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Designing Model for Career Development Service

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The purpose of this thesis was to design a model for a new career development service. The service has to solve the existing career development problems, such as understanding personal position and opportunities in the job market, ways to develop new skills, and how to keep the skill set up-to-date.

This study was based on existing knowledge and best practices about Service Design and Database modelling. The chosen conceptual frameworks for different parts of the service model execution created a holistic conceptual framework for service model design. It can be used for modeling other online services.

The model was explained graphically by using Service Encounter Blueprint, Entity-Relational modelling with verbal description. The validation of the service model was done by creating database prototype with real-life data. After that it was tested with specialists from chosen occupational area.

This thesis fulfilled the assigned objective. The designed model received good assessment from the users. Nonetheless, this study is only the first step for creating an online Career Development Service. The model can be changed in the next steps of service creation due to different reasons (for example, data analysis results, software specifics). But this is a well-described and validated model for the next steps of service creation.

Keywords	Service, Service design, career service, service concept, Entity-Relational model, Service Encounter Blueprint

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Appendix 1. Survey.

List of Abbreviations

CV	Curriculum Vitae
CVC	Customer Value Constellation
ER	Entity-relational
IoS	Internet of Services
IoT	Internet of Things
IT	Information Technology
MSD	Multilevel Service Design
SA	Strategic assessment
SC	Supply Chain
SEB	Service Experience Blueprint
SSA	Service System Architecture
SSC	Smart Supply Chain
SSN	Service System Navigation

1 Introduction

Career is a significant part of human life. Due to diversity of professions and difficult structure of industries it is challenging to make right decisions about career for an ordinary person. That is why career development services are useful for people. Different types of career services can be found: recruiting agencies, web-sites with job vacancies, tests for analysis of personal skills in the Internet, mentoring.

This thesis is devoted to design a model of new online career development service. Existing knowledge about service design, database modeling and supply chain management was used as a basis for model design. Also customers' points of view about the service were actively used for both the service design and validating the final model. Meanwhile the results of analysis are a model of new career service with database filled with real-life data.

One occupational area was chosen for service design – Data Science. Five specialists from this area participated in the study: interview and model testing.

The contents of the thesis are split into five chapters.

Chapter 2 reviews the methodology of research.

Chapter 3 presents the service design based on chosen conceptual framework for service concept execution.

In Chapter 4, database design and query (form) design are presented: existing knowledge about ER modeling and query design, the final model of the database, and list of queries for service.

Chapter 6 describes the validating process of the new online Career Development.

Finally, main findings of the paper are presented in Summary.

2 Methodology

This chapter provides general information about research methodology. Research design subsection shows the main structure of this study. Also reader can find here what kind of research approach, what data and validity methods were used.

2.1 Research design

Research design is determined by specifics of studied problem. The main objective of this study is to create a model of the service. The creation of this model has to be founded on theoretical and practical knowledge that is why existing knowledge has to precede the analysis of current situation. In the Figure 1 research design describes main stages of research. The detailed descriptions of each stage are following.

The first stage is to understand existing knowledge by analyzing literature and documented practice. The output of this stage is a framework for the next stage of current state analysis. It includes structure of analysis, surveys' and interviews' questions, key definitions.

The next stage is current state analysis that is based on chosen conceptual framework.
The third stage is building of an initial version of the model. It is based on existing knowledge of service design. This stage is inextricably linked with the next one of validating the model because all problems that will be found should be repaired.

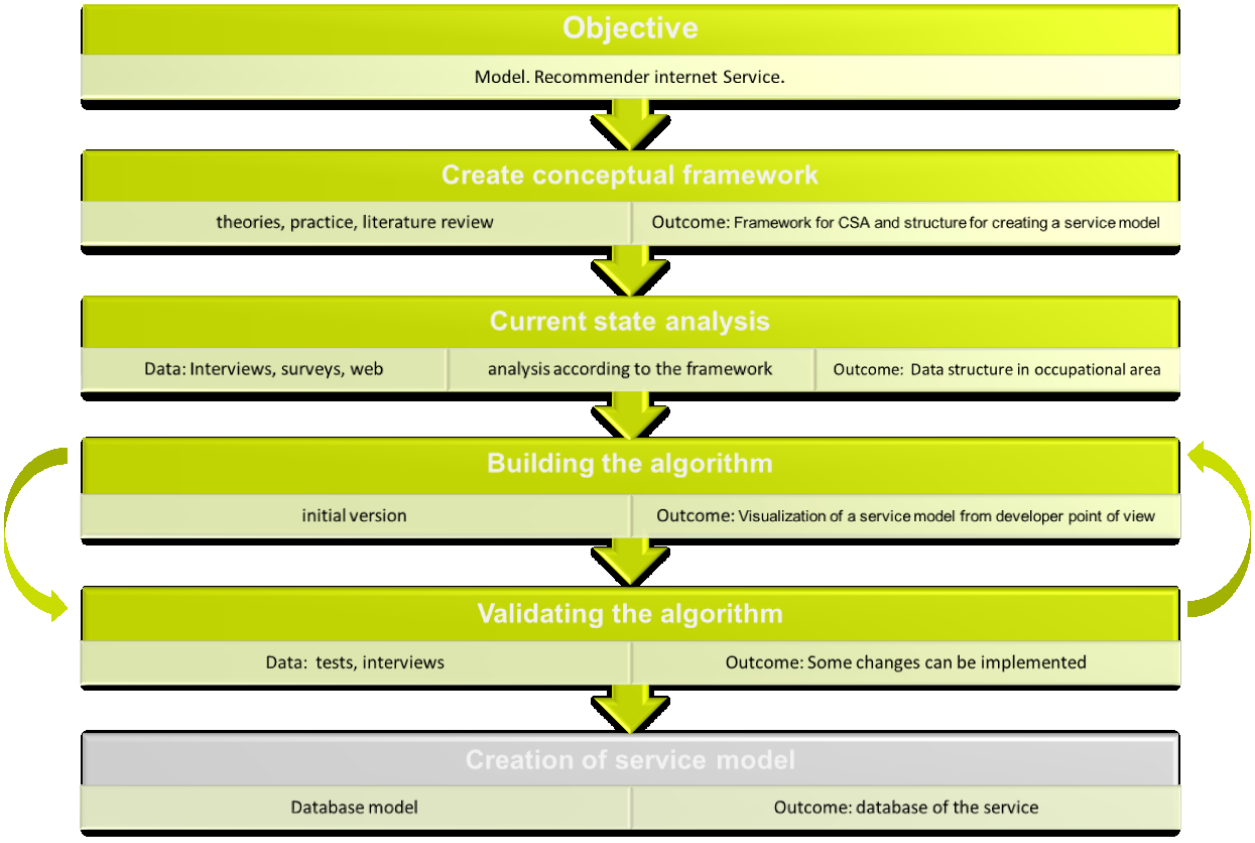


Figure 1. Research design.

2.2 Data collection and analysis

The main goal of analysis is to understand what kind of new services are needed in career development area. Moreover, how this service can be implemented.

Thus, structure of data collection and analysis is described on Figure 2. Data collection includes two main methods: interviews and web-data gathering. Five people with Data Science background participated were interviewed for better understanding customers' need and expectations from new career development service. On the stage of filling database of new service all data was gathered manually from different web-sources.

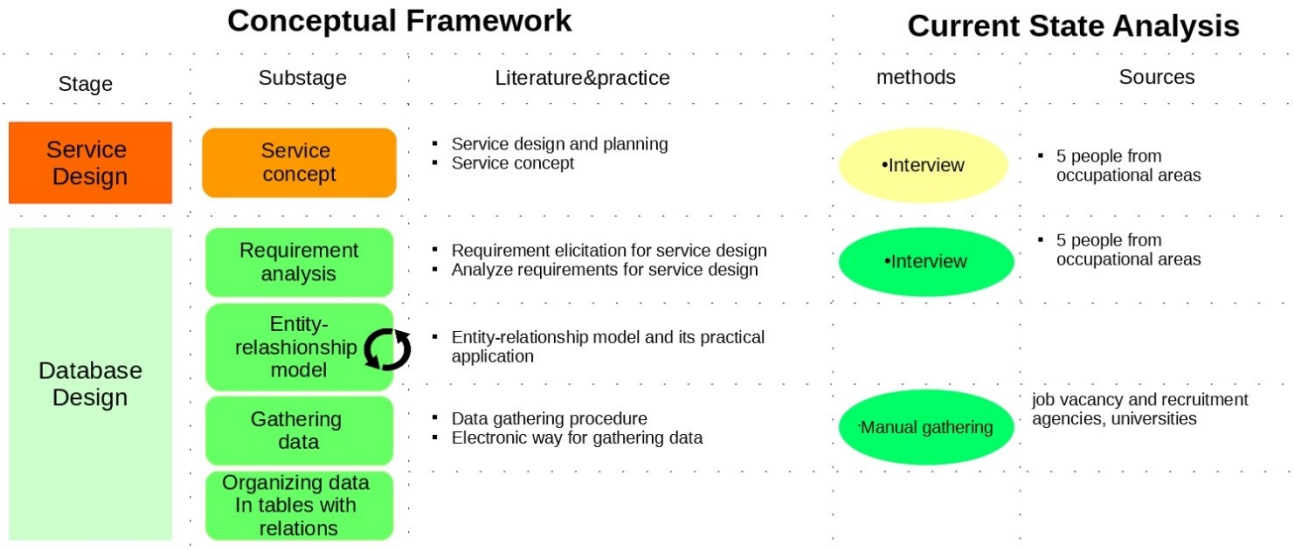


Figure 2. Structure of Data collection and analysis.

2.3 Validity plan

For validation of the model of the service the service prototype was created as a database and then tested with the same respondents that participated in first interview. They filled survey for better understanding their opinion about the new service. The result of validating is presented in Chapters 5.

3 Service design

In this section the main idea of the Career Development service is described. The focus is on those parts that relate to service model on the first stages of service design. Firstly, the conceptual framework of service designing is determined. The output is used on the next steps of creating the service model.

3.1 Conceptual Framework for Service design

In literature different definitions of service design can be found. Some authors think that service design begins when the new service execution process is launched [1]. Others describe it as “an appropriate mix of physical and non-physical components” [2] or the way to design different resources that are needed for the service including specifications, procedures and policies [3].

During this study one definition of service design was taken as basic. Mager and Sung [4] describe its goal at “designing services that are useful, usable and desirable from the customer perspective, and efficient, effective and different from the provider perspective”. This definition includes the ideas of efficiency and usefulness of the service that is close to the strategic goal of the new Career Development service. So, there are several tasks to be solved during this study: to determine influential factors for the service, to design the system of the service and understand this system and its actors.

From the literature review we can see that the service concept is a central and usually first-mentioned component of the service design (see, for example, [5]).

According to the Edvardsson et al. [6] service concept is “a detailed description of the customer needs to be satisfied, how they are going to be satisfied, what is to be done for the customer, and how this is to be achieved.” Additionally, it helps to mediate between organization’s strategic goals and customers’ needs within the target market [2].

The process of service concept development includes strategic positioning, idea generation and concept development [7]. For strategic positioning it is important to use market and customer analysis to understand the competitive situation and customer logic [5]. As a result market positioning decision of the organization can be to become a ‘service leader’, ‘middle-of-the-road’, or a ‘service laggard’. The second important decision is the type of relationship with its customers [2]. After idea generation and concept development the key factors influencing the quality of the service have to be determined [5].

The most important thing of designing attractive and customer oriented service is a dialogue with competent and demanding customer. It helps to define a lot of value-loaded activities in the service [5]. In other words, during the dialogue with the customers the mental picture of the service is received. According to the Johnston and Clark [8] customers have a “preconceived notion of what a service is, even if they have not experienced it previously”. Moreover, Clark at al. [9] highlight the importance of taking into consideration of all stakeholders in order to create a good service concept and a service as a result of service design.

Clark et al. [9] and Johnston and Clark [8] define several components of service concept:

1. value of the service: what customer are paying for.
2. service operation: form and function, delivering approach, how it is created and how it operates.
3. service experience;
4. service output: the benefits (results) that the service provides the customer and the organization.

The value of the service is the basic point for the service within contemporary customer centric approach. It is important for service provider to identify the value that is delivered to customers and the value that is expected by customers [7].

Often authors associate value with the monetary worth. But the more general definition was given by Ziethaml and Bitner [10]:

> “value is an individualized customer perception based on a composite judgements of a number of product/service attributes such as perceived quality, perceived costs; monetary or personal and other high level abstractions, intrinsic and extrinsic attributes such as prestige, accessibility and performance.”

The new Career Development service is supposed to be a web-based (or online) service that accumulates data from different sources. There are some specifics of Internet services, or Internet of Services (IoS). IoS is “an infrastructure that uses the Internet as a medium for offering and selling services” [11]. In this case value goes out of interaction between the company, company’s customers, intermediaries and suppliers. This has to be taken into consideration during the process of service concept development; especially it is important for service operation.

Based on existing knowledge the Conceptual Framework for Service design is presented below in Figure 3. At the beginning the strategic assessment has to be done by making market analysis, customer analysis, dialogue with customers, and alignment with stakeholders. The

next step is idea generation based on strategic assessment results. And finally, service concept development.

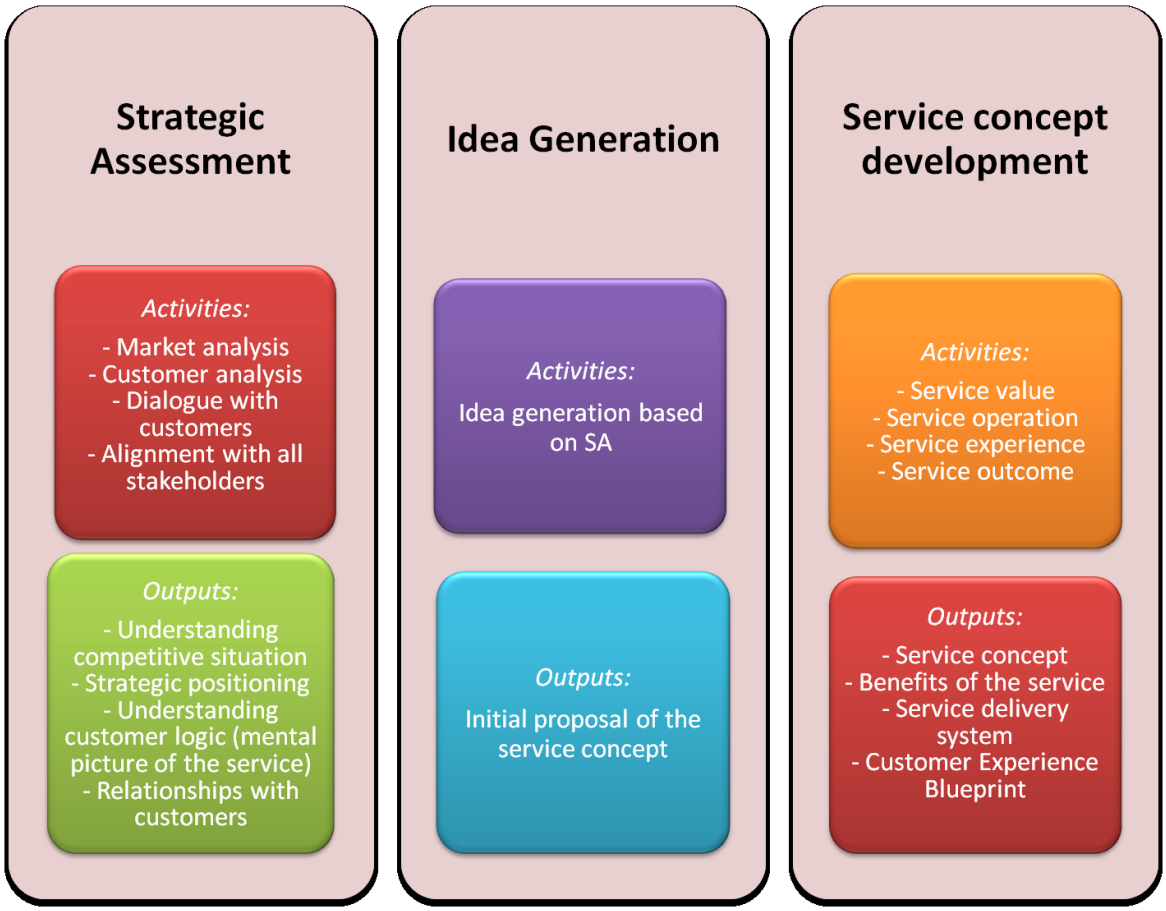


Figure 3. Conceptual Framework for Service Design.

3.2 Service Concept Execution

3.2.1 Strategic Assessment

3.2.1.1 Market and customer analyses

Market of career development services

Market analysis was made for the whole international market of career development services without focusing on chosen occupational area or particular country. It included two steps:

- Gathering data about existing career development services both online and offline,
- Analysis and synthesis of data.

During the process of analysis the key parts of market of career development services were determined and presented in this paper: goals and tasks, access channels, organizations that

provide this service, structured list of services provided by those organizations, and the existing needs in career development services from working-life point of view.

The basic definition was taken from Canadian Standards and Guidelines for Career Development Practitioners [12]. Career development for an individual is “the lifelong process of managing learning, work, leisure and transitions in order to move toward a personally determined and evolving preferred future”. According to the given definition career development includes several activities: learning, work, leisure, transitions (changing job place, new occupation).

Access channels:

- Offline
- Online (from different devices: PC, smartphones, tabs)

Reaching audience:

- Local
- Global
- National
- In particular industries or occupational areas

Career development organizations:

- Universities, colleges, schools (appropriate study program, consultation about career choice, mentoring, organizing job fairs, testing, career planning)
- Labor Departments (jobs for unemployed, trainings, courses, career planning)
- Internet sources (testing, open job vacancies, job descriptions, career planning, information about companies)
- Mobile applications (job search, information about companies, salaries)
- Recruiting agencies (open job vacancies, career planning)

Career development services offer:

- Help with CV, Cover letter, Applications, Interview
- Mentoring
- Career planning
- Job searching
- Tests and skill assessments
- Job descriptions
- Educational options
- Certification

Processes of career development (before, during and after job activity):

- Skills' learning (before)
- Testing (before)
- Certification (before)
- Mentoring (before)
- Job searching (before)
- Beginning of work activity or getting new job place (during)
- Work (during)
- Improving skills (during)
- Changing a job place (after)
- Changing the occupation (after)

Customer segmentation

Customer segmentation has only basic information about customers. More detailed information was gathered during the interview and presented in point 3.2.2.2.

The target audience of career development services:

- Students
- Unemployed
- Workers which want to change career or current job
- Organizations (looking for candidates)

Users' expectations from career services:

- Find a job
- Get advices about career
- Get a help with job searching
- Understand career options
- Skill assessment
- New useful skills and educational programs

Important qualities of career services:

- Usefulness
- Efficiency
- Availability

3.2.1.2 Strategic positioning

Visualization of career development services that are exist on the market is presented on Figure 4 and based on market and customer analysis from point 3.2.1.1. As we can see there are no services in the work area (red ellipse area).

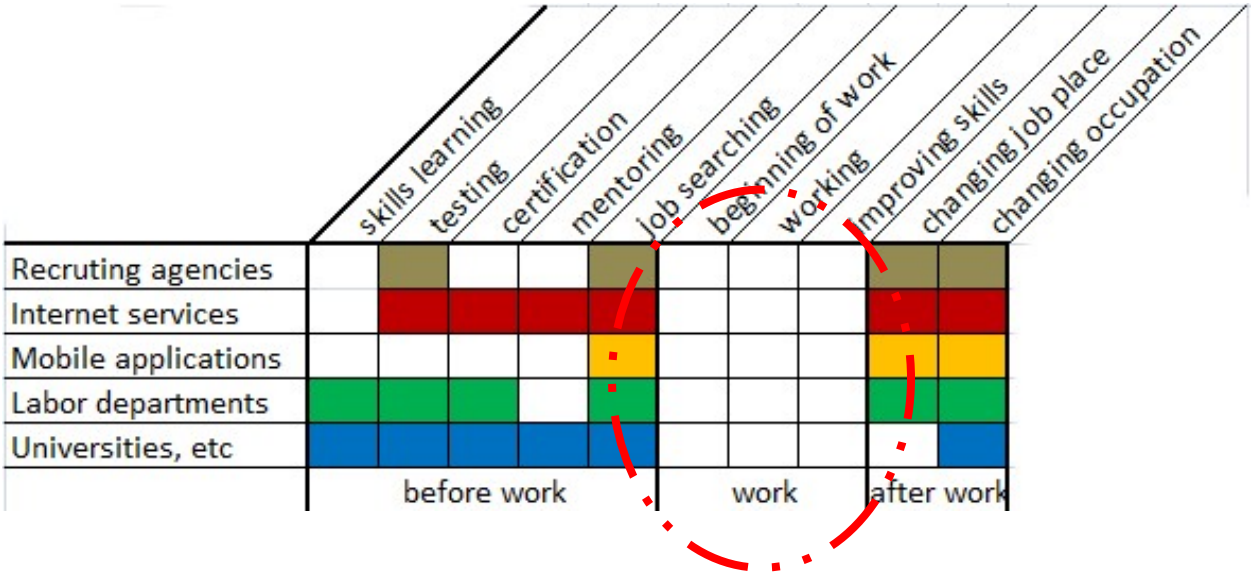


Figure 4 Strategic positioning map.

So there is a niche where new career development service can be implemented.

3.2.2 Dialogue with customers

As long as this service is supposed to have customer centric strategic positioning it is important to have the direct dialog with future customers for better understanding of their needs, expectations, customer logic and existing experience with career development services.

There were five (5) interviews with people from Data Science occupational area. The main characteristics of respondents are presented in Table 1.

Table 1. Basic information about interviews.

Total number of interviews		5
Occupational area	Data Science	5
General characteristics	Ages	27-39
	Gender	F – 2 M – 3

	Language of interview	English
	Country	Finland
Current occupational status	PhD students	2
	Postdoctoral position	1
	Working	2

3.2.2.1 Questionnaires

There were several main groups of questions:

- General: about general characteristics: ages, gender, working status, etc.
- Using of career development services: what kind of services, for what purposes and needs, customers' expectations and unsatisfied needs from the career development services.
- How respondents use services for developing their professional and personal skills: purposes, services, channels, etc.
- Present the idea of new career development service and get a feedback.

3.2.2.2 Interview results

All interviews were recorded and analyzed. The results are presented as a quintessence of information of all interviews.

1. *Needs*: job requirements, recommendations about skill improvements, collect and analyze twitters from the industry, trends.
2. *Customer experience with career services*: LinkedIn, Talent recruiting, Aalto career service. Purposes: requirements for jobs, articles, subscriptions.
3. *Web-sources*: quora.com, LinkedIn, Talent recruiting, Aalto career service. A bunch of sources for personal skills.
4. *Customer logic*: things are changing; generals are the same, recommendation about generals, skills in different industries for one occupation. How to manage within a big information flow? Important for fast changing industries.
5. *Key factors influencing the quality*: analytics, predict the future, relevance.
6. *Professional skills*: LinkedIn, lectures, meetings, twitter
7. *Basics about occupations*: job description of the big companies, study programs.
8. *Personal skills*: time management, knowledge of important factors for occupation would be useful, communication skills.

3.2.3 Value of the service

Based on market analysis and interviews main value of the new web-based Career development service can be listed:

- A self-service portal is always available in the Internet, 24/7.
- Personalized information about customer's options on job market
- Saving time by providing information about what occupation and skills are suitable for customer and how to develop skill set
- An easy-to-use self-service portal will help during the process of career planning because it provides information about industry specifics, job descriptions and needed skills.

3.2.4 Service operation

Service operation shows the way how the service operates.

Service will use data from different sources (internet sources). It will gather data, analyze and give the result based on customers' orders.

From the strategic point of view the service has to be useful for its customers. It means that it has to give right answers on customer questions. On the operational level it means that all data should be relevant, comprehensive, reliable and actual.

During the process of service operation the important part is supply chain (SC). Thus, supply chain model is taken as basis for demonstration of the service operation. For this purpose the existing knowledge about developing SC and specifics of service and internet-based services was analyzed. As a result of this step the framework of developing a draft of SC was chosen.

The next step was designing the draft of the SC for the service by following the framework.

3.2.4.1 Conceptual framework

Developing the supply chain for a new Career development service revealed some challenges and specifics.

3.2.4.1.1 Service vs. Manufacturing

First of all, in literature the main topics are about SC for tangible goods. But new career development service is supposed to be a web-based service with the product that is created

mostly from the materials (data) from the Internet, sales are through Internet too. All product life cycle is tied to the web except the way how customers will use data.

According to the Aitken, et al. [13], there are five unique attributes of services that are important when the manufacturing-based supply chain management best practice frameworks is going to be transferred into the service sector: intangibility, perishability, heterogeneity, inseparability, and customer participation. Based on the findings of their study all these attributes are not always the reason of not using the manufacturing Supply Chain Management framework in service sector.

How can they influence on the developing of the SCM for career development web-based service? The output of analysis is presented in the Table 2.

Table 2. Analysis of the presence of service attributes in Career Development service.

Attribute	According to the Aitken, et al. [13]	Career development web-based service
Intangibility	"unable to be touched ; not having physical presence", yet many service processes can be viewed as tangible in terms of their outputs"	The output of the service can be considered as a report on the screen of the device or can be printed out. Also, it contains information that can be used for the next activities. So, the output can be viewed as tangible.
Perishability	"queues in services equate to inventory in manufacturing supply chains, and both are used to buffer against demand uncertainty"	There is no time-sensitive nature of the Career Development service due to the fact that it is online service. So, customers can use service any time, service capacity is easily to be stored.
Heterogeneity	"Both service and manufacturing supply chains offer customers the ability to specify their own unique output from a pre-determined menu of input options."	The output of the service can be both personalized and typical. It depends on customers order. But as long as algorithms of creating the personalized output are the same for all customers it can be said that the output of the career development service is closer to manufacturing than to service.
Inseparability	"Not every service supply chain is deemed to be inseparable in nature since delays often occur between the times of customer input and service output."	The output of the service is immediate after the customer order, but it can be used by customers any time. So, the inseparability of the Career Development service is closer to manufacturing than to the service because it doesn't have to be consumed immediately.
Customer participation	"Service supply chains experience customer participation in three	The participation of customers is important for the outputs of the Career Development service.

	forms: actual physical presence, product input, and information input. These same three forms of customer participation are also reflected to some extent in manufacturing supply chains as multiple material and information inputs.”	Actual physical presence is the using of web-site or application, but also can be matched to the buying the tangible product through e-store. There is no product input, but information input is presented as an order specification, filled forms or customers CV. But as long as all outputs are based on the same algorithms for all customers it can be said that it is close to the meaning of manufacturing process with specific inputs.

Thus, the application of manufacturing frameworks for developing SC for the Career Development service is possible based on the result in the Table 2.

3.2.4.1.2 Smart Supply Chain

The second specifics of the developing SC for Career Development service is a web-based service with high importance of real-time and high quality information. Also the collaboration with suppliers and customers is very important and influence on quality and actuality of data. So, during the process of creating the SC the specifics of Smart Supply Chains should be taken into account.

According to the Wu,et al. [14] Smart Supply Chain (SSC) is

> “the new interconnected business system which extends from isolated, local, and single-company applications to supply chain wide systematic smart implementations. The smart supply chain would possess most of the features … including technologies such as IoT, smart machines, and intelligent infrastructure, and capabilities such as interconnectivity, fully enabling data collection and real-time communication across all supply chain stages, intelligent decision making, and efficient and responsive processes to better serve customers.”

There is a list of features of SSC that can be applied during the process of development SC for the online Career Development service:

- Algorithms that will allow gathering data from different (suppliers) web-sites can be considered as the sensors of SSC;
- Interconnectivity;
- Intelligent decisions of SC will help to optimize performance;
- Automated processes on the whole SC road;
- Integrated collaboration across SC stages (information sharing, decision making);
- Innovative approach of creating customer value;
- Real-time transmission over network;

- Creating more value with right type of information;
- Control the information sharing and privacy protection;
- Advanced analytics.

There is a need in integrating IT system that will help to organize and unite information flow, advanced analytics and process automation.

3.2.4.1.3 Conceptual framework for developing SC

The main framework was taken from the book ‘Introduction to Supply Chain Management’ by David Ross [15].

The Figure 5 shows the main components of SC ([15] p19). They are the basic points for developing SC for the Career Development.

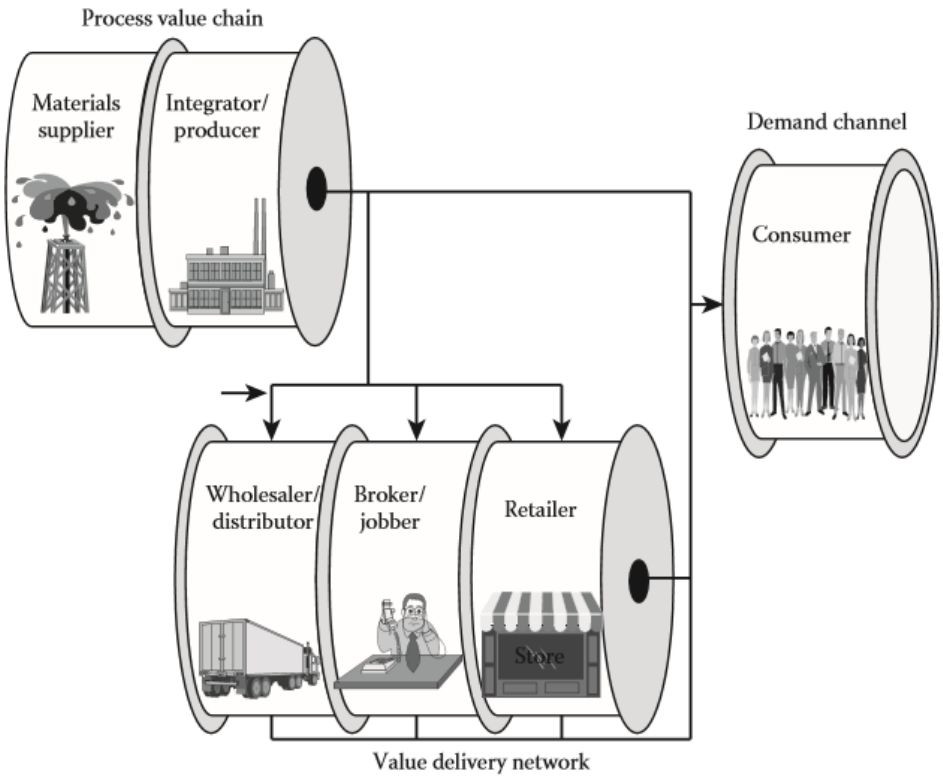


Figure 4. Supply Chain components

1. Demand channel. Understanding demand is very important; and, it is used on the next steps of developing SC.

2. Process value chain is about materials, resource and resource suppliers.

"The role of the process value chain is to receive demand information in the form of marketing intelligence and actual orders, and then translate that demand into the products and services demanded by the customer" ([15] p20).

3. Value delivery network. Delivery channels help the effective allocation of the service.

3.2.4.2 Service operation model

Analysis of current situation was done based on the conceptual framework that is described above. Figure 6 shows the Supply Chain networks designed for the Career Development service. All processes are automatic: gathering and analyzing data. It describes the way how the service delivers the value to the customers and operates with suppliers.

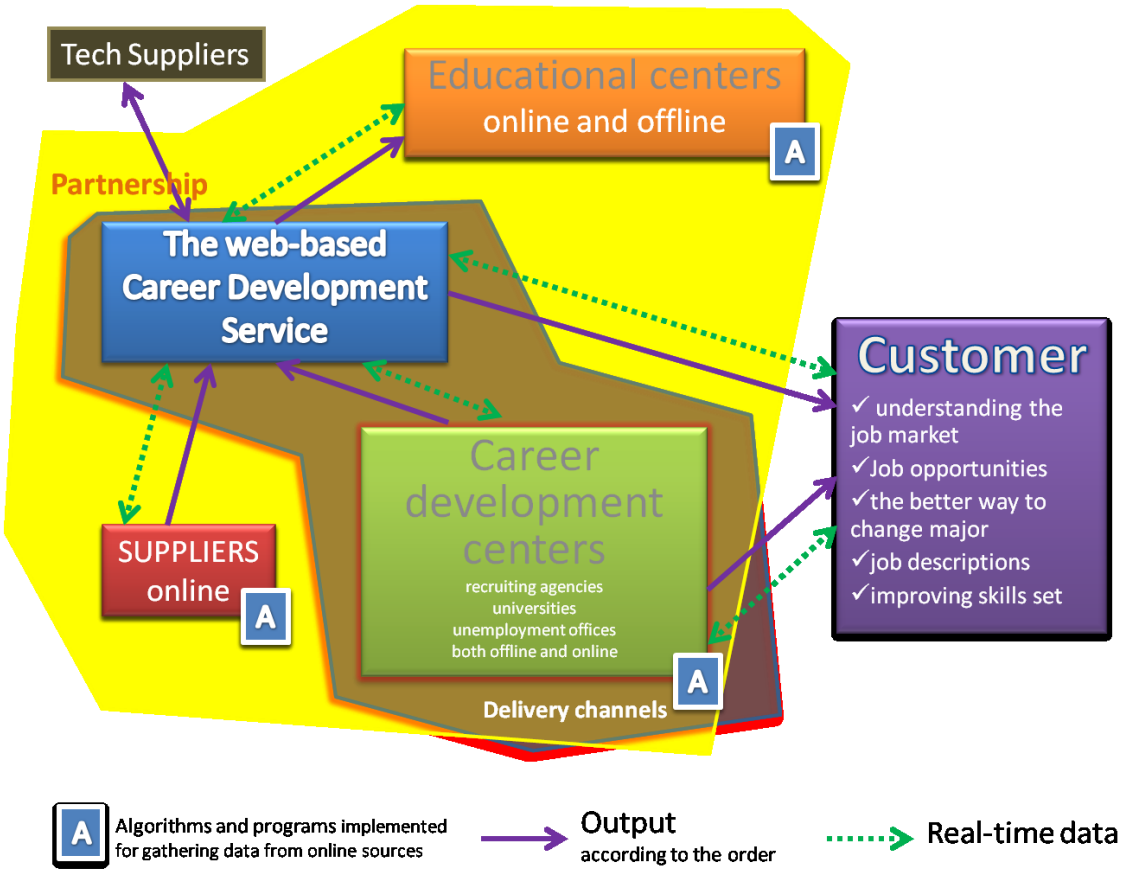


Figure 6. Draft of Supply Chain for the Career Development service.

Demand channel

The main customer needs that the service is going to fulfill are the understanding the current job market situation, career opportunities, the better way to change major, job descriptions, and improving skill set. The important part of the service is that it can give a personalized advice for the customers. Data are moving both ways. Customer sends order and additional information, and service sends back answers based on the order inputs.

The important part of this stage is creating the data gathering about customers' orders with the future possibility to transfer those data to suppliers and to use it for upgrading service.

Process value chain

This part of SC includes the suppliers' network that includes:

- suppliers of the data about job market, industry structure, job descriptions (online);
- educational centers (online and offline);
- Career development centers (recruiting agencies, universities, unemployment offices, both offline and online);
- Tech suppliers. They support all technical needs of the service.

Data are moving both ways. It is important to create partnership with suppliers. Also the algorithms for gathering data from suppliers' websites have to be implemented.

Value delivery network includes the own websites and application, career development centers.

3.2.5 Service experience

Conceptual framework for Service experience was taken the Multilevel Service Design method by Patricio, L., at al. [16]. MSD is "an interdisciplinary method for designing complex service systems". It includes new service development, interaction design, and the emerging field by integrating development of service offerings at three hierarchical levels: (a) Designing the customer value constellation of service features; (b) Designing the service system (Service System Architecture and Service System Navigation); and (c) Designing Customer Journey with the Service Experience Blueprint.

3.2.5.1 Customer Value Constellation (CVC)

Figure 7 shows Customer Value Constellation with existing career development services and new career development service exploration. New service adds new links (red lines) between (a) skills assessment and advices about career; (b) skill assessment and understanding career

options; (c) skill assessment and new skills and educational programs; (d) understanding career options and new skills and educational programs; (e) new skills and educational programs and advices about career; and (f) understanding career options and advices about career.

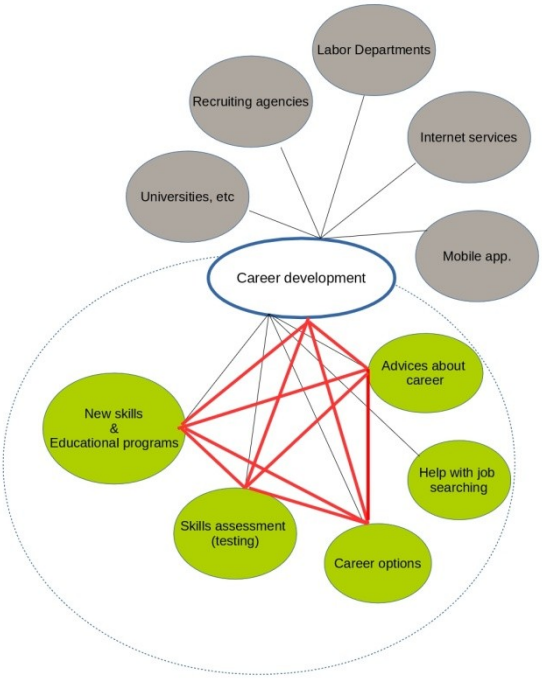


Figure 7. Customer Value Constellation

3.2.5.2 Service System Architecture (SSA)

Customers are supposed to have the next service experience (a) analyze current skills, (b) create a map of current skills, (c) find their career options according to their skills, (d) get advices about career development based on current skills, (e) find new useful skills and educational programs that are useful for a person with one's current skills, (f) finding job descriptions, (g) finding industry structures. SSA of the new career development service is presented on Figure 8.

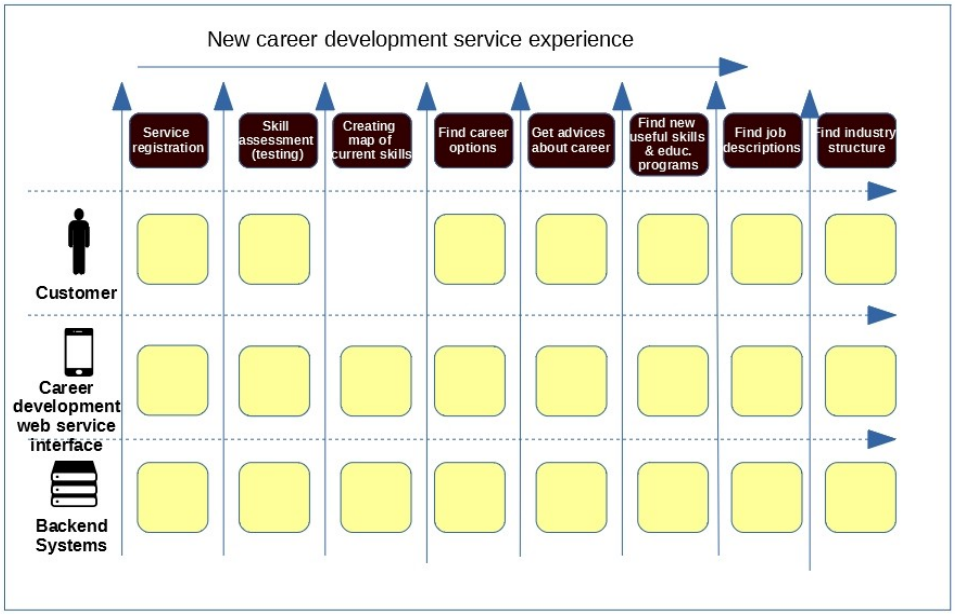


Figure 8. Service System Architecture of the new career development service.

3.2.5.3 Service System Navigation (SSN)

The SSN of the new career development service is presented in Figure 9. It shows possible customer journeys across service interface. We can see links between different service options. Registration on the service is obligatory. Than customer can analyze her skills and get a personalized map. It shows her position on career map, jobs with the closest skills requirements. Customer can check the closest positions and extra required skills after that.

The next point is information about where customer can get those skills or get more useful sources about them (educational programs, courses, trainings, magazines, web-pages, forums, etc.). Other possibility is eliminating testing point and going directly to the job descriptions. Customer can go to the new information about new skills and educational programs after job descriptions. Almost the same procedure if customer goes to the Industry structure. But before getting information about new skills and educational programs customer has to pick a job and look through its description. The last option is to go directly to the skill set where customer can pick one and get information about it.

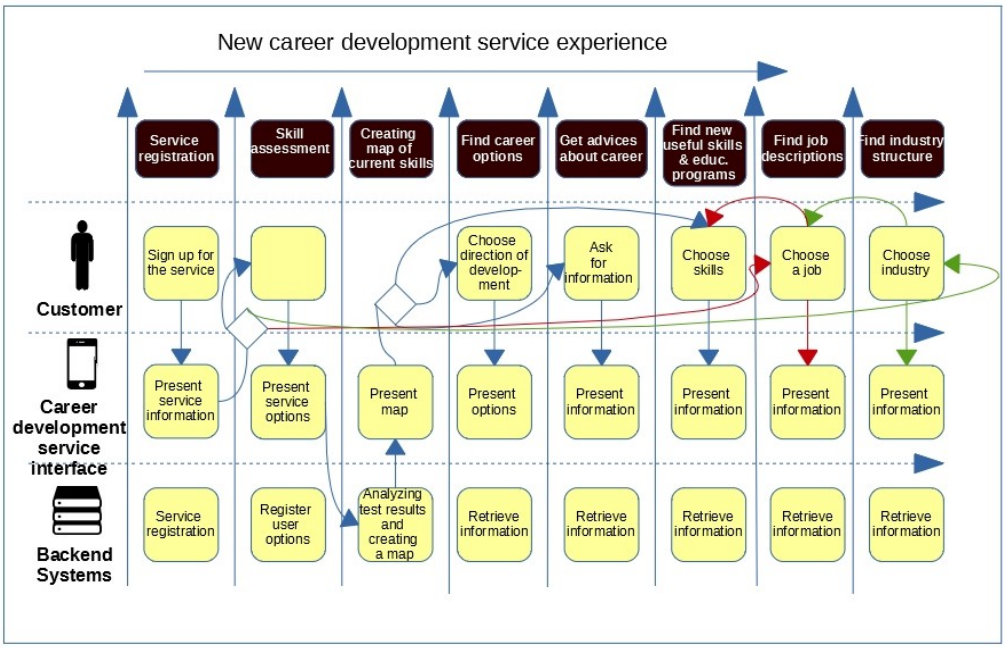


Figure 9. Service System Navigation of the new career development service.

3.2.5.4 Designing Service Encounter Blueprint for career development service

Figure 10 demonstrates Service Experience Blueprint (SEB) for the new Career development service.

Customer has to register to get access to the service interface. After registration customer picks one of the following options.

The **first one** is to analyze her skills by using special tests and forms. At the end of this journey customer gets a map with her position on job market. Example of a map is presented on Figure 11. From this map we can see that customer has five jobs that are close to her current skill set. The size of circles and the color intensity represent the relationship degree of different jobs and skills.

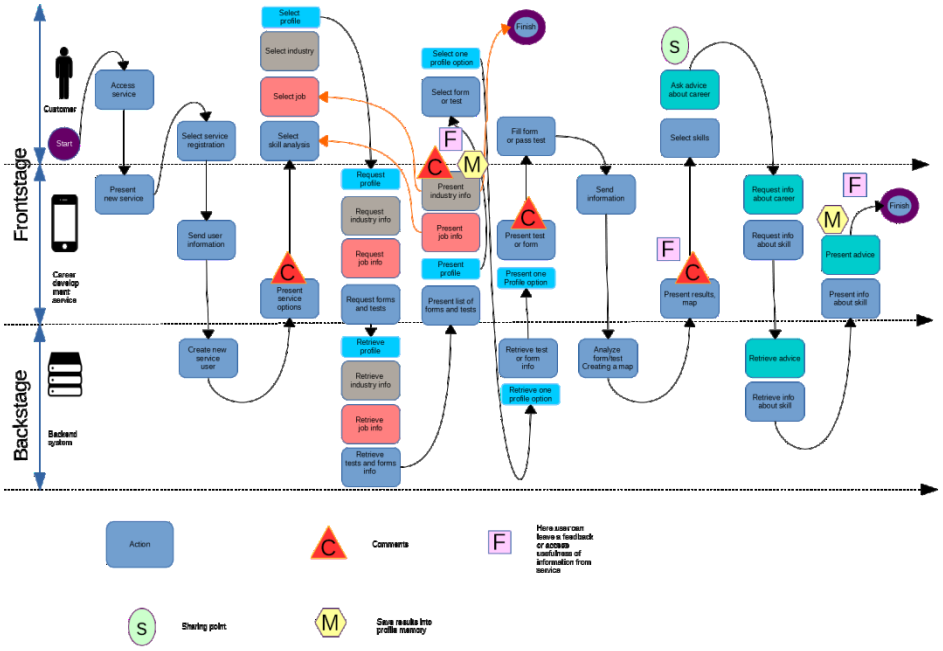


Figure 10. Service Experience Blueprint (SEB)

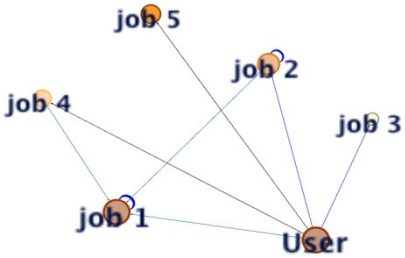


Figure 11. Example of a personalized map of personal position on job market.

By clicking on particular job (node on the map) customer can get job description. Job description includes required skill set, both personal and professional. All skills that customer does not have will be highlighted with color. So, customer can easily see what new skills she needs for this job. After that customer can pick one skill at a time and get information about that skill: description, courses, study programs, magazines, trainings, etc.

Moreover, customer can get advices about career based on skill assessment and map. For that she has to choose one question from the list.

The **second option** is to search particular job by name. As a result customer will get job description. She can pick one skill at a time to look though it and find useful information about it, which was mentioned in previous option.

The **third option** is to pick one of the industries and familiarize with its structure and pool of occupations. Here customer also can choose at first one particular job and skill after that.

Moreover, for better customer experience there are several useful options. Customer can save information that she looked for or got after analyzing skills (Save button on the Figure 10). The next useful feature of the service is Comments. They are going to help customer at each step by providing information about how to use service. This option can be switched off when customer became familiar with the service. Also customer can share information about its skill assessment via Social Networks or e-mails.

4 Database design

In this chapter modeling of database for the new Career Development service is presented in three steps: choosing conceptual framework, database model design and structure of database.

4.1 Conceptual framework

In general database design is the “process of determining the organization of a database application” [17].
The objectives of database design are the following:
• to fit all the requirements of all users;
• to provide easy-to-understand information structure;
• to keep the created semantic information for further redesign;
• to reach the required level of efficiency and all the processing requirements;
• to keep independence in logic of query and transactions [17 p1].

The final database model had to be understandable and comprehensible. For this reason the entity-relationship model (ER model) was chosen due to its simple graphical representation (using diagrammatic technique).

Another reason why this database design methodology had been chosen is because it does not require deep knowledge in theory, implementation limitations and the programming problems for designing a database diagram [17].

Other advantages of ER model are listed below [17 p9-12]:

- It has strong theoretical basis;
- For modeling only essential information needs to be presented. So, result looks more natural and simple, without repetition and redundancy.
- According to existing observations schemes are between three and five times simpler than those obtained using other models.
- The methodology is easily accepted and led to more accurate and correct modeling of complex relationships.
- The ER model allows multiple abstraction layers, modularization and zooming. Those parts of the schema that are out of interest at this moment can be abstracted by putting them into modules, zooming out and zooming in.
- Strict hierarchical structure leads to safe implementation.

ER model was developed by Peter P. S. Chen. He said in his seminal paper:

"The entity-relationship model adopts the more natural view that the real world consists of entities and relationships. It incorporates some of the important semantic information about the real world" [18].

The design process includes several steps [17 p30]:

1 Starting with data analysis and meaningful examples. The main goal of this step is to understand database requirements.

2 Developing the structure of the database:

(a) identify sets of the entities and the relationships;

(b) determine semantics in the relationships such as an one to many, many to many, etc.;

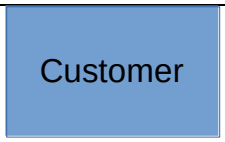
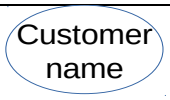
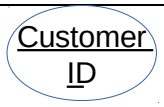
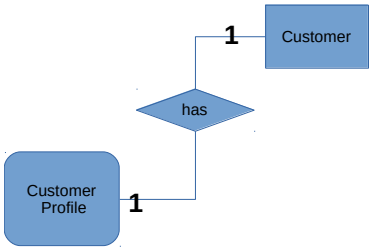
(c) determine the attributes and value sets;

(d) organize data into entity-relationship diagrams with primary keys [18].

3 Modeling the database and database operations.

The list of figures for each object and relations that are used in Entity-relationship diagram is presented in Table 3:

Table 3. List of figures for entity-relationship diagram

Name	Figure	Description
Entity or Entity set		Kernel objects. Entity sets contain entities with the same set of characteristics, or attributes.
Attribute		Characteristics which describe entities.
Key attribute		The attribute which is unique for every entity.
Relationships		Associations between entities.
Cardinality of a Relationship, or semantic information		They specify how many of each entity type is allowed. Relationships can have four possible onnectivities as given below. 1. One to one (1:1) relationship 2. One to many (1:N) relationship 3. Many to one (M:1) relationship 4. Many to many (M:N) relationship
Module		Module represents group of entity sets that are united based on some features. It can be split up. But within this ER model modules help to make ER diagram more understandable and less cumbersome.

4.2 Database design

4.2.1 Data analysis and requirement acquisition.

In this section the results of data analysis and requirements for the database for the new Career Development service are presented. There were two steps.

The first step was the service concept creation (Chapter 3). At the beginning the interview with 5 respondents from chosen occupational area were made. During the interview the main customer expectations from the service were discovered. Based on customer expectations the Service Encounter Blueprint (Figure 10) was designed. Information from interviews and service concept was a basis for database design requirements.

The second important step for understanding requirements for database was the analysis of data for future database. List of sources with main characteristics for chosen occupational area is presented in Table 4. All sources were arranged into groups according to the type of information they provide.

Table 4. List of sources with main characteristics for Data Science occupational area.

Type of sources	What kind of information it provides	How information is presented	Example
Job searching web sources	Occupation descriptions, industry	text	Linked In [21], Glassdoor [22] Kaggle.com [23]
Professional societies and websites	Occupation description, job searching, skill sets for different occupations, trends, career advices, news	Text, links, video	Data Science Association [24] Societies and Groups for Data Science [25]
Professional blogs and microblogs	Trends, more deep information about particular skills and trends	Text, short sentences, links, video	Twitter [26] Rushter.com [27]
Web sites for personal skills	Deep information about personal skills	Text, links, video	Dale Carnegie Training [28] The Gottman Institute [29]
Universities and	Information about	Text, videos	www.coursera.org

educational programs	basic skills for occupations, specific education programs and courses		[30] MIT online courses [31]
Companies web sites	Occupation descriptions, industry specifics	Text	Google [32] Twitter [33]

Requirements for database for Career Development service:

- Each customer has to register for the service and log in if she wants to get any information.
- Profile stores all information about the customer.
- Customer fills her profile manually. One profile per person.
- Customer has to fill as many forms as she wants in order to get recommendations.
- Each occupation has following set of information: professional skills, personal skills, industry, and occupational area.
- All data from the set of information about occupations have to be described thoroughly in primary skill.
- Primary Skill data (professional and personal) have to be analyzed and cleaned due to differences between words, word order and meaning from different sources of data.
- Clean skills have the information about possible way to be familiar with or improve them (education programs or trends).
- One occupation has a lot of skills. But one skill can belong to many occupations.
- One industry can have many occupations. One occupation can belong to one industry.
- Customer can search for particular industry, occupation, or skill.

4.2.2 Developing the structure of the database.

Database design process included the following steps:

(a) identify sets of the entities and the relationships;

(b) determine semantics in the relationships such as an one to many, many to many, etc.;

(c) determine the attributes and value sets;

(d) organize data into entity-relationship diagrams with primary keys [18].

The result of points (a)-(c) is presented in Table 5. Key attributes are highlighted.

Table 5 Objects of the database for career development service

Entities	

Name	Attributes	Semantic information	Description
Customer	CustomerID, CustomerName, Date of Birth, email	One customer has one profile. One customer can fill many forms and orders for recommendations.	A person that uses the service.
Occupation	Name, OccupationID, IndustryID, Description , Occupation area	One occupation has many skills (basic, professional, personal). One occupation can belong to one industry.	A job or profession. Data taken from real job searching websites. Each occupation belongs to one particular company and industry
Industry	IndustryIName, Industry ID, Description	Industry has a lot of occupations.	Is a classification of all economic activities according to the ISIC [34]
Primary Skill data	Primary Skill name, Description, General type (professional, personal, specific)	Primary Skills can be a part of many different occupations.	Primary Skills that are specific professional and personal skills for one particular occupation. Skills are described the same way as in the source.
Clean skills	Clean skill name, Description, Skill type	Clean skill can have many different Primary Skills. Every clean skill can have zero or many education programs.	Clean skills are the set of skills that were analyzed after data gathering. Cleaning is needed because of the differences in sources, definitions and word order.
Education program and trends	Education program and trends name, Type (trend or education program), Link, Description, Clean skill	One education program or trend relates to one or more Clean skills.	Education programs and trends for one particular skill.
Relationships			
Name	Attributes (if needed)	Description (if needed)	
HAS			
FILLS forms	Type of Form, Date of filling,		

Belongs		
Includes		
Sends	Date of sending	
Returns	Type of recommendation, Date of recommendation	Search engine analyzes the customer forms and returns recommendations.
Insert key words	Date of inserting, Type of searching information	Customer has to insert key words it she wants to search for industry, occupation, trends, skills, education program.
Modules		
Name	Description	
Search engine	Search engine is a module within database that helps to analyze customer forms and return the results.	
Forms	This module contains different type of forms that customer can choose and fills to get recommendations from the service.	
Customer profile	This module includes all information about customer skills, education, filled forms and gotten recommendations.	
Recommendations	This module represents those recommendations that customer gets based on her orders.	

4.2.3 Modeling the database and database operations

In this section the entity-relational model of database for the new Career Development service is presented (Figure 12).

There are two main parts of the model: customer and data. The main distinctive feature between them is the customer activity. In customer part customer is active user of the service, but in data part all data are gathered and stored without customer participation.

Customer can insert and store information about her skills, education, filled forms and useful recommendations from the service in Customer profile module. Also customer can search information about occupations, industries, education programs, and skills by inserting key words into searching area and sending them to Searching engine module. Searching engine uses data from Data part and returns recommendations into Recommendations module. All modules were created for better visualization and to reduce the complexity of the ER model. Semantic information is organized in such way that Customer can have one profile, fill a lot of different forms, search for different information.

In Data part there are five main entities (Industry, Occupation, Primary skill data, Clean skills, Education programs and trends) and three relations (INCLUDES, BELONGS, HAS). The semantics of this part connected with structure of job market. One occupation can belong to one industry, but one industry can have many occupations. One occupation can have a lot of skills, but one skill can belong to different occupations. One skill can have a lot of educational

programs and trends, but one program and trend can belong to different skills. Moreover, one entity (Clean skills) demonstrates the result of analysis of Primary skills data. The main goal of this analysis was to reduce the tautology within data.

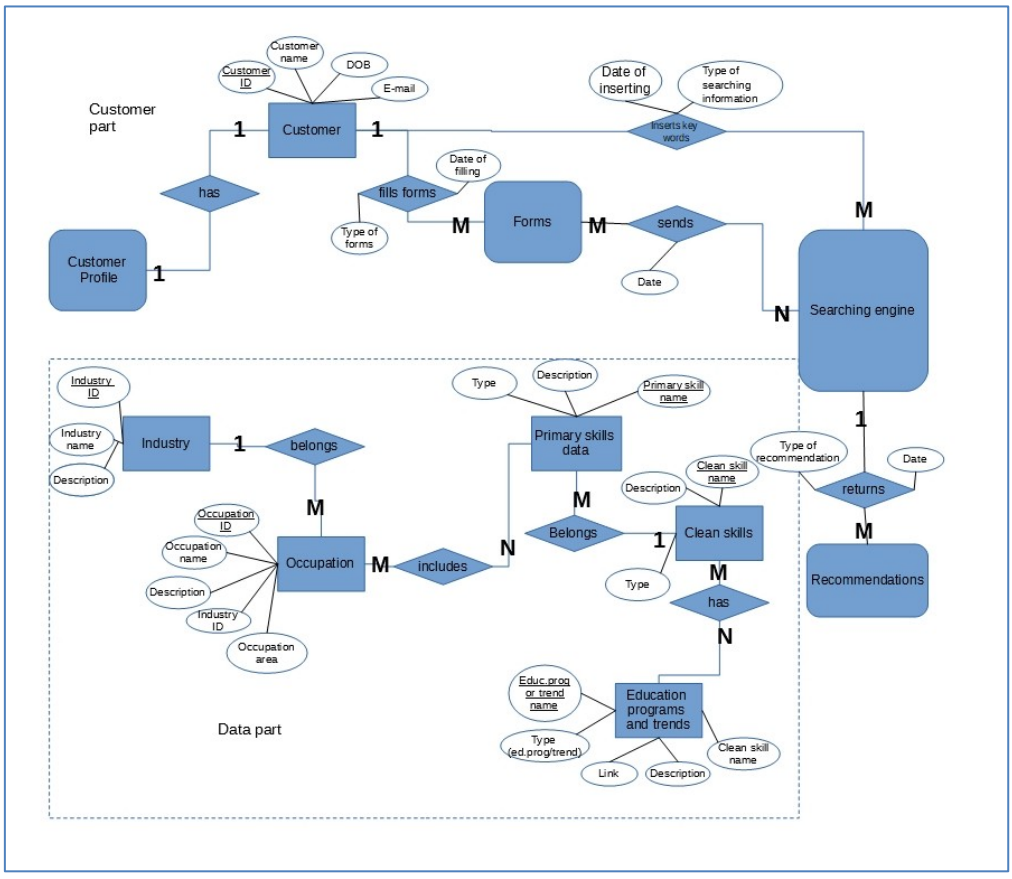


Figure 12. Entity-relational model of database for the new Career Development service

4.3 Query (Form) system design

According to the Career Development service customers have to fill forms if they want to get personalized recommendations. The ER diagram contains the FORMs module.

4.3.1 Existing knowledge

Query form is a well-known method for querying databases. The traditional query forms are the most suitable due to some features of career development service database. Features are listed below:

- Database for career development service has not so many entities.
- It is easy to predefine and design all types of forms due to low complexity of the service.

- Database does not need big number of query forms, so it is not worth using of the Dynamic Query forms. The Dynamic Query form system is a query process that can dynamically generate query forms for customers [19].

Traditional query forms are usually designed without user interaction. Design process includes (1) finding a set of data attributes; (2) generation query forms based on chosen attributes [19].

4.3.2 Design query forms

Firstly a set of data attributes for future query forms were selected based on the Entity-relation model and interview results. For this purpose customer expectations from interview were taken as a basis for query form types, but attributes were taken from ER model.

Customer need: job requirements, recommendations about skill improvements, trends.

Query form types:

- Find occupation according to customer's skill set.
- Find occupation
- Find education programs for one particular skill.
- Find trends of skill.

All features and attributes of each query form are presented in Table 6.

Table 6 Query forms descriptions.

Query form type	Description	Attributes (fields to fill)	Output
Find occupation according to customer's skill set	Customer inserts data about her skills (or picks it from the drop-down list) and gets a list of occupations that are more suitable for her	Skills	Ranked list of occupations according to the degree of compliance
Find occupation	Customer inserts occupation name or picks it from the drop-down list of occupations; and get the occupation description with skill set.	Occupation name (drop-down list with extra field "Other")	Occupation with description and skill sets
Find education programs for one particular skill	Customer inserts skill name manually or picks it from drop-down list. And gets a	Skill name (drop-down list with extra field "Other")	Skill with description and education program list.

	list of education programs for it.		
Find trends of skill	Customer inserts skill name manually or picks it from drop-down list. And gets a list of trends for it.	Skill name (drop-down list with extra field “Other”)	Skill with description and trend list.

5 Validating the service model

In this chapter the model of new career service was validated. For this purpose the database of one occupational area was created based on real data. The next step was testing the model.

5.1 Existing knowledge for validating process

According to the Dynamic Process model of service quality [20] individuals' current perceptions of the service quality is the result of two steps: their expectations before contact with the service, and the delivered service.

Information about customers' expectations was gathered during the interview stage and used actively during the process of service model design.

The best way to deliver service to the customer is prototyping. For this purpose the database prototype of new career service for one occupational area was done. After that the real CVs were analyzed based by using this database data; and results were presented to respondents.

Finally, respondents filled the survey about their feelings.

The second step of service model validation is database validation.

5.2 Database creation

The ER model of new service was used as a basis for database creation. MS Excel and Access programs were used as tools. Figure13 represents main tables of Data part of ER model for prototype database with key fields and relations.

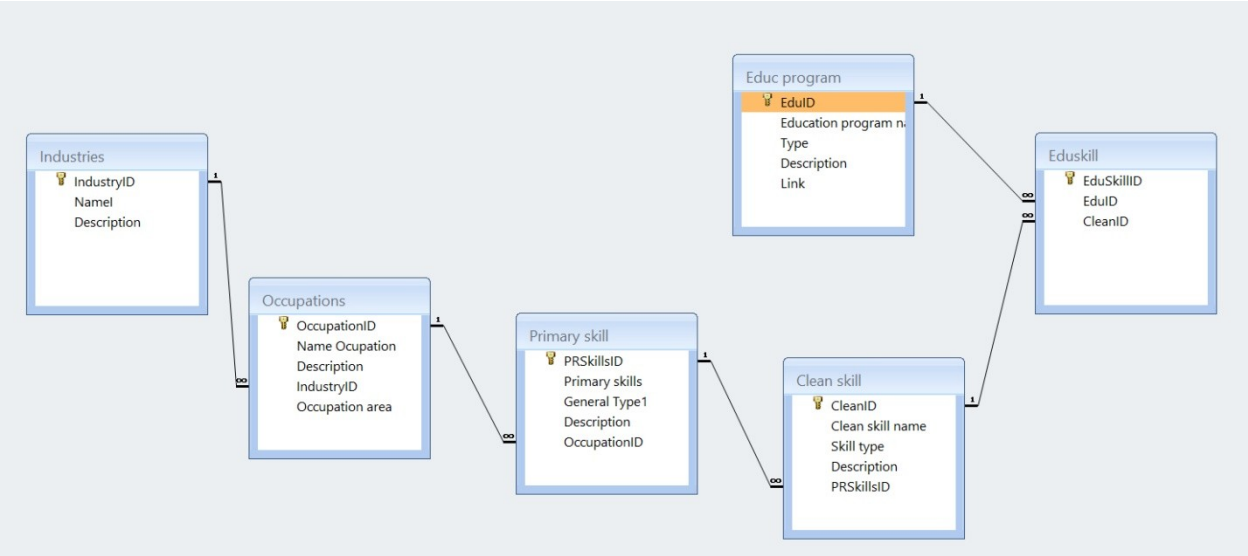


Figure 13. Structure of the tables of Data part for prototype of the online career development service.

During the process of data gathering and analysis the ER model was changed 5 times due to data specifics and complexity. Almost all processes of data gathering, processing and analysis were done manually.

As long as the main goal of database creation is to test the model of the service there is no need for big amount of data. So, the limits were specified for each type of data.

5.2.1 Data gathering process

During the data gathering process only two of tables from Figure 13 were filled with data. Main characteristics of gathered data presented in Table 7. During this process data was not changed and put in Tables as they were in original sources.

Table 7. Characteristics of gathered data.

Table	Column	Number of Sources	Number	Number of lines
Occupations	Primary skills	1	10	378
Education programs	Education program	1	25	25

The results of the data gathering stage were 378 lines in Table ‘Occupation’ and 25 lines in table ‘Education’.

5.2.2 Data analysis

The main goal of data analysis was to fill all tables for each occupation and skill.

This is the step-by-step plan of data analysis:

(a) Determine General type of skills (Professional, Specifics, or Personal)

(b) Determine Skill type that has more narrow specification (like Data Analysis, Data Mining, etc.). List of Skill types were gathered from open web-sources and improved during the data analysis process.

(c) Determine Clean skill. At this stage the idea is to reduce complexity, unclearness, and repeatability.

(d) Find Education program by using keywords from Table ‘Clean Skills’ column ‘Skill types’ and ‘Clean skills’.

(e) The Table ‘EduSkill’ was done where for every education program the Clean skills were determined, and vise versa.

5.2.3 Structure of Occupational area

Structure of Data Science occupational area is presented on Figure 14. This structure based on gathered data about only 10 job vacancies and cannot be considered as a absolute data. But still it gives the understanding of Data Science occupational area. For example, Business skills are on 4th place after Experience, Machine Learning, and Programming. Communication skills are the most important for companies, but the Leadership is not required. Also Data Scientist should have appropriate education, be a good problem solver, and have good self-management skills.

All analyzed occupations were from three industries: web-based services, Technology companies, and Finance.

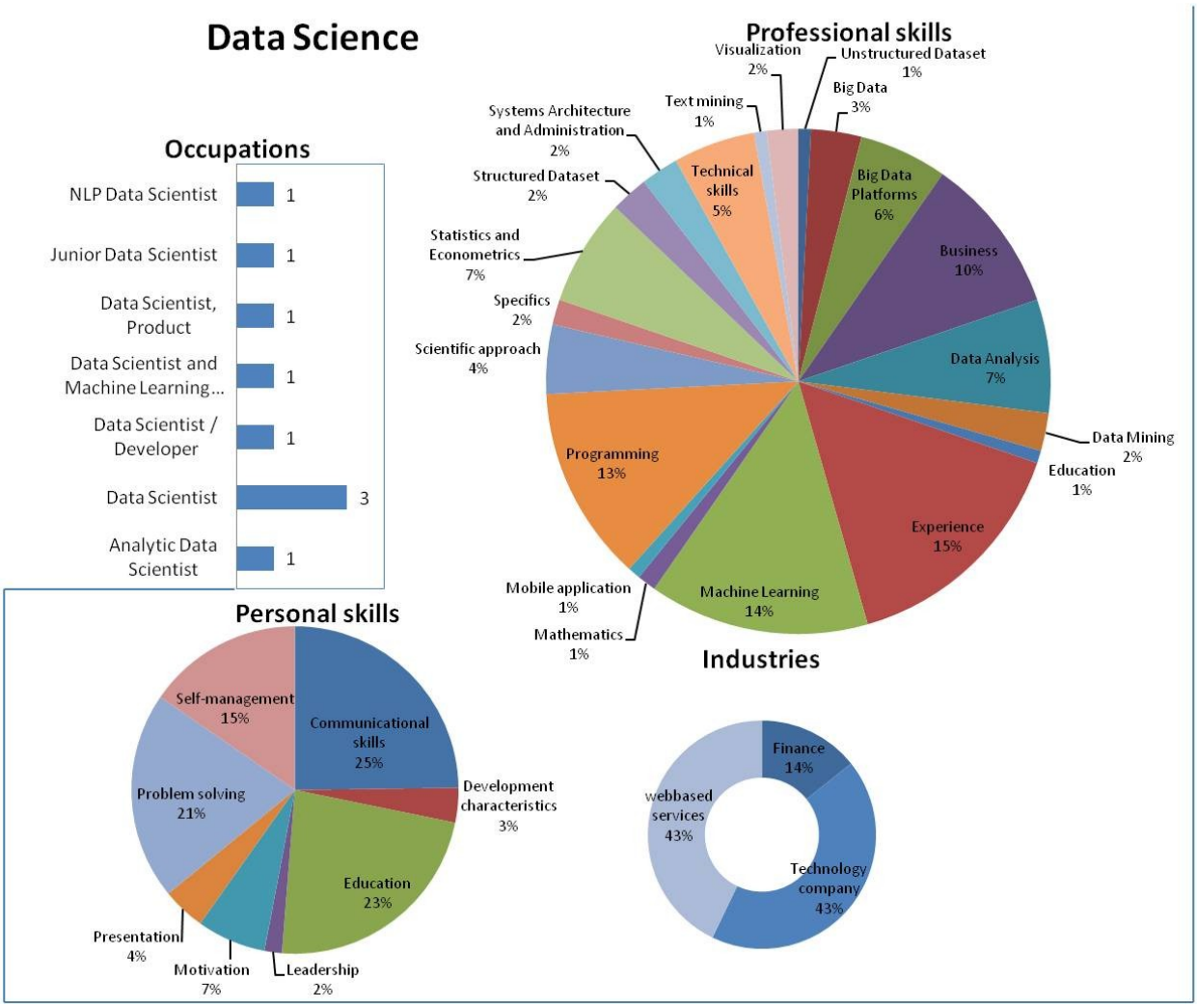


Figure 14. Structure of Data Science occupational area.

There are also Specific skills that relate to company activities and field of interest, like ‘Understanding Google data structure’, or ‘Identifying cyber security attacks’.

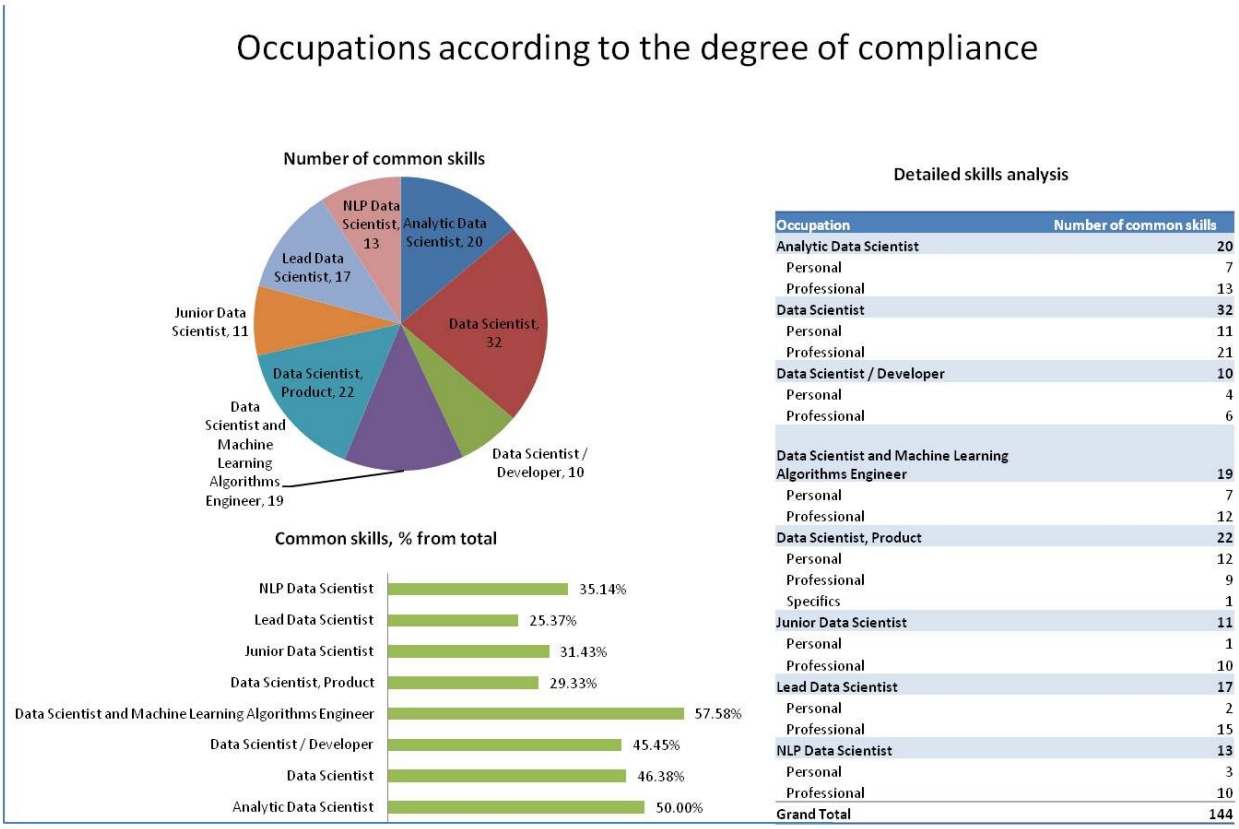
5.3 Database Testing

Database was tested in several steps. Firstly CVs of five respondents were analyzed. All respondents participated in the first stage interview. After that results of the analyses were given to respondents with survey with response scale (Strongly Agree, Agree, Undecided/Neutral, Disagree, Strongly disagree). Survey form (Appendix 1) contained the following fields: Usefulness, Actuality, and Applicability.

Each respondent got the results of analyzed information as presented on Figures 15, 16:

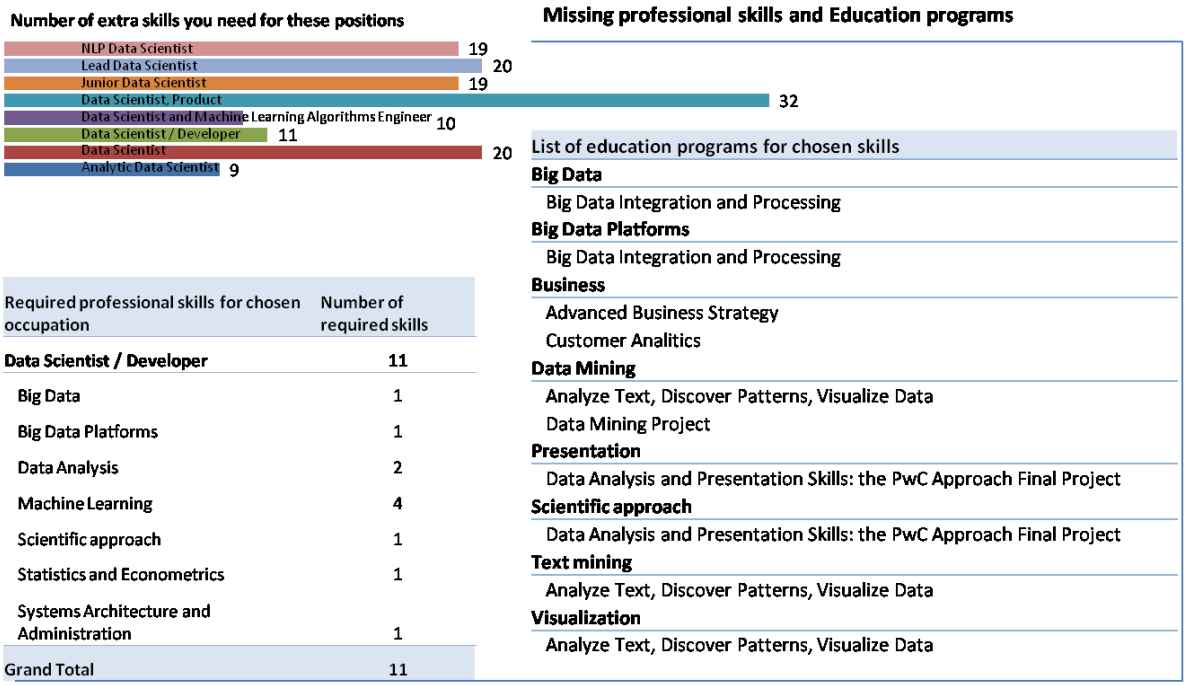
- Number of common skills for existing occupations in numbers and in percentages to all required skills for those occupations;

- Detailed skills analysis for each occupation;
- General information about skills that respondent does not have in numbers;
- Detailed information about extra skills those are required for one occupation;
- Detailed information about sources where respondent can learn more about those skills that she does not have.



Occupation	Number of common skills
Analytic Data Scientist	20
Personal	7
Professional	13
Data Scientist	32
Personal	11
Professional	21
Data Scientist / Developer	10
Personal	4
Professional	6
Data Scientist and Machine Learning Algorithms Engineer	19
Personal	7
Professional	12
Data Scientist, Product	22
Personal	12
Professional	9
Specifics	1
Junior Data Scientist	11
Personal	1
Professional	10
Lead Data Scientist	17
Personal	2
Professional	15
NLP Data Scientist	13
Personal	3
Professional	10
Grand Total	144

Figure 15. Occupations according to the degree of compliance



Required professional skills for chosen occupation	Number of required skills
Data Scientist / Developer	**11**
Big Data	1
Big Data Platforms	1
Data Analysis	2
Machine Learning	4
Scientific approach	1
Statistics and Econometrics	1
Systems Architecture and Administration	1
Grand Total	11

Figure 16. New professional skills for chosen position

The next step of testing the service model was the survey. Respondents agreed or disagreed with the statements about the service. The results are presented in numbers in Table 8. Almost all respondents assessed the service as a useful tool for themselves with actual information about their current position on job market and professional skills. The most interesting result is that mainly respondents are going to use this information for education purpose than for career planning.

Table 8. Results of survey report.

	Strongly Agree	Agree	Undecided/ Neutral	Disagree	Strongly disagree
Usefulness					
The result of CV analysis was useful for me?	1	3	1		
The result of my skill set analysis "Occupations according to the degree of compliance" was useful for me?	2	3			
Applicability					
I am going to use this information for my career planning?	1	2	1		1
I am going to use information about education programs?	1	4			
Actuality					
I think that the result of my CV analysis represents the real-life situation?	1	2	2		
I think that result of the analysis of my professional skills corresponds to reality?	1	4			

Generally, testing the service model from customers' point of view showed that new career development service is a useful tool.

6 Summary

The main objective of the Thesis was to design the model of new career development service that helps its customers to solve career development problems. The following qualities of services were taken as a basis: usefulness, applicability, and actuality.

For this purpose the existing knowledge about service design, supply chain management and database design were used.

There are two significant findings of the Thesis.

First of all, during the process of existing knowledge analysis the conceptual framework for service design was created. It includes the following steps:

1. Strategic assessment (market analysis, customer analysis, dialogue with customers, alignment with all stakeholders);
2. Idea generation based on strategic assessment.
3. Service concept execution:

- value of the service.
- service operation: Design of Supply Chain model with elements of Smart supply chain (Demand channel, Process value chain, Value delivery network);
- service experience: Multilevel Service Design method by Patricio, L., at al. [16]: (a) the customer value constellation; (b) Designing the service system (Service System Architecture and Service System Navigation); and (c) Designing Customer Journey with the Service Experience Blueprint;
- service outcome.

4. Database design by using Entity-Relational model:

- Starting with data analysis and meaningful examples;
- Developing the structure of the database:

(a) identify sets of the entities and the relationships;
(b) determine semantics in the relationships such as an one to many, many to many, etc.;
(c) determine the attributes and value sets;
(d) organize data into entity-relationship diagrams with primary keys [18].

- Modeling the database and database operations.

5. Query form design: 1) determine a set of data attributes; (2) generation query forms based on chosen attributes.
6. Validating the service model: (a) create a prototype of the service as a database (with real data gathering and analysis); (b) testing prototype with customers.

The second one is the model of the new online service. It has clear structure, reflects customers' needs and wishes. The Service Experience Blueprint is the main explanation of the new service. Also Supply Chain and Database models explain how service will operate and what kind of data has to be gathered.

It could be said that this thesis is the first step of design of the online career development service.

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Survey

How much do you agree with the following statements about the result of your CV analysis?

Please do not select more than one answer per row.

	Strongly Agree	Agree	Undecided/ Neutral	Disagree	Strongly disagree
Usefulness					
The result of CV analysis was useful for me?					
The result of my skill set analysis "Occupations according to the degree of compliance" was useful for me?					
Applicability					
I am going to use this information for my career planning?					
I am going to use information about education programs?					
Actuality					
I think that the result of my CV analysis represents the real-life situation?					
I think that result of the analysis of my professional skills corresponds to reality?					