
            return this.prod3ID;
        }

        public void setProd3ID(int prod3ID) {
            this.prod3ID = prod3ID;
        }
    }

    public class Products {

        private int prodID;
        private string productName;

        public string getProductName() {
            return this.productName;
        }

        public void setProductName(string productName) {
            this.productName = productName;
        }

        public int getProdID() {
            return this.prodID;
        }
    }

```

```

public class Profile_Summary {
}

public class Rating {

    private int ratingID;
    private int ratingScore;

    public int getRatingID() {
        return this.ratingID;
    }

    public int getRatingScore() {
        return this.ratingScore;
    }

    public void setRatingScore(int ratingScore) {
        this.ratingScore = ratingScore;
    }
}

public class Ratings_List {

    private int numberOfRating;

    public int getNumberOfRating() {
        return this.numberOfRating;
    }

    public int getID() {
        // TODO - implement Ratings_List.getID
        throw new UnsupportedOperationException();
    }
}

public class References extends Profile_Summary {

    private int refID;
    private int referreeLinkedIn;
    private string refDate;
    private string refJobID;

    public int getRefID() {
        return this.refID;
    }

    public int getReferreeLinkedIn() {
        return this.referreeLinkedIn;
    }

    public string getRefDate() {
        return this.refDate;
    }
}

```

```

        public string getRefJobID() {
            return this.refJobID;
        }
    }

public class Registered_User extends USER {

    private string regDate;
    private string regProduct;

    public string getRegProduct() {
        return this.regProduct;
    }

    public void setRegProduct(string regProduct) {
        this.regProduct = regProduct;
    }
}

public class Registration_Form {

    private int RegFormID;

    public int getRegFormID() {
        // TODO - implement Registration_Form.getRegFormID
        throw new UnsupportedOperationException();
    }
}

public class Seniority extends Profile_Summary {

    private int senLevelID;
    private string senLevel;

    public int getSenLevelID() {
        return this.senLevelID;
    }

    public string getSenLevel() {
        return this.senLevel;
    }
}

public class Strategy extends Methodology_Skills {

    private int opportunityEvaluation;
    private int marketing;
    private int productStrategy;
    private int sellingStrategy;
    private int productDev;
    private int StrategyPlanning;
    private int businessUnderstanding;

    public int getOpportunityEvaluation() {

```

```

        return this.opportunityEvaluation;
    }

    public int getMarketing() {
        return this.marketing;
    }

    public int getProductStrategy() {
        return this.productStrategy;
    }

    public int getSellingStrategy() {
        return this.sellingStrategy;
    }

    public int getProductDev() {
        return this.productDev;
    }

    public int getStrategyPlanning() {
        return this.StrategyPlanning;
    }

    public int getBusinessUnderstanding() {
        return this.businessUnderstanding;
    }
}

public class Studies extends Profile_Summary {

    private int studyID;
    private string school;
    private string studyLevel;
    private string studyStartDate;
    private string studyEndDate;

    public int getStudyID() {
        return this.studyID;
    }

    public string getSchool() {
        return this.school;
    }

    public string getStudyLevel() {
        return this.studyLevel;
    }

    public string getStudyStartDate() {
        return this.studyStartDate;
    }

    public string getStudyEndDate() {

```

```

        return this.studyEndDate;
    }
}

public class Subscription {

    private int subscriptionID;
    private string subStartDate;
    private string subEndDate;

    public int getSubscriptionID() {
        return this.subscriptionID;
    }

    public void setSubscriptionID(int subscriptionID) {
        this.subscriptionID = subscriptionID;
    }
}

public class Support extends Methodology_Skills {

    private int qualManagement;
    private int riskManagement;
    private int itGov;

    public int getQualManagement() {
        return this.qualManagement;
    }

    public int getRiskManagement() {
        return this.riskManagement;
    }

    public void setRiskManagement(int riskManagement) {
        this.riskManagement = riskManagement;
    }

    public int getItGov() {
        return this.itGov;
    }
}

public class Support_User extends USER {

    private string AccessRightLevel;

    public string getAccessRightLevel() {
        return this.AccessRightLevel;
    }

    public void setAccessRightLevel(string AccessRightLevel) {
        this.AccessRightLevel = AccessRightLevel;
    }
}

```

```

/**
 *
 * @param password
 */
public void changePassword(string password) {
    // TODO - implement Support_User.changePassword
    throw new UnsupportedOperationException();
}

/**
 *
 * @param password
 */
public string getPassword(string password) {
    // TODO - implement Support_User.getPassword
    throw new UnsupportedOperationException();
}
}

public class SysAdmin extends USER {
}

public class SystemBasic extends TechnologySkills {

    private string software;
    private string database;
    private string hardware;
    private string webSystem;
    private string platform;
    private string network;

    public string getSoftware() {
        return this.software;
    }

    public void setSoftware(string software) {
        this.software = software;
    }

    public string getDatabase() {
        return this.database;
    }

    public void setDatabase(string database) {
        this.database = database;
    }

    public string getHardware() {
        return this.hardware;
    }

    public void setHardware(string hardware) {
        this.hardware = hardware;
    }

```

```

    }

    public string getWebSystem() {
        return this.webSystem;
    }

    public void setWebSystem(string webSystem) {
        this.webSystem = webSystem;
    }

    public string getPlatform() {
        return this.platform;
    }

    public void setPlatform(string platform) {
        this.platform = platform;
    }

    public string getNetwork() {
        return this.network;
    }

    public void setNetwork(string network) {
        this.network = network;
    }
}

public class TechnologySkills {
}

public abstract class USER {

    private int id;
    private string name;
    private string surname;
    private int accessLevelRights;

    /**
     *
     * @param id
     */
    public string getName(int id) {
        return this.name;
    }

    /**
     *
     * @param id
     * @param name
     * @param surname
     */
    public USER(int id, string name, string surname) {
        // TODO - implement USER.USER
    }
}

```

```

        throw new UnsupportedOperationException();
    }
}

public class UsersList {

    private int numberOfUsers;

    /**
     *
     * @param id
     */
    public USER getUser(int id) {
        // TODO - implement UsersList.getUser
        throw new UnsupportedOperationException();
    }

    /**
     *
     * @param user
     */
    public void addUser(USER user) {
        // TODO - implement UsersList.addUser
        throw new UnsupportedOperationException();
    }

    /**
     *
     * @param id
     */
    public String getUsername(int id) {
        // TODO - implement UsersList.getUsername
        throw new UnsupportedOperationException();
    }

    public int getNumberOfUsers() {
        return this.numberOfUsers;
    }
}

public class Utilization extends Methodology_Skills {

    private int serviceManagement;
    private int design;

    public int getServiceManagement() {
        return this.serviceManagement;
    }

    public int getDesign() {
        return this.design;
    }
}

```

}