THE MINISTRY OF EDUCATION OF THE REPUBLIC OF AZERBAIJAN

AZERBAIJAN STATE UNIVERCITY OF ECONOMICS

INTERNATIONAL GRADUATE AND DOCTORATE CENTER

MASTER DISSERTATION

ON THE TOPIC

"The Influence of Management Information Systems on Human Resource Management: Azerbaijan example"

Ibrahim Chingiz Rovshen

BAKU – 2019

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Code and name of Programme:060409 Business Administration

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BAKU – 2019

İNSAN RESURSLARININ İDARƏEDİLMƏSİNDƏ İNFORMASIYA İDARƏETMƏ SİSTEMLƏRİNİN TƏSİRİ

XÜLASƏ

Tədqiqatın aktuallığı. Qloballaşma və texnologiyanın artan təsiri ilə təşkilatların son illərdə müxtəlif funksiyaları və bölmələrində informasiya sistemləri istifadə etməyə başlamışdır.İnsan resurslarının idarə edilməsi əsasən idarəetmə informasiya sistemlərindən istifadə edən şöbələrdən biridir.HR proqram təminatı insan resursları fəaliyyətinin və proseslərinin elektron şəkildə həyata keçirilməsinə imkan verir.
Tədqiqatın məqsəd və vəzifələri. Bu tədqiqatın məqsədi müəssisələrdə insan resurslarının idarəedilməsi və proseslərin effektivliyinin artması üçün, HR proqramının hansı parametrlərə malik olması və Azərbaycan əmək qanunvericiliyinə uyğun HR proqram təminatı modelini hazırlamaqdır.
İstifadə olunmuş tədqiqat metodları.Tədqiqatın metodik əsasları müxtəlif müasir metodlara əsaslanır: sistematik yanaşma, analitik və iqtisadi-statistik təhlil, analoji metod, müqayisəli və ekspert qiymətləndirmə metodları, proqnozlaşdırma, modelləşdirmə və s.
Tədqiqatın informasiya bazası.Tədqiqatın informasiya bazası Azərbaycanda istifadə olunan HR proqram təminatlarının parametrlərinin analizi, dünyada istifadə olunan texnologiyaların analizinə əsaslanır.
Tədqiqatın məhdudiyyətləri.Tədqiqatın məhdudiyyətləri sırasında əsasən Azərbaycanda fəaliyyət göstərən müəssisələrin bir çoxunun istifadə etdikləri proqram təminatları haqqında məlumatları konfidensial xarakter daşıması səbəbiylə paylaşmamasıdır.
Tədqiqatın nəticələri.Tədqiqat nəticəsində Azərbaycan Əmək Qanunvericiliyinə uyğun, kiçik və orta ölçülü müəssisələr üçün online İnsan Resursları İdarəetmə Proqram Təminatı modeli hazırlanmışdır. Bu model proqram təminatı üçün çox büdcə ayıra bilməyən müəssisələrə daha az maliyyətlə əldə edə biləcəkləri tam funksional HR proqram təminatı təklif etməkdədir.
Nəticələrin elmi-praktiki əhəmiyyəti. Bu dissertasiya HR menecerləri və proqramçılar üçün çox faydalı olacaq.İnsan Resursları menecerlərinin perspektivindən bu proqram təminatının istifadəsinin əhəmiyyətini və proqramların parameterlərinin müəssisə məqsədləri doğrultusunda dizaynı üçün yardımçı olacaq.Proqramçılar da bu disertasiya vasitəsilə, İnsan Resurslarının proseslərini daha yaxşı anlayaraq, effektiv modelləri hazırlayacaqlar.

Açar sözlər: İnsan Resursları,HRMS, Proqram təminatı

ABBREVIATIONS

HRM	Human Resource Management
ERP	Enterprise Resource Planning
HTML	HyperText Markup Language
SQL	Structured Query Language
GUI	Graphical User Interface
MIS	Management Information Systems
CSS	Cascading Style Sheets
PHP	Personal Home Page
UX	User Experience
UI	User Interface

CONTENTS

INTRODUCTION

The relevance of the research topic. The purpose of this dissertation is to demonstrate how HRM can increase its process efficiency by applying new technologies and software. In the developed countries, organizations and institutions have tight relationships and collaborations in the research area. Companies are interested in the new approaches and theories that can be applied in the practice. Universities should not only provide theory, but also must contribute new techniques and models for the industry. Companies often acquire knowledge for innovation from external sources and then integrate it with the internal Research and Development. Unfortunately, in Azerbaijan, companies are not interested in collaboration with universities. Moreover, the reason is that, universities are not playing a role of research institutions. Nevertheless, in the near future, universities will adapt to the new research university model and students will develop new management models for the fields like Marketing, Human Resource Management, Logistics or Production. This dissertation does not only explain the connection between two disciplines: Management Information Systems and HRM, but also creates a possible web application model with all the technologies used to develop it and the scenarios it can be used for.

Level of studying the issue. For the first chapter of this dissertation a lot of theories in the Human Resource Management discipline and their implementations in the real organizations have been analyzed. For the second chapter analysis of the current applications in the local markets has been studied for their user experience and user interfaces.

Purpose and tasks of the research. It is very important to choose the right HRIS. Companies must invest in the system that will fit their goals, objectives, mission and values. It is very crucial to customize the software to the unique needs of the company. Because if software is not well customized or well-adapted to the company's environment it will not meet the organizational needs. Purpose of this thesis is to find answers to the following questions: How Management Information

Systems influences human resource management?How did MIS change the HRM models?What features an HRIS must have in order to successfully meet the organizational goals? How to design an HRM software that will fit well in company's environment? Whichsoftware do companies use in their HR departments in Azerbaijan?Are HR managers satisfied with their current software?After answering the questions listed above, this thesis will explain how to develop an HRM software from the scratch: starting from database design to backend coding and creating a graphic user interface (GUI).

Object and subject of research.Object of research is the space, place, object, event or process to study selected topic. In this dissertation, research topic is Human Resource Management processes. Subject of the research is the usage of MIS – new technologies in the HR Management

Research methods.Research method was based on analyzing the currently used software in terms of their front-end and back-end languages, Graphic User Interfaces and the parameters. By analyzing them, this dissertation proposes a software model.

Research database.The research database is based on analysis of HR software parameters used in Azerbaijan, analysis of technologies used worldwide.

Research limitations. Among the limitations of the research is that most businesses in Azerbaijan do not share information about software used because of their confidential nature.

Scientific and practical significance of the results.This thesis will mainly help the software companies, whichoffer HRM systems. In addition, it will help HR managers to choose suitable software for their needs. Application area of this dissertation is management information. HR specialist will benefit from the results of this dissertation for choosing the software or designing their own software according to their structure. This thesis will define HRM software as a term and create a standard set of features and parameters that HRM software must have in order to cover the organizational needs. It aims to show the importance of using an automated system in HRM.

Not only HR specialists but also companies who offer IT solutions to enterprises or software developers will benefit from this research. Programmers can create suitable applications for enterprises only when they have clear understanding of management policy of the company in the field of HR including recruitment, compensation, payroll system, KPI system, performance measurement. This thesis is going to help developers understand the key HRM functions and how to implement them in their software.

Structure and volume of dissertation work. This research consists of an introduction, 3 chapters, conclusion, 19 images, 15 tables and 11 figures. In work - 84 pages of text. During the work on the thesis,41 sources were used.

CHAPTER 1: DEFINING AN HRM SOFTWARE

1.1. HRMS as an intersection of HR Management and MIS

Management Information Systemscan be consideredlike an intersection of computer sciences and organizational management, which deals with issues such as infrastructure, needs, or planning related to information systems within an enterprise. Management Information Systems have several fields of studies like: Decision Support Systems, Executive Information Systems, Marketing Information Systems, ERP Systems, Office Automation Systems and HRM Systems (UKEssays, 2016).

Human Resource Management Systems is the direct impact of MIS with HR Management. To understand the relationship between these two disciplines, we must clearly identify the focal points, application areas and methods of both. As our aim is to define what Human Resource Management Systems stand for, we must start discussing the core of these systems: Human Resource Management.

It is undeniable fact that Human capital or as we call it resources are commonly accepted as vital and crucial part of each organization. No matter if company manufactures goods or provides services, without the manpower no company can function or operate. As Lyndall Urwick a famous management consultant and business thinkerremarked: “Business institutions are successful or fail in the long term not by markets or equipment, but by employees.” (Groth, p15) Human resource management is the science that searches the effective ways and methods to manage the employees to reach the goal of making them more fulfilled andbeneficial. Every organization has its grand strategy, a roadmap to follow within certain time scope, which contains the total philosophy, culture, objectives and goals that company intends to reach. It is impossible to realize any plan without making your strategy adopted and applied by your human resources. Human Resource Management covers all the activities developed for the effective

use of workforce of theemployees within the company. The essentialobligations of an HR manager fall into three main areas:

- staff management
- employee allowance and assistance
- job description or design

Essentially, HRM's goal is to boost the efficiency of the company by improving the productivity of its employees. Despite the increasing speed of the development in the global market, it is not quite possible to change this task in any radical way.

Figure 1: Scope of Human Resource Management

Source: Berthel, 2007, p 133

We must understand that the purview of HRM is ample and covers all the processes related to people's dimension of the organization. The graph above shows the objectives of HRM.

The main mission of HRM as a discipline is to make sure that, company hires the best talent and develops its employees' skills and creates working environment, which aligns the workforce with the needs of organization, and make an excellent contribution to the task. Well-established HRM practices help to make

the organization more flexible to adapt to the environmental changes experienced by organizations. We can group these changes as follows:

- Growing competition
- Globalization of the market
- Rapidly developing technologies
- Faster cycle times
- Higher customer expectations
- Increased demand for competencies
- Changes in the legislation

1.2 Human Resource Management

1.2.2. Design of organizational structure, Job descriptions and requirements

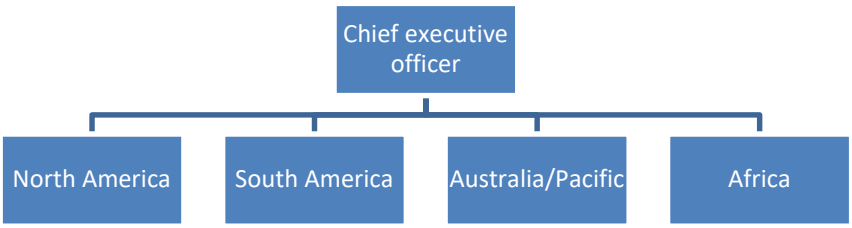
Organizational structure is the formal arrangement of assignment and expert connections that controls how people are to cooperate and use resources to achieve the organizational objectives.(P.G. Aquinas, 2008, p145). Itshows the basic relationships existing within an organization, including command chain, responsibility and authority hierarchy; theyare established through organizational structure and are represented by organizational diagram. Organizational structures play the biggest role in how organization operates and describes it as a whole. These structures define whether the organization will be centralized and formal or decentralized and informal. Most of the time, centralized structures occur in a top-down form with well-defined strict work roles. But in parenthesis, decentralized organizations are more likely to occur in in a cooperative way where informal relations play an important role and employees often perform ample spectrum of functions (Шекшня, 2002, p75). There are quite different types of structures for example:

- Market oriented structure
- Client oriented structure

- Product orientedstructure
- Functional structure
- Geographic structure
- Matrix structure

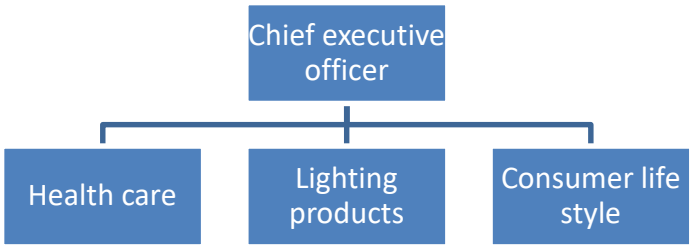
Organizational structure must be designed in a way to meet the organizational needs and objectives. Because it defines the work and information movement within thecompany.

Figure 2: Geographic organizational structure



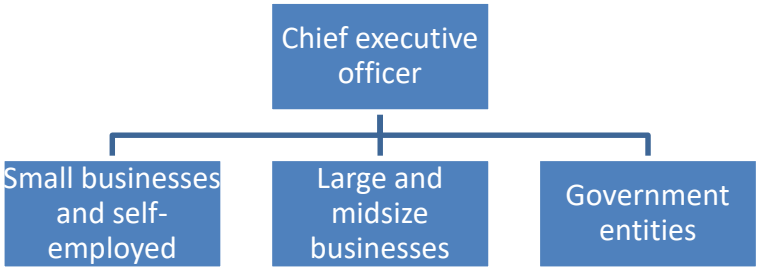
Source: Hentze J, 2001, p 174

Figure 3: Organizational structure based on product line



Source: Hentze J, 2001, p 174

Figure 4: Client-oriented organization



Source: Hentze J, 2001, p 174

The HR manager acts relying on the results obtained about work in the execution and development of programs designed within the human resources planning process to ensure effective use of HRs within an enterprise. This data is developed partly through organizational planning and partly at the end of the job analysis process.**The job analysis** answers the following important questions:

- What is actual job?
- What are employee duties and responsibilities
- What information, personality and mental / physical characteristics should employee have?

The result of job analysis reveals**job requirements** and **job descriptions**. Job descriptions play important role not in just Recruitment, Selection and Induction process but also in processes like training and development. It helps to identify possible training needs to make employees more suitable to their positions.

1.2.2. Training and Development

In modern conditions, the professional skills of any employee may not be sufficient to perform the current tasks of the company. A competitive market environment constantly dictates new requirements; therefore, the success of a business largely depends on the opportunities for staff training and development.

A personnel training is aimed at expanding his professional competencies. Ideally, this is part of the company's strategy and is planned: for example, in the

development of new markets for goods and services, technical re-equipment and modernization of production, expansion of business areas. There may be unforeseen reasons for the start of staff training: a decline in production and financial performance of the entire company or its divisions, changes in legislation.

Employee training can be organized internal (within the company) or outsourced (also known as external):

- **Internal:**It can be organized if there is a staff training and development department or with a sufficient number of reputable professionals who can train, less experienced employees and monitor their work. The advantage of this approach is the continuity of production, as well as strict binding to the needs of the company. The downside of in-house training is the lack of fresh ideas and methods from the outside.
- **External:**If the company does not have human resources to organize training, employees are sent to specialized courses or invite third-party teachers. This approach is often more costly for a company than organizing internal training. In addition, external training is more general in nature and does not take into account the specifics of the work of a particular company.

1.2.3. Performance Management

Performance within the work life means briefly the goods or services that an employee has obtained because of realizing the goals and objectives required by the workplace and work. We can say that an employee's performance depends mainly on three variables. These 3 variables are: capacity, possibility and desire. Performance management is one of the tools used to get a better result from all of the company components, such as company resources, financial structure, employees (Marr, 2015, p 126). The goal of performance management is to develop employees' motivations and skills, to strengthen their sense of belonging and responsibility to work, and to increase the efficiency and success of the company accordingly. The concepts of performance management and performance

appraisal are interrelated but fundamentally different concepts, even though they are sometimes mixed. Performance management is a process that will exist as long as the entity remains in existence, and performance evaluation covers certain periods and work within this process. Mostly, HR managers use KPI system in order to track the performance and productivity of the employees. **Key Performance Indicator** is a quantifiable statistic, whichshows how well employee is achieving his or her stated goals and objectives. KPI is very crucial part for Performance tracking and evaluation of the employees that is why its adaptation and integration to Human Resource Information System plays an important role for the usability and effectiveness of the HR software as a solution.

As for the practical application of KPI, this indicator is introduced in enterprises in order to conveniently measure the results of the work of the company as a whole, individual departments and employees directly, as well as motivate staff to achieve the desired results (Marr, 2012, p 45). With the help of these indicators, we can create if not perfect, then a very effective system of motivation and incentives for the employees of the organization. Of course, their usage makes sense mainly for those employees, whose work mostly affects or is related to the financial and economic indicators of the enterprise. In insurance companies, these are primarily agents, in trading firms sales managers, and in recruiting offices recruitment consultants. KPIsare also used to determine the performance of administrative and management personnel.Key performance indicators can be divided into (Kureshi, 2013, p38):

- Delayed indicators: reflect the results of activities after the period. These include financial indicators that show potential, but do not convey the current effectiveness of the divisions and the company as a whole;

- Operational (advanced) indicators: provide an opportunity to manage the situation within the reporting period in order to achieve specified results after it expires. They talk about the current situation in the company, in parallel showing

what kind of cash flows there may be in the future, and also demonstrate the quality of processes and products and the the level of consumer satisfaction.

Not only the company's management needs key indicators - it is more convenient for them to work and for the employees themselves, especially those whose income directly depends on the results of their work. KPI employees can easily calculate the steps that are needed to achieve the desired result. For example, in the insurance industry, especially in European and American companies, where such a system has long been justified and used everywhere, KPIs allow increasing the number of sales due to transparency and a clear understanding of the necessary actions that an employee must take.

By types of key indicators are different. KPI results - show the quantity and quality of the result.Cost KPIs show the resources spent.KPI functioning - refer to the performance of business processes and allow you to assess how the process corresponds to the desired algorithm for its implementation.

1.3. Types of HRM-systems

HRM systems are conventionally divided into three levels. They are determined by the level of automation of the processes:

1. **First level systems.** Solutions designed for automatic payroll. This is a typical product with limited functionality, the further configuration of which is impossible, and the number of potential users is extremely narrow.
2. **Second level systems.** More developed solutions to automate personnel records. They are provided with good functionality for maintaining a competent personnel policy. Software products of this level can be supplemented.
3. **Third level systems**.The most progressive solutions, which, besides payroll accounting and accounting of the personnel movement, allow developing individual training programs for specialists, creating "portraits", planning promotion and carrying out certification. Third-level

programs can be an independent product, but most often they are part of an integrated enterprise automation system (ERP).

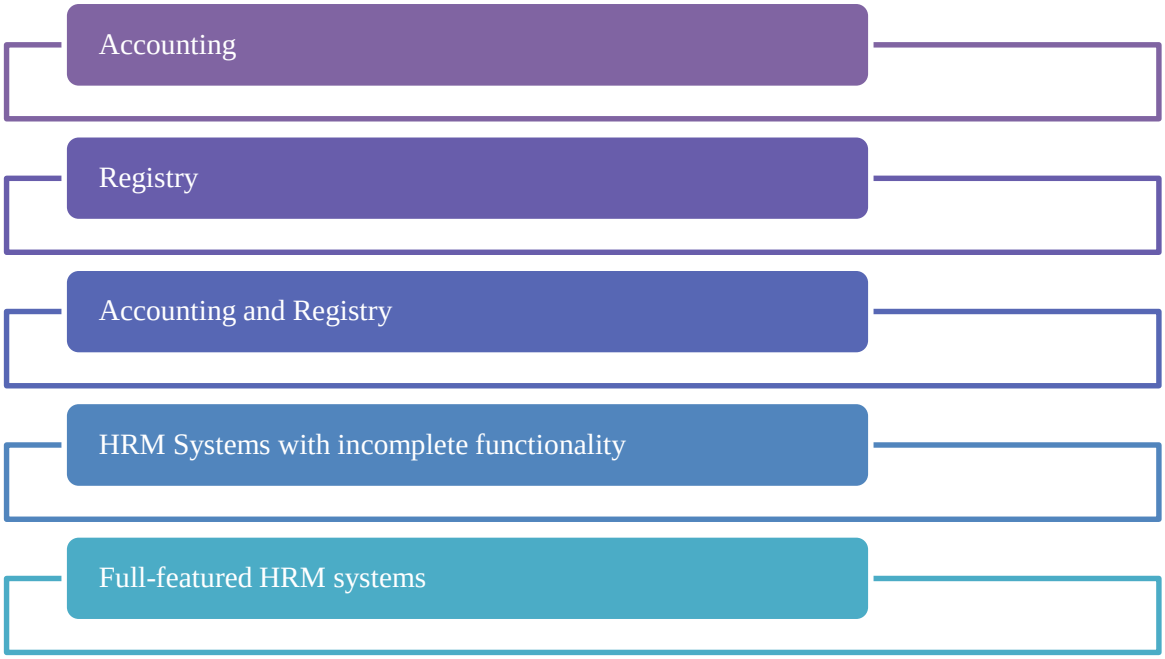
Another classification of HRM systems is based on the composition of functions. From this position, software products can be divided into five groups:

Accounting: Provide payroll, travel expenses, bonuses and deductions, work orders, etc.

Registry: This is the compilation of staffing, personnel reporting, accounting holidays, travel, sick leave, keeping personal files of employees.

Accounting and registry: Systems combining the first two groups.

Figure 5 : Classification of HRM systems based on functions



Source: “Комсомольская правда”, “Зачем внедрять автоматизированную систему управления персоналом и как выбрать оптимальное решение”, AccessedMarch, 2019 https://www.kp.ru/guide/avtomatizirovannye-sistemy-upravlenija-personalom.html

HRM systems with incomplete functionality: The software products of this group, in addition to accounting and accounting functions, include HR-contour: motivation management, analysis of staff performance, certification and assessment of professional suitability of employees, planning personnel changes, ways to improve the system.

Full-featured HRM systems: These are HRM-systems of the fourth group, to which the function of generating reports for control bodies or management of the holding, and statistics is added.

In practice, modern HRM-systems contain functional blocks or also called as modules distributed over three technological levels: operational, user and strategic. The first two software levels are well developed in most software products. The system of strategic personnel management is still undergoing active technological development, the leadership in which does not always belong to the major players in the world market.

1.4.An independent HRM system or module within ERP?

Using HRM as part of ERP allows companies to integrate it with other modules. This is convenient from the point of view of using a single database of management of all departments of the company, it reduces the speed of operations, eliminates the discrepancy of data. Management must be prepared for the considerable costs of integration and staff training. However, if the ERP-system has already been implemented, the development of HRM as an additional module will be more appropriate than the purchase of a separate product (Bradford, 2015, p 33).

The use of an independent HRM solution is justified when a foreign system is installed in the company as an ERP. Combining HRM with it is not easy for a number of reasons. For example, due to the specifics of payroll processing in the legal framework if the country, constantly changing legislation, peculiar methods of material incentives, etc. This is the case when two systems are best used autonomously. The process of implementing a personnel management system as an EPR module or as a standalone product is identical. The only caveat: when using a specialized solution, managers should think about integration with other work applications.

Another important question that comes from the result of the choice between HRM system and an ERP module is that should company acquire an individual software or the integrated (package) software. Here it is necessary to understand

one thing that individual development, if an organization wants to get a quality product at the output, a very costly undertaking not only monetarily, but also in time. In addition, it lays down the risks associated with the compatibility and integration of the created system with third-party automated platforms and modules from various developers and vendors. Contrarily, such a development will initially meet the functionality of all the needs of the enterprise, taking into account the specifics of the business utmost.

The developers of package, integrated solutions take care of the widespread, serial distribution of software in advance, making it scalable and as compatible as possible with various software solutions. In addition, in such automated systems are laid almost unlimited possibilities for customization of all modules for industry-specific business. As a result, package solutions in most cases turn out to become much more cost-sufficient products than custom software. And given the accumulated experience of implementation and adaptation of ready-made platforms in various enterprises, they have already taken into account and corrected most of the shortcomings that will have to be fixed in personal development over the years. Therefore, the HRM-system allows to significantly reduce decision-making time at all management levels, ensures the effectiveness of these decisions. The cost of personnel management is reduced, and labor productivity is increasing. For medium and large enterprises that are interested in this result, the introduction of appropriate software solutions is necessary.

1.5. Importance of HRMS in organizations

It is very important to choose the right HRIS. Companies must invest in the system that will fit their goals, objectives, mission and values. It is very crucial to customize the software to the unique needs of the company. Because if software is not well customized or well adapted to the company’s environment it will not meet the organizational needs. Almost all areas of HRM have sophisticated software that automates HR processes to varying degrees. For example, the number of software platforms and systems that help both employers and jobseekers electronically align

organizations and candidates and manage interviewing and hiring processes has grown enormously.

HRM systems are one of the most important enterprise applications used in companies of all sizes and in all industries. The need to implement HRM-systems is determined by critical needs for successful business development such as:

- Expense management
- Effective business process management
- Compliance with all legal regulations governing the relationship between employee and employer.
- Increasing the value of human capital.

Expense management: Labor costs are one of the largest cost items. According to Forrester Research labor costs' share in the United States is on average 36.4% of total expenditures(Hamerman, 2008, p6). HRM systems are used to plan and optimize costs.

Effective business process management. HRM systems support many business HR processes: making personnel decisions, keeping employee records up to date, calculating payroll, developing motivation schemes, etc. Improving efficiency in performing these tasks occurs by providing direct access to employees (Employee self-service) and managers (Manager self-service) to the information they need.

Compliance with all legal regulations governing the relationship between employee and employer. The use of HRM-systems allows you to competently resolve complex issues, implement flexible schemes for payroll calculation and personnel workflow.

Increasing the value of human capital. Despite the economic crisis, few will argue about the value of human capital as a corporate asset. Companies with a strong personnel management function will focus on the "quality" growth of employees, developing incentive programs and motivation schemes.

1.6. HRMS's contribution to Decision Making process

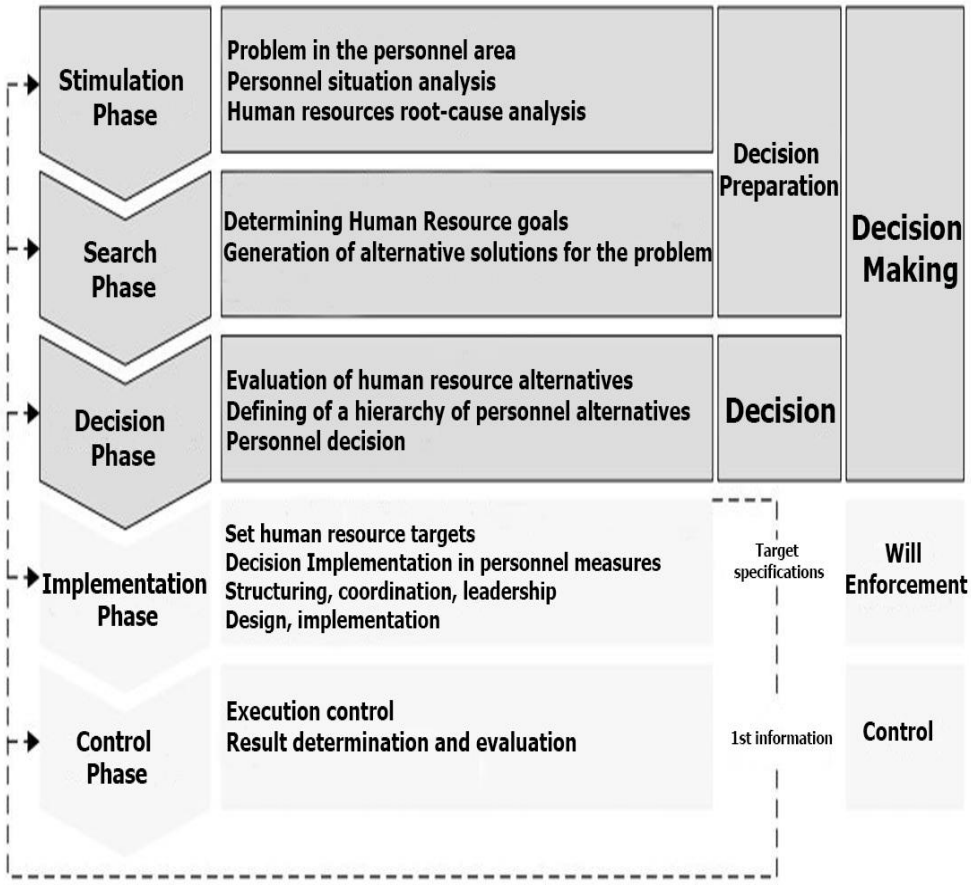
The dynamic situation in which companies are today demands efficient decision-making processes. This requires accurate and solid analysis of business data. Continuous development and the desire to capture more and more data creates huge amounts of data. (Köster, 2002, p86)This is also evident in Human Resource Management , where a large amount of data is available. As in other areas of the company, this flood of data results in the need for HRM to generate relevant information and make it usable for decisions Human Resource Management Systems can make a valuable contribution here. The question then arises as to which techniques of HRMS are particularly suitable for this and whether there are areas that can be better supported than others.

From this question, the research goal of the present work can be defined as a systematization of support potentials, which HRMS can offer for decisions in Human Resource Management. The systematization of the assignments and goals of information systems, it can be said that the design goal-oriented preparation of the desired model to achieve the goal builds on the knowledge-based analysis of the decisions of the HR department and the methods of HRMS.

According to Hentze and Kammel, the HR decision-making process consists of five successive phases. This decision-making process reveals that the actual decision-making phase is preceded by two more phases. According to Berthel and Becker the identification of the HR issues, the analysis of implementation options and the prognosis of consequences as well as the evaluation of alternative measures are part of creating a problem-adequate information base for decisions.

Decision Making Process plays a crucial role in not only the planning phase in the Human resource management, but also in other HR processes like employee selection, training and development processes, hiring or firing the employees and so on. Figure 6 below demonstrates the whole decision making process in the HR field.

Figure 6: The human resources decision-making process



Source: Hentze J, Kammel A (2001) Personalwirtschaftslehre 1. Paul Haupt, Bern. p 67

In order to be able to support a decision by providing information, it therefore makes sense to take the decision phase as well as the two preceding phases of decision preparation (search and stimulation phase) in the consideration.

1.7.Software used in local market

1.7.1. General Overview in Human Resources Management in Azerbaijan

In our country today, financial resources for enterprises are generally in the foreground compared to human resources. The success of the enterprises is largely suspended from the qualifications of their employees, the value they create and the skills they have.In Azerbaijan, human resources management and personnel management concepts are accepted as equivalent and used synonymously. In most

of the small and medium-sized enterprises (SMEs) in our country, only personnel management works are carried out under the name of Human Resources. Mixing this concept in Azerbaijan is different in terms of sectorial basis. In the private sector, enterprises are encouraged to carry out human resources functions such as recruiting, coordinating workers, controlling workers, and performance measurement in order to be successful. Each business is able to utilize its own software to optimize its software or to have ready automation systems.In public sector organizations, there is no possibility to get software suitable for the organizational needs such as private sector, and the developed applications or software usually add more than one organization within its own structure.

1.7.2. 1C Enterprise adapted software solutions

1C: Enterprise is a business-based platform that can be used on a server-based platform that can be used to manage the business processes, current projects, data relations and processes of small and medium-sized enterprises, which are marketed by the Russian Federation 1C software company.

Today, the ERP systems established on the 1C platform also include the HRM function. BestSoft LLC is the most important software company in Azerbaijan to adapt the 1C platform to the legal system and laws of Azerbaijan. Best Soft is the official Franchisee of 1C and started its activities in 2009.

Many big companies in Azerbaijan acquire 1C software to maintain their HR function. 1C is not a software for only Small and medium sized enterprises, now it is fully operational even at holding level. Organizations like Baku City Educational Administration, which has more than 42000 employees to manage, process and store their data, acquired in 2004 October 1C: Salary and Personnel Management version 8. This purchase allowed the organization to use the software at 90 workstations at the same time, allowing 5 thick clients and 85 thin clients to work simultaneously.The second mobile operator of the country Bakcell is also using the same software as Baku City Educational Administration. Bakcell acquired the software in 2012 September. It also worked with client/server connection. As a database server Microsoft SQL Server was used (1C, 2012).

1.7.3.Sinam ERP (SERP)

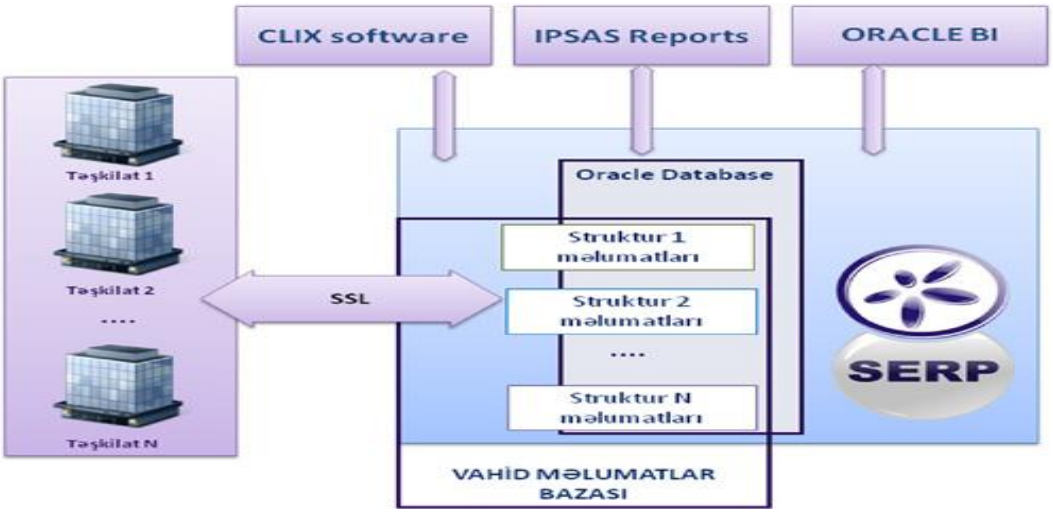
The "SİNAM Business Resources Management" automation system created by SİNAM is a unique system for the management of resources of budget-financed institutions and organizations. The software complex created in the SERP system consists of several modules. Each of these modules consists of a large number of sub-modules. These are used as serp.sinam.net and erp.gov.az domain names.The Financial and Accounting system of the Budget Organizations known under the name Farabi will ensure the implementation of the modern accounting and customer accrual information system in accordance with the national accounting standards for budget organizations. Within the scope of the project, a web-based Farabi book system consisting of Oracle BI and Clix LMS components for training courses will be created for accounting, general book, human resource accounting, salary, financial statements, and analytical reports. In the first stage, 35 institutions and 4 ministries will use Farabi system.

It is envisaged that the number of institutions to participate in this system will be increased and the total number of users (licenses) participating in the system will be transmitted to 4000. In general, all the ministries and other public institutions of Azerbaijan are planned to participate in the Farabi system. Other institutions that provide financial reports to the Ministry of Finance will also participate in this system. The operating module of the system is based on Oracle database.

As a graphical user interface, the SERP system provides time-consuming challenges to the user. Because it is complex in terms of GUI, users must always be trained in focus groups in the form of focus groups. In the development of the system, rather than user-friendly interface, the importance of compliance with the local finance and HR system have been given importance.

In addition, the whole interface in Azerbaijan has enabled it to be more successful than many of today's applications.

Image 1: Sinam ERP Module layers



Source: ICT News, "SINAM LLC's new ERP Software", Accessed Mai 6, 2018 http://ictnews.az/read.php?lang=1&result=ok&content=29051

All data provided on the website is transmitted via SSL system using MD5 unidirectional hashing method. Server SQL attacks from the large part of this way is saved. At the same time in the system, taking into account the inactivity period (logout) is done for security measures.

1.7.4.Prospect ERP: Pro ID - HR and Attendance management module

Prospect is the second largest software company in Azerbaijan and provides IT consulting and software services to businesses. Many large companies use the ERP application package prepared by the company for business management. In the field of Human Resources, personnel management and continuity help to create a checkpoint on the tip. There is no need for large HRM branches with ProID, and mutual reporting with the accounting department is simplified. Because the common database is being worked on. With the ProID application, you can see the current view of the cadres, find out whether each worker (those from the side branches) is online or not, and it is possible to reward them based on the information gathered and benefit more effectively from the motivation tools.The modules for the ProID application are:

- 1st module: Company's structural scheme
- 2ndmodule: Employees' database
- 3rd module: Calculation of salary
- 4 th module: Employee recruitment
- 5th module: Trainings and courses
- 6th module: Branch network

At present Prospect ERP system is used in "Sirab" OJSC. This system, which has been developed more and more every day, has been recently distributed to Android users. Other enterprises that benefit from ProID software are as follows:Araz supermarket chains, Oba supermarket chains, Absheron Logistics Center, Ministry of Health of AR, Ministry of Culture and Tourism of the AR, ANAMA, Hilton Hotel and Resorts, Veysəloğlu LLC, Ulduz LLC, Sirab CJSC, Rabitabank, Centron LLC, IDEA LLC.

1.7.5.Logo HR Applications

The most widespread spread of the human resources management applications offered by the Logo software company to the local and global application markets, Jaguar 3 HR and Tiger HR have the ability to work with the network and it can be tailored to the customer's business structure and be changed according to the needs.

The advantage of the Tiger HR human resources management system in comparison to other applications is that it has quick access to the right selection of labor. This module of the application is called Recruitment Module. In addition to this module, it carries out the activities of publishing the advertisements, which are required by the recruiting function, and examining the applications to the enterprise because of these advertisements. They can access the system via Linkedin, the professional social network of applicants.

Companies that use Logo HR in Azerbaijan are ATA Technology LLC, EMS Consulting Azerbaijan, SOLITON ICT MMC, GeoTek BS LLC, RES SYSTEMS MMC.

1.7.6.Bitrix24

Bitrix - established in 1998 and headquartered in Alexandria, Virginia. Bitrix presently incorporates in excess of 200 staff around the world, in excess of 2000000 clients and in excess of 12000 accomplices. Bitrix24, is the lead product created by Bitrix, Inc.. Bitrix24's current value list is as per the following:

Table 1 : Bitrix24 HR Software Price list

Edition	Number of users allowed	Price
Bitrix24 Self host	Maximum 12 users	1490 $
Business edition	50-500 users	2990 $
Enterprise edition	More than 1000 users	24990 $
Standart (Cloud)	Maximum 50 users	99 $/month
Professional (Cloud)	Maximum 150 users	199 $/month

Source: Bitrix24, "Find Bitrix24 users near you", Accessed November 27,2018 https://www.bitrix24.com/prices

Bitrix software is quite popular in Azerbaijan. According to the data provided by Bitrix24.com, we can observe that there are 620 Bitrix users. Majority of users (430 users) are operating in the capital - Baku. According to the map of users, we cannotconclude that, all the users are using Bitrix24 for HR processes. Bitrix24 is just a simple tool to manage HR activities in SMEs. Main usage of Bitrix is of course CRM activities. In Bitrix24, free HRIS is offered to clients, for example, custom person-to-person communication, nonattendance diagram, hierarchical logbook, record administration, CV vault, worker entry, authorization demands, outstanding burden planning, errands and task administration. In excess of 2,500 HR offices, faculty offices and expert enrolling offices around the globe utilize Bitrix24 to take care of issues related to the HRM. The Bitrix24 cloud release is free for up to 12 clients and goes to the client with 5 GB of online report stockpiling for every single Human Resource administration need.

CHAPTER 2: TECHNOLOGIES USED TO DEVELOP AN AUTOMATED HR SOFTWARE

2.1. Database design

We may not know what is included in the concept of a database, but the fact that we constantly use them is accurate. Every time we search for something in a search engine, we use a database. When we enter our username and password to log into any service, they are compared with the values that are stored in the database of this service.

Despite the fact that we constantly use databases, for many it remains unclear what it really is. In addition, this is partly becausepeople to define completely different things use the same terms related to databases.Let us understand the terms and concepts of databases:

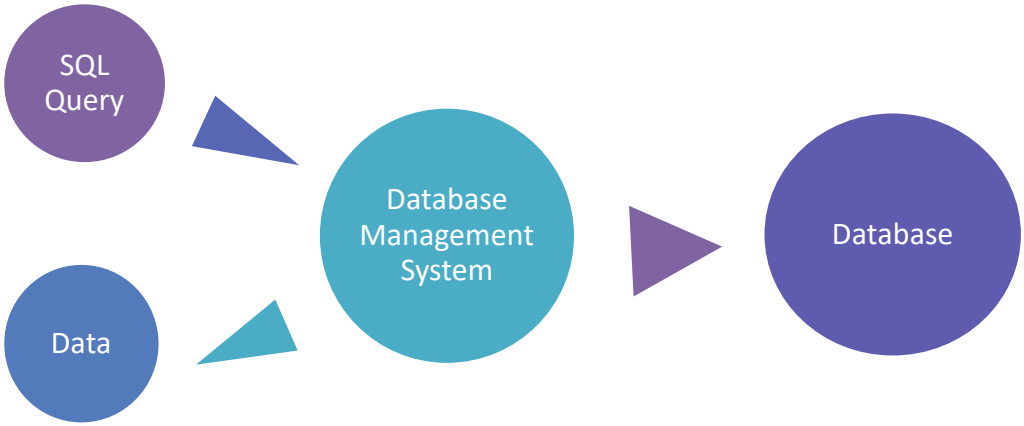
A database is a collection of information stored in some orderly way. You can compare the database with the cabinet in which the documents are stored. In other words, a database is a data warehouse. The databases themselves would not be of interest if there were no database management systems (DBMS).

A database management system is a collection of language and software tools that provides access to data, allows them to be created, changed and deleted, ensures data security, etc. In general, a DBMS is a system that allows you to create databases and manipulate information from them. It provides this access to the DBMS data through a special language - SQL.

SQL is a structured query language whose main task is to provide a simple way to read and write information to a database. So, the simplest scheme of working with a database looks like this:

Creating a database, we strive to organize information according to various criteria in order to then extract from it the data we need in any combination. This can be done only if the data is structured.

Figure 7: Scheme of working with a database (was created by author)

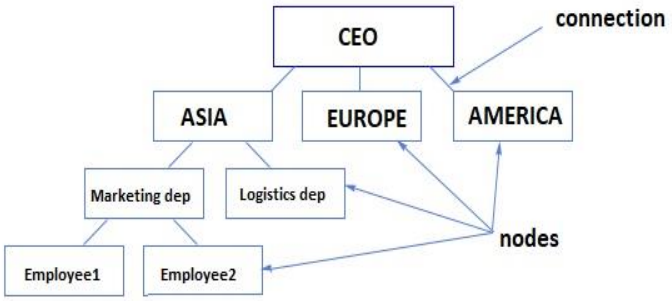


Source: Bradford, 2015, p 26

Structuring is a set of conventions on how to present data. It is clear that information can be structured in different ways. Depending on the structure, hierarchical, network, relational, object-oriented, and hybrid database models are distinguished.

The hierarchical structure of the database is a tree-like structure for presenting information. Its peculiarity is that each node at a lower level has a connection with only one node at a higher level. Let us look, for example, at a fragment of the hierarchical structure of the database "Multinational Holding":

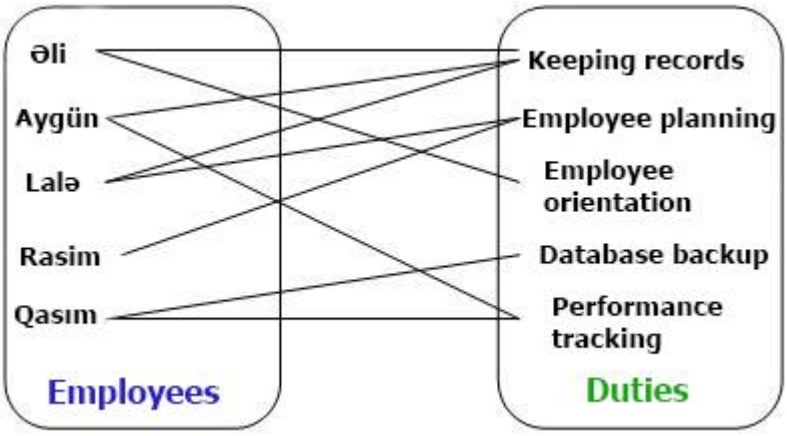
Figure 8: Multinational Holding - database structure



Source:Created by author based on Betts, Stephen & Laud, Robert & Mir, Raza & Vicari, Vincent. (2015)

In all databases, there are certain relationships or so-called connection types that are used to build an effective well designed database design. They are one to one, one to many and many to many relationships. One-to-one connection is used when one item can only have a connection with one item. For example let's assume that our first item is Department and our second item is the Head of the Department. Each department can only have one head of department. This is where we use one-to-one relation. When it comes to one to many connectionshere a lot of items can have connection with one item. Just like the employees of the departments. In each department, we can have dozens or hundreds of workers. In order to show this kind of relation we use one to many connections.Many to many connection on the other hand provides an opportunity to demonstrate difficult relations just like project managements. For example, employees can take part in different projects. Connections here are vice versa, projects also may have many employees that work on it at the same time. To show how many-to-many relation work let us imagine that in our Human Resources Department there are 5 employees and they have duties, but some work are done by several employees. For example, as we can see from the Figure 10 below, for keeping records about the employees 3 our employees are responsible (Əli, Aygün and Lalə). In parenthesis, Əli is also responsible for the employee orientation.

Figure 9: Employee and Duty relation (created by author)



Source: Created by author based on the information given above.

Network database structure: In essence, this is an extension of the hierarchical structure. All the same, but there is a many-to-many relationship. The network structure of the database allows us to add groups to our example. The disadvantage of the network model is the complexity of developing serious applications.

Relational database structure: All data is presented in the form of simple tables, divided into rows and columns, at the intersection of which the data are located.

Object Oriented and Hybrid Databases: In object-oriented databases, data is stored as objects, which is very convenient. But today such databases are still common, since inferior in performance relational. Hybrid databases combine the capabilities of relational and object-oriented, so they are often called object-relational. An example of such a DBMS is Oracle, starting with the eighth version.Undoubtedly, such databases will develop in the future, but for now the primacy remains with relational structures. Therefore, I will focuson relational database structures.

2.1.1. Relational Database Design

Relational databases, as we already know, are made up of tables. Each table consists of columns (they are called fields or attributes) and rows (they are called records or tuples). Tables in relational databases have a number of properties. The main ones are as follows: The first one is that, a table cannot have two identical rows. In mathematics, tables that have this property are called relations, hence the name - relational. The second one is that, the columns are arranged in a specific order, which is created when the table is created. There may not be a single row in the table, but there must be at least one column. The third main property is that, each column has a unique name (within the table), and all values in one column have one type (number, text, date ...).Finally, the last one is that, at the intersection of each column and row can only be an atomic value (one value that does not

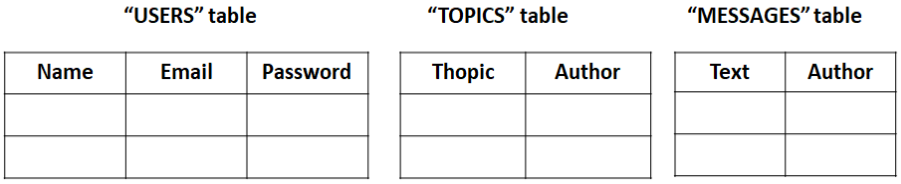
consist of a group of values). Tables that satisfy this condition are called normalized.

Everything will be clearer by example. Suppose we wanted to create a database for the forum. The forum has registered users who create topics and leave messages in these topics. This information should be stored in the database. Theoretically (on paper) we can arrange all this in one table, for example, like this:

Name	Email	Password	Topic	Message

But this contradicts the property of atomicity (one value in one cell), and we have an unlimited number of values in the Topics and Messages columns. This means that our databaseshould be divided into three tables: Users, Topics and Messages like in the image below.

Image 2: Database structure of commentary section for a forum



"USERS" table

Name	Email	Password

"TOPICS" table

Thopic	Author

"MESSAGES" table

Text	Author

Source: Created by author based on the information given above.

Our table Users meets all conditions. However, the table of topics and messages –does not. After all, the table cannot have two identical lines, and where the guarantee is that one user will not leave two identical messages, for example:

Image 3: Messages table

"MESSAGES" table

Text	Author
In my opinion...	Adam
Agree	Emily
When it comes to me...	Tilda
Agree	Emily

Source: Created by author based on the information given above.

In addition, we know that every message necessarily refers to a topic. In addition, how can we find out that? To solve thesekindsof problems, there are keys in relational databases.

A primary key (abbreviated as PK) is a column whose values are different in all rows. Primary keys can be logical (natural) and surrogate (artificial). Therefore, for our table Users the primary key can be an e-mail column (after all, theoretically, there cannot be two users with the same e-mail). In practice, it is better to use surrogate keys, since their use allows you to abstract the keys from real data. In addition, the primary keys cannot be changed, but what if the user changes the e-mail?

The surrogate key is an additional field in the database. As a rule, this is the sequence number of the record. Let us enter the primary key fields in our tables.

Now each entry in our tables is unique. It remains for us to establish a correspondence between the topics and the messages in them. This is also doneby using primary keys. We will add another field to the message table:

Table 2: Messages table with topics_ID

MESSAGES table

message ID	text	author	topics ID
1	I think that,...	Adam	1
2	We can demand that...	Emily	4
3	In my opinion...	Tilda	1
4	We can demand that...	Emily	1

Source: Created by author based on the information given above.

Now it is clear that the message with id = 2 belongs to the topic "climate" (theme id = 4) which is created by Emily, and the remaining messages belong to the topic "climate" (theme id = 1) created by Adam

Table 3: Users, Topics and Messages table details

USERS table

user ID	name	email	password
1	Adam	adam@gmail.com	4gt67u
2	Emily	emily@gmail.com	9jky84
3	Tilda	tilda@gmail.com	2etu94

TOPICS table

topics ID	topic	author
1	climate	Adam
2	technology	Emily
3	cities	Tilda
4	climate	Emily

MESSAGES table

message ID	text	author
1	I think that,...	Adam
2	We can demand that...	Emily
3	In my opinion...	Tilda
4	We can demand that...	Emily

Source: Created by author based on the information given above.

. Such a field is called a foreign key (abbreviated FK). Each value of this field corresponds to a primary key from the "Topics" table. This establishes a one-to-one correspondence between the messages and the topics to which they relate.

Let us suppose that the new user has registered on the forum, and her name isEmily:

Table 2: Users table

USERS table

user ID	name	email	password
1	Adam	adam@gmail.com	4gt67u
2	Emily	emily@gmail.com	9jky84
3	Tilda	tilda@gmail.com	2etu94
4	Emily	emily@hotmail.com	gt95r3

Source: Created by author based on the information given above.

How do we know which Emily has left the message? For this field, foreign keys will distinguish the author in the «Topics» and «Messages» tables. As we can see from the Image below, when user wants to retrieve information from the

database, results of both tables combined into one result. Connectors among these tables are ID fields, which play a significant role.

Table 3: Topics and Messages tables

TOPICS table

topics ID	topic	author ID
1	climate	1
2	technology	2
3	cities	3
4	climate	1
5	politics	4

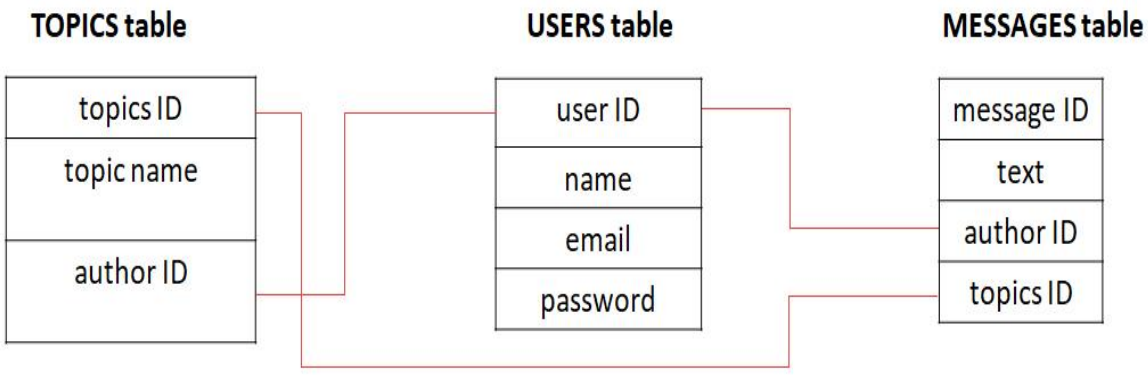
MESSAGES table

message ID	text	author ID	topics ID
1	I think that,...	1	1
2	We can demand that...	2	4
3	In my opinion...	3	1
4	We can demand that...	2	1

Source: Created by author based on the information given above.

Each topic, stores the user ID in its own "TOPICS" table. Each message or entry that is created, stores its author's identification author ID as well as the ID of the topic itself – topics ID.

Table 4: Connection among tables



Source: Created by author based on the information given above.

The reason why Messages table has three ID fields is that apart from its own primary key message ID, this table stores the entries that may not be writtenwith the topic that was created by another user. Cut a long story short, user may post an

entry to a topic that was created by another user. These connections show how this works in the form of relation tables.

2.2. MySQL as database management system

MySQL is the most used DBsystemon the Internet. It is not designed to work with large amounts of information, but its application is ideal for Internet sites, both small and large enough. This software allows us to connect to the database, send SQL queries and receive a response (result set). As I mentioned above, that MySQL was not designed for large amounts of information. However big platforms like Facebook, Twitter and Pinterest use MySQL (Дюбуа, 2007, p45).

MySQL is distributed under the terms of the GNU General License. GNU stands for “GNU's not UNIX”(Oracle Corporation, MySQL 8.0 Reference Manual).Within the frame of GNU project the author transfers the software he or she developed into the public ownership/access.

Previously, for long-term storage of information, developers worked with files: they placed a certain number of lines in them, and then extracted them for future work. The task of long-term storage of information is very often encountered in programming Web applications: counting visitors in the counter, storing messages in the forum, remotely managing the content of information on the site, etc.

Meanwhile, professional methods of working with files are very time consuming: you need to take care of placing information, sorting and retrieving it. In addition, you should not forget that all these actions would take place on the server of the host provider, where it is very likely that there is one of the UNIX variants, therefore, we also need to take care of file permissions and their location. At the same time, the amount of code increases significantly, and making a mistake in the program is very simple.

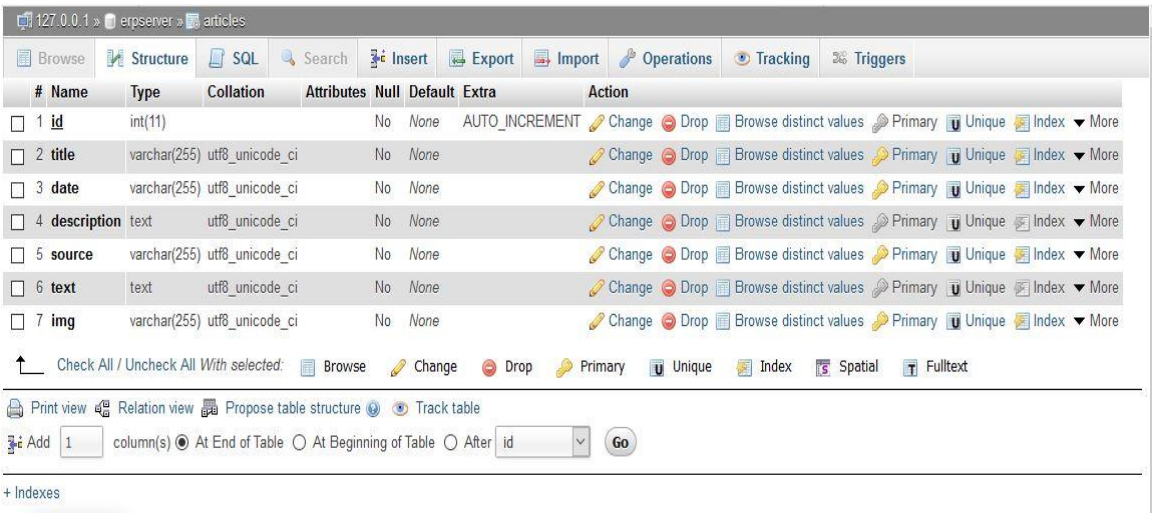
All these problems solve the use of the database. The databases themselves take care of the security of information and its sorting and allow you to extract and place information with one line. Code using a database is more compact, and

debugging is much easier. In addition, do not forget about speed - the selection of information from the database is much faster than from files.

A PHP application that uses a database to store information (in particular, MySql) always runs faster than a file-based application. The fact is that databases are written in C ++, and writing a program in PHP that would work with a hard disk more efficiently than a database is an unsolvable task, by definition, because PHP programs are slower in principle than C ++ programs, since PHP is an interpreter, and C ++ is a compiler. Thus, the main advantage of the database is that it takes over all the work with the hard drive and does it very effectively.

There are certain types of fields in the tables that we can use in MySQL. It is not a secret, which the records in the tables should correspond to these types. In addition, each cell of the record must satisfy certain conditions, which are precisely defined by the field type in MySQL.

Image 4: Structure of "articles" table in PHPMyAdmin



Source: Created by author using PHPMyAdmin DB Management tool

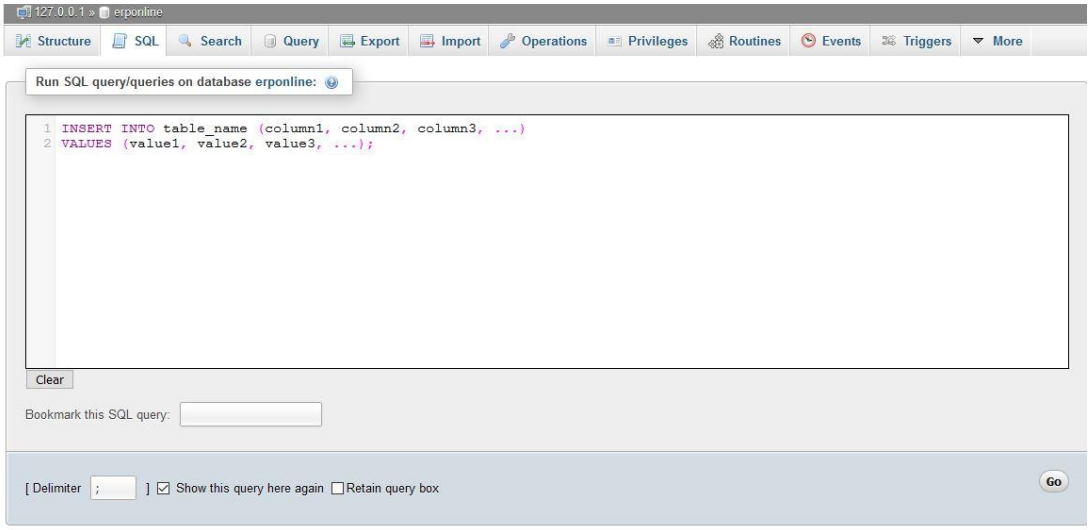
When we develop a database, we must predict what the user of application wills to input to these fields. When we make a mistake during the database design step, it will lead to critical functional errors in the future. In the Image 4 we can see how simple articles table function and which data types were used in it.

2.2.1. PHPMyAdmin as an interface for administering MySQL DBMS

PHPMyAdmin is a web application that is distributed with open source, written in the web programming language PHP and is a web interface for administering MySQL DBMS. PHPMyAdmin to work with the database you need a browser that will send all the commands to the server. The well-known SQL is used as the database language.

PHPMyAdmin is widely distributed throughout the world and is one of the leaders in the work of the DBMS. The interface is available in more than 60 languages. Thanks to a simple and intuitive interface, novice users can even use this application. PHPMyAdmin features easy creating, viewing, editing and deleting: databases, users, tables and records in them.

Image 5: PHPMyAdmin SQL command line



Source:PHP Official Documentation, Accessed 01.01.19

https://docs.phpmyadmin.net/en/latest/

It is convenient and clear import and export of databases, tables and records. While running an SQL query in built-in command line GUI hints in SQL errors and syntax errors by highlighting them. This can be easily seen in the Image 17 above.

2.3. Graphic user interface design with HTML5 and CSS

2.3.1. What is HTML?

HTML is simply a text markup language for web documents. It is appliedalmost in every web resource all over the world. The browser interprets the HTML code to display it on any device for example on a computer, tablet or phone. Tim Berners-Lee developed HTML. First, the HTML language was intended for the exchange of scientific documents. The layout of documents takes place with the help of special descriptors, but most often, they are called tags. A simple HTML documentis a text containing many tags that makes up a web page.Moreover, these documents are very easy to edit on any editor.

There were many versions of HTML,each of them had its own functions. With time as the Internet became more and more accessible and websites became more popular the main language of Web has also developed itself.Now, the latest version is called HTML5. The first beta version of HTML5 appeared in the fall of 2007. Final version was released in 28 October 2014. Most used function of HTML is linking the documents. A hyperlink (or just a link) is part of an html document, and it refers to another HTML document. By clicking on it user redirects to the target document/page.

HTML was designed so that the pages displayed on all devices the same.

For many years, web developers have been waiting for the appearance of support for new functionality described in the HTML 5 specification in a new generation of browsers. NowHTML 5 has a powerful functionality, such as multithreading, geo-location, embedded databases and embedded video. Over time, HTML has had many updates.

An HTML document starts with <! DOCTYPE html> - every web page starts with it. There used to be a huge number of options for the DOCTYPE tag, but in accordance with the new version of HTML, only this! DOCTYPE is needed, which is shown on the Image 18. Doctype is the tag that tells the browser the HTML version. This tag must be written on the first line of the HTML

document.Then comes the pair of <html></ html> tags. This tag is a container of a web page, that is why, before and after this tag there should be no code.

The required tag <title></ title> is written in the pair <head></ head> tag. In the title tag is written the title of the page, which is displayed in the search results and in the browser tab. The <head></ head> container usually contains various meta tags and styles and scripts are connected, it is no longer needed for anything.

All text, graphics and other code must be inside the <body></ body> tags. In this example, the HTML document created the first level heading and paragraph. Notice that they are inside the <head> tag.

HTML code itself doesn't have any design and functions like calculation, account logging and etc. That is why on the background developers use write the main code – engine of the page. However, for better user experience and design Cascading Style Sheets are attached to make web document more user-friendly.

2.3.2. What is Cascading Style Sheets?

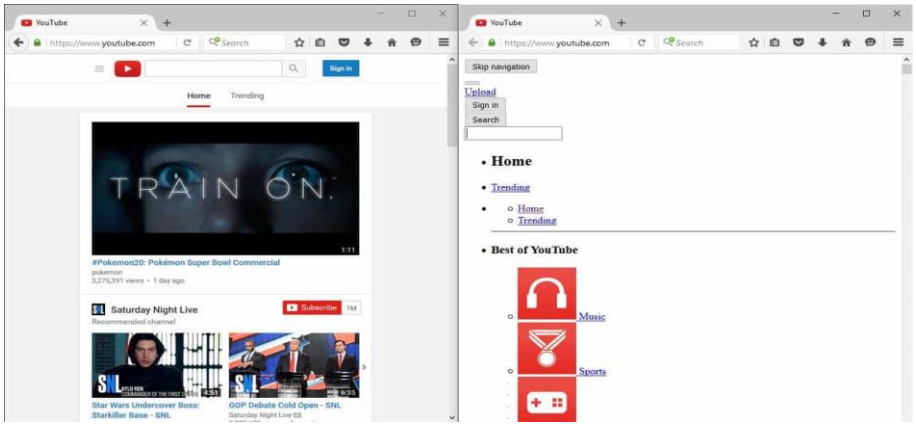
CSS is actually a style language that defines the display of HTML document and its components. CSS works with fonts, with colors of characters and backgrounds, with borders, with lines, with height and width of display elements such as div containers or tables, with background images, with positioning of elements and with so many other things that actually make a web page.For better understanding we can say that, if HTML is needed to structure the content of the page, then CSS is needed to format this structured content(Макфарланд, 2016).

Using CSS makes it easy to create high-quality websites, allowing us to set styles for individual site pages in specific .cssfiles in order to be sure that all pages on the site will be designed in the same style. The most important of all style files is the style.css file where all the basic styles of the site elements are specified.

In order to show exactly works CSS and what characteristics does it add to the main layout of HTML code, let's compare the one of the most famous video hosting website- YouTube and compare its home page with and without the CSS applied. As you can see from the Image 20 below, the image on the left is the normal form of the webpage where everything looks smooth and user-friendly. On

the other hand, the right image shows the webpage without CSS file applied. We can observe that such specific things like alignment, color, style of the text, shadings and border designs and bullet styles.

Image 6: YouTube home page with and without CSS



Source: html.com, Learn CSS Today The Easy Way, Accessed 01.01.19 https://html.com/css/

A striking example of the advantages of using a single style file style.css is the design of the tables: by setting the width of the cells in all the styles in the style file width: auto; and the height of the cells in all tables height: auto; you can be sure that the width and height of all cells in all tables of the site pages will be automatically determined by the content of the cells.

2.4. Factors affecting the UX

UX states for user experience and describes what the user experiences by exploitation our software by interacting with the user interface (UI) we provide.

In order to create a user-friendly design we must at first think like our user. What does he or she want to do in our application, what is the most important parameters that will be used frequently and which form of interaction suits best to the solution we are going to provide. Users will to use a software that is not very complex. If the software requires special training in the form of focus groups, they tend to be anxious about that software. Application must be easy-to-use so that person can use and benefit from it without reading a manual. Simple and easy view makes applications more approachable and usable. Developers must focus on what

problems this software is designed to solve: for example if it is an online payment system so it must focus on transactions, if it is accounting software main goal of it must be payroll management. Extra features are always handful but adding dozens of extra functions, that nothing to do with the main function will create a mess on user's mind and will not increase the user-satisfaction. Main problem of software nowadays is that, in order to show how their application rich with functionality is, add dozens of buttons and text fields without grouping them in certain relation and hierarchy. All the processes must be divided into simple, understandable modules or sections so that user does not get confused.

2.5. PHP and JavaScript as programming languages

2.5.1. PHP in backend programming

PHP actually has little to do with the internet in its original form. Rather, it is a simple programming language, but due to its structure it is well suited for Internet applications(Савинов, 2014, p35).When PHP is used in web pages, it is parsed when the page is called by the server, which is evaluated. It creates a new file, mostly encoded in HTML, which is then sent to the client's browser. The browser never gets to see the source code of the file, but only the output. This is why we also speak of server-side scripting.PHP is very close to some other programming languages, such as C, ajar, which is why there are many features in several versions. The best example of this is the output of a string.The benefits of having a PHP-style website over pure HTML are that they are flexible, and therefore easier to change. PHP makes it possible to create active content such as Forums, guest books or counters that can be changed by the user (Wallace, 2001, p103). In addition, PHP scripts can be split into multiple files, making cross-page changes much easier, e.g. Changes in the design, which would otherwise be possible only via frames. In addition, we can access SQL databases very well with PHP.PHP is a programming language used to write web pages (Маклафлин, 2013, p43). Among the server-side programming languages PHP is the most widespread.

The server side means that the language can only perform actions on the server: for example, it can establish connections to a database or delete files on the server.

An HTML file can easily be converted to PHP. You simply have to save the HTML file under .php. You can upload this php file to your server - without the actual PHP code. The output is unchanged.

PHP can be used to process user input. For example, if you would like to include a contact form on your website, the entries must be processed further. Only with HTML, this is not possible. For example, you can use PHP to check whether all fields have been filled in and, if successful, send an e-mail.

If you want to retrieve content from a database, it makes sense to use PHP. For example, if you want to program a news website, you can save your texts in a database and then output them with PHP to the desired places in your HTML code. You do not have to create a single HTML file for each article, and you can implement changes much faster.

2.5.2. JavaScript for a better user experience

JavaScript is a scripting language that is commonly used in web pages and then executed by the user's browser. Originally,it was used primarily to validate a user's input data to check if it fits the requirement for the particular process. It was developed by Netscape and was later used in all browsers. There are no less than three extraordinary things about JavaScript:

- Full incorporation with HTML/CSS.
- Straightforward things are done just fast and simple.
- Backing by every single browser

Since then the possibilities of this language have been expanded more and more, so that meanwhile it has become a complex programming language, with which almost everything is possible. JavaScript ensures that web pages can dynamically build up and adapt to the user. In JavaScript, complex control queries can be programmed and linked to databases to test users' inputs: their logins, search queries, passwords and so on.

The best way to explain JavaScript is to use examples. JavaScriptis insertedinto the HTML of a web page and then are executed by the browser. This means that as long as a browser does not execute a JavaScript, the underlying action will not happen.Let's have a look how JavaScript code looks like and how it is linked to the html code of the page.

The code has onkeyup function which is linked to letterOnly() function that is created before. These text fields name, surname must be only text to be valid and transferred into our database. User may make a mistake by typing the name of an employee and add some numbers or symbols. In order to prevent such errors at the real-time we use this basic function. This function checks the each symbol that user inputs on every key press on the keyboard so that user cannot type any number to the field that is required to contain only text. The time when user types any number for example, function replaces it with blank space. Just imagine how easy it is to make the user experience better just using a small script. The same function can be used in the fields where user must input only letters for instance: telephone numbers or Social Security Numbers.

2.6. Securing the private data about employees

Privacy of the employee data plays an undeniable important role when HR professionals decide which software to purchase. There is not any software that can guarantee 100 percent security and confidentialityof the information that will be stored on the databases. Even big platforms like Facebook, Twitter or Google itself have faced several information leaks and hacker attacks. We cannot manage all the human resource function on paper based methods. We have to create a digital information that can be processed through algorithms and help us to predict future employee demands.

Web applications are a lot vulnerable to hacker attacks, because they store all the information on databases at servers. The most used method to retrieve information from database is called SQL injection. As we can understand from the term itself, intention of this method is to send an SQL request to the server and get information from it in the form of response. Relational database management

systems (RDBMS) such as Oracle, and Microsoft SQL Server are among the most popular in the market according to the current DB engine ranking. Since they are considered very reliable and avoid inconsistencies in the datasets, for decades they have been the established standard for databases in most companies.

In order to query and edit them, the database language Structured Query Language is usually used. For example, users communicate via a product search mask in a web shop with a server, which in turn queries a database and plays the results back to the web shop as a search result.

In this way, the stored information is vulnerable to so famous SQL injection, which injectsan SQL queryto the database requests. This makes it possible to read or change information without authorization. Sometimes it is even possible, for the hackers tohave a control over the database.

The attack method is known since 1998 and has since been considered one of the most persistent threats. Among the top 10 Web application security risks regularly released by the independent Open Web Application Security Project (OWASP), SQLi has been consistently ranked first since 2010 (Open Web Application Security Project, 2017). So recently a glitch (a software or programming error leading to computer program misconduct) was discovered on the website of the Canadian Internet Service Pover Altima, about which it was possible with a blind SQL injection to access an extensive customer database.

One reason why SQLi is so popular with hackers is that it's a very simple attack. At the 26th DEF CON hacking conference, held in Las Vegas in 2018, an eleven-year-old child was able to hack and manipulate a copy of the Florida State Election Appearance website in just ten minutes via SQLi (Lee, 2018). On the other hand, defense measures are as simple as they are effective.

Let us suppose that our company has built a web application where HR manager can access theinformation of an employee by typinghis or herSocial Security Number. The text form of the softwaresends the entered textto the server in the form of an SQL query. The database executes an SQL request and responses the result of that query.

HR manager searches the employee with the SSN of 58746931452. The query of that particular search is shown below:

*SELECT * FROM isciler WHERE ssn='58746931452'*

Suppose the user enters the following customer number in a field on the web form instead:

*SELECT * FROM isciler WHERE ssn='58746931452'; DELETE * FROM isciler WHERE 'x' = 'x'*

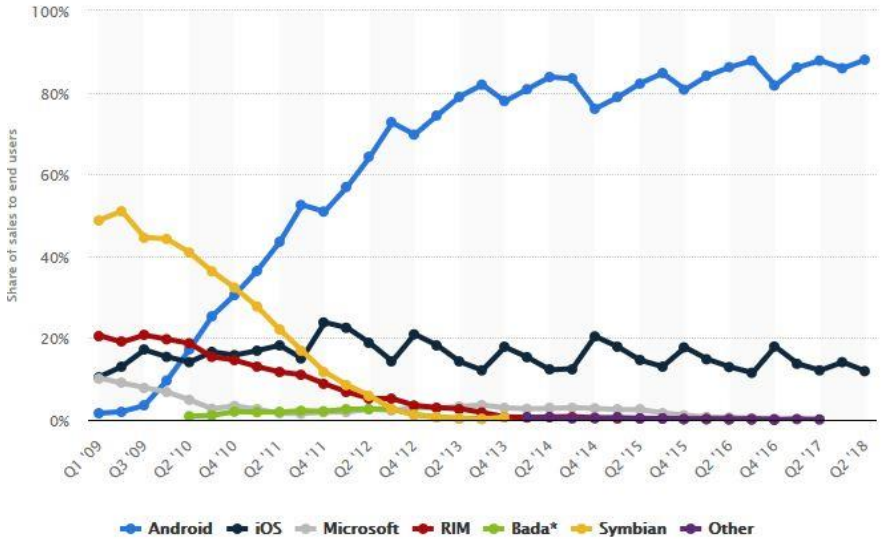
Databases execute multiple SQL statements in turn, separated by a semicolon (;). If the input is not pruned for the single quotation mark ('), an attacker can delete the entire table.

2.7. Usage of Mobile and Desktop Applications

At first I would like to define what Desktop and Mobile applications are and how they differ. Desktop applications are the ones that are developed especially for the operational systems that run on personal computers and laptops. They are designed to work in Windows, Macintosh or in Linux. Each platform differs from the others with its architecture and resource usage. That's why software companies release on the same soft for different OS's independently. The main reason is that vendors like Microsoft, Apple require their own development kit to be used. Desktop applications have limitations such as in order to use certain software we must have it installed on our computer. Even certain software like document network systems requires access to the corporation network.

Mobile applications do have a lot in common with desktop applications. Mobile apps also need to be installed on the device to be used. Development process is pretty the same like desktop app development process. According to statistical data from Statista, market share of mobile OSs for the second quarter of 2018 is as follows: Android OS leads the market with 88%, IOS is the second most used mobile OS with 11.9 % (Statista, 2018).

Table 5: Global market share held by the leading mobile OS



Source: Statista, Market share of Mobile OSs, Accessed 02.01.19 https://www.statista.com/statistics/266136/global-market-share-held-by-smartphone-operating-systems/

Developments of applications that run on mobile devices are difficult as well. Unlike desktop Operational Systems, mobile Operational Systems have a lot of versions. Almost every year a new version is released. In desktop computers, users are able to run even old software that was designed for older OS versions in compatibility mode or use emulators. Also virtual machines are very widespread among desktop users.

Only Apple Inc. has released 12 versions of IOS from 2007 until now; Google also has released 14 different versions of Android. Of course more than half of these versions are not supported anymore and aren't used by device manufacturers.

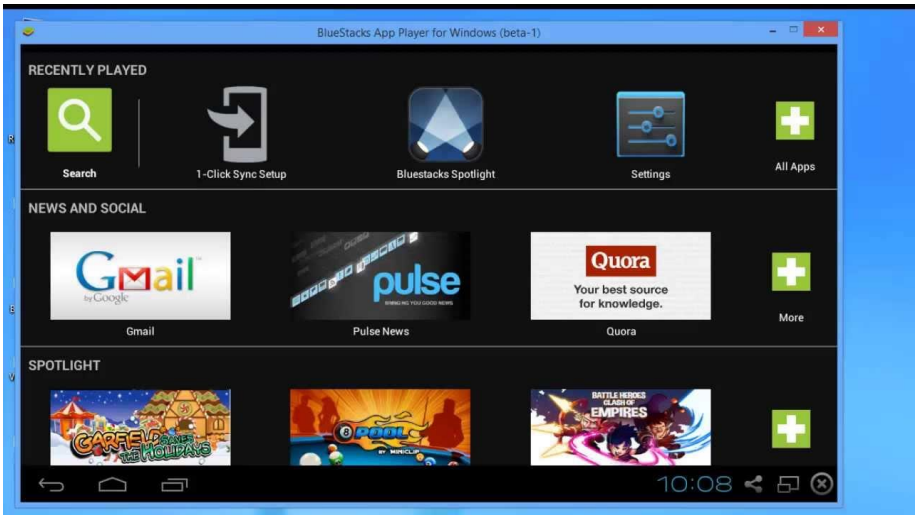
However developing process of software becomes more difficult because, applications must be programmed for each version differently. Nowadays people use their mobile devices more often than their computers, so the demand for mobile applications to solve their problems is enormous.

The main reason why people tend to use mobile applications more, is that mobile applications are 24/7 reachable and can be used smartphones, tablets, smart watches and so on. Demand for mobile apps is so high that, android emulators are

being used by a lot of desktop users. For example,more than 300 million users (Bluestacks, 2019) use Bluestacks an android emulator. These emulators show how important and undeniable role does mobile applications play in our daily life.

As we can understand, each solution has its own advantages and disadvantages. But what if we can create something that can be run on any platform? That is how web applications work. Web applications are stored on servers and users do not need to download or install any file, the only thing that is needed to run these apps are internet connection and a browser. For the first sight, it can be understood and perceived as an ordinary website. But it does not just show us any content or data. Web apps bring us interaction the way desktop applications provide without their limitations. Cross-platform access makes these applications reachable through all the systems and devices that have browser.

Image 7: Bluestacks emulator, running Android OS within PC



Source: BlueStacks Official Webpage, Accessed 01.01.19 https://www.bluestacks.com/ru/index.html/

2.8. Web Applications

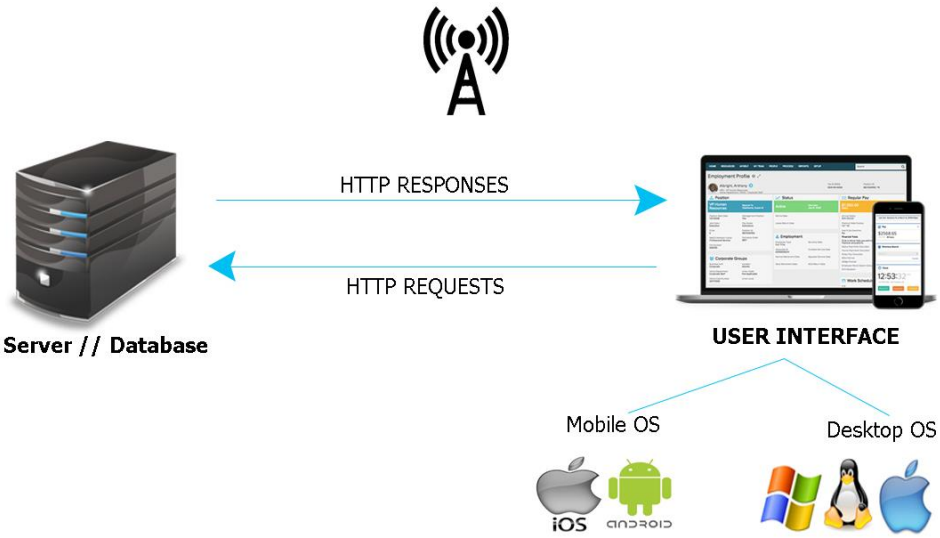
Web application is the application that works within the network, no matter local or global; and has cross-platform access, which makes it 24/7 accessible through all the devices and operational systems. Cost of web applications are lower

than the software dedicated to work only in one platform. Client-server connection, the main part of web application is contained on a remote server, and the user interface (UI) is displayed in the browser in the form of web pages.To start a web application, the user does not need to install any additional programs; it runs on any device with a browser and with Internet access.

The client does not depend on the operating system on the user's computer, so when developing web applications there is no need to write separate versions for Windows, Linux, Mac OS and other operating systems.

To create a server-side web application, use such programming languages as: PHP, ASP, ASP.NET, Perl, C / C ++, Java, Python, Ruby, NodeJS. To implement the client side developers are using HTML, CSS, JavaScript and Ajax.

Image 8: Web Application Architecture



Source: Created by author based on the information given above.

The use of web applications brings certain benefits both to website visitors and to their developers (Adobe Systems, 2018):

- Web applications enable guests to rapidly and effectively discover the data they need on sites with a great deal of data.

- Web applications enable you to gather, spare and examine information from website guests.
- The web application can be utilized to refresh sites with intermittently evolving substance.

CHAPTER 3: DEVELOPING AND TESTING ONLINE HRM SOFTWARE

3.1. Software database structure

As a database management system, we have chosen the MySQL. For the reason that MySQL is free and open-source and there are dozens of online expertise communities, this is one of the best choices we can have for an online HR application. MySQL can run databases with the physical size of up to 10Gbs without lags as long as the queries are optimized. Main table in our database will be used to record and store the employees' general information and it will be named as "Employees" table. In this table, we will store information such as employee's first name, last name, father's name, job, contact, gender, marital status, birth date, Social Security Number (SSN), department and other information. In the Table 4 below, we can how table structure looks like:

Table 6: "Employees" table structures

Name	Type	Collation
id	int(11)	
first_name	varchar(255)	utf8_unicode_ci
last_name	varchar(255)	utf8_unicode_ci
father_name	varchar(255)	utf8_unicode_ci
job_id	int(11)	
age	int(11)	
muqavileno	varchar(255)	utf8_unicode_ci
contacts	varchar(255)	utf8_unicode_ci
gender	varchar(255)	
marriage	varchar(255)	
citizen	varchar(255)	utf8_unicode_ci
stat	int(11)	
departament_id	int(11)	
kids	int(11)	
mense	varchar(255)	utf8_unicode_ci
day	int(11)	
month	int(11)	
birthyear	int(11)	
nationality	varchar(255)	utf8_unicode_ci
image	varchar(255)	utf8_unicode_ci
hemkarlar	int(11)	
exp_year	int(11)	

Source: Created by author based on the information given above.

Collation column shows specific rules that are used to store the information in the fields. These rules are helpful to set certain character width, case sensitivity and view of the characters on the database. In this HR software project, we are providing user experience fully in Azerbaijani language, so that final user of this application will be able to benefit from the software with its full potential. But one important nuance here is that, our database must store information in Azerbaijani characters. If we set collation to ASCii then we fill face with different symbol problems while displaying the results of the queries on the software. UTF-8 supports all Azerbaijani symbols and is supported by all the browsers.

As we can observe from the table, in Employees table we have two fields that play connector role. These fields are job and department. Because these fields are linked to the job and department fields.These fields are storing the only the ID number of particular department or job. This is how jobs table looks like:

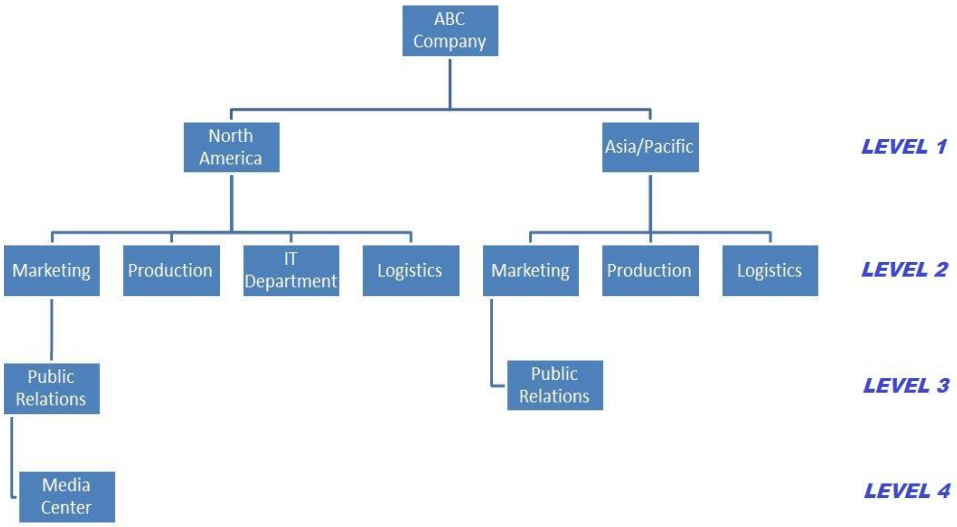
Table 7: Jobs Table structure

Name	Type	Collation
id	int(11)	
name	varchar(255)	utf8_unicode_ci
salary	int(11)	
duties	varchar(255)	utf8_unicode_ci
stat	int(11)	
dep1	int(11)	
dep2	int(11)	
dep3	int(11)	
dep4	int(11)	

Source: Created by author based on the information given above.

Duties field in “Jobs” table, helps to store the job description and requirements as a pdf file, which later can be downloadedby the employees or be edited or updated by the HR manager. An important nuance in this table is linking the jobs to the organizational structure. This table must identify where this position belongs. In this particular case, I have developed software that supports four level organizational structures. As I have analyzed the Small and Medium sized companies this fits to their organizational structure. In the Figure 11 below, levels in the organizational structure is shown.

Figure 10: Levels in Organizational Structure



Source: Created by author based on the information given above

As we can observe from the Figure 11, each lower level in the organizational structure is linked to the higher levels. For example, Media Center which is on Level 4, is belongs to the Public Relations Department on Level 3.This levels create a hierarchy and makes it easy to find where department belongs. I have used the same system to develop a database to resemble the structure. In my database, each level of the organization is recreated in the form of tables and all these tables are linked to each other so that relation between the levels can be created on that basis.

In database of the application, tables are called in a way to resemble the each particular level of the organization.

That is why, table names are as follows: dep1 table, dap2 table, dep3 table and dep4 table. Each table has the same fields.

Structure of department fields can be observed on the Table 10 below:

Table 8: Departments table structure

Name	Type	Collation
id	int(11)	
name	varchar(255)	utf8_unicode_ci
sub	int(11)	

Source: Created by author based on the information given above.

Each table has department names and their unique identification numbers. All the departments on dep1 table, represent the highest level on the organization. Departments that are on lower level, are stored on dep2 table. In dep2 table also, each department has its own unique identification number, name. But also, here on dep2 table, departments have sub field, which helps to create a connection between Level 2 and Level 1 objects. In the field sub on table dep 2, related department ID on the Level 1 is stored. This plays a key role of a Foreign Key (FK).

In the creation of the database, the possible needs of the Human Resources were taken into consideration and the dynamic structure was given priority in many subjects. For example, the organizational structure is dynamically designed, not static, which allows the user to add new structural units if the organizational structure becomes more complex. First, the user is given the opportunity to create a 4-level organizational structure. Nevertheless, user can always add other levels to the database when it is required.

As we have already designed our main tables in the database, we can move on to other tables to store additional information of the employee. Next tables that I am going to explain the structure are as follows:

- Education table
- Skills table
- Personal documents of the employees table

Education table shows the basic information related to the educational background of the employee. This table stores information like graduated high schools, universities, degrees that employee have, education years including

periods of education and their specialty.Education table must store the information I stated above, make it convenient for the later search, and filter functions. That is why the structure of the table is designed to store all the data related to education. Structure of the education table looks like this:

Table 9: Education table structure

Name	Type	Collation
id	int(11)	
school	varchar(255)	utf8_unicode_ci
specialty	varchar(255)	utf8_unicode_ci
degree	varchar(255)	utf8_unicode_ci
worker_id	int(11)	
start_date	varchar(255)	utf8_unicode_ci
end_date	varchar(255)	utf8_unicode_ci

Source: Created by author based on the information given above.

Once again, worker_id field here plays a role of a Foreign key (FK), linking this Education table to our main employee table. Another most important part of the Human Resource Application is to store employee documents like application, CV, ID Cards, certificates, diplomas and other important documents. Our Application stores these documents on the server in the form of a PDF, Excel, Word, JPEG files. Once HR Manager uploads these documents to the server, these documents can be accessed via both the application itself and via its Android application. In order to store the information about the uploaded documents, we need to create a table and link it to our main Employee table.

In order to link the tables, we just need to add a field where we can store employee's ID number.

Table 10: Personal Documents table structure

Name	Type	Collation
id	int(11)	
worker_id	int(11)	
name	varchar(255)	utf8_unicode_ci
link	varchar(255)	utf8_unicode_ci
date	varchar(255)	utf8_unicode_ci

Source: Created by author based on the information given above.

With that ID number, we can choose the documents that belong to the employee. On the Table 8, we can see the fields of the Personal documents table.

Through the android application, employees can upload all their documents to the system themselves. This process reduces the document collecting time and increases the efficiency, because both employee and HR manager can access those documents and use them when necessary. Documents at size smaller than 100 Megabytes can be uploaded to the server. Limitation of the upload size helps to maintain free space on the server. However, 100 Megabytes itself is quite enough size for a one document.

Next table in our database will be used to store the information about the skills of the employees. At this point, I have grouped the skills of the employees into three main categories. They are as follows:

- Employee's foreign language skills
- Employee software skills
- Personal qualities of the employee

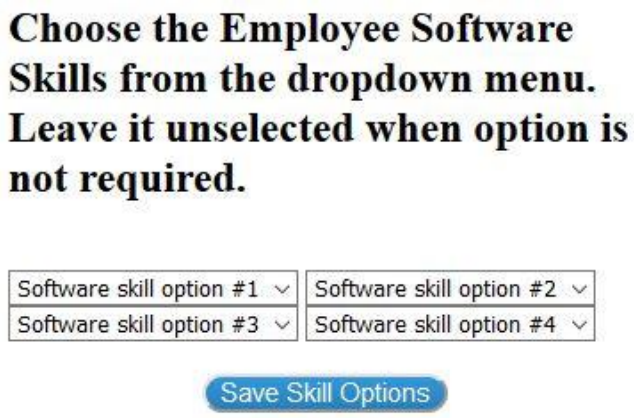
Each of these categories have their skills/options. Employee's foreign language skills include employee's knowledge of English, Russian, Turkish and German. These languages can be changed by the HR Manager in the settings, and the languages that company requires employees to speak can be attached to the system.

Employee software skills for default has four options and they are Microsoft Office, Adobe Photoshop, AutoCAD, Adobe Premiere. As I mentioned above, these four options are set by the software for default. HR Manager can add or remove certain software or Operational Systems like Microsoft Windows, Linux or MacOS for the needs. Microsoft Office includes Word, Excel, PowerPoint, Outlook, OneNote, Access, SharePoint. Each of these programs can also be added as an option. Most of the time MS Office programs are the frequently used ones in SMEs.

An important point in this skill category is that, each employee may have their own set of software skills. For example, an employee who works in the IT

department has totally different set of software skills, comparing to an employee who works in the Finance department. That is why; these options of software skills must be individual for each employee. In order to provide the used information about the software skills, I have created a dropdown menu which shows all the Software grouped by the their category. HR manager, when filling the information of the employee to the system just selects the required software from the dropdown menu and adds it as an option of Employee software skill. This increases the effectiveness when HR manager fills employee cards to the system.

Image 9: Select Employee Software Skill Option



Source: Created by author using HTML, PHP and JavaScript

After selecting the options, HR manager sets values for those skills. In order to evaluate the skills I have used five star systems, which represents the employee's level of software using. Five star means that employee uses that software fluently and professionally. Three stars means mediocre usage of the employee, from time to time employee faces problems with the interaction with the particular software. One star means that, employee does not haveany experience at all or is able to use only the basic functions in that software.

The last category of the Employee skills is Personal qualities of the employee. Here again by default I have given four options. These options are as follows:

- Working in the team / Teamwork

- Hard work
- Leadership Skills
- Affiliation to the organization

These skills also are evaluated with 5 star system. The table below shows the structure of the Skills Table in the HR application software.

Making as many skills stored on the database as possible helps to use these skills for filtering the employees. Each of the skills entered to the database, can be used as a keyword to find out which employee fits to certain parameters. Within the application search filter, each option helps to narrow down the search and find the exact people with the required skill set.

Table 11: Employee Skills table structure

Name	Type
id	int(11)
worker_id	int(11)
lang_skill_1	int(11)
lang_skill_2	int(11)
lang_skill_3	int(11)
lang_skill_4	int(11)
soft_skill_1	int(11)
soft_skill_2	int(11)
soft_skill_3	int(11)
soft_skill_4	int(11)
teamwork	int(11)
hardworking	int(11)
leadership	int(11)
affiliation	int(11)

Source: Created by author based on the information given above.

Next table in the database will contain information about the experience of the employee and his or her career activities. This table will be called as “career” table. Here information about employee’s former work background, his former positions in the former companies and the periods of work activities will be stored. Apart from this information, this table must help us to calculate the experience of the employee both generally and within the company (Müəssisədaxili və xarici staj müddəti).

Table 12: Career table structure (was created by author)

Name	Type	Collation
id	int(11)	
worker_id	int(11)	
job	varchar(255)	utf8_unicode_ci
company	varchar(255)	utf8_unicode_ci
start	DATE	
end	DATE	
doc_date	DATE	
doc_type	varchar(255)	utf8_unicode_ci

Source: Created by author based on the information given above.

Table above shows the structure of the "career" Table. With the help of this table, it is possible to calculate the sum of all periods that employee has worked. Both general experience and organizational experience is calculated and updated automatically. Once again, worker_id here is used to link this table to our main "Employees" table. Doc_type is used to identify which type of document (order, application or reference) is used to ground that activity. Accordingly, doc_date and doc_number represent the dates and numbers of those documents. These fields make it possible to search employee by just entering the document number on the search field. And the final table in the database will be used to store vacation information about the employees, therefore table's name will be "vacation". This table will be available for both employees and for the HR manager as well.

Table 13: Vacation table structure (was created by author)

Name	Type	Collation
id	int(11)	
worker_id	int(11)	
start	DATE	
end	DATE	
type	varchar(255)	utf8_unicode_ci
used	int(11)	
unused	int(11)	

Source: Created by author based on the information given above.

This table will be a basis for the calculation of the used vacancy days and unused vacancy days. Calculation of the vacancy plays a huge role in the HR management. The compensation must be provided to the employee for the unused

vacation according to the Azerbaijani Labor Law. According to Article 135 of the Labor Code, employer is obliged to give a worker leave. Furthermore, paragraph 2 of Article 135 states that if the employee does not use any of his or her employment leave in the relevant business year, he or she shall be compensated in the manner and amount determined for the unused vacations for that business year. This table will show each year's vacation of the employees and how many days of it have been used. Application will calculate the unused vacation days automatically for each employee.

3.2. Graphic User Interface of the Application

Typical for all applications, main page of the application is the login page. This page requires email and password credentials to access to the system. In order to secure the access all the login and passwords are stored on the database in the form of hashes. SHA-256 is used to hash the credentials. Also login form of the application is protected against the SQl-Injection with the JavaScript. If required two step verification can also be used to create even more secure login process.

Also login form of the application is protected against the SQl-Injection with the JavaScript. If required two step verification can also be used to create even more secure login process. After logging in to the system, main page of the software provides user with the dock menu including the options listed below:

- Main page
- Employee cards
- Online Resume Pool
- Statistical Reports
- Exporting data to Excel
- Job descriptions database
- Filter page
- Organizational structure page
- Administrative agenda
- Administrative Contact book

- Online library
- Birthday calendar
- Frequently Asked Questions page
- News summary related to Human Resource Management

The dock menu can be seen on the top of the each software page as well as on the Image. First option of the software dock menu is main page icon, which redirects user to the main page of the software. Second option is Employee Cards page. User gets all the information about the employees and the list of employees. On the image you can see the main elements of the Employee cards. Main function of the HR software is to store the information related to the employees. That is why, this page has a direct link to New Employee page. This page also includes the fast search for the employees according to certain criteria. These criteria are name, surname and contract number. Search has two options, which include not only the current employees, but also the one who has worked in the company in the past.

Image 10 : Main page of the HR Application

Ən son əlavə olunan işçilər

Ad, soyad	Vəzifə	Departament	Yaş	Müqavilə nömrəsi	Əlaqə telefonu
Adilə Vəliyeva	Xadimə	Texniki işlər üzrə departament	28	56564563	070 558 45 18 adile_v@gmail.com
Asif Əliyev	Marketing manager	Sosial Media Marketinq departamenti	43	45745754	070 999 54 16 asif_aliyev@gmail.com
Qasımova Zeynəb	Marketing manager	Marketinq departamenti	29	6181866	050 994 87 46; emily_bett@gmail.com
Əsədov Vaqif	Marketing manager	Marketinq departamenti	42	11558185	053 987 45 69; amell@gmail.com

Source: Created by author using HTML, PHP and JavaScript

Moreover, the Employee cards page shows the table of most recently added employees. This table has 6 columns: Name and Surname, Position, Department,

Age, Contract number and Contacts of the employee. This information gives a quick overview about the recently added employees.

When HR manager needs to add a new employee, he or she clicks on “Add new employee” link at the left of the search box. This redirects user to the new page where initial information about the employee will be stored. On the Image you can see the form that software uses to create an employee card. This form includes information like name, surname, father’s name, gender, birth date, marital status, number of kids, email or telephone number, job and department of the employee, nationality, citizenship, Social Security Number, membership to labor unions and social origin.This form also uses JavaScript tocheck all the fields to be filled and checked for the relevance to the field. For example, on the name text box where user must type the name of the employee, user may accidentally type certain symbols or numbers. ButJavaScript code of the page checks these fields for the relevance and deletes the symbols that do not meet the needs for that particular field. The same function works for the fields that only numbers can be inputted. Fields like Social Security Number, Pin Code of the employee use only number input. “Add” button at the bottom of the form will not be active unless user fills all the fields. If user forgets certain fields; software uses modal boxes to inform the user which fields are empty. Software redirects user to the successfully created Employee Card page.

Employee Card page has 6 main sections which shows different aspects of the employee information. These sections are general information, education, experience, skills, vacation and documents. Each section is designed in the form of a button, which changes the table of information below when clicked. In general, information page, we get to see the information we added when we created the employee card. Here user can edit this information or delete the created employee card. Also software provides the image upload function. User can upload the image of the employee to his or her employee card by clicking the “Upload Image” link.

On the education section of the Employee Card, we can add the educational background of the employee. Software offers all the local university names in the

form of a dropdown menu or user can type the university name manually. Specialty , educational level (bachelor, master or PhD) and education periods are also stored in this section. All the information about the education can be edited.

On the Experience section, all the information related to the employment history of the employee including the name of organizations, positions, employment periods are stored. Main function of the Experience section is to calculate the experience of the employee both within the company and generally. After adding the employment periods of the employee, system automatically calculates it. All the information in this section can also be edited or updated.

Image 11: Employee Card - HR Application

Ştat vahidi və vəzifə maaşı	1 ştat; 700AZN
Evlilik durumu və uşaq sayı	44 yaş Evli; 1 uşaq
Sosial Sığorta Nömrəsi	818153151866515
Pinkod	18181269
Müqavilə nömrəsi	11558185
Əlaqə nömrələri və email	053 987 45 69; amell@gmail.com
Vətəndaşlığı və milliyyəti	Azərbaycan; Azəri
Sosial mənşəyi	Qulluqçu
Həmkarlara üzvlük	Hə

Source: Created by author using HTML, PHP and JavaScript

Next section contains the information related to the set of skills that employee has. Our HR software provides three set of skills. They are Employee's foreign language skills, Employee software skills, Personal qualities of the

employee. In this page user chooses the options for the skills.These set of skills based on these three categories, individually. The reason why, software stores the information related to the skills of employees, is that it makes it possible for the HR manager, to filter the employees based on their specific skills.

Vacation section shows the vacations of the employee according to the years in the form of a table. It also shows the total used and unused vacation days. It helps HR manager to create a vacation schedule for the employees.

And finally, the last section of the Employee card, consists of the list of the files of the employee. These files are his or her Diploma scan, ID card or any document that relates to the employee. Files in the format of JPG, PDF, Word, Excel, RTF can be uploaded in this section. Later, HR manager can easily access those files 24/7, they can be downloaded, printed directly within the application. Moreover in the Employee Card page, whole information can be downloaded in the form of a PDF file. This file contains all the sections that I have stated above on each page and can be used to get a detailed look on the employee.

Apart from the real-time reporting, HRM Application provides, online resume pool, which stores all the resumes that candidates have sent to the company. This application provides HR managers to design an online form of application and publish it on the official website of the company. All the filled data to the form will be transmitted to the application database. Application in the background will automatically detect the candidates that fit the vacant position requirements and can provide an analysis of comparison for the selected candidates. It will help HR managers to see the difference of each employee and select the one who meets all the requirements. Main advantage of this method is that, manager does not spend time and energy to read all the resumes and compare them manually. This process of initial selection could take a lot of time when company has multiple vacancies and for each vacancy dozens of candidates.

Within the HR application, user can add new jobs to the system and attach job descriptions, salaries, time schedules, Key productivity indicators to that particular job. Moreover in the Jobs page of the application, user can see the full

list of the added jobs in the form of a table. In order to edit the information about the job, user clicks to the link of that job. In the opened page, edits the already stored information and then clicks to the “Save” button.

Software redirects user to the new updated job page. Job descriptions also can be edited the same way as the job information. HR manager uploads job description as a PDF file to the system. This PDF file will be accessible by employee android application. Employees will just open their accounts in the application and read their job description.

Image 12: Jobs page - HR Application

Source: Created by author using HTML, PHP and JavaScript

HR application supports the excel file export. On the dock menu there is a special excel file icon, by clicking on it, user opens the page he or she can download the reports. By default there are 10 forms of excel reports. These default reports are the most used excel exports. In order o save time and increase the efficiency in the decision making process, the creation of these reports is done automatically. However, of course, there is an option, where user can export a report based on specific filter criteria.

Filter of the application provides user all the available searchcriteria starting with the basic name, job, and ageetc. combinations to the complex skill set mixed search criteria. Results of the search are in the form of a table. This table can be

downloaded in the form of an Excel file. By clicking the links on the names of employees appearing on the result, software redirects user to the Employee Card.

3.3. Real-time reporting system

HR Application by default automatically shows certain reports, whichis called a real-time reporting. Real-time means results of that reports are immediate. HR manager does not have to create any form or click on any button after each change. These reports are automatically generated and are as follows:

- Distribution of the employees according to their departments- İşçilərin departamentlər üzrə dağılımı
- Gender distribution within the organization- Müəssisə üzrə işçilərin cinsiyyət dağılımı
- Average age for departments - Departamentlər üzrə ortalama yaş hədləri
- Average age for positions - Vəzifələr üzrə ortalama yaş hədləri
- Statistical indices of the enterprise - Müəssisənin statistik göstəriciləri
- Employee Turnover Rate Report - İşçi dövriyyəsi əmsalı
- Employee Vacation Report –İşçi məzuniyyət hesabatı

Moreover, HR Application provides notification within the application menu, relating to the upcoming important events and deadlines. Most of the time, keeping track of all the employee contracts is a time and energy consuming process. Viewing the upcoming expiry dates of employee contracts 2 or 3 weeks before the expiry date, helps HR manager to plan his or her actions.

3.4. Security aspects of the application

In order to secure the application, login to the software is encrypted. Email and the entered password during the logging process is compared to the email and password stored on the database, but this process is secured by SHA-256 Secure Hash Algorithm. Moreover the fields where user has to fill the credentials in order

to login to the application, is secured by the JavaScript code. This code checks the input of the user for SQL Injection attacks and for the compliance to the email and password texts.

Another security aspect is related to the inactivity time within the application. For example, user of the application has logged to its account, but reasons left the working place without logging out the system. Anyone in this case, can use the software, because the computer is already logged into account. In order to prevent such scenarios, inactivity time within the system will be detected and account will automatically be logged out. I have created a 15-minute inactivity period, which waits 15 minutes for inactivity and then logs out. Inactivity period here stops when the user uses mouse on the screen of the application, clicks on any place in the application or presses any key. Advantage of this inactivity period is that, it can be used in all systems and devices. When using a mobile device, screen swipes and screen presses also stop the inactivity timer. Even if somebody has an access to the system within 15 minutes, certain actions within the application will require two-step verification. It means that, user apart from his or her login credentials, must know his own pin code.

Today even the most secured government portals face critical data leak because of security holes in the system. A famous example of the recent years is the leak of sensitive information nearly 14 million documents. Security flaw was on the website of Federal Service for Supervision in Education and Science of Russian Federation. Information like diplomas of education (series, number, year of enrollment, year of graduation, series and passport, date of birth, nationality and so on. In Human Resources, security of the private and sensitive information is quite a serious issue.

In order to prevent SQL injection, I have used MySQLi Prepared Statements, which prevents hacker to input a SQL query into a text field and run it on the database. Here I have created a template for each query, where inputs have four strict variable types and inputs that user types on the text fields play a placeholder role here. Of course, this does not cover the application fully from the

SQL Injection. To be more sure, PHP Data Objects also known as PDO must be used in all the queries. Again, this does not guarantee a 100 percent protection against SQL Injection. Therefore, in our HR Application, database is daily backed up.

Another security aspect is the IP address allowance. If required access to the system can be limited to the certain IP addresses. With the PHP code of the application, limitation to only allowed IP addresses can be applied. As a result, only the IP addresses within the organization will have an access to the application. When someone from other network tries to access the application web page, he or she will be redirected to other webpage, which will check and store the IP address and the time user tied to enter the web page. The IP addresses that look suspicious can be added to the blacklist.

3.4.1. Speed and performance tests on server

Testing the application for response time in the server was successful, the response times of the application was below 1.00 seconds (average 841 ms). All the tests were done on Pingdom Tool by Solarwinds. Moreover the response time tests were done on the local server where WAMP (Windows, Apache, MySQL and PHP pack) was installed. Compared to the server, on the local computer web application performed little bit slower with the response time at 1.2 seconds. The reason for slow response, is that, local computer parameters were not enough to function as a host. Nevertheless, installed on local network server within the company, application can perform as fast as it does on the web server.

File exporting from the server is very fast, with the 0.8 ms response time for the download. However, of course speed of download response depends on a database size. However, tests were done, with the 1500 employees stored in the database.

3.5. Android application for accessing reports and data from different devices

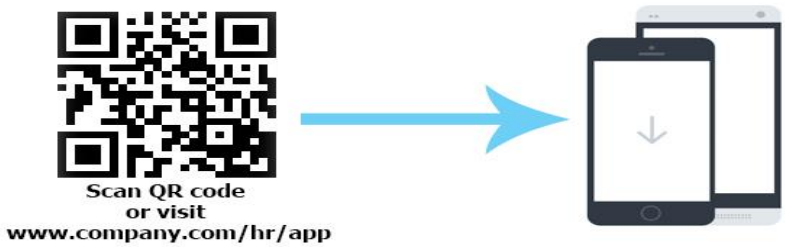
Nowadays we cannot imagine our everyday life, work without smartphones, tablets and other devices. Because these devices make it easier to get the information wherever we want and in the form of how we want. Getting the information in the right time plays an undeniable vital role in the management. A lot of managers and employees can be skeptic about the android or ios applications to be used for Human Resource processes. But in fact, These applications provide 24/7 access to the system without the software to be runon a computer. As we developed an online web application, we can also use our database to retrieve information for our application.

There are many scenarios for HR applications. The most obvious benefit of the application is for the managers. They download and install the app on their devices. With those applications they can check the attendance of an employee, performance of an employee, view the information about the employee, view the organizational structure, view the vacancies and their requirements, view the organizational calendar with events and meetings, view the organizational phonebook/or emails. Manager can be notified about the end of the contract with an employee in the application. As you can see, there are a lot ofscenarios where these applications are important to access the data on-the-go.

Another useful example of application usage in HR management is employee access to the system to view his or her performance evaluations and view vacation dates or even evaluate his or her supervisors. These application are easy to use as it does not need any trainings at all.

HR managers just need to hang a picture of application’s download link as a QR code or as a text on the wall and employees can easily download and install it on their devices as it is shown on the Picture below.

Image 13: Installing application via QR codes



Source: Created by author based on the information given above

Each employee will have his or her own login and passwords, whichthey will use to enter the system. In the application, they will see their own personnel information and if they find any errors about their education, working experience or skills they will be able to report it to the HR manager through the application. Employees will alsobe able to get notifications about their contracts.

3.5.1. Web App and Native App

From developer's perspective, there is a huge difference between native applications and web applications. In order to explain let us understand what an application is. Application is a program written in particular programming language to provide user an interaction with the device. Each operational system requires particular programming languages. For example in order to create an app for IOS devices SWIFT programming language must be used. However, for Android OS applications Java, Kotlin and C# is being used.In addition, let us not forget the fact that, each operational system has several versions, so that developers must write application repeatedly for each android or ios version. And when we think about how often Google and Apple send OTA – over the air update to the systems, we can easily see that maintenance of an application in all systems are very difficult and costly. Even when developing sometimes three or four teams work to develop an app. Theapplications that are written in the programming languages I stated above are called as native applications. The reason is that these

applications are native to the system and have direct connection with the device. Native applications are very popular because of their high-speed performance. But main reason why native applications are more preferred for big enterprises and dedicated operations is that these applications can access every detail or component of a device such as camera, microphone, sim card, memory, contacts, geo location, fingerprint scanners, face recognition function, or other sensor such as pulse or pressure sensor. These functions are only available if the application is native.

When it comes to web applications, they are actually the websites that run on a build in browser – a web view. The reason why web apps are more and more on high demand is that development process of web apps are respectively lower than the native apps. Because web apps are developed only once and they are compatible with all the platforms. Web apps are developed just like web sites and can be used online as well as offline. Back in the days when Google's Android and Apple's IOS didnot have a proper web view technology, all the applications that were developed like web sites had lower performance speed compared to native applications. In addition, main disadvantages were that web apps didnot have permission to use devices certain parameters such as vibration, notification, camera, sensors, contacts and so on. But now web apps can be developed with third-party plugins that support all the permissions and usage of device's full capacity. But now mobile systems have very fast built-in browsers that support JavaScript, HTML5.Moreover it is one application for all platforms and for their versions. This reduces the time spent on the development process and cost of applications. Today web applications and native applications have very small differences, because plugins that support GPS location, microphone, and camera can be easily added to the application which makes web applications appeal a lot of companies and developers.

3.5.2. Frameworks for android HRM application development

There are quite a few mobile development frameworks for web applications. The most popular are Apache Cordova and IONIC. Apache Cordova was first

developed by Canadian company Nitobi Software but in 2011 Adobe Systems have acquired the Nitobi Software company and its product - Cordova framework. After re-branding Apache Cordova was renamed as PhoneGap. (Stefan Offermann, 2011). PhoneGap supports most of the Operation Systems and provide APIs to control parameters like accelerometer, battery, camera and etc.

IONIC provides an open source software development kit to create Android and iOS applications without the need of deep programing skills, however knowing in Angular, CSS and HTML is required.According to IONIC's documentation, previous versions like ionic 1supported devices with iOS 7and up and Android OS 4.1 and up. However, IONIC 2 supported OS 8and up, Windows 10 UWP (Universal Windows Platform) and Android OS 4.4 and up (IONIC Documentation Overview, Cordova). When we compare these two platform, obviously Adobe's PhoneGap is more advantageous to rely on. And there is a huge community that provides new APIs and plugins to make web application's user experience even more responsive.

3.5.3. HRM Android Web Application build and testing

As we are developing an app based on HTML5, we must either create our own design or just use gratis templates under the Creative Commons 3.0license which makes the development of an application even more easier and reduces the cost of extra application design. Under Creative Commons 3.0 license, we are free to use and adapt the design by only giving credit to the author. Applications can be both for commercial and personal use. That is why I decided to use Future Imperfect Template by HTML5Up (Ajlkn). The reason why I use responsive template is because, responsive webpage can adapt itself for mobile devices, as well as for the tablets. After downloading the template, we edit the menu names to create a better understanding for the user. We delete the posts and articles part of the template so that we can get simple main page for an application.

Main advantage of our HR Application will be that user will have an access to the system on-the-go. That is why, I have grouped the most important

information about the human resource management processes in the menu of the application.

The first submenu is the Employee List. By clicking the Employee List, user of this application can view all the employees of the company according to their names, positions, departments, ages and other details. Here can user also view the personal information of each employee by clicking to his or her name. In the new page, much more detailed information about the employee such as Social Security Number (SSN), contract information, marital status, education, wage, photo, identification card, documents related to the employee, working experience, vacation, skills, and nationality and so on.

Second submenu is Birthdays in current month. Here user can easily view the employees that have birthdays in particular month and their ages. A lot of organizations in order to increase the motivation of the employees and increase employee loyalty pay attention the employees' birthdays and give them with presents, gift cards, day offs, salary bonuses or organizational congratulations. This increases the employee recognition and pushes employee engagement forward. In the long term, it creates a tight connection between the company and the employee and finally reduces the turnover rate of the employees.

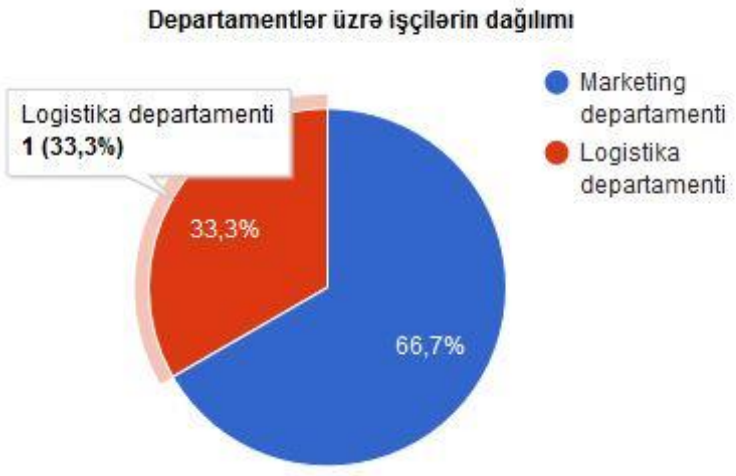
Third submenu is Organizational structure, which is used quite frequently. Because most of the time Human Resource managers deal with organizational issues like coordination, information flow, project management. In order to have a clear vision of the organizational structure this option in the menu will give managers on-the-go view at the structure.

Next option is Contacts submenu, which provides information about the employees' phone numbers and emails according to their jobs and departments. This menu will be quite useful when manager tries to initiate a contact with an employee. Calling or sending email via application saves a lot of time. Especially in Azerbaijan, HR managers have to search employee contacts through their personnel folders. From that point of view, this function is necessary.

In Events menu option, user can view the list of meetings and events that are planned to hold and see their time and dates, their themes and the people who must take part. Another submenu is the Distribution of the employees. By clicking this menu, user views the employee distribution according to their positions and departments in the form of a pie chart. This chart makes it clear, how many workers does company have in which departments.

Pie Chart shows not only the number but also the percentage, so that manager can analyze which department needs more assistance or analyze which department works more efficiently. Imagine your organization only has two departments: Marketing and Logistics departments. If only one employee works in Marketing department and two employee in Logistics, then distribution would look like as it is on Image14.

Image 14: Distribution of the employees according to their departments



Source: Created by author using HTML, PHP and JavaScript

Another submenu provides statistical information related to the average age. By clicking the option, application will show the mean age of employees according to their departments and jobs. It is undeniable fact that aging of the workforce plays a crucial role in management. Occupational health and safetyproblems of the older workforce require different approaches when compared with younger employees. This significantly affects employment and labor markets. Age

composition of population and population are the main variables that determine labor supply. Therefore, a change in the demographic structure will directly affect the structure of employment and labor markets (Naci Gündoğan, 2001). This phenomenon is also important in the organization level, so that when it comes to human resource planning and predicting the future employee need of the company HR managers must take their current median ages into consideration.

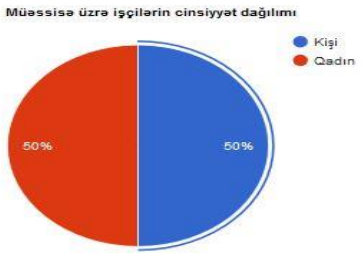
Next option in the submenu is used to view the statistical information regarding to the permanent staff of all employees at the enterprise. This information includes total job number, total number of full time employees, total number of part time employees, total number of temporary employees and also the available vacancies regarding to jobs. Here by clicking on the name of the job, Human Resource manager can view the salary, job description and job requirementof that particular job. In the opening page job descriptions and requirements can be downloaded into the device's memory as a PDF file.

Nowadays one of the most important and trending issues in the human resource management is the gender inequality. Distribution of the employees by their genders plays an important role not only for the company itself but also for the communities. ManyNon-governmental organizations (NGO) which are dedicated to bring transparency to the gender inequality in the companies. Many big corporations annually publish their statistics about the employee diversification regarding to the gender. Moreover, gender diversity in the company brings benefits to the company. When gender diversity is achieved, company will have a better reputation in the community and the market, in the production processes different point of views and perspectives will lead to better products and services which will increase clients 'satisfaction. According to the Morgan Stanley Capital International's research, companies with more women on boards shows higher productivity growth and companies with fewer women on boards shows negative productivity rates (Eastman, 2018). That is why, analyzing the current gender distribution is important. This option in the menu, gives user an opportunity to view the condition in the form of a pie chart with percentages. Pie chart shows the

overall percentage by male and female employees. In addition, the table below the chart shows the distribution for each department.

Another significantly important in Human Resource Management is obviously the Employee Turnover Rate. This rate helps to find out the percentage of the employees that leave the company within the given period. This coefficient is calculated with the formula that indicates the number of employees leaving the company within a year divided to the average number of employees the company had within the year. Considering this indicator is best in the dynamics for the last several periods to compare the rates and analyze the reasons. If the ratio grows, this indicates destabilization of the team, inefficiency of the personnel policy, and dissatisfaction of the needs of the employees within the company.

Image 15: Gender distribution within the organization



Halhazırda Müəssisədə 4 sayda işçi çalışmaqdadır.

Departamentin adı	Kişi işçilərin sayı	Qadın işçilərin sayı	Toplam
Texniki işlər üzrə departament	0 işçi (0 %)	1 işçi (100 %)	1 işçi (100%)
Sosial Media Marketinq departamenti	1 işçi (100 %)	0 işçi (0 %)	1 işçi (100%)
İnformasiya Texnologiyaları departamenti	0 işçi (0 %)	0 işçi (0 %)	0 işçi (100%)
Marketinq departamenti	1 işçi (50 %)	1 işçi (50 %)	2 işçi (100%)
Mühasibatlıq departamenti	0 işçi (0 %)	0 işçi (0 %)	0 işçi (100%)
İctimaiyyətlə əlaqələr departamenti	0 işçi (0 %)	0 işçi (0 %)	0 işçi (100%)

Source: Created by author using HTML, PHP and JavaScript

A reduction in the coefficient may indicate an improvement in the situation in the team and a competent approach to personnel management. HR Online Application has a direct option to view the employee turnover rate and it shows the tendency whether this rate growths or reduces for years. This helps HR professionals to analyze and make predictions on the go.

Next option in the HR Android Application is to view the upcoming expiry dates of employee contracts. HR managers must be aware of all the contracts and

their expiry dates beforehand, in order to renew or terminate it when expiry date comes. But it is not as easy as it looks like, in a company where 200 and more employees work. Keeping track of the contracts must be automated, so that manager can decide whether to renew the contract or renew it for a next period. That is why, this option, brings the page, where a list of upcoming contract expiries within next two months appear with details. In addition, application starts to send notification to the user to remind manager about the contract's details two weeks before the expiry date.

In order to give fast access to the employee information, application's menu has a search field, where user can type either name or the surname of the employee to search the database. This search box can also be used to type position names for example translator or driver. The result will bring all the employees with the current position. By clicking on the results, user opens the employee profile within the app.

Of course, the simple search box cannot meet the needs of HR professional. In view of this, I have created another option in the sidebar menu for more dedicated searches. This search will function as a filter.

By opening this filter page, user will be able to set multiple parameters of the search query. This parameters will be provided in the form of drop down menu and will include almost every option that HR manager can set a search on.

As you can see from the Image below, left image shows the given parameters with the arrow next to them, when clicked dropdown parameters will open and the user chooses one of them. Right image shows already created search query, where user intends to look for the employees who are male, work in Marketing department, on a part-time basis, as a Marketing manager.

When clicked search button, application shows the results of that query. All the employees, which meet the given parameters will be listed in the new page.

Image 16: HR Application Filter: unselected parameters (left), selected parameters (right)

Source: Created by author using HTML, PHP and JavaScript

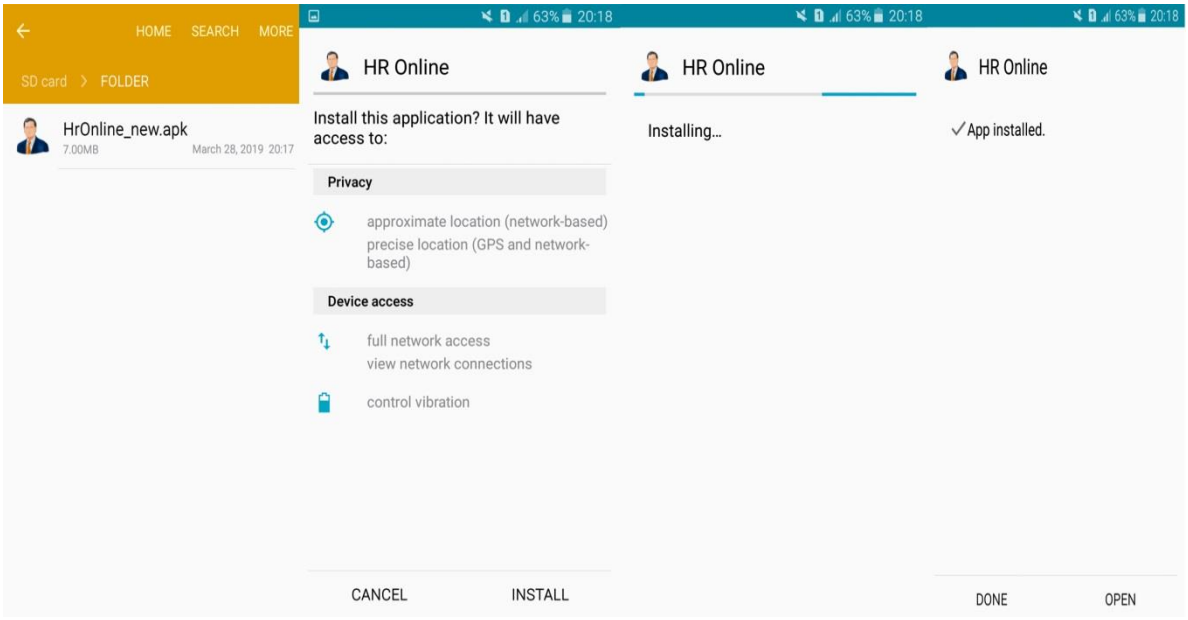
Application checks the current installed version of the application and compares it with the latest version in the server, if installed version is outdated, application notifies user to download and install the updated application from the server. As we do not want our application to be used by everyone, we are not going to publish it on any application markets like Google Play, Aptoide or Getjar. This will provide privacy to the system.

In addition, application will require login and password to enter the system. Even if someone has the application installed on the his or her device, will not be able to login to the system and get the private data of the employees and the organization.

Application has been tested on several devices both mobile and tablets. During the installation process, no errors have been observed. There were no problems related to the download of the documents from the server.

After finishing the main functions that HR application will have, I have used Phonegap to build the installer file- apk file. Application was successfully compiled and the result apk file was built.

Image 17: HR Application Installation process



Source: Created by author using HTML, JavaScript and PhoneGap

In order to cover as many devices possible, in the manifest of the application I set android version (API level) to 21 which means that, application can be installed and run on all devices that have Android Lollipop or higher versions. Installation process is as simple as installing an ordinary application. User will download the apk file of the application to the device and install it. The process is shown on the Image 19 below. As you can notice, application does not require a lot of device functionality access. Application in the initial form requires only network access, vibrations in order to notify the user about the important deadlines, meetings, contract expiry dates, application updates and so on. After the successful installation, application can be found within the Application Drawer of the device. As we are on android platform, every user can put the application shortcut wherever it is suitable.

RESULTS AND SUGGESTIONS

The purpose of this dissertation is to demonstrate how Human Resource Management can increase its process efficiency by applying new technologies and software. In the developed countries, companies and universities have tight relationships and collaborations in the research area. Companies are interested in the new approaches and theories that can be applied in the practice. Universities should not only provide theory, but also must contribute new techniques and models for the industry. Companies often acquire knowledge for innovation from external sources and then integrate it with the internal Research and Development. Unfortunately, in Azerbaijan, companies are not interested in collaboration with universities. In addition, the reason is that, universities are not playing a role of research institutions. However, in the near future, universities will adapt to the new research university model and students will develop new management models for the fields like Marketing, Human Resource Management, Logistics or Production.

This dissertation does not only explain the connection between two disciplines:MIS and HRM, but also creates a possible web application model with all the technologies used to develop it and the scenarios it can be used for. Main problem in the HR Management in Azerbaijan, is that majority of HR professionals are not aware of the new technologies and software. There are several reasons for that. First, HR managers do not have a clear understanding of what HRM application is and what parameters should it have. Second reason why most HR applications used in local market do not provide all the required HR tools is that software companies do not know which processes Human Resource Management has and how can these processes be automated. The main problem of almost all software in local market is that, their only goal is to store information and show results of search queries. They do not provide the information necessary for the Decision Making Process and Human Resource Planning.

Today markets are changing every day, and keeping up with the changes require very flexible organizational structure and employees. No matter how

companies try to increase efficiency in processes, at the end of the day employees' skill sets and abilities, their motivation, performance play the crucial role. Human Resource experts must keep track of the employee performances, their attendances, health issues, trainings and personal developments so that it could be possible to assign the right employee to the right position. When employee fully meets the requirements of his or her current position, there is a high probability that he or she will be successful. Selecting the best candidate is very difficult and is dependent on multiple factors. In the local market, most of the admissions to the work are done by submitting paper resumes. Imagine a situation where HR manager has to deal with all the resumes and read them manually and evaluate on the go. This is physically not possible to keep track of all the resumes and make a decision based on candidate criteria. Without automated resume system, HR manager cannot increase the speed of the selection process. That is why, the HRM application model that I have designed, has its own online pool of employee resumes. That online CV pool in advance will define certain parameters, which will help Human Resource managers to differentiate and compare the candidates for the positions that they have applied for.

Next option that, software model presents is real-time reporting, which demonstrates important statistical information about the employee attendance, Key Productivity Indicator, distribution of the employees related to their position, department or gender, average age of employees relating to their departments and positions, employee turnover rate and vacation statistics. This reduces the time HR managers spend to prepare reports and make decisions about the future plans of the organization. All the reports are presented in the form of tables and pie charts which makes analysis even more understandable. Users of the application have the option to download this reports in the form of an excel file or pdf file.

This dissertation will be very useful for both HR managers and developers. From the Human Resource managers' perspective, this dissertation can be useful to understand the importance of the software usage and how they can start designing their own software. In most cases, companies ask software studios to develop an

application without providing a particular design or database scheme or functionality. Main reason is that, most people who work in the HR department are not familiar with the technologies used in software development. Most of the companies still use only Microsoft Office programs to store the information. In addition, the sources in the local market where they can get information about the HRM technologies are not many. Nevertheless, trends in the HRM are changing and the software are almost everywhere. Selecting or designing the best software to meet the organizational structure and to fulfill the HRM needs plays an important role in the Decision Making process. Software can make processes easier, when they are designed to increase the process efficiency. This dissertation provides a software model that can be easily adjusted to the needs of HR managers. This software model is not a market standard; it just provides the functionality that HR software meant to have. With that model, HR managers can demand Software companies to design software with those characteristics. From the developers' perspective, with the first chapter of this dissertation they can get information about the essence of HRM and its processes. Better understanding the problem helps to come up with innovative and efficient solutions. The more developers know the work HR managers do, the better the design and the user experience of the software will be.

The most important result of this dissertation is that, even small companies with low budgets can acquire software with all the functionalities required in the Human Resource Management. The HRM Application model is budget application, because technologies used in the development of the software were mostly open-source and free. Even the application front-end design was a gratis template. Using all the possible open source tools in the development eventually makes the costs of development process lower. Instead of paying huge amount of money to acquire a license for the software or using a subscription method to get access to cloud based applications, this model can be acquired with a lifetime license and comparably with lower costs.

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LIST OF FIGURES

LIST OF TABLES

LIST OF IMAGES