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STRATEGIC INTEGRATION OF ELECTRONIC HUMAN RESOURCE MANAGEMET

Master's Thesis

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Tallinn 2017

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ELEKTROONILISE PERSONALIJUHTIMISE STRATEEGILINE INTEGREERIMINE

Magistritöö

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Tallinn 2017

Author's declaration of Originality

I confirm that I have constructed this Master's thesis individually and that the current paper has not been presented by anyone before. All resources, viewpoints, citations and other materials from other authors that have been used in this thesis have been referred to.

Author: Nina Khomeriki
10.05.2017

Abstract

Human resource management has gained an electronic function, which increased its strategic role in organization. Studies in electronic human resource management show a lack of awareness of the benefits information technologies can incorporate into human resource management. There is a challenge of achieving efficient conceptual understanding of human resource integration by introducing information technologies in the field.

This master thesis brings strategic advantages of information technology in human resource management. It addresses the benefits and challenges of electronic human resource management and finds best practices in information technology solution architecture. It is found that electronic human resource management has general business requirements, which applies to the human resource electronic systems functional requirements. The functional requirements of the system include basic administrative module, recruiting, performance appraisal, training and development, payroll and reporting of the each requirements performance. This way it is possible to manage human resources in an electronic manner and make sure it is strategic.

The study adopts agent-oriented modelling and unified modelling language to design the system. Electronic human resource functional requirements are divided into modules, which remain integrated. The functional requirements are shaped through conceptual domain modelling, which is followed by platform independent computational design of electronic human resource management. Conceptual architecture is proposed for strategic integration of electronic human resources. It shows all the internal and external actors and entities that are involved in the system integration. The integrated electronic human resource management system is deployed by means of platform specific design.

Keywords: electronic Human Resource Management (e-HRM), Electronic Human Resource Information System (HRIS) functional requirements, strategic integration, agent-oriented modelling (AOM), enterprise architecture

This thesis is written in English and is 101 pages long, including 6 chapters, 18 figures and 10 tables.

Annotatsioon

Elektroonilise Personalijuhtimise Strateegiline Integreerimine

Elektrooniline funktsioon on suurendanud personalijuhtimise strateegilist rolli organisatsioonis. Elektroonilise personalijuhtimise uuringud näitavad, et puudub teadlikkus sellest, millist kasu võib tuua infotehnoloogia personalijuhtimisse. Infotehnoloogia kasutuselevõtt selles valdkonnas on toonud esile probleemi, kuidas saavutada tõhus kontseptuaalne arusaam inimvara integreerimisest.

Siinses magistritöös juhitakse tähelepanu infotehnoloogia strateegilistele eelistele personalijuhtimise valdkonnas. Töös arutletakse, millised on elektroonilise personalijuhtimisega seotud kasutegurid ja probleemid, ning selgitatakse välja parimad tavad IT-lahenduste arhitektuuris. On teada, et elektrooniline personalijuhtimine peab vastama üldistele äritegevusega seotud nõuetele, mis kehtivad ka personalijuhtimise elektrooniliste süsteemide funktsionaalsetele nõuetele. Süsteemi funktsionaalsed nõuded hõlmavad peamist haldusmoodulit, värbamist, personali hindamist, koolitusi ja arengut, palgaarvestust ning iga nõude tulemuslikkuse aruandlust. Nii on võimalik personali elektrooniliselt juhtida ja tagada selle strateegilisus.

Siinses magistritöös kasutatakse süsteemi loomiseks agentorienteeritud modelleerimist ja unifitseeritud modelleerimiskeelt. Elektroonilise personalijuhtimise funktsionaalsed nõuded on jagatud kolme moodulisse, mis säilitavad oma ühtsuse. Funktsionaalsed nõuded kujundatakse kontseptuaalse domeen-modelleerimise abil, millele järgneb elektroonilise personalijuhtimise arvutuslik disain, mis on platvormist sõltumatu. Selleks et elektroonilist personalijuhtimist strateegiliselt integreerida, pakutakse välja kontseptuaalne arhitektuur. Selles näidatakse ära kõik sise- ja välistegurid ning üksused, mis on süsteemiintegratsiooni kaasatud. Integreeritud elektroonilise personalijuhtimise süsteem on paigaldatud platvormispetsiifilise disaini abil.

Märksõnad: personalijuhtimine (e-HRM), personaliarenduse tarkvara (HRIS), funktsionaalsed nõuded, strateegiline integreerimine, agentorienteeritud modelleerimine (AOM), ettevõttearhitektuur

Magistritöö on koostatud inglise keeles 101 leheküljel, sisaldades 6 peatükki, 18 joonist ja 10 tabelit.

List of abbreviations and Terms

AOM	Agent-oriented Modelling
DSRM	Design Science Research Methodology
ERP	Enterprise Resource Planning
ESS	Employee Self-Service
HCM	Human Capital Management
HR	Human Resources
HRIS	Human Resource Information Systems
HRM	Human Resource Management
HRMS	Human Resource Management System
IS	Information Systems
MBO	Management by Objectives
IT	Information Technology
MSS	Management Self-Service
UML	Unified modelling Language
e-HR	Electronic Human Resources
e-HRM	Electronic Human Resource Management
e-HRMS	Electronic Human Resource Management System

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Chapter 1 Introduction

In this master thesis field of electronic Human resource management system (e-HRM) is investigated. This study outlines main trends and tendencies in e-HRM and explores existing information technologies (IT) solutions in the field. It categorizes functional requirements of e-HRM, integrates and deploys them.

1.1 Literature Overview

Analyses of Human Resource (HR) related articles suggest that there are numerous interest area gaps between HR professionals and academics. HR Academics are most interested in organizational behavior and Motivation-related topics. While HR Professionals seem to be more interested in the technical aspects of their job, which they cannot find in the existent academic studies. [64] In order to better understand strategic role of HR more stress should be put on institutional phenomena to get a better insight of value creation. [5] It is important to see how and why focusing on innovations and development in HR field can make organizations competitive; [54]

An evidence of e-HRM's positive influence on HR is also poor. The empirical research found the lack of theoretical foundation for e-HRM. An evidence-based review of e-HRM and strategic Human Resource Management (HRM) shows limited systematic empirical evidence about the connection between e-HRM and strategic outcomes. knowledge gaps need to be addressed in a way that provides helpful guidance for HR academics. [53]

Except for Strohmeier literature review, most of the researchers have focused on the effectiveness of various applications in HR. Much of the research on e-HRM has focused on e-learning and e-recruiting. As there is a lack of theory and research on e-HRM, HR scholars should focus much more attention on the topic. Future research is needed to examine their effectiveness and help HR professionals to design systems that satisfy the criteria of organizations. [71]

Another challenge for e-HRM research is conceptualizing relationships between e-HRM and human capital development considering the strategic use and consequences of e-HRM. e-HRM involves not only the implementation of e-tools but also the creation of a clear HRM vision and

(re)structuring of the HR function. A good e-HRM academic study should have a multidisciplinary nature of the e-HRM field. [13]

Future studies should consider the main role of e-HRM in its contribution to the perceived effectiveness of HRM by different stakeholders. The practitioners should focus on the quality of the e-HRM application. More research is needed to integrate findings of IT / HRM studies are recommended. [12]

According to Tansley and Watson, the concept of reorientation of electronic Human resources (e-HR) research mainly focuses on processes of social construction. It is stated that more process-oriented research is needed. [24] Future research on e-HR should focus on the transformational e-HR technologies. [55]

1.2 Significance of the Research

Organizational success depends on HR efficiency.[18] Human resource management (HRM) tends to move from administrative to a strategic function.[51] Nowadays, any company's economic progress depends on its strategic plan – the main contributing factor for developing this plan successfully is the HRM – Efficiency is impossible without involving IT resources in the whole process.[70] HR is now one of the leading areas of business management. [18] Traditional HR processes changed into online processes and it improved efficiency and effectiveness of organizational activities.[1] e-HRM will take an active role in HRM strategies, practices and policies. [39] e-HR has been one of the most important advancements in HRM. [55]

HRM must be strategy-oriented, service-oriented and customer oriented at the same time.[60] HR successions are created from a combination of business strategy, human recourses, knowledge, and technology. [9] Watson Wyatt consultants have identified several trends that will influence HR management. It includes increased use of portals/intranets and use of virtual tools, continues optimization of HRM with better contingency planning and higher awareness of HR data privacy [14]. HR develops intellectual and social capital in order to improve organization's competitive advantage. [36] Modern views about HRM state that in the 21st-century technological advancements encourage e-HRM.[4] Enhanced firm performance is the result of progressive HR practice. [67]

Automating Human Resources (HR) tasks and practices turn labour-intensive, time-consuming tasks into fast-response activities. [60] Electronic Human Resource management (e-HRM) is capable of improving HR practice, increasing HR operations and a number of employees in HRM,[3] e-HRM enables HR employees to move from data support to the strategic utilization of human resources.[79] Use of technology in HR is an essential aspect of many personnel-related decisions. Using IT in HRM frees HR staff from intermediary functions. [14] IT can automate routine tasks and therefore, support HR professionals to focus on strategic matters. [10] e-HRM supports easier storage, updating, classification and analysis of data [1]. A successful way to run a business today is the proper usage of IT in HRM.[4]

e-HRM will be a sole owner of HR information and managers/employees will be able to use this information through Web-Based systems. HR professionals will be able to focus on transforming information into knowledge.[14] There is a big role of e-HRM system in capacitating globalization paradigm.[59] Nowadays, a logical continuum of processes is that HRIS is moving to employee self-service (ESS). [34]

e-HRM focuses on developing the strategic orientation of HRM, achieving expense decreasing/effectiveness and customer service improvements.[37]Main objectives of e-HRM are a high commitment (change Agent role), high competence (capacities of employees), cost effectiveness (competitiveness) and higher congruence (internal organizational communication). [18]. e-HRM offers the opportunity to automate administrative HR work and to optimize value creating HR-activities. [18] Human Resource Information System (HRIS) is expected to be a large tool for sharing information over functional areas of various organizations [12].

1.3 Goal of the Thesis

Based on the knowledge gap found in the literature review, the goal of the thesis has been identified. The goal of the thesis is to achieve strategic integration of electronic human resource management.

1.3.1 Research Questions

Research questions of the thesis serve the goal of the thesis.

The central research question of the thesis is presented below, which is divided into three research questions.

How to achieve Strategic Integration of electronic Human Resource Management (e-HRM)?

RQ.1 How to determine and organize the requirements for integrated e-HRM?

a. What are the existing open-source and commercial solutions for e-HRM system?
b. What are the proposed conceptual domain models for e-HRM?
c. What are the functional requirements of e-HRM system modules?

RQ.2 How to design an integrated e-HRM system so that it is strategic?

a. What are the proposed platform independent computational design models for e-HRM?
b. What are the pre-conditions for e-HRM system functioning?
c. What is the proposed conceptual architecture for e-HRM?

RQ.3 How to rapidly deploy a strategy-matching e-HRM system that predominantly uses open-source software, while the remainder should be populated with commercial software solutions?

a. What are the factors influencing adoption of e-HRM?
b. What is the proposed deployment model for the designed e-HRM system?

Answering these research questions enables leads the study to achieve strategic integration of e-HRM.

1.4 Research Methodology

The study adopts Design Science research methodology and uses Top Down deductive approach. “Design science creates and evaluates IT artifacts intended to solve identified organizational problems .” It involves a rigorous process to design artifacts to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results to appropriate audiences. Such artifacts may include constructs, models, methods, and instantiations. They

might also include social innovations or new properties of technical, social, and/or informational resources; in short, this definition includes any designed object with an embedded solution to an understood research problem.'' (p.4) [66]

Design Science can be incorporated in business and IT considering information systems and organizational infrastructure.

Design science research consists of three cycles. The relevance cycle makes a platform for the circumstantial environment of the research project for design science activities. The rigor cycle makes a connection between design science and existing body of knowledge for scientific competence, groundwork, and experience in correspondence with a research field. The central design science cycle repeats the action to improve the important activities of creating and evaluating the design artifacts and the workflow of the research itself. [78]

Goldkuhl (2012) states that there are different types of IS studies. The first one is policy studies, which focuses on policy analyses in the context of design and its effects (use of design). The second one is policy-based design, which is a combination of incorporating policy analysis into the design in the context of effects of IT artifact. The third one is design studies having its focus on designing an e-solution with the only focus of design process, but it takes a better look in terms of policy analysis and design effects. The fourth one is concerned about design evaluation putting a stress on both design process and its effects regarding the policy. The fifth is design effect evaluation only keeping its focus on measuring effects regarding policy and design process. The six is referred as policy design and design effect studies with the focus on policy and design effects in regards to design. The last research is integrated studies of policy, design and its effects altogether understanding and discussing all the three sides of research.

It is noteworthy that e-government artifact is not just a techno-centric outlook on the design. The concept of policy contains declarations, regulations, laws and objectives that are normative by nature. A programmatic statement from policy moves to design process and its effects. IT artifact should be under design process relating to the basic policies implemented in the design. It should also be related to potential and actual effects when put in use.[78]

1.4.1 Framework of Design Science Research

Design Science Research methodology **(**DSRM) procedures include a process model and mental model for research outputs. There are mainly three objectives that are pursued to meet the solution. First, is providing a nominal process to create a possibility for DSR. Second is focused on the theoretical background about Design science and the last step is having a mental model for research output structure.[66]

The information systems research framework is given in the figure.1 [78]

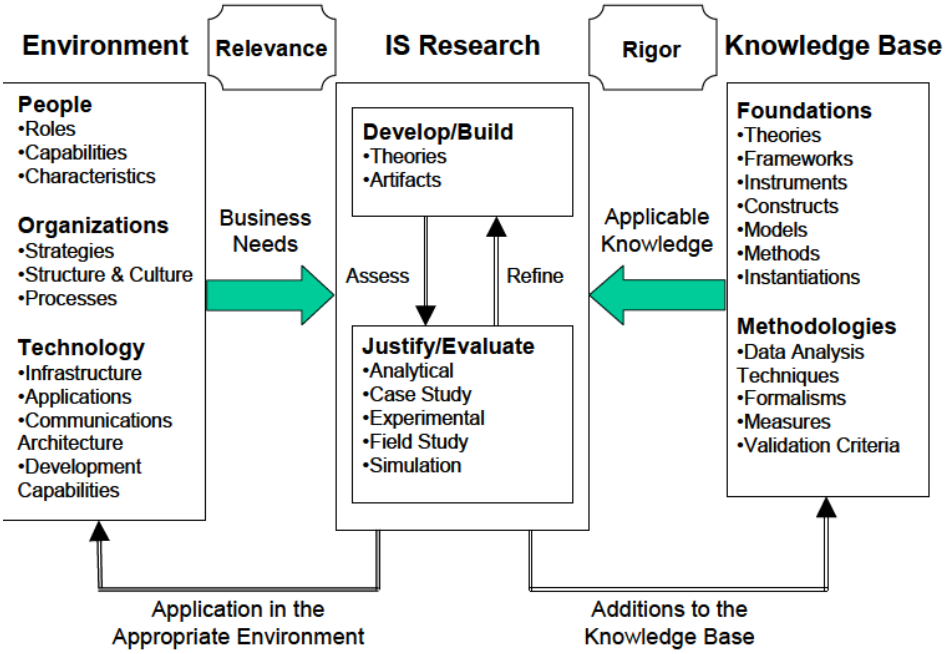

Figure 1. Information system research framework (Alan. R. March S.T, 2004)

Development of the design science research methodology is composed of several activities:

a. Problem identification and motivation;
b. Defining objectives for a solution. These objectives can have both quantitative and qualitative nature. The objectives are built rationally from the first activity discussed. Current challenges of the knowledge base for the problem and its solution needs to be analyzed;

c. Design and development stages. This is where the building of the artifact starts. It can be models, methods, constructs or instantiations or new features of socio-technical or IT resources. Detecting artifact's purposeful functionality is followed by building its architecture, which results in having an artifact.
d. Demonstration stage. An artifact is introduced to show its capabilities of problem-solution features of one or more aspect of the defined problem. There are many ways to approach this activity, which includes case study research, discussion, modeling, simulations, and testing. A good knowledge of using the artifact is required.
e. Evaluation. At this stage observation and measurement, takes place referring the artifacts relationship with the problem-solution approach. Objectives that were set before needs to be correlated to the actual outcomes of artifact demonstration. This kind of evaluation usually consists of appropriate empirical evidence. Feasibility of the iteration depends on the nature of research venue.
f. Communication. Communication of rigor of the design, artifact's utility and novelty, the level of importance that the problem carries to relevant audiences is outlined.

Hevner and Peffers [66] emphasized the main e-Government design research principles that include:

1. Incorporating Design research theory building to apply theoretical administration to design and develop theoretical outcome from design science research;
2. Policy analysis is needed to consider policy value base for the designed artifact so that scholar can build a policy-ingrained artifact;
3. Combining IT and work practice design in overall design;
4. Evaluation system needs to be understood as evaluation of both IT and work practice;

1.5 Structure of the Thesis

The second Chapter provides a literature review of e-HRM. It presents research background for the investigated topic in this master thesis and serves as a bridge to understanding the remaining chapters. It gives a strong overview of the tendencies taking place in e-HRM field, identifies benefits and drawbacks in the area and clearly outlines the importance of bringing information technologies to HRM. Additionally, the theoretical approaches are developed. This chapter finds the knowledge gap that exists in e-HRM field. Based on the knowledge gap research questions are formulated, which is already presented in the first chapter of the thesis referred as an introduction.

The third chapter collects and organizes all functional requirements for e-HRM. It finds the existing e-HRM system solutions and maps them on to the e-HR management requirements. After this, conceptual domain modeling is proposed so that motivation layer of the e-HRM system is built. The aim of this chapter is to find e-HRM system functional requirements and organize them.

In the fourth chapter integrated e-HRM system is designed. All the determined and organized functional requirements of the system is taken to propose the design of the system. After the platform-independent computational design is made, the conceptual architecture of the e-HRM system is proposed.

In chapter five, designed e-HRM system adoption process is discussed. Factors that are involved in the process is determined and deployment model for the designed e-HRM system is proposed.

Chapter six makes a conclusion for the entire thesis, identifies summarized findings of the work with research limitations and proposes future directions of the research.

Chapter 2 Research Background of electronic Human Resource Management

In this chapter, theoretical research background is discussed. It includes 2.1 Terms and definitions that will be used throughout the thesis, 2.2 Historical evolutional stages of the investigated field, 2.3 Impact of Information systems on HRM, 2.4 Types of e-HRM, 2.5 and 2.6 Benefits and Drivers of e-HRM, 2.7 Planning of e-HRM which includes 2.7.1 Strategic approach to the planning process and 2.7.2 legal standard for functional requirements in HRIS.

2.1 Terms and Definitions

This subchapter discusses terms and definition used in this master thesis.

Human resources (HR) – Resources that build a workforce for an organization.

Human Resource Management (HRM) – Management of people within the organization including personnel recruitment, training and development, performance appraisal and reward management.

Electronic Human Resources (e-HR) – A method of HRM affairs through the internet as a function of HR [61]**.**

Human Resource Information Systems (HRIS) – Used in enterprise resource planning as a software [1]. IT utilizes computerized accumulation, store, and restoration technique to improve administration and management of the HR information within the organization. [79].

Electronic Human Resource Management (e-HRM) - "a mode of realizing HRM strategies, practices and policies in organizations (p.4) [67]. ''an umbrella term covering all possible integration mechanisms and contents between HRM and Information Technologies aiming at creating value within and across organizations for targeted employees and management''. [13]

Both HRIS and e-HRM have the capacity to provide a basic mechanism for computerized resource management for the organization.[35]

2.2 Historical Evolution of electronic Human Resource Management

HRM has passed four development stages[11]:

Stage I Personnel management (pre-world war II). Term ''Personnel'' appeared, which was followed by the term "Employee Welfare". Personnel started to keep information about workers such as name, address and phone number, which was paper-based.

Stage II: Post world-war-II era (1945-1960). After World War II, large organizations in U.S. started to recruit personnel from the military. Personnel departments appeared in Shell and Philips. Employees created trade unions. Employment law regulated the relationship between companies' management and labor unions. Personnel records were kept in computers.[26]

Stage III: Legislative era (1960-1980) In this stage, term HRM emerged. labor legislation regulated employees discrimination, health and safety, retirement conditions and taxation. However, HR information system could only keep administrative data.[4]

Stage IV: Low-Cost Era (1980-1990). Companies started to reduce costs on competitive market and HRIS appeared. Adoption of HRIS started from payroll system in the 1950s. In 1960-1970s large organizations started to install programs on mainframe computers to centralize personnel databases. HRIS's analytical information has influenced to decision- making processes. Since 2000 HR technology started to include hiring, benefits management, payroll, training and development in their systems. [80]

Stage V: Tech Era (1990 to the present). The emergence of Strategic HRM became obvious. Organizations considered HR as a strategic partner. [11]

2.3 Impact of Information Systems on Human Resource Management

Approximately fifty percent of HR workers agree that HRIS is has a positive impact on meeting strategic goals. Particularly, it improved their strategic decision-making. [7], [68].

While e-HR tools are transforming HR into a strategic partner, these five areas are affected:

1. Processes used to deliver HR;
2. HR capital competencies;
3. Culture of HR organization;
4. Organization's structural and technological development. [61]

e-HRM enables the company to form a long-term strategic plan for the company. [68] e-HR turns HR into a strategic business partner with the task to recruit, develop and retain talented employees through reducing paperwork. [11]

e-HR systems and related human attitudes, intentions, and behaviors may influence four important variables:

- Information flows- The use of e-HR systems may increase an opportunity for organizations and individuals to access the job information;
- Social interactions- e-HR systems may alter social interaction in organizations. They may decrease the level to which individuals realize role requirements.
- Perceived control- e-HR systems try to ensure incumbents' behaviors in ways that promote the achievement of organizational goals.
- System acceptance- The acceptance of e-HR systems will be a joint function of the nature of the systems and the attitudes, intentions, and behaviors of individuals who use them. [72]

2.4 Types of electronic Human Resource Management

Contemporary e-HRM literature distinguishes three types of e-HRM: operational e-HRM, relational e-HRM, transformational e-HRM. [67] Operational HRM, concerns the HRM activities in the administrative area. Relational HRM's emphasis lies on HRM tools that support basic business processes. Transformational HRM refers to HRM activities pertaining to organizational change processes. [12] Transformational activities (innovations, cultural, structural, strategic changes) add value to the organization [14]. Lepak and Snell define the three levels of e-HRM as following: Operational e-HRM works on basic administrative HR tasks, such as payroll operations. Relational e-HRM focuses on recruitment and selection of new employees, training, rewards and performance management; Transformational e-HRM focuses on company's strategic choices about workforce and future development. [59] Building a strong basis for e-HRM at the operational level is an essentially important prerequisite for relational and transformational e-HRM. [67]

ESS (Employee Self-Service) systems enable employees to manage their personal information directly. These systems have helped HR departments to reduce their operational costs. [76]

MSS (Management Self-Service) allow managers to access information about themselves and about the employees who report to them. MSS systems reduce the workload of the HR generalists; they contribute to data integrity/accuracy and improve processing time. [14]

2.5 Benefits of electronic Human Resource Management

Areas that benefit from e-HR use can be grouped into three categories:

a. strategic goals (company image, cost reduction);
b. HRM goals (employee development and retention, communication and satisfaction);
c. processes (time management, mistake reduction, decision-making). [61]

Fundamental reasons for adoption of HR technology include cost savings and faster processing of information with the ability to provide relevant information. [76]

HRIS is believed to reduce costs and employee number; make information easily accessible and more accurate. It can also improve shareholder value. [7] Regarding e-HRM ability to streamline decision-making in public sphere, study shows that 60% of HR workers believes that information gained from the HRIS helps institution decide on employee raises, 40% believes that it enables them to make more effective promotion decisions and HR decision-making is more effective. Only 10% believes that HRIS helps them to decide when recruitment, training, and development need to take place. [9] With increased visibility and accessibility of personalized information, employees gain a greater appreciation of the value of their employer-provided benefit and HR programs. For their part, employers have the opportunity to save a substantial part of the estimated $1,700 per employee, per year, that companies routinely spend communicating information on benefits and HR policies. [32]

Ruel et al. have identified four aim of implementing e-HRM: cost reduction/efficiency gains, client service improvement/facilitating management and employees, improving the strategic orientation of HRM and allowing integration of HR functions. [12]

Less administrative burden due to automation, cost and time effectiveness, improved employee communication, faster and more accurate information delivery are the main e-HRM benefits. [69] e-HR can substitute physical capability to re-use information. In addition, it can facilitate virtual “customer relationships” and internal labor markets. [55]

e-HR supplies better knowledge management, which can develop an institution’s competitive benefit. [79] HRIS decreases a need for human resource specialists, ensures error prevention, accelerates transaction processes and develops service delivery. [22]

2.6 Drivers of electronic Human Resource Management

The three driving forces of e-HRM are cost reduction, improving HR services, and improving strategic orientation. [67]

e-HRM drivers are identified at three levels:

A. Operational driver: cost reduction by rightsizing employee number and lowering transactional prices;
B. Relational driver: meeting the growing demands of line managers, employees and business partners;
C. Strategic driver: becoming a strategic business partner by determining and helping accomplish strategic business goals of the organization. John Kay (2004) also added The Reputational Driver, which considered brands and reputations necessary for competing. [69]

Activation triggers can be operational, relational, transformational drivers and external, institutional factors among which are imitative behaviors. Coordination capabilities and socialization features are important antecedents. Formalization, utilization, and centralization are main factors of HRM development. [54]

Strategic perspectives that drive HR agenda can be categorized as industrial, organizational and economic. [53]

The focus of the strategic drivers of e-HR of parent organization is transactional goals, which is meant for global HRIS. [55]

2.7 Planning electronic Human Resource Management

There are some factors to take into account in the process of planning an e-HRM. In the adoption phase- organizations should carry out their needs analysis. “Organizations should consider the needs of stakeholders and then deploy required tools to meet those requirements. [37] Technology innovations should carefully opt. [1] Before carrying out e-HRM, there should be certain inherent or specific HRM policy theories and practices already in use. [34]

Shared leadership is considered to be a priority in e-HRM. Shared leadership encourages team leadership. Below are the reasons for adopting shared leadership: [27]

1. ERP modules are complex and require large numbers of decisions;

2. HRM system implementation is a separate process;
3. IT and functional expertise are equally important;
4. There should be a high collaboration between and within the teams.

There are several suggestions that can help managers avoid organizational change drawbacks: determining support level; awareness of minor changes that follow the major restructure; training on executive management, operational personnel, and middle management levels is needed; communication among organization members is critical. [81]

The dynamic and iterative nature of absorptive capacity (ACAP) investigates the link between potential and realized the capacity of an organization to sort and apply new knowledge in HRM.

A dynamic pattern of ACAP for e-HR in organization covers:

a. Acquisition: HR department's capacity to assimilate knowledge about e-HR. This dynamic capacity has three elements: speed, intensity, and effort.

B. Assimilation: HR department's culture: the professional status of staff, its routines, and social capital. When assimilation with the e-HR is not based on HR specialists' background knowledge, e-HR dissemination is held back.

C. Transformation: innovating approaches, applying new techniques and merging them to face-to-face HR experience.

D. Exploitation: exploit knowledge; connect traditions of the corporation HR management with the innovation e-HR perspectives. The region, sector of industry and national culture are the critical factors for HR development. [69]

E. Social integration mechanisms: learning and acquiring do not necessarily mean transforming.'' Both formal and informal methods of integration are needed to lower the barriers to change and to increase the efficiency of knowledge sharing and exploitation''. (page 10), [54]

2.7.1 Strategic Approach

The strategic function is one of the most important HR function. Three conceptual themes are shaped throughout the process: shifting HRM identity, taking an innovation practice perspective and a move towards service thinking. Two out of five major organizations have e-HRM strategy, other organizations have general objectives toward e-HRM but the connection between e-HRM and HRM strategy is not evident. [74] HR must use HR technology appropriately to help

organizations capitalize on their human capital. HR needs to be proactive rather than reactive. [76]

HR can only be a real strategic partner if:

1. It takes the business part in the strategy formulation process;
2. Spreads the strategic word throughout the organization;
3. Takes an active role in the implementation;
4. Generates the necessary competencies for the accomplishment of the strategy. [6]

e-HRM should support the improvement of functions capacity of service. [5] The emergent conceptualization and application of e-HR programs are strongly influenced by Ulrich's HR business partner model. Ulrich's conceptualization of shared services and e-HR is oriented on the results and strongly influenced by the notion of a "bias for action and impact." [24]

Strategy facilitation process effectively uses formal communication channels of the organization and creates an interaction between top management, HR professionals, and employees. This process methodology has a direct managerial implication, which suggests further exploitation of existing resources within the organization with marginal extra investment. [6]

A company that takes the time to invest in an HRIS that fits its goals, objectives, mission, and values, is a company that is investing in its future and in its success. It will be necessary to customize any HRIS to the unique needs of a company so that the system remains flexible and relevant throughout the lifecycle of the company or enterprise. [4]

HR manager plays an important role in strategy formulation. When the strategy is formulated, he/she should create an HR competency model, which describes a particular combination of knowledge, skills, and characteristics needed in an organization. At the top of the model, there should be a statement of competitive advantage of the company and its strategy. This statement is the manifesto of company core competencies. These core competencies should not be confused with the HR competencies. [6]

Any model of effective e-HR strategy might be perceived in terms of cycles in the design and implementation of an e-enabled HR strategy. This cyclical process suggests a more dynamic relationship between an emergent e-HR strategy, HR technologies and the ability of the managers, employees, HR staff to adapt these technologies. [55]

There are three archetypes, that resemble the well-known prospector, defender, analyzer typology including:

- The dominant strategy on investment in human capital
- The associated forms of work organization and psychological contracts with employees
- The levels of investment in social capital [57]

e-HRM suggests new ways of solution mechanism in informational technologies; It also provides new opportunities for partnership and collaboration and supports innovation practice leading to value creation. [5]

Integrating electronic resources in HR management leads to effective consequences and provides the efficient electronic system. [18] Organizations must record good HR planning efficiency if HRIS lines up with information system strategy and HR strategy. Companies need to integrate HRIS functions with other business tasks. [57]:

The latest development in HRM is "Six Sigma" approach addresses reengineering business activities by going through five key processes: define, measure, analyze, improve, control (DMAIC). [76] HRIS is examined in its two aspects: in its strategic and administrative use. Absolute efficiency and effectiveness of an organization can only be reached through strategic deployment of the information provided by an HRIS. Conversely, strategic HRIS is more difficult to examine. [7]

HRM aggregates to a company level of analysis and has macro-level consequences. It focuses on HRM activities as an independent system and underlines organizational performance outcomes. [53] Usually employers focus more on day-to-day transactional activity and lose sight of the overall strategic objectives. [32]

2.7.2 Legal Standard

In this subchapter, the legal standard of HRIS functional requirements is discussed. The case of Georgia, on a national level, is taken as an example.

HRM information systems standard for public services was adopted according to the resolution of Georgian government in February 2012. [29] According to the standards the system consists of three modules.

1. Administrative module.

2. Attendance module.

3. Payroll module.

The Administrative module contains main information about staff and organization. It determines and gives a direction for functioning other modules. The module mainly consists of three sub-components:

1. General input about the organization. It is obligatory to have minimum two thematic categories: identification and contact information.

2. The structure of the organization. It refers to the information about both central apparatus and the institution. Each institution is represented with the input organizational elements. It is compulsory to have minimum three thematic categories: organizational elements, staff list, and job descriptions.

3. Employees electronic private data. It consists of detailed information about each employed person individually. There should be represented minimum six thematic elements: the identification information about the worker, contact information, information about education and experience, current status, issued orders about employee and various reports with documented proof along with material values (inventories) attached to the employee (temporarily issued at his/her disposal).

Apart from the general functions, it is obligatory to fulfill some quantities of compulsory functions adopted by the standard for organizational modules:

- An identification of potential employees corresponding to the vacant job description in case of dismissing the position;
- Displaying the statistics of changes made in any field periodically
- The simulations of organizational changes (reorganizations) according to the parameters;
- Information filter with any kinds of apparatus
- An indication of organizational structure both on the whole and other sub-levels. It should be possible to see the structures in different formats such as an organizational tree, hierarchical scheme.

Attendance module registers exact expended time of the working period performed by the worker. The organization is free to its point of view on the selection of concrete/form of attendance registration, but the selection method of attendance registration should necessarily give the opportunities to edit the following type of information:

- Appointed working time for worker;
- Overrated working hours;
- Paid holiday;
- Uncompensated holiday;
- Maternity leave;
- Time spent on holiday;
- Day dated on the hospital paper;
- Time spent on professional training/qualification;
- Reasonable absences of working hours;
- Unreasonable absences of working hours;

Payroll module automatically calculates staff salary according to the relevant legislation. In order to do that, the module has to have a direct connection with administrative and attendance modules. Each worker of the organization has a permission to have an access to the secured information.

The organization has a complete freedom to organize this module and determine its components; however, it is needed to have an opportunity to calculate these components: positional pay; premium; social benefit; salary appendage determined by legislation; holiday expenditures; income and other types of deductions.

The Payroll module should have at least following functions:

- Standard accounts originator on each secured parameter in the module;
- Determined non-standard accounts originator by a customer according to parameter (s);
- Individual electronic notification regarding the need for an income declaration filling

According to the accepted method in approved standard, HRIS should contain overseeing modules of separate HR technology, which will be connected to each other, and simultaneously, have an opportunity to function separately.

The standard does not include either appraisal and selection nor training module.

Chapter 3 Determining and Organizing Requirements of electronic Human Resource Management

In this chapter, requirements for e-HRM are determined and organized. In 3.1 Overview of existing open source and commercial e-HRMS solutions is made, which is followed by 3.1.2 Mapping the found solutions onto e-HRM requirements. In 3.2 Conceptual Domain Modelling is introduced, which consists of 3.2.1 Goal Model, 3.2.2 Role Model, 3.2.3 Organization Model and 3.2.4 Domain Model. After this, 3.3 Functional Requirements of e-HRM system is discussed module by module. The latter consists of 3.3.1 Basic module, 3.3.2 Performance Appraisal Module with its appraisal methods. Particularly, 3.3.2.1.1 Management by Objectives and 3.3.2.1.2 360 degree Appraisal. Sections 3.3.3, 3.3.4 and 3.3.5 cover functional requirements of Training and Development Module, Selection Module, and Payroll Module. In 3.4 Analysis of e-HRM functional requirements is made. Section 3.5 concludes the chapter and answers the first research question.

3.1 Overview of Existing Systems

''Open source software development projects are Internet-based communities of software developers who voluntarily collaborate to develop software that they or their workplace may require''. (P.4)[63] Open-source projects can be accessed online and usually, it is a work in progress. End Users can give their feedback and developers have an opportunity to take it into account.

Open source HRIS adoption by the organization is linked to several factors. It includes internal server infrastructure and cloud hosting that leads to investment in IT infrastructure. Business process mapping is needed, which is followed by HR process shaping skills. Negative viewpoints from both decision makers and users perspective can be considered as internal barriers for open-source HRIS adoption. Company needs and advantages of the adoption should be analyzed considering budgetary limitations and availability for technical resources for customization. [63]

Below is an overview of open-source e-HRM systems predominantly. However, it also includes commercial one.

- OrangeHRM – It started in the U.S.A for small and medium sized enterprises. Available Modules are performance, recruitment, employee self-service, time and attendance, leave

administration and management, personal information management and administration. Modules that are offered with a fee are document management, training, advanced reporting, travel management, 360-degree performance, job and salary history, security authorization and insurance benefits; [40]

- Oracle HRMS- Oracle Human Resources combined with Oracle Self-Service Human Resources the firms can manage flexible working arrangements, meet business objectives, identify required skills/qualifications, measure/monitor performance and motivate the workforce. Payroll, Time and Labor (submit/review/track/approve timecards), Learning Management (competency management, manage learning content, support online learning/assessments, build a unified learning catalogue, schedule and manage resources, tie training to organizational goals, extend learning to customers/partners), Tutor (create/maintain documentation/training/reference materials), Workflow, Advanced Benefits (manage benefit plans and eligibility rules, reduce costs, optimize benefit plan usage and value, make decisions globally, share data and support shared service centers), Self-Service Human Resources, *i*Recruitment, Incentive Compensation, Human Resources Intelligence (analyze/manage HR processes); [41]
- ERPNext – It includes employee internal and external work History, Daily work summery, Recruitment, Payroll, leaves management, Performance appraisal, training, and development, Employee Loan management are included. [42]
- Odoo - It consists of recruitment, Leave management, expense reimbursement, working time management, performance assessment, goal setting for employees; [43]
- LATRIX- Sourceforge web-based e- HR application. It offers attendance reporting, leave management, simple presence recording (barcoded ID and magnetic strip cards), block periods for seasonal jobs, multiple locations and time-zone support; [44]
- Open Applicant- It provides online candidate assessment tools, resume and email screening, answer reply and report generation, candidate benchmarking and matching along with standard test libraries and their creation; [45]
- ICeHRM- Sourceforge hosted Java based solution. It covers applicant tracking, leave management, recruitment, payroll, staff training and expenses management; [46]
- TimeTrex – Is based on Canadian Payroll services offering payroll management, attendance management, scheduling, leave management and job costing; [47]

- SAP Human Capital Management (HCM)- Commercial ERP, which provides employee administration, personnel time management and evaluation, organizational management, benefits management, payroll calculation and talent management. The latter includes recruiting, career management, succession management, enterprise learning, employee performance management and compensation management; [48]

  A case study in Saudi electricity company shows the following achievements of SAP implementation in HR. It shows 33% reduced paperwork, expenses; 2.5% reduced necessity of hiring employees; Time saving during data delivery; Creating Better work procedures; better level of customer satisfaction, faster transactions. [33]
- JIRA - Job tracking system based on Atlassian software platform. Atlassian JIRA is a task management tool for software development teams developed by Atlassian. It allows the user to create, prioritize and track the progress of tasks across multiple team members. Projects are treated as and formed from, in this software, collections of issues, which can be managed individually or in bulk in multiple ways. Tasks can be delegated and issues can be started anonymously if need be. Customizability and functionality are extended via extensive support for plug-ins. JIRA covers project and issue tracking, IT service desk and customer service management, essential business management, incident communication, document collaboration, collaboration visually and file sharing, Git code management, Git and mercurial desktop client management, Integration and release management. [49]
- Alfresco - Document management system based on. Alfresco is an enterprise content management solution designed to enhance organization's productivity and workflow. It offers a variety of features and tools to help easier allocation and access to documents, edit files and share data. One of the standout features available on this enterprise digital document management system is the workflow and collaboration options it includes. This solution enables easy sharing of files with certain members of your team. Documents can be routed to certain individuals for processing, approval or review.

  Document flow management by Alfresco includes: [50]

  1. Document scanning and registration
  2. Document assignment
  3. Creation and viewing of document registries

4. Processing of documents
5. Review and approval of submitted documents
6. Generation of various performance reports for Organization/unit/employees.

Alfresco system provides a flexible workflow definition engine that can be used to customize the document workflows as the processes evolve over time. It also provides functionality to implement a full-fledged electronic document management system utilizing Electronic Digital Signatures. It offers a smart digital business platform with application development framework application programming interface, integration, and extensions. Process, content, and government services are available. [50]

3.1.2 Mapping Existing Solutions onto Management Requirements

In order to provide a vivid picture for the shaped requirements of e-HRM, Open-source and commercial solution mapping onto e-HRM requirements are created. The latter discusses general requirements for e-HRM, under which seven main requirements are categorized. It covers job tracking, performance appraisal, training, recruitment, payroll and document management.

1.General Requirements include the following:

- Ensure compliance with legislation and best practices;
- Ensure effective access and security control for all system components;
- Ability for the system administrator to customize system workflows as processes evolve over time;
- Possibility of flexible integration with existing information systems;
- Ease of administration and technical maintenance;
- Use of open source software platforms;

2.Document management includes the following:

- Support full capture and management of electronic documents;
- Allow organization-wide searching electronic documents by metadata and/or document content

- Allow effective lifecycle management for all records from creation to disposal;
- Include a workflow system to allow user defined workflows to be built around document processes
- Manage inwards correspondence scanning and distribution;
- Electronic storing/archiving of the incoming and outgoing documents

3.Recruitment includes the following:

- Ability to attract qualified candidate;
- Ability to analyze requirements for a job;
- Screening an applicant;
- Ability to provide selection of an applicant;
- Ability to hire qualified candidate;
- Ability to integrate new employee to organization;

4.Performance Appraisal includes the following:

- Ability to create organization structure and jobs descriptions;
- Ability to define performance appraisal criteria, measures, scales, and weights;
- Ability to have an ongoing interactive personnel management process whereby both employees and supervisors complete electronic evaluations;
- Ability to generate performance reports for employees;

5.Training includes the following:

- Ability to create organizations training plan and policy;
- Ability to offer various training options for employees;
- Ability to offer various training options for decision makers;
- Ability to identify training and development needs in organization through appraisal and job analysis;
- Management of training and development course delivery;
- Ability to assess training programs;

6.Job Tracking includes the following:

- Ability to enter and maintain company plans;

- Ability to enter and maintain structural unit and employee plans;
- Ability to monitor plan, project and tasks execution;
- Ability to generate plan execution performance reports for company/unit/employee;

7. Payroll includes the following:

- Ability to calculate total compensation to be paid to employee;
- Ability to pay required amount periodically;
- Ability to calculate Gross pay;
- Ability to calculate amount withheld by organization from employees earnings;
- Ability to calculate Net pay;
- Ability to register and store information about paid amount to employee;

Existing e-HRMS open-source and commercial solutions mapping onto e-HRM requirements is demonstrated in figure.2.

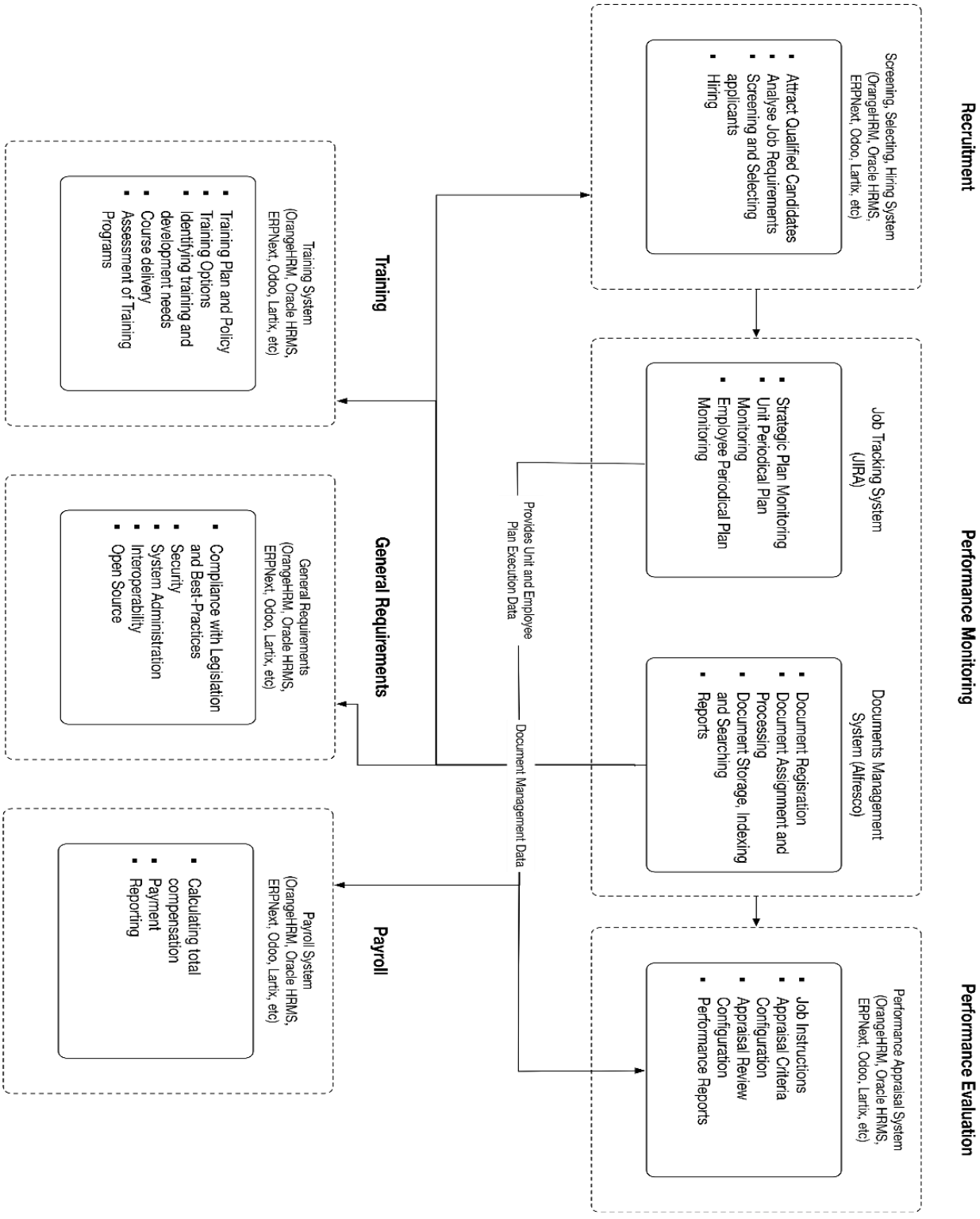

Figure 2. Existing Solutions Mapping onto e-HRM Requirements (Nina Khomeriki)

3.2 Conceptual Domain Modelling

Conceptual domain modeling is adopted through agent-oriented modeling (AOM) and is used to build motivation layer for the system to be designed. It includes goals, policies, roles and domain entities, which should be communicated with platform independent and platform specific models in future phases of design and deployment of a socio-technical system. [73] AOM models are built in ''yworks'' diagramming tool.

3.2.1 Goal Model

Goal model shows goals and roles of a system. It represents goal hierarchy distinguishing the types of goals included. ''Quality goals'' represent a non-functional or quality requirement of the system. [73]

Goal model first focuses on the purpose of the system to be designed. The main goal is to perform HR management, where HR manager, employee, organization, and system administrator roles are needed. HR management should be automated, secure and simple to use.

The sub-goals that serve the purpose of the e-HRM system are strategic development, cultural changes, management development, recruitment, training, evaluation, and payment. Strategic development should be adaptive, while cultural changes should be progressive. Management development is meant to be strategic and goal-oriented. Recruitment should be transparent, fast and online, where a role of a job applicant is needed in order to submit a job application. Training is seen to be specific and held on a regular basis to bring value to employees and to the whole organization, where training manager role is brought out. Performance evaluation of employees requires roles of evaluation council, head of unit and appeals commission so that it is ongoing, transparent and systematic. Admin/finance role is needed for reaching payroll goal of the HR management.

The goal model creates a big picture of the system to be designed and sets a solid ground for the remaining types of models in Agent-Oriented modeling. [73] Goal model for e-HRM system is given in figure 3.

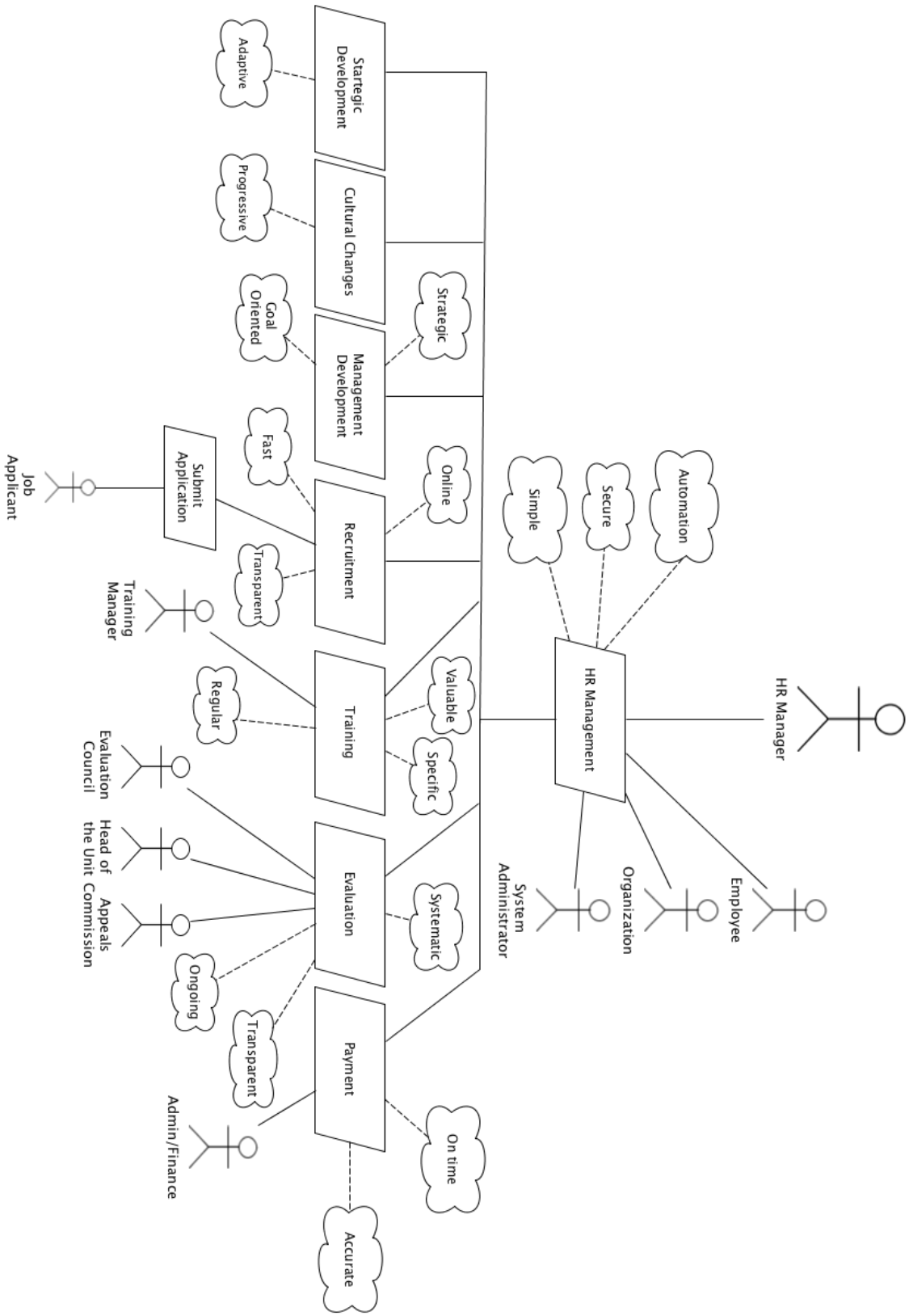

Figure 3. Goal Model (Nina Khomeriki)

3.2.2 Role Model

Seven role models were designed to explain roles associated with goals in order to achieve them. [73] The tables (1-7) below describe roles with its responsibilities and constraints for the integrated e-HRM system.

1. Role Name	**System Administrator**
Description	Manages Information System
Responsibilities	Maintain Organization Information
	Maintain Position cards
	Maintain Individual cards
	View system log and Activity
	Maintain system Users
	Generate Reports and Statistics
	Grant/Revoke Privileges
Constraints	The higher the level of IT literacy, the fewer chances of system error
	System administrator must have access to computer
	Only the System administration can maintain the organization information
	System administrator must work under the guidance of Organization's strategy
	The system administrator must graduate from computer science
	The system administrator must have access to position and individual cards
	Only the system administrator can see the system and activity logs
	Only the system administrator can maintain system users
	System administrator must collaborate effectively with all units in the organization
	The system administrator must contribute to system development

Table 1. Role Model for System Administrator (Nina Khomeriki)

2. Role Name	**Admin/Finance**
Description	Automation of Calculations for each pay period
Responsibilities	Calculate Gross salary
	Calculate Net Salary
	Calculate deductions
	Provide salary slip
	Generate Financial Reports
Constraints	Only the admin/finance can manage all financial calculations
	In order to calculate salaries, the admin/finance must request attendance information from HR manager
	The admin/finance must deduct taxes from the gross salary
	The admin/finance must provide financial reports weekly, monthly, annually
	The admin/finance must have a degree in Financial management
	The admin/finance must analyze all kinds of costs in terms of salary budget

Table 2. Role Model for Admin/Finance (Nina Khomeriki)

3. Role Name	**HR manager**
Description	Manages Human Resources
Responsibilities	Forming Tests
	Test administration
	Generate results
	Performing recruitment
Constraints	Only HR manager can perform recruitment
	HR manager must oversee Human Resource management
	HR manager must lead employees to encourage efficient performance and dedication
	HR manager must write and submit evaluation performance reports to the evaluation committee

	HR manager must monitor employee daily activity
	HR manager must have excellent organizational management skills
	HR manager must have minimum of a Bachelor's degree or equivalent in Human Resources, Business, or Organization Development
	HR manager must authenticate him/herself to use the system

Table 3. Role Model for HR Manager (Nina Khomeriki)

4. Role Name	**Training Manager**
Description	Manage Training and Development
Responsibilities	Plan Training
	Enroll Employee Into Courses
	Create training Schedule
	Recommend courses to employees
	Reserve training Classrooms
	Reserve Training Inventory
	Make Trainers assessment
	Select Trainers
	Produce Invoices
Constraints	Only Training Manager can perform job analysis to confirm current and future training needs
	Training Manager must communicate with team members, trainers, and management to ensure all needs are met
	Training Manager must have a Master's degree in Education, Human Resources, or relevant fields
	Training Manager must have 2+ years' experience in training, designing and implementing curricula preferred
	Training Manager must have a proven track record of executing successful training programs
	Training Manager must have excellent computer skills to use the eHRM
	Training Manager must have excellent presentation skills

Table 4. Role Model for Training Manager (Nina Khomeriki)

5. Role Name	**Employee**
Description	Works for Organization
Responsibilities	Trainers assessment
	Select Training
	View Training schedule
	View Course Information
Constraints	Employee must complete assigned tasks on time
	Employee must have computer skills
	Only employee can participate in the training
	To access the training materials, the employee must have a computer with Internet connection
	The employee must have the ability to work independently when required
	Employee must allow all involved stakeholders to get/provide any kind of performance and activity reports
	Employee must collaborate within a team environment
	Employees must continuously learn and improve skills
	Employee must reply any emails or correspondences
	Employee must have an official email address to communicate electronically

Table 5. Role Model for Employee (Nina Khomeriki)

6. Role Name	**Evaluation Committee**
Description	Manages Evaluation of Employees
Responsibilities	Planning Evaluation procedures
	Monitoring Evaluation Procedures
	Execution of Evaluations
	Generating Assessment
	Generating Final Report

Constraints	Only Evaluation Committee can review employees performance reports
	The committee members must have Master's degree in quantitative discipline (preferably in Social Science, Economics, or Statistics)
	The Committee members must have access to e-HRM to receive the activity reports from HR manager
	The Committee must collaborate on training design and development

Table 6. Role Model for Evaluation Committee (Nina Khomeriki)

7. Role Name	**Job Applicant**
Description	Looks for a job
Responsibilities	Participate in recruitment
	Get Familiar with Organizations Profile
Constraints	Job Applicant must apply through Online Job Portals
	Job Applicant must have the basic computer and web surfing skills to find a job and submit their applications

Table 7. Role Model for Job Applicant (Nina Khomeriki)

3.2.3 Organization Model

Organization model is created to show roles that are partially defined by its relationships with other roles in the designed system. [73] These relationships can be seen in figure 4 below. According to the organization model, the applicant is benevolent to an organization where structural units are aggregated. An employee works for the organization. Admin/finance is peer to HR manager and evaluation committee and pays to the employee. The evaluation committee is peer to train manager. The latter trains employee, whereas evaluation committee evaluates the employee.

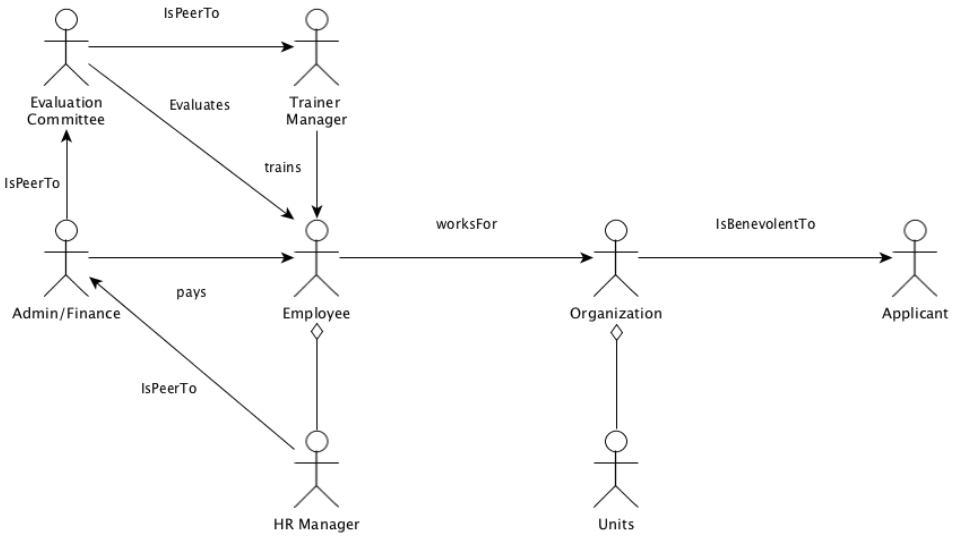

Figure 4. Organization Model (Nina Khomeriki)

3.2.4 Domain Model

Created Domain model introduces the e-HRM system environments, the types of resources produced and stored by them along with the relationships between roles, environments, and resources. Each environment is associated with particular knowledge that the designed system copes with. It should be noted that domain entity can be referred as environment object. [73]

The following domain model depicts the relationship between roles, environments, and resources associated with HR knowledge and the e-HRM system deals with. According to this model shown in figure 5, the job applicant applies for jobs through the job portals announced by the organization. After recruitment, he/she becomes an employee, who works for a structural unit of the organization, which is referred as organizational subdivision and division. Each position card belongs to a particular employee. All position cards belong to a subdivision. The system administrator maintains the position cards, manages the system users and maintains the information of an organization. The HR manager provides reports, which can be used for the evaluation and performance appraisals. Evaluation committee performs evaluation procedure. The committee introduces employees to take part in the training managed by training manager. Each employee receives their salary prepared by admin/finance. The organization conducts a survey for quality assurance, where employees and HR managers participate in the surveys.

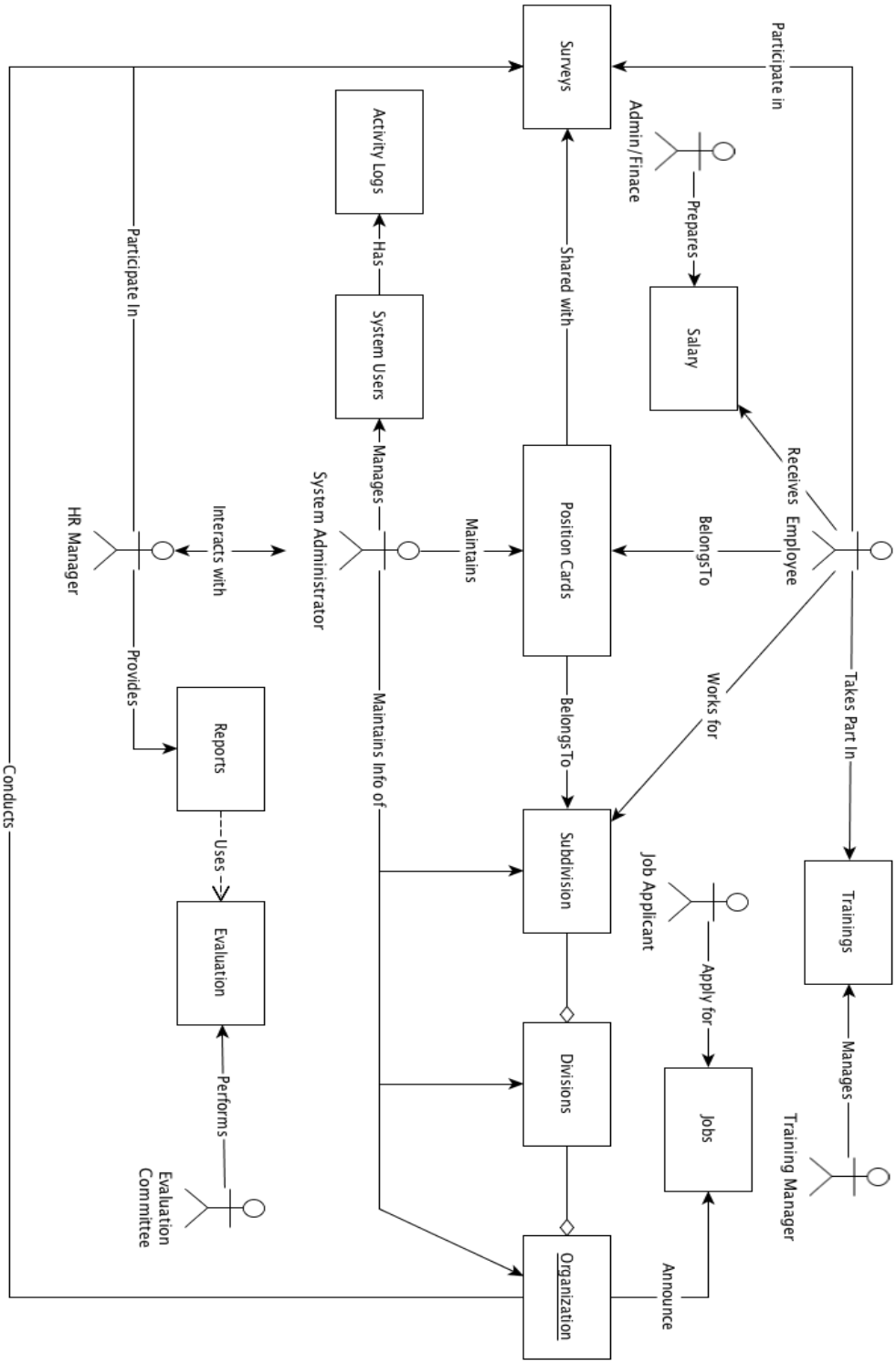

Figure. 5 Domain Model (Nina Khomeriki)

3.3 Functional Requirements of System Modules

This subchapter discusses modules and its functional requirements for designed e-HRMS. Unified modelling language use case diagrams are used to demonstrate system functionalities [56] ''Dia Diagram Editor'' is used to draw the diagrams.

Here is the list of activities that organization needs to carry out beforehand. It includes: analysing of work for each job; identifying required competencies for each job; identifying and approving the criteria and rating scales; development and approval of policies and procedures for the selection of human resources; development of incentive system and job management system; development and deployment of the performance appraisal system with and development of a training system. [9]

3.3.1 Basic module

The basic module must give an opportunity to edit, view and enter information on the structure and existent human resources of the organization. It should provide necessary information to Performance Evaluation and Training and Development modules and receive and archive the data from the last. Thus the core element of e-HRMS, the database of organizational data will be formed. The administrative function should comprise the definition of users' access level and interactive user interface. [76]

The basic module contains information about the structure and existent human resources of the organization. In the basic module, following functions are automated:

- Creating structure of organization, editing and archiving
- Creating card for each position, editing and archiving
- Apportioning positions according to subdivisions
- Archiving and creating individual cards for employees, probationers, applicants, and reserve
- Appointment, discharge, and transfer of employees
- Registering employees' presence

- Conducting different types of survey providing on organizational structure, jobs, employees;
- Searching/filtering according to different criteria and forming reports - reporting
- Forming of change log with date, user's name and information changed

Creating, editing and archiving organization structure is also included. Particularly, the module should allow creating (append), remove, change, move structural subdivisions and entities within the administration sphere of the head organization. With this, creating, editing and archiving position card should be available.

Additionally, allocation of position according to subdivisions is needed. The system should allow forming the tree of positions on the basis of position cards. Archiving and creating individual cards for employers, probationers, applicants, and the reserve is also included.

Hiring, transferring and dismissal of employees is available in the system according to the given number of order, date and key word. Contract date or trial period expiration date, which is used by the program to formulate the message for the manager before the deadline, has to be indicated as well. During the operation, the program automatically has to formulate required order and archive it in the employee's personal card.

The employee has an Attendance Account. The attendance has to be presented in a form of a calendar, where the amount of day offs, vacations, illnesses, absences, maternity leaves, business trip days and overtimes will be calculated by days and hours.

Conducting different types of a survey regarding organizational structure, jobs, employees is included. The system must support providing analysis through different questionnaires aiming the improvement of internal organizational issues and working environment as well as analyzing data on individual employees and group of employees collected through selection and performance appraisal modules.

Searching and filtering of information should be achievable by any parameter or their combination. The user should be able to form parameters and save once formed filter for further usage through dialogue box; required information should be received on the type of reports, which can be standard as well as of user defined form.

Forming change log should be available. In the case of changes in database program must automatically fix change date and author. The user has the opportunity to view any changes made in the database (by date) and situation before changes were made (by date). Change log function should give the user the opportunity to view the list of changes made in the database for any desirable period. The list must contain the name of the change author, essence, and date of the change**.**

To describe the functionality of the module UML use-case diagram is used.[56] Use-case diagram for a system administrator is presented in figure 6.

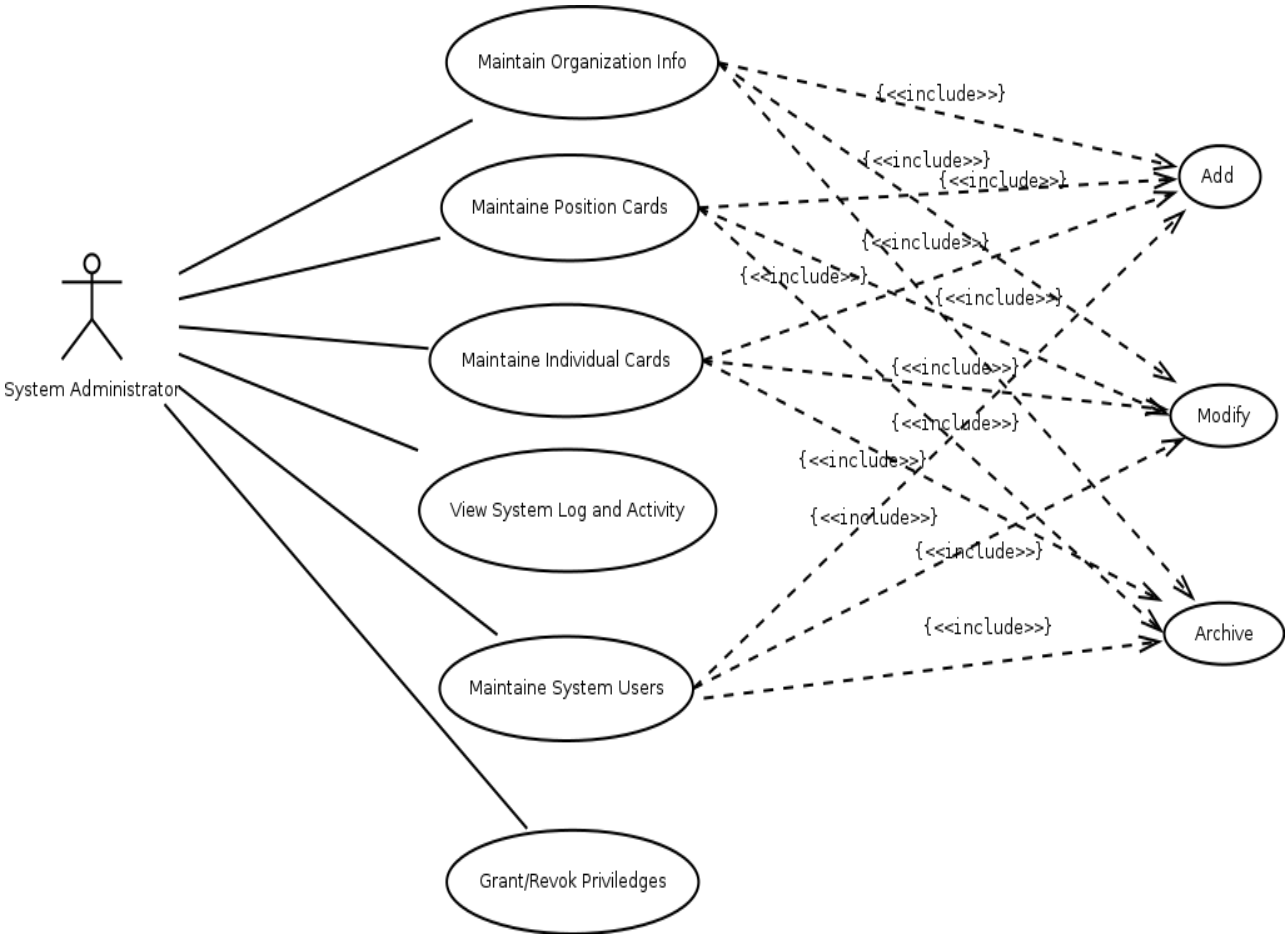

Figure 6. Use Case Diagram for System Administrator (Nina Khomeriki)

3.3.2 Performance appraisal module

Appraisal of employees and structural units is essential for the job performance management process. It will not have the sense to diminish organizations' strategic aims to specific aims of structural unit or employee if periodically performance appraisal is not done. The appraisal also gives the direct supervisor and employee opportunity to elaborate plan, which will help them to improve weaknesses found during performance appraisal process. It also supports career planning by revealing employees' strong and weak sides. [23] From this point of view, the linkage of Performance appraisal module and Job Tracking System designed for purposes of monitoring and reporting employees individual development plan fulfillment should be assured. Apart from this, performance appraisal affects decisions about payment and promotion. This process ensures increasing of qualitative benchmarks of personnel, the effectiveness of performance and increasing of motivation. [2]

Performance appraisal module provides:

- formation of potential assessors' list, on the basis of basic module data,
- Tool for setting of percentages of weight in final score for each assessor;
- Tool for setting of percentage of weight in final score for relevant structure's assessment;
- Tool for forming criteria for management by objectives
- Tool for forming list of criteria for competency based and/or 360-degree appraisal or evaluation by quantitative results
- Tool for forming weights for each criterion
- Top limit of criteria weight
- Ground limit of criteria weight
- Step of increment of an argument
- Ground limit of criteria assessment scale
- Increment of criteria assessment scale
- Tool for making corrections in automatically formed list of assessors
- In case of need, user makes correction of criteria formed for each position

Appraisal module must have the option of producing appraisal results according to each criterion, appraisal results according to criteria groups and result of the whole appraisal.

3.3.2.1 Performance Appraisal Methods

e-HRM system should provide establishment and automation of transparent mechanism for appraisal of each employee and structural unit by different methods and draft relevant recommendations. For example, it is possible to use next methods:

- Management by Objectives (MBO)
- 360 degree appraisal

Both for MBO and 360 degree appraisal one of the most simple and objective criteria is quantitative results (amount, time, outputs, outcomes, products.). By this criteria, employees and structural units are assessed, which have to execute financial or other types of quantitative plans. For such positions, the level of implementation of plans must be one of appraisal criteria.

3.3.2.1.1 Management by objectives

In this method, the emphasis is made on work results, not on actions and activities. Method contains six stages: [38]

1. Definition of organization targets. Next years' specific targets are defined in accordance with organizations' strategic plan.

2. Definition of structural unit aims. On the basis of organization's plans, structural unit's aims are defined.

3. Discussion of structural unit aims. Chief of structural unit discusses its aims with his employees and asks them to define their own, individual aims, which will help the structural unit to reach its aims.

4. Definition of estimated results. Chief of structural unit and employees together define short-term individual aims of work and appropriate appraisal criteria.

5. Checking the work done. Chief of structural unit compares work done by each employee to appraisal criteria.

6. Chief and employee together discuss employee's results and draft development plan.

Usage of MBO has next priorities [23]:

- organization's aims are promptly and clearly defined
- structural unit's aims are in accordance with organization's aims
- tasks to be done by structural units and employees are clearly defined
- helps heads of the organization in the elaboration of the work plan and identifying needed resources
- employees clearly understand what is expected from them and what is their role in structural unit's and organization's activities

3.3.2.1.2 360^0 Appraisal

The method provides an appraisal of employees' competency by priory defined criteria. This process lets each employee get feedback on his/her activity from chiefs, colleagues, subordinates and users. Employee acknowledges how work done by him is perceived by others and what his/ her strong and weak sides and aspects which will need training, development or help. [77]

In the beginning of the process, people who can objectively assess employee are defined. An employee can take part in the selection of his assessors. The number of assessors must be enough to count maximally adequate to performance final score.[12]

Each of the assessors fills the questionnaire about work done by the employee. The questionnaire should contain both qualitative and quantitative data. Additionally, self-assessment of the assessment object can be used. After this, results are scored up and feedback is given to an

employee in the form of a report. Employee discusses his results with his chief and together they plan employee's self-development.[77]

3.3.3 Training and Development Module

One of the important functions of organizations' management is to define necessity of short/long-term training for employees' development. Training and development management module should focus data entry on what occurred and what will occur, not on the content of training exercises. Training should contain following methods: Training on the workplace, consultations of experienced professionals, self-training, inner group meetings, etc. All these processes need planning, implementation, and registration.[76]

Passing training may become necessary if following reasons occur:

- New employees' adaptation and job orientation;
- Manifested problems during monitoring job performance or evaluation;
- New procedures, systems, standards, initiatives;
- Changes in organizations' goals;
- Promotion;
- Taking additional duties;

Training and development management module satisfies following functional requirements:

- Based on formed results in Evaluation module, system must form development competence schedule (according to priorities) and should recommend user, which courses are necessary to develop designated criterion;
- Each employee should have an opportunity to get familiar with available courses schedule within the organization and choose desired training;
- Head of structural subdivision should have an opportunity to draw up a development plan for subordinated employers, which contains all necessary training courses/programs in advance (including those required by particular position);

- Modifying course delegates results, training materials, methods. Trainers evaluation possibilities should also be given;

With the help of module, the user has an opportunity to:

- Register received statements according to competencies, positions, and number of employees and course listeners;
- Drawing graphs of course schedule;
- Reserving classroom, with furniture;
- Reserving necessary training inventory and manual;
- Selecting trainers/instructors;
- Optimally distribute other resources.

Taken courses by each employee is registered in employee's personal card.

It is of high importance to consider individual developing schemes and plans for each employee starting from the getting into the position, adaptation and job orientation to training needs for career development. The user should have an opportunity to view and archive any type of information concerning, current and conducted lessons, training passed employers and hired trainers.

With the help of a module, the user has an opportunity to calculate value of selected training, training courses or training programs according to following parameters: Sum of money for each structural unit, fixed amount on employee and cost of trainer/instructor;

An authorized user should have an opportunity to produce a relevant invoice, electronically sign it and send the document to the financial office.

Use case diagram for training and development module is presented figure 7.

Figure 7. Use Case Diagram for Training and Development module (Nina Khomeriki)

3.3.4 Selection Module

The function of selection module is to automate forming, administering, scoring, interpreting results of computerized tests.

There must be a possibility to form a test. The interface of computerized tests includes:

- Program for forming biographical particulars database;
- Test examples with relevant instructions and explanations;
- Practical exercises with explanations;
- Time limited test questions with automatic timer;
- Program for automated generation of test's tasks;
- Program for scoring.

Computerized tests have advantages. Test tasks are generated automatically, thus memorizing them is practically impossible, which minimizes the possibility of spreading test. Test administration process is simplified and there is no need for printing test booklets and answer sheets. Besides, scoring, forming results in a database and interpreting them according to normative groups is possible. This kind of database gives an ability to save/use results for the unlimited period. Thus, treatment and archiving big amount of answer sheets will be avoided; It also simplifies a searching process for needed person by his/her level of competence as well as by any parameter.[72]

The program should have an ability to load and use any type of test. By setting universal parameters, empty form (template) of the test must be created, where the user will be able to upload real test questions and possible answers to test. The entire process of test administration will be automated. After filling a form filled information must be sent automatically to applicant's personal card. Instructions for testing should be available. Here applicant must have a possibility to get acknowledged with instructions for filling of the test. Additionally, there should be a possibility to fill exercise part for a better understanding of principal and logic of filling the test. After that applicant should fill a main time limited test in this part of a module. Scoring and interpreting results need to be available**.** The program automatically sums correct answers score for each applicant.

Use case diagram for selection module is presented in figure 8.

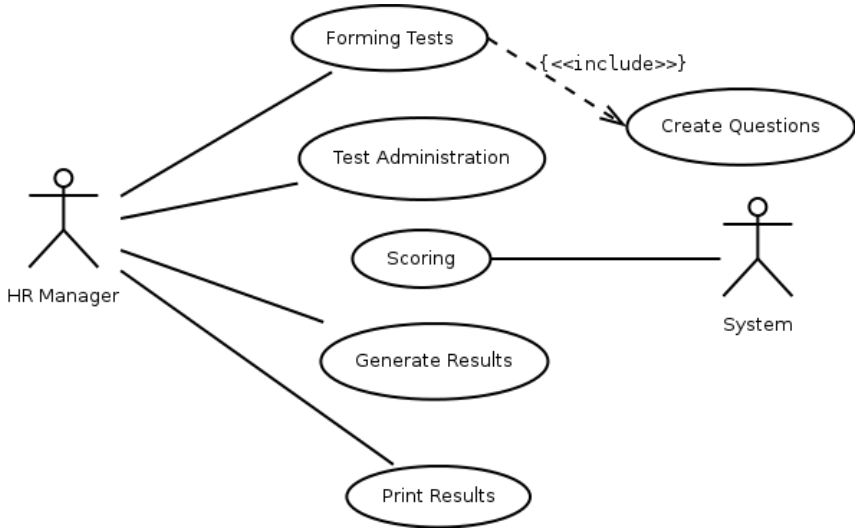

Figure 8 Use Case Diagram for Selection Module (Nina Khomeriki)

3.3.5 Payroll Module

One of the main problems for organizations' management is to attract and retain suitable staff. This problem can be solved with establishing effective payroll, transparent and fair mechanism for employees' motivation. Payroll should be based on pre-established principles and conditions. The employee has to know what are expected results of work and what will be the remuneration. The mechanism should be easily understandable for each employee.[10]

The module must provide automation of calculations for each pay period, which include gross salary, deductions, and Net salary.

The module provides following functional requirements:

- Calculate annually paid wages and deductions;
- Automatically define conformability of paid wages to salary fund;
- Calculate Gross salary by end of each pay period on the basis of presence/absence data accumulated in basic module;
- Control amount of salary according to amount of already paid and to be paid amount;
- Control number of paid leave days for each employee and provide appropriate messages;
- Register unused leave according to existing legislation;
- In case of retiring from the position module must calculate compensation amount of money according to existing rules and legislation;
- Make all kind of calculations as for whole organization, also for its particular structural unit according to parameters chosen by user;
- Register any kind of paid wages in employee's personal card;
- Archive any type of fiscal operation;

Use case diagram for payroll module is presented in Figure 9.

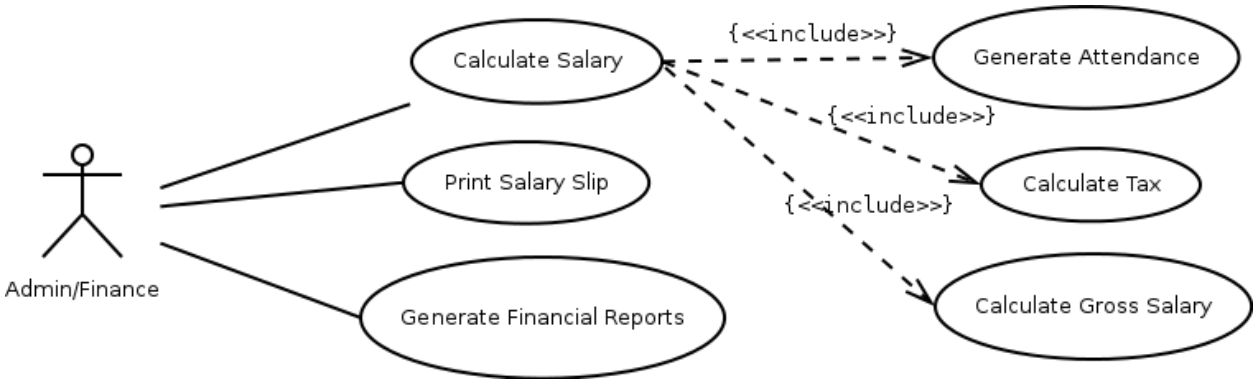

Figure. 9 Use Case Diagram for Payroll Module (Nina Khomeriki)

3.4 Analysis of Functional Requirements

While examples of poor HR architectures are frequent, many enterprises have developed HR tools, that successfully serve the purpose of the HR organization. The development of integrated HR data makes it possible to develop new service models for HR delivery. HRIS functions are interactive with HRM systems.

e-HRM can be explained in three level continuum: Electronic data processing, Management information system and decision support system. Most HRISs are organized by modules that help users to deal with HR data more effectively. A modular approach is adopted to map the main contents of HRIS. [10]

e-HRM functions can be divided in three. In the first place, it can be developing HR management effectiveness. HRIS can help companies set up computerized staff files, estimate staffs knowledge, abilities, experiences, and rapidly predict the organization's future HR necessities. Secondly, mixing HR management business processes is available. HRIS includes a series of work module containing post management, training scheme, and salary management. Thirdly, supplying worth-added services for companies and staffs is possible. [80]

e-HR impacts each area of HRM, which include: HR planning (accurate record keeping and flexible data updating); Acquiring HR (online recruitment), HR evaluation: Online performance appraisal; fast communication through e-channels, Rewarding HR: with an advanced payroll management. [61]

HR functions can be expanded according to the organization's business needs.

3.5 Conclusion

First research question has been fully answered in chapter three.

RQ.1 How to determine and organize the requirements for integrated e-HRM?

- Requirements for integrated e-HRM is determined and organized through analysis of existing open-source and commercial solutions for e-HRM. The study revealed certain kinds of functional requirements of e-HRM. The answer to this question consists of three parts, which are stated below.

  a.What are the existing open-source and commercial solutions for e-HRM system?

- An overview of open-source and commercial e-HRM systems is made to demonstrate existing solutions for e-HRM system. The open source systems are analyzed in a way that enables to display a big picture of all kinds of requirements e-HRM includes. Not all of the open-source and commercial systems offer a full range of functional requirements for e-HRM. Therefore, existing open-source solution mapping onto the e-HRM requirements is created. The study found functional requirements for e-HRM, which has general requirements. Under general requirements, there are certain kinds of requirements. They consist of job tracking requirements, performance appraisal requirements, training requirements, recruitment requirements, payroll requirements and document management requirements.

  b.What are the proposed conceptual domain models for e-HRM?

- The agent-oriented modeling language is used to provide conceptual domain modeling for the e-HRM socio-technical system. Computation independent models include goal model, role model, organization model and domain models for e-HRM.

  c.What are the functional requirements of e-HRM system modules?

  - Functional requirements were developed for each e-HRM system module. It consists of a basic module, appraisal module, training and development module, a selection module and payroll module. Use case diagrams were introduced for each module to display the system's functional requirements.

Answering first research question provides a good ground for proceeding and answering remaining research questions.

Chapter 4 Designing an Integrated electronic Human Resource Management System

In this chapter, the design of the integrated e-HRM system is presented. Conceptual architecture is proposed to fully understand the idea how e-HRM architecture should be expanded. In 4.1 Performance Appraisal business process modelling is carried out, which is followed by Platform independent Computational design (4.2). The Latter includes Interaction models (4.2.1) consisting of Interaction model for recruitment (4.2.1.1), Interaction Model for Appraisal and Training (4.2.1.2) and Interaction model for Payment (4.2.1.3). Section 4.2.2 Introduces Knowledge model, while 4.4 proposes conceptual architecture for e-HRM. Section 4.5 shows system analysis for the integrated e-HRM system design. And Lastly, the chapter is concluded by 4.6 section by answering second research question.

4.1 Performance Appraisal Business Process

The algorithm that organization may adopt for assessment by objectives of structural units can vary. However, Insuring connection of Performance Evaluation module with Job Tracking System is crucial as the latter makes it possible to monitor the implementation of the company's strategic plan and recording employees' initiatives and ideas. Thus, the data gained from Job Tracking System will be the main source for the head of the company to form and assess quantitative and qualitative criteria for the appraisal. [23]

Each of structural units must be assessed by the same principle as an employee in MBO. Aims of structural unit are defined and achievement level of the aim is assessed later. One of the components of final appraisal of the particular employee must be the result of his/her structural unit's appraisal.

It should be possible to assess the competencies of employees (essential for staff training and development). Additionally, it contains IT mechanism for controlling performance appraisal process through preventing overvaluing.

a. At the beginning of the year, evaluation council defines the goals and objectives of each unit according to the goals and objectives of the organization.
b. After defining the goals and objectives the Head of the unit has to develop and submit an action plan for approval for the fulfillment of these objectives. It is proposed that

employees of the unit participate in the development of the action plan and get familiar with it.

c. According to the action plan and on the basis of existing job descriptions Head of the unit assigns tasks to employees. Each employee has to be notified about tasks and deadlines and accept it through signing the relevant document.

d. At the beginning of each working period, the goals and objectives can be adjusted. A decision on changes makes the Evaluation Council. Changes must be agreed with the Head of the unit. The latter is to make due corrections in relevant documents according to the prescribed rules.

e. At the end of the working period Heads of units shall submit reports on performed activities to the Evaluation Council.

f. Evaluation Council assesses the level of unit's achievements against planned goals and objectives as well as the deadlines of specific tasks and quality. As it was discussed above the linkage of Performance appraisal module and Job Tracking System designed for purposes of monitoring and reporting employees individual development plans fulfillment, should be assured as essential statistical information for assessment by objectives will be provided by Service Desk and Job Tracking System.

g. On the basis of assessment, each unit is assigned a score (from 0 to 1), which determines the effectiveness of its functionality (operations).

h. The assessment score of a unit is automatically assigned to the Head of the unit as his/her initial assessment score.

i. The head of the unit monitors the activities of subordinates systematically and at the end of the period assesses each employee with the respective score (from 2 to 5), by competencies given in respective job descriptions.

j. The employee has the right to appeal no later than 2 days after the announcement of the results. Commission has to discuss the complaint within no more than 2 working days.

k. Appeals Commission shall review the claims and complaints on its meeting, and in the case of satisfaction of the claim submits the conclusion to the Evaluation Council for a final decision.

There should be a possibility to:

a. To determine to what extent each assessed employee meets the criteria and identify where he/she has weaknesses;
b. Define the overall level of existing competencies within the organization.

''SIGNAVIO'' business process modelling tool was used to describe Performance appraisal business process steps in figure 10 below.

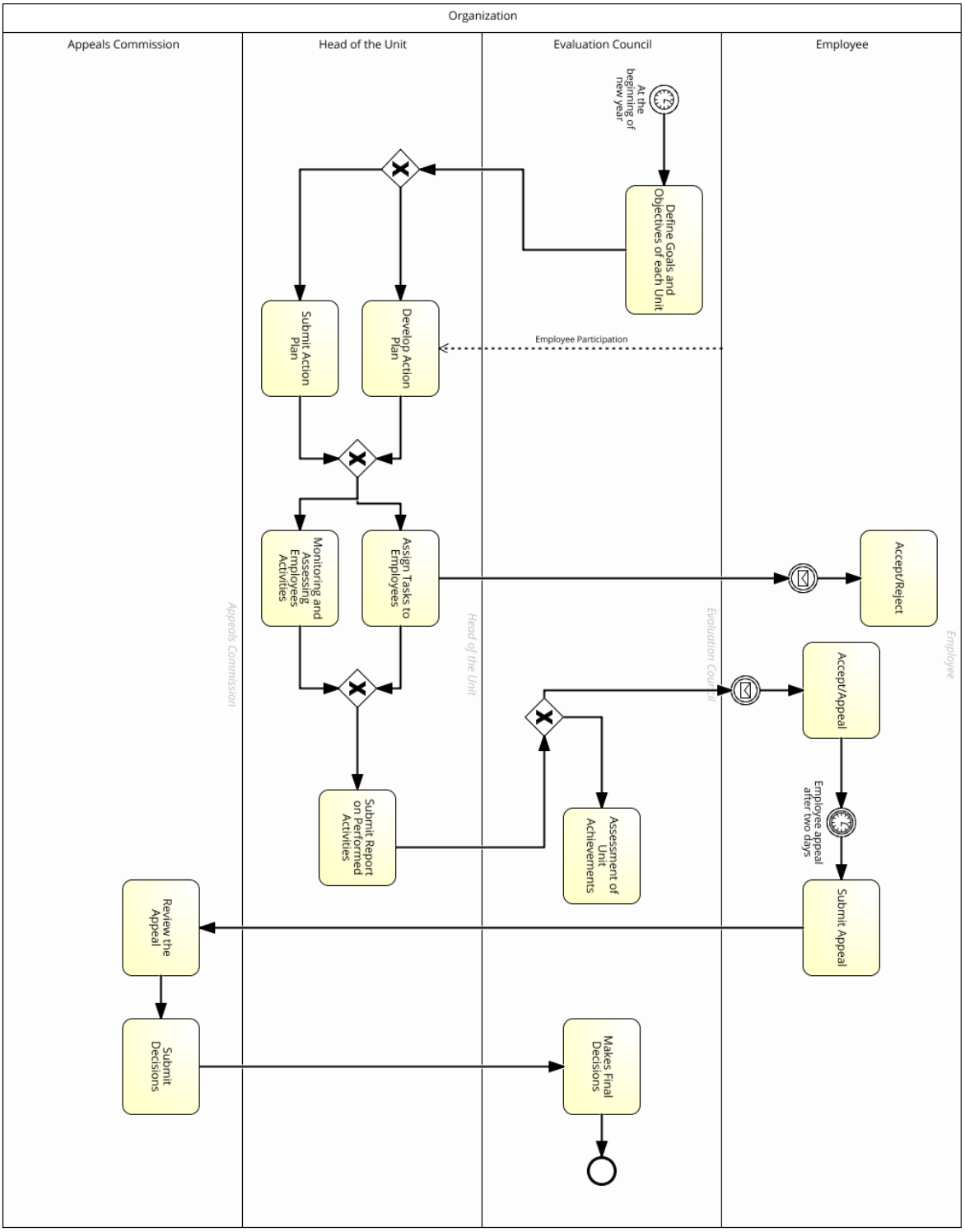

Figure 10. Performance Appraisal Business Process Model (Nina Khomeriki)

4.2 Platform Independent Computational Design

In this sub-chapter platform independent models are built. In order to create system design layer, conceptual modeling that was described in the third chapter will be used. It can also be referred as a motivational layer. Goals that were shaped is associated with activities and concrete actions taking place, rules and knowledge items. Legislation and strategic frameworks are country and organization specific. Therefore, the policies and designed roles are identified to rules, viewpoints and concrete agents. Goals help to harvest knowledge items, where domain entities are involved. [73]

4.2.1 Interaction Model

Interaction model shows interaction patterns between agents. The patterns are based on responsibilities made for the corresponding roles. The model demonstrates a way specific agent interacts with another specific agent. It also states which party starts the interaction so that the sequence of the interactions become clear while considering the discussed problem domain. Modelling interactions are seen as one of the most important parts in AOM. [73]
There are three interaction models designed for the system. It consists of interaction models for recruitment, appraisal and training and payment.

4.2.1.1 Interaction Model for Recruitment

The interaction model for recruitment consists of human (applicant), the system (job portal), organization and HR (HR management) agents. [73] The interaction between these agents is following. According to the model, organization posts jobs on job portal, where applicant searches for a job. Job portal displays results and applicant is capable of submitting his/her application. Organization requests submitted applications and job portal is providing them. HR management screens application and notifies the applicant about the decision as a result of screening.
The interaction model for recruitment is presented in figure 11.

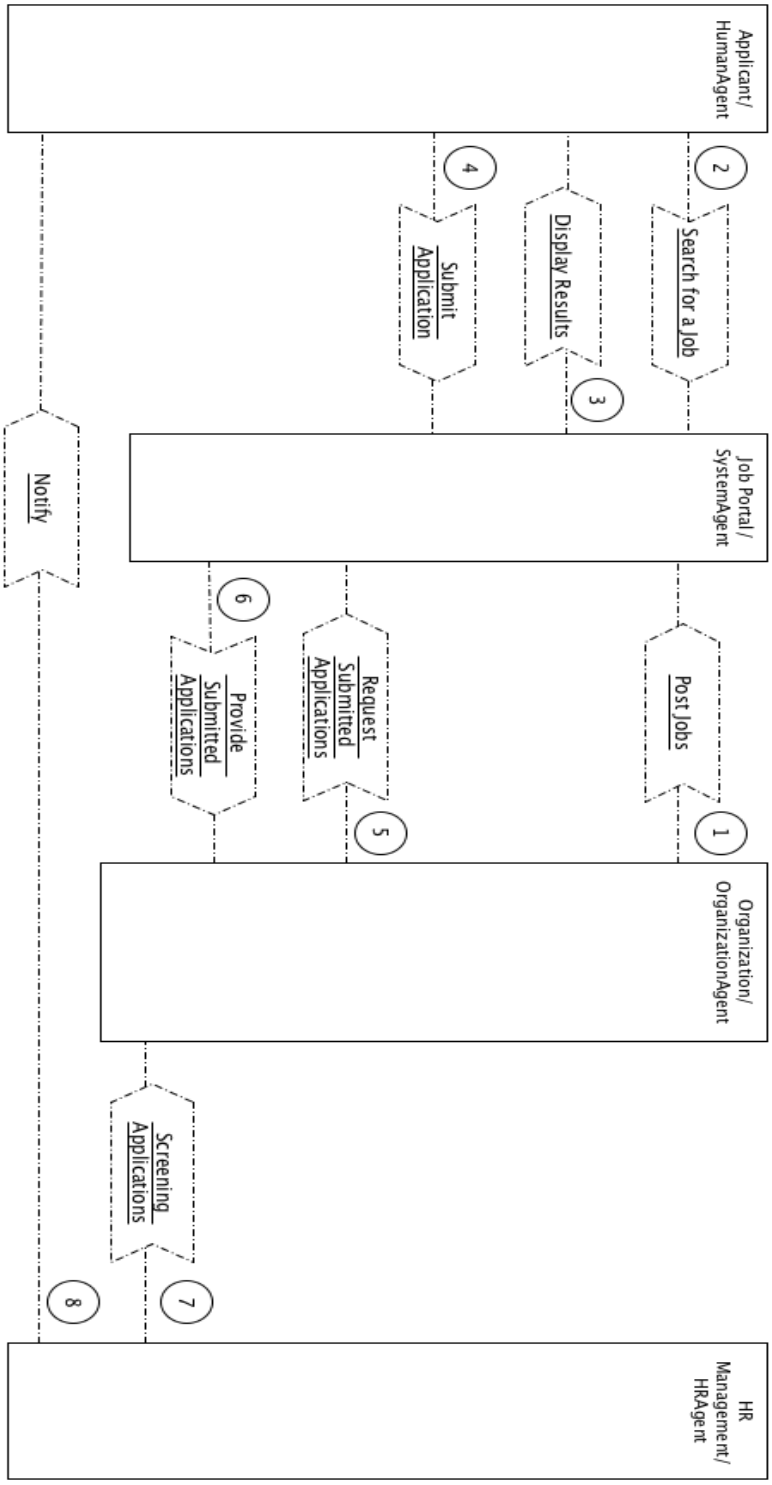

Figure 11. Interaction Model for Recruitment (Nina Khomeriki)

4.2.1.2 Interaction Model for Appraisal and Training

The interaction model for appraisal and training includes five agents:

1. Evaluation agent (evaluation committee)
2. HR agent (HR management),
3. Employee agent (employee),
4. Administrator agent (system admin) and
5. Training agent (trainer).

According to the model presented in figure 12, HR management asks for daily activity reports and employee provides them. Evaluation committee requests for employees performance reports and HR management provides the reports. Evaluation committee provides the list of trainees and system admin notifies selected employees about the training. After that employee confirms his/her participation and system admin informs trainers about the latter. The trainer confirms and provides training for employees.

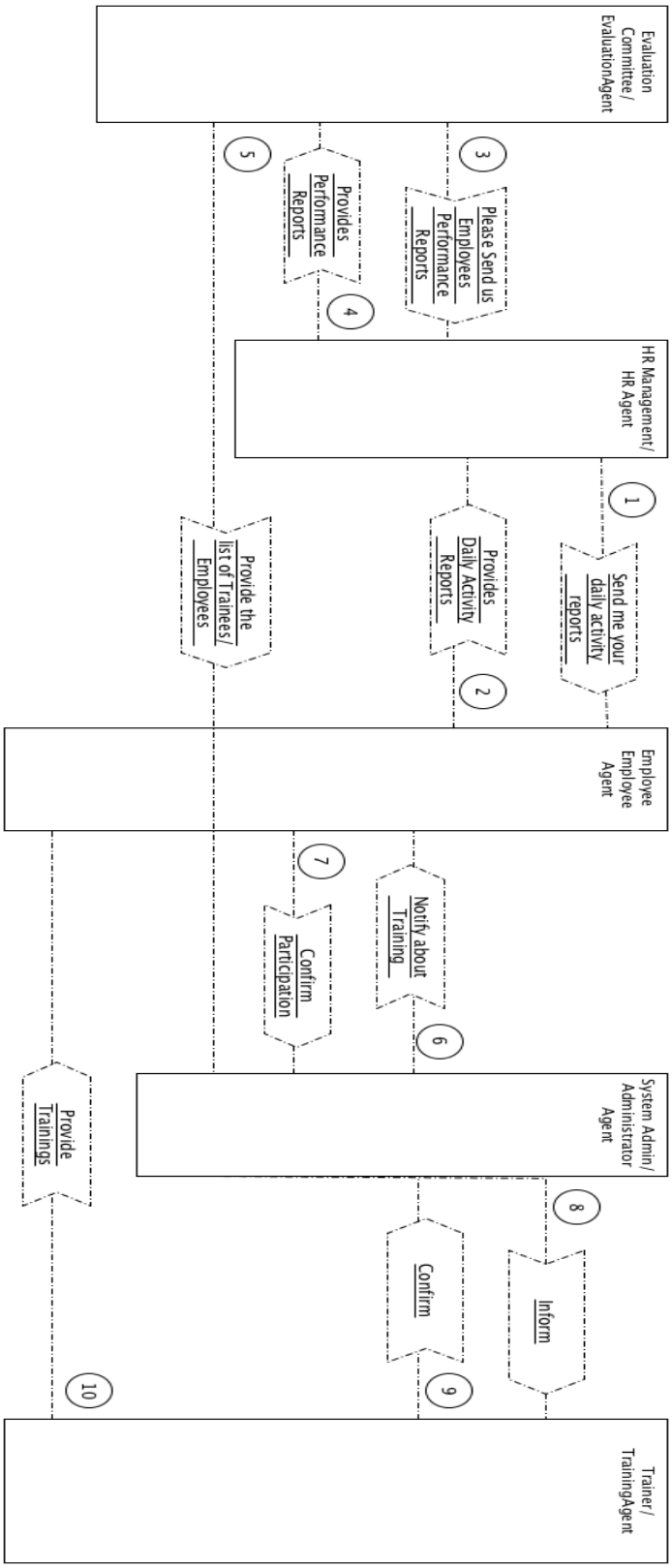

Figure 12. Interaction Model for Appraisal and Training (Nina Khomeriki)

4.2.1.3 Interaction Model for Payment

In the interaction model for payment three types of agents are involved that are listed below:

1.Admin/finance (Admin/finance Agent);

2. HR management (HR Agent);

3. Employee (Employee Agent);

In order for the HR manager to create attendance sheet for employees, the HR management records employees presence. Admin/finance asks for employees attendance, which is provided by HR management. Admin Finance prepares salary slip and asks an employee to sign it. Employee signs the salary slip, after which admin/finance enables the employee to receive his/her salary. After receiving the salary employee notifies the admin/ finance that it is received in order to confirm.

The interaction model for Payment is shown in figure 13.

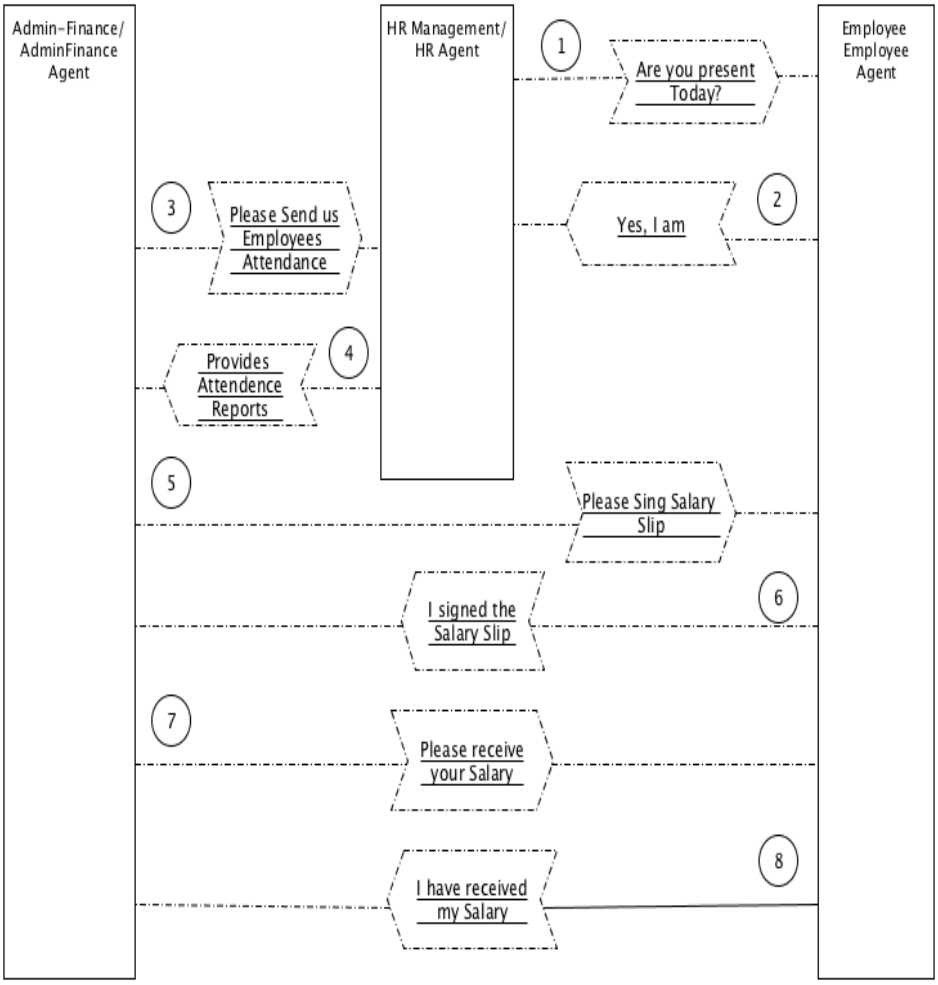

Figure 13. Interaction Model for Payment (Nina Khomeriki)

4.2.2 Knowledge Model

To fully gain insight into the e-HRM system domain and link all knowledge together as represented in figure 14, a knowledge model is needed. Knowledge is held by agents, rather that roles. Despite this, roles may become necessary in this kind of model, because the knowledge that the agent carries counts on the role(s) the agent has. Knowledge model demonstrates knowledge about the agent as well as agents and objects where the agent is present. By means of knowledge model, various agents are provided with a common framework of knowledge, which makes it easy for them to comprehend each other's interactions. [73]

According to this model, an organization and HR manager knows about all employees and each employee has one or multiple position cards. All the position cards are maintained by the system administrator. The training manager manages all the training conducted by an organization. All employees have to take part in the training. The admin/finance calculates employees salary and each employee can have only one salary for a position.

It should be noted that employee, system administrator, and HR manager are system users, which has a username, password, and a specific rule. Each organization conducts surveys, where each employee participates in surveys and all survey aggregates a sort of questions. With this, Evaluation committee evaluates all employees performance, for which the business process steps were described in figure 10.

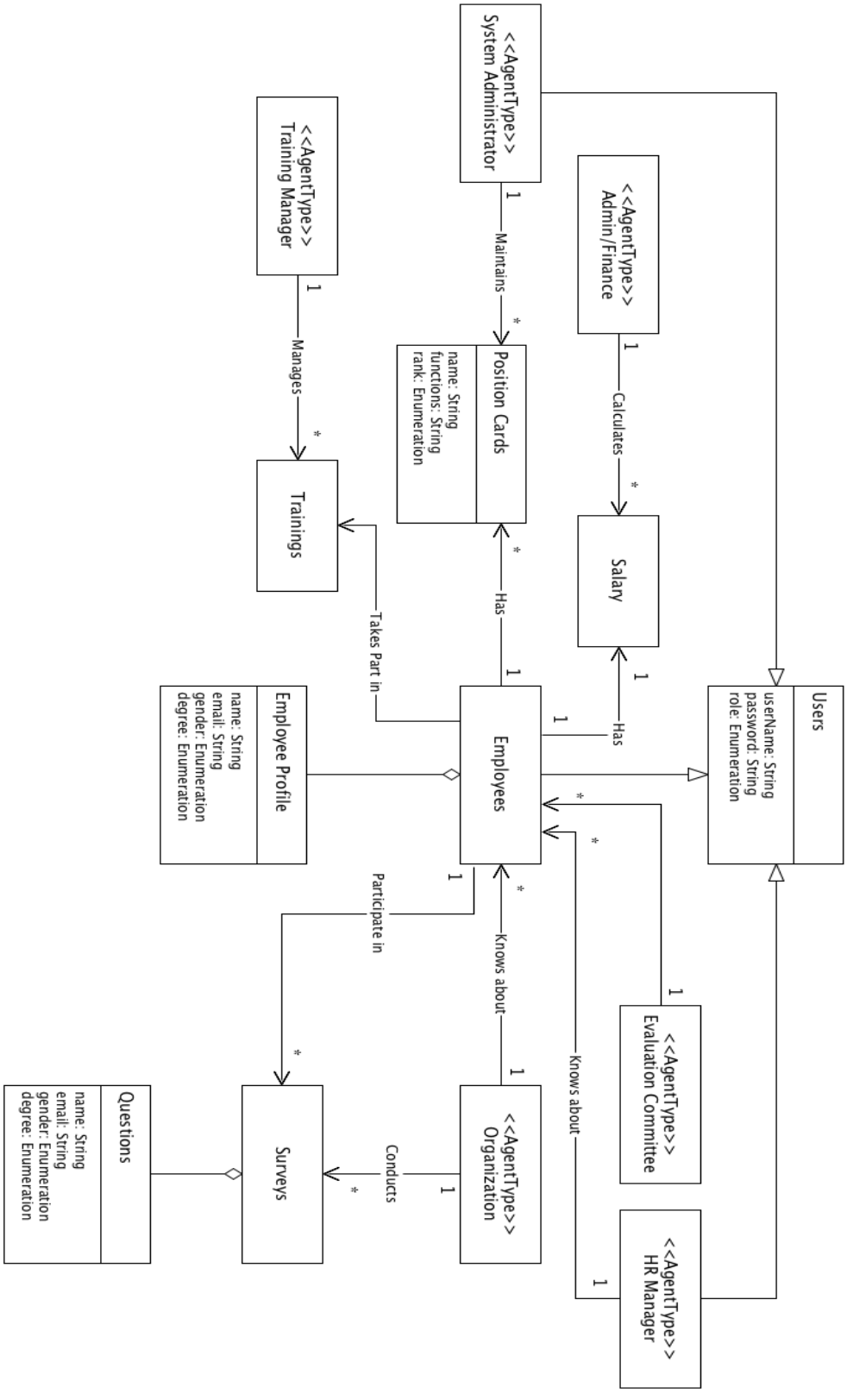

Figure. 14 Knowledge Model (Nina Khomeriki)

4.3 Preconditions for System Modules

It is important to discuss preconditions for the designed e-HRM system because it provides a valuable information for the functioning of the designed modules. Preconditions for the e-HRM system modules is presented in Table 8.

e-HRM system Modules	Preconditions
Basic module	- Existing digital data on organization structure, positions, and employees - Job analysis to be conducted
Performance Evaluation module	- Functioning Basic module - Evaluation criteria with relevant weights of competencies gained through conducted job analysis
Training and development module	- Functioning Basic module - Data gained through Performance Evaluation
Selection module	- Functioning Basic module. - Data gained through job analysis
Payroll module	- Functioning Basic module.

	- Internal job classifier and salary matrix developed via job evaluation. - Data gained through Performance Evaluation.
Reporting module	- All modules are functional

Table 8. Preconditions for e-HRM system modules (Nina Khomeriki)

4.4 Conceptual Architecture

e-HRM should be flexible enough for further development and step by step implementation. Therefore, it is proposed to develop e-HRMS as separate modules. To describe a conceptual architecture of the designed e-HRM reference model is created, which is shown in figure 15.

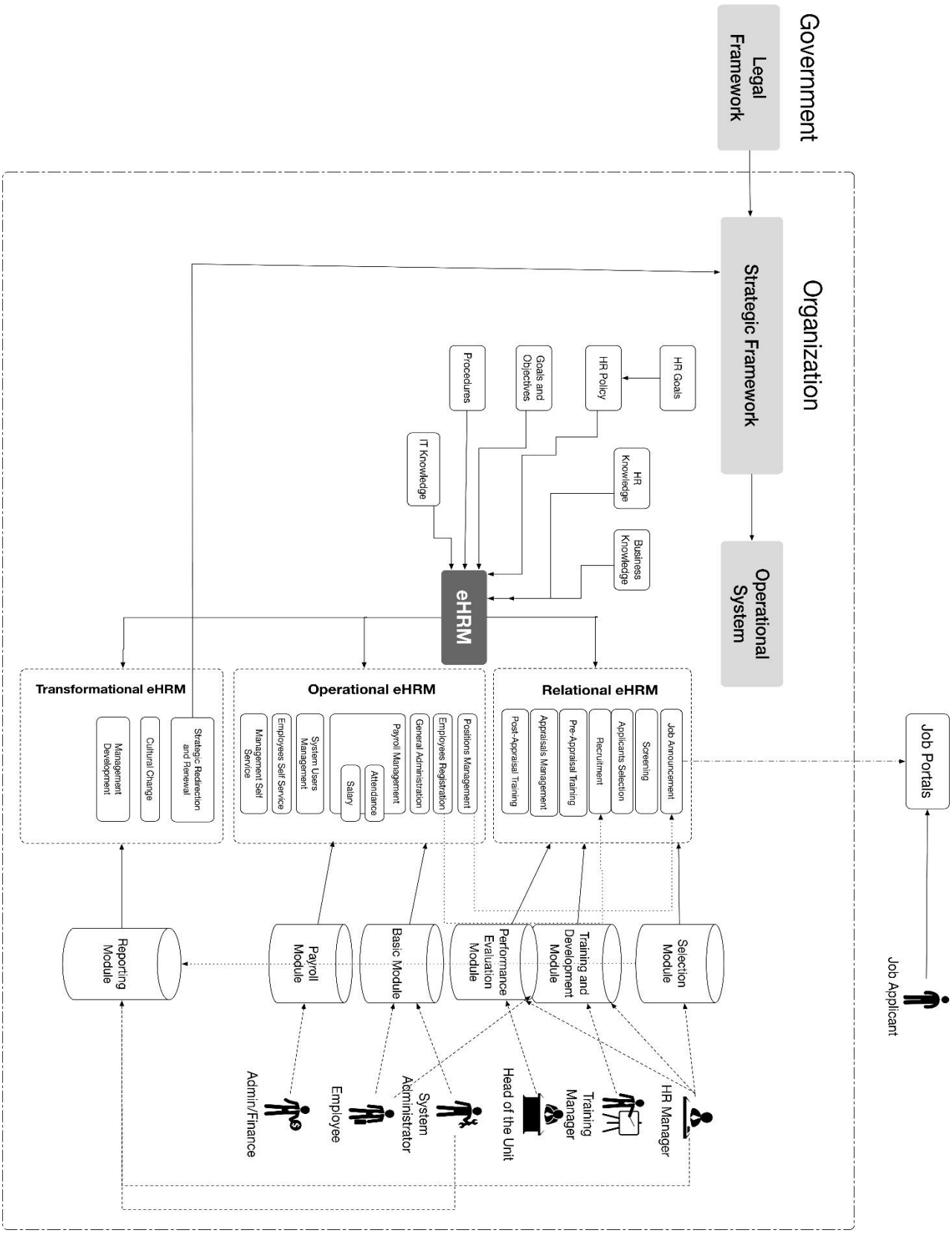

Figure 15. Reference Model (Nina Khomeriki)

According to the model, the government is associated with the legal framework for e-HRM system. Within organization strategic framework is analyzed. HR goals are formulated, which is followed by HR policy, its goals and objectives and specific procedures need to be taken into consideration for carrying out the set goals. Business knowledge, IT knowledge, and HR knowledge are needed to achieve efficient e-HRM. E-HRM itself is divided into three categories. In Relational e-HRM recruitment (selection module), training (training and development module) and performance appraisal (performance and evaluation module) take place. The process starts from job applicant introduced as an external actor. Internal actors, such as HR manager, training manager, head of the unit and employee provide the relational e-HRM. Operational e-HRM is concerned with the general administration of HRM, positions management, employees registration, system users' management, ESS and MSS (Basic module) and payroll (payroll module). In this case, remaining internal actors get involved, which include system administrator, admin finance, and employee. Transformational e-HRM deals with strategic redirection and renewal, progressive cultural change and management development, where reporting module plays an important role. The latter stores all reports from other modules, and compile information from other modules' data. It helps the decision makers to see statistics coming from the remaining modules and help them with strategy planning and modifications. HR manager and system administrator are the internal actors responsible for transformational e-HRM.

4.5 System Analysis

In order to fully understand the designed e-HRM, it is important to look at the components constructed it all together and integrated them. With the help of agent-oriented modeling conceptual space was determined. It should be noted that every kind of modeling, including AOM, is an abstraction and it may leave out important aspects of the factors changing the nature of the system functionality. However, it is a good way to understand and visualize e-HRM system in the most comprehensive manner. After building motivation layer for e-HRM system it became possible to move onto system design layer. Platform independent design showed interaction process between agents. It described the whole process and identifies each agent's type of interaction. Thus, interaction patterns among the agents were brought out in much more detail. The order of interactions was also determined. These models were built for recruitment,

appraisal and training and payment. Business process modeling for employee and structural units appraisal was done separately to draw a better picture of each step to be taken in the process. In domain models for e-HRM, it was fully understood how knowledge on an abstract level in e-HRM is expected to be coped with. In the design section of the e-HR system, it was possible to already model the knowledge of agents. Knowledge model was built to demonstrate a framework of knowledge for the e-HRM agents of the problem domain. This way it was possible to introduce knowledge each e-HRM agent and group of agents and objects in human resource management. Conceptual objects of e-HRM are used by the agents so that knowledge about resources employed is shown. The model also gave the opportunity to administer various e-HRM agents with a common framework of knowledge. The latter results in the agents understanding each other in interactions more easily.

Based on conceptual domain modeling and platform-independent computational design reference model was built. The reference model was capable of keeping all the knowledge needed by various actors to demonstrate the strategic integration of e-HRM. It expanded existing architecture for the conceptualization of the whole system and brought a more strategy-oriented approach to e-HRM. The conceptual architecture matched relational, operational and transformational e-HRM to e-HRM system modules. All the external and internal actors were linked to their functions in the conceptualization process. Therefore, it became possible to guide HR academics and practitioners to achieve strategic integration of e-HRM.

4.6 Conclusion

After collecting all the functional requirements necessary for the e-HRM system platform independent models were designed. It included important activities and actions within each module, rules, perceptions, agents and knowledge items. The goal model that is presented in the conceptual domain modeling is designed.

The conceptual architecture that is proposed as a reference model takes a big picture of the electronic human resource management. It stands out from the other e-HRM architectures because it offers strategic integration of the system. The reference model involves all the internal and external stakeholders to deliver the idea of efficient integration of human resources.

In this chapter, second research question has been fully answered.

RQ.2 How to design an integrated e-HRM system so that it is strategic?

Strategic integration of the e-HRM system involves the efficient cooperation of the E-HRM modules and organizations strategic framework. To answer this question the platform-independent computational design of Agent-oriented modeling is adopted, preconditions for the e-HRM system functioning is determined and conceptual architecture for the designed e-HRM is proposed.

a. What are the proposed platform independent computational design models for e-HRM?

- For performance appraisal module staff appraisal business process steps are described. Interaction models for recruitment, appraisal and training, and payroll is designed. Knowledge model is also built.

b. What are the pre-conditions for e-HRM system functioning?

- For each module of the designed e-HRM preconditions are determined so that the system is functional.

c. What is the proposed conceptual architecture for the designed e-HRM?

- Conceptual architecture is proposed for strategic integration of the designed e-HRM system. In the reference model, both external and internal actors and entities are brought out to see a big picture of the designed system. e-HRM is categorized and modules are linked to them.

It is very important to design e-HRM reasonably according to its needs. Any data system design and application should regulate the benefits it can bring to an organization. Hence, companies should have their business needs analysis carried out and remember these necessities in all modules of the system creating and application. Ultimately, enterprises decide the functionality anticipations of HRIS. [80]

Chapter 5 Adopting electronic Human Resource Management System

In this chapter, adoption and deployment of the designed e-HRM system is discussed. Section 5.1 analyses the factors influencing adoption of e-HRM, which includes organizational (5.1.1) and environmental factors (5.1.2). The first one consists of the need for efficient usage of human resource competences (5.1.1.1) and staff training (5.1.1.2). The second one puts stress on security and privacy in HRIS (5.1.2.1). Section 5.2 opens e-HRM system deployment discussion, where enterprise business process modelling is proposed. Business layer (5.2.1), application layer (5.2.2) and infrastructure layers (5.2.3) build the deployment model altogether. Section 5.3 Concludes the fifth chapter and answers the third research question of the thesis.

5.1 Factors Influencing Adoption

Many types of research have been done about factors influencing adoption of HRIS. The most popular factors are organizational, technological and environmental. [16] Since this paper has a strategic theoretical approach, organizational and environmental factors are analyzed. The theoretical framework of IT innovation adoption in e-HRM consists of three characteristics: Innovation (relative advantage, compatibility, and complexity), organizational (Top management support and HR expertise) and environmental (competition). [1]

5.1.1 Organizational Factors

The size of the organization is one of the organizational factors, which impacts the adoption of e-HRM. Its usage mostly depends on company's size and affordability to implement the IS. [8] Larger firms integrate much more tools, offered by HRIS than small and medium-sized firms (SMEs). [57] SME's should extend HRIS applications. [80] Mainly large organizations consider HRIS implementation. Nevertheless, e-HR can be used by all types of firms with different enterprises. [25]

Top management is the another factor in e-HRM adoption. The degree of centralization within organizational management practice can be considered as one of the additional factors as well. [6] Understanding Human Resource competencies and Staff training in HRM are crucial influencers for organizational factors in e-HRM.

5.1.1.1 Human Resource Competences

The key competencies for HR are mastery of HR technology, strategic contribution, personal credibility, HR delivery and business knowledge. [76] Most well-known work about HR competencies by Ulrich suggests two kinds of roles in HR management: Strategic and Functional. First one is associated with business-related works, and the second one with – credibility, delivery, and technology.

Concept mapping in HR competencies brings out leadership and relationship, cultural adaptability, strategic focus and drive, input and support, business awareness, HR acumen and technology in HRM field. [39]

A great number of findings mention that functional competencies are more sufficient than a strategic one, which argues that business roles and knowledge are more associated with strategic competence and self-assurance and social fields are supposed to be crucial in Functional competence. Moreover, the degree of technology being used in HR competencies in still debatable. [39], [13] Bell, Lee, and Yeung (2006) showed that while organization started applying e-HRM, HR staff needed more knowledge of business, technology, and HR delivery, which, as respondents claimed, lead them to be strategic business partners rather than casual employees.[53]

There are four main domains of competencies that e-HR brings to HR professionals, which include knowledge of the business, delivery of HR practices, change management and technology expertise in HRM. [9]

5.1.1.2 Staff Training

All users need training on operational and strategic levels to increase their knowledge in using e-HRM. Creating modern socio-technical systems need a high level of potential skills and their productive development.[14] Staff needs to raise its IT literacy and acquire e-learning [54] Technical/database skills are essential for the HR specialist to develop. [76]

HR professionals must understand the bidirectional connection between HR practices and the business. There are three learning strategies that can help HR professionals to prepare for the new role while adopting HRIS such as active learning, experiential variety and learning from errors. [9]

The resilience of changes and fear of the unknown can represent a big risk for the organization. Therefore, it is important to conduct necessary training. HRM staff competencies for using the electronic system should be reassessed and depending on the level of the IT literacy and understanding of the need for the e-HRM on strategic and operational levels. Abilities of the system should be defined in detail through premeditated training.

Staff who knows how e-HRM system works and how it assists the progress of their work, recognize the HRIS as more beneficial. [51] Training aims to achieve agreement between employee's responsibilities and individual ability. IT is utilized by HR to grow human input to the business. [35]

5.1.2 Environmental Factors

Industry Type, government regulation, legislation, and infrastructure are considered to be environmental factors of an organization. The government can play an important role in promoting technology adoption in organization and setting standards for HRIS.

Competition, labor market, compensation and employee relations also are considered as environmental factors for the company. In transnational organizations cultural and institutional, environmental factors impact on HRIS. Multinational companies should keep a ''right'' balance between local and international elements of HRM environment. To fit local market company must think globally. Staff with other cultural experience in organizations in other countries could process the obligatory HRIS usage in a different way. [51] For example, as Latin America's societies mostly rely on social relationships, it might be difficult to adopt some aspects of an e-HRM strategy, for instance, recruiting. It is important to explore how the social contracts environment might influence e-HRM acceptance and adaptation. The digital divide is a major difficulty that may create some problems for firms to implement an e-HRM strategy as well. [60] Field of e-HRM is wide, most of the researches were made in Europe and outside Asia, currently, studies in the various geographical area are lacking. [16]

5.1.2.1 Security and Privacy

Security and privacy are a top priority for any HRIS. [4] HRIS should supply precise and appropriate data to users of the system. The basic goals regarding privacy and security in HRIS are:

1) Country specific legislation on Information security and Personal data protection;

2) Information security related challenges associated with HRIS and e-HR;

3) Circumstances that impact HRIS and e-HR security. [82]

Information security deals with confidentiality and access level of HR information. Privacy refers to the fact that private data is safe from unpermitted access, access to the database is functional and service is supplied immediately to those who are permitted to utilize them. Establishing security profiles is a very important. They determine who has the access to specific data. Security profiles are attached to a job description. Users need to adhere to the company confidentiality and code of ethics policies. [14] The security is administered via users and user roles. [8]

HRIS must consider the following:

- Only relevant data should be captured;
- Data should be accurately maintained;
- Data should be retained for a reasonable time;
- Data should be used for legitimate purposes;
- Access to data must be controlled;
- Multiple systems should comply with generic assess standards;
- Data must be disposed of safety. [10]

Data security policy faces increased significance when introducing new HRIS functions is organization. [82]

5.2 System Deployment

The organization needs to adapt increasingly quickly to market changes and anticipate changing their business requirements and business goals so that it can stay competitive. This need influences the entire chain of activities of organization's business nature starting from the goals, organizational structure, business processes, application to the network and its technical infrastructure. [58]

Deployment sections of enterprise architecture modeling provide an integrated architectural approach that describes and visualizes the different business, application, infrastructure, domains and their relations for an integrated e-HRM system. Using these integrated architectures benefits organizations and key decision-makers in assessing the impact of system design choices, viewpoints, changes, and deployment.

''ArchiMate''modelling tool is used for enterprise architecture modelling of e-HRM system. The following architecture is divided into three layers. They consist of business, application, and infrastructure. It should be noted that each layer speaks its own language, draws its own models, processes, and relations. Existing and emerging standards of e-HRM system are used or integrated accordingly.

5.2.1 Business layer

The following diagram shows the metamodel of business layer concepts for e-HRM. This layer includes the business processes, business functions, interfaces and internal and external actors.

Enterprise architecture model for the business layer is presented in figure 16.

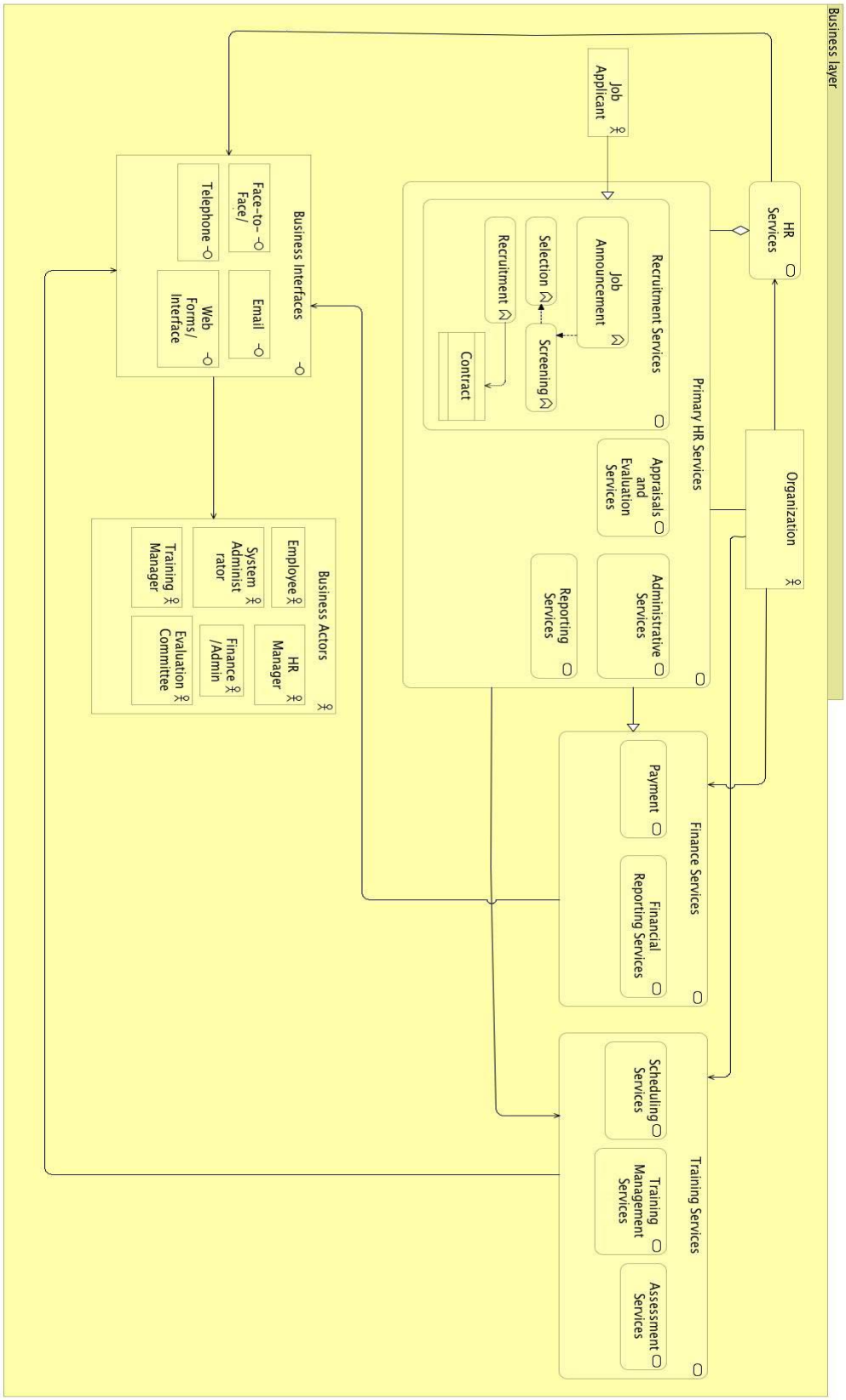

Figure 16. Enterprise Architecture Model for Business layer (Nina Khomeriki)

Following terms needs to be understood for defining the business layer.

Business function – major business functions of organization and their relationships in sense of flows of information, value or goods between them.[17]

Business process - high-level structure and composition of one or more business processes. It is seen as internal behavior performed by a business role that is required to produce a set of products and services.[17]

Business Actor – business role is assigned as a responsibility for performing specific behavior

Business Interface – Displays the functionality of a business service to other business roles that are provided by the interface. [17]

In order to fully demonstrate business layer elements following table 9 is made.

Type	**Elements**	**Description**
Business Services	HR Services	Management of HR
	Primary HR Services	Groups main HR services
	Recruitment Service	Manages job announcement, screening, selection and hiring services
	Appraisal and evaluation services	Manages employee and structural unit appraisal and evaluation
	Administrative services	Manages staff and organization's administration
	Reporting services	Statistical analysis of e-HRM system, reporting from each service
	Finance services	Administration of Reward management
	Payment	Performing payment of salaries and calculating deductions
	Financial reporting services	Reporting administration of

		financial operations
	Training services	Management of staff training
	Scheduling services	Arranging timetables for training, reservations for classroom and inventory
	Training management services	Recommending training and enrolling participants
	Assessment services	Evaluation of trainers and training courses
Business Functions	Job announcements	Management of job announcements
	Screening	Pre-selection arrangement administration for recruitment
	Selection	Interviewing and test administration for job applicant
	Recruitment	Hiring and adapting new employee
Business Interfaces	Face to face/video	Face to face/Video, email and telephone streamline communication to administer Primary HR services, finance services, and training services. Web-forms adopts the communication purposes but is also used for data entry and maintenance
	Email	
	Telephone	
	Web-forms/interface	
Business Actors	Organization	Unit of people structured to meet a need or reach collective goals

	Job applicant	Person applying for a job
	Employee	Person working for organization
	HR manager	Arranging recruitment, employee performance evaluation, mediating among employees and managing HR department
	System administrator	Managing maintenance, configuration and operation of e- HR services
	Finance/Admin	Performing financial administration for payroll
	Training Manager	Arranging and running training courses
	Evaluation committee	Manages employee's and structural units performance appraisal

Table 9. Business Layer Elements (Nina Khomeriki)

5.2.2 Application layer

The following figure gives an overview of the application layer concepts and their relationships. It describes how applications are used to support one or more business processes and how they are used by other applications. It can be used in designing an application by identifying the services needed by business processes and other applications, or in designing business processes by describing the services that are available. Furthermore, it identifies the dependencies of business processes upon applications, it may be useful to operational manager responsible for these processes. The application layer supports the business layer with application services, which are realized by (software) applications. [17] Figure 17 presents application layer.

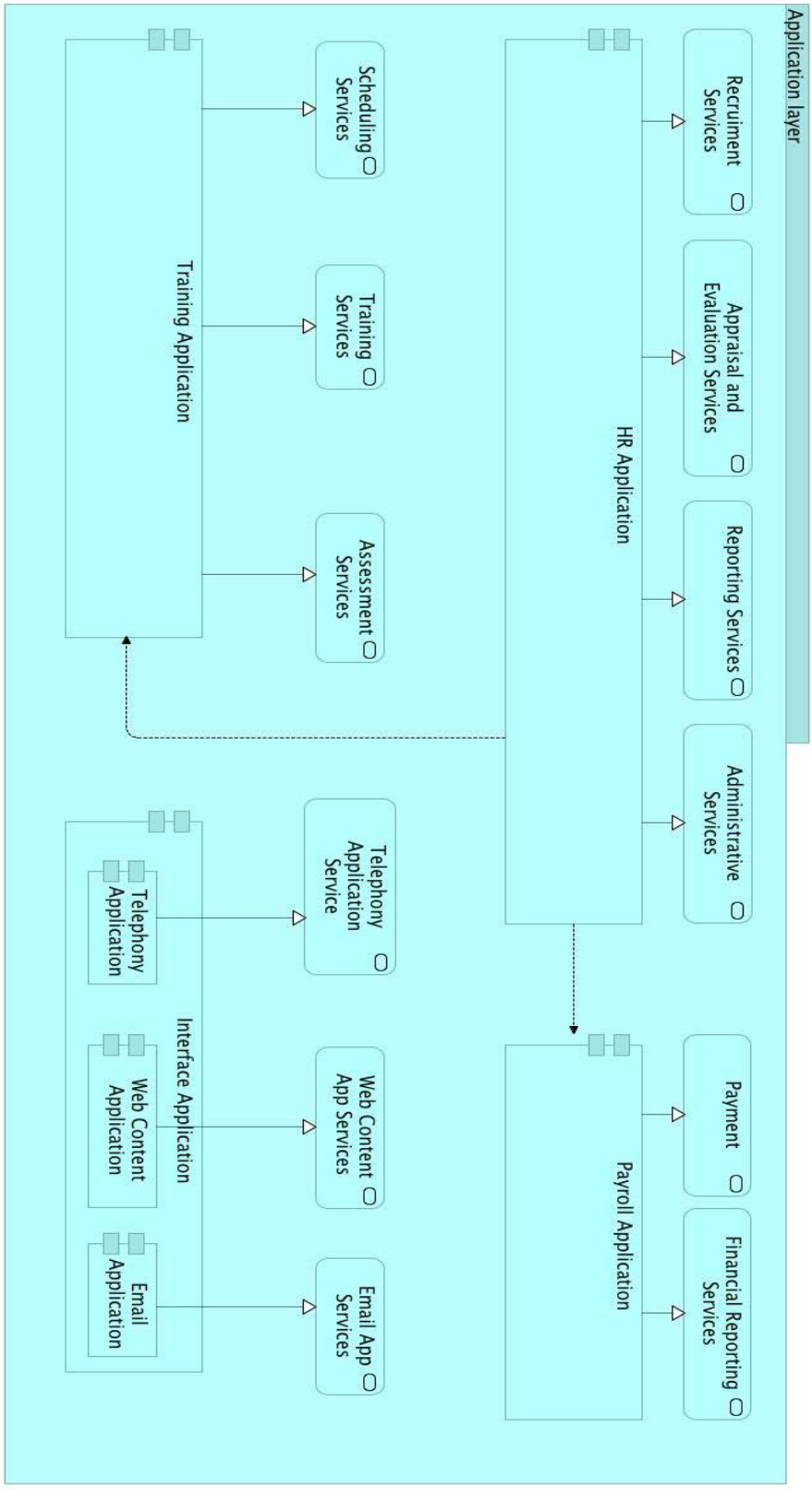

Figure 17. Enterprise Architecture Model for Application layer (Nina Khomeriki)

In order to define application layer following terms needs to be outlined.

Application component- ‘’the main structural concept for the application layer is the application component. This concept is used to model any structural entity in the application layer. It is a modular, deployable and replaceable part of a software system that encapsulates its behavior and data and exposes these through a set of interfaces.’’ (p.3)[58]

Application service - ‘’An application service exposes the functionality of components to their environment. This functionality is accessed through one or more application interfaces. An application service is realized by one or more application functions that are performed by the component. It may require, use, and produce data objects’’(p.5)[17]

Application services for services represented in business layer consist of the following:

- HR application services provide recruitment services, appraisal and evaluation services, reporting services, administrative services.
- Payroll application services include payment and financial reporting services.
- Training application services provide scheduling services, training services, and assessment services.
- For communication purposes Telephony, Email and Web content Application services are developed. The latter is also used for data entry and maintenance.

5.2.3 Infrastructure layer

The infrastructure layer includes the hardware and software infrastructure on which application layer depends. It consists of physical devices and networks along with supporting system software such as operating systems, databases and middleware. [58]

Figure 18 introduces enterprise architecture model for infrastructure layer.

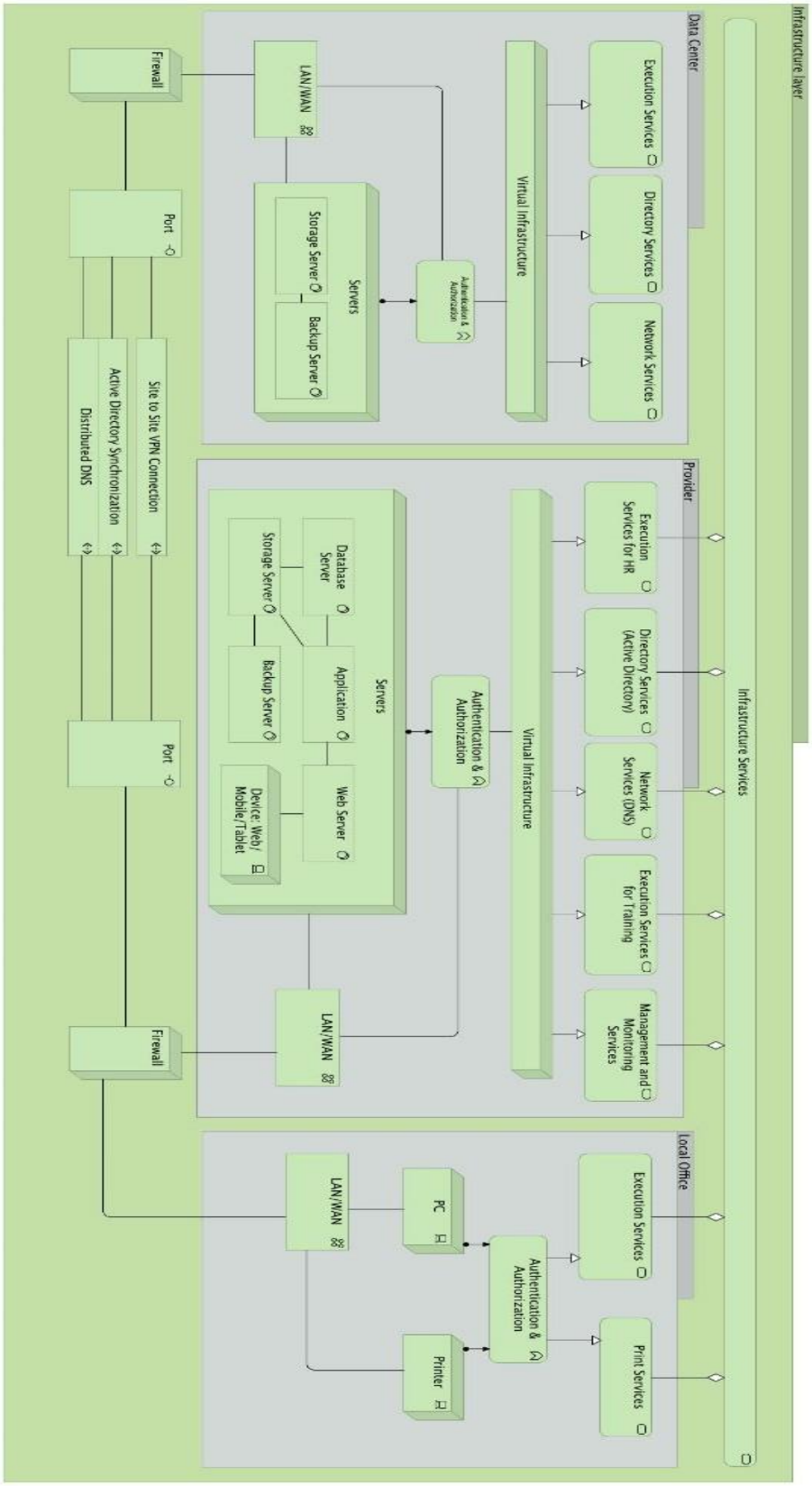

Figure 18. Enterprise Architecture Model for Infrastructure Layer (Nina Khomeriki)

Infrastructure layer is divided into three parts.

1. Provider- this is the core of infrastructure layer, which provides the essential technical services, virtual infrastructure, local area network, authentication and authorization mechanism and all the relevant servers. This part comprises the essential execution, directory, and network services.
    a. The execution services are considered to provide all the necessary technical solutions for the application layer.
    b. Since the designed e-HRM is an internet based system, and domain name services (DNS) are the central part of Internet, Network services are considered to provide DNS and all the remaining network services that are required. ‘’Directory services are the crucial component of a network operating system, which is a customizable information store that functions as a single point which users can locate resources and services distributed throughout the network’’.
    c. The virtual infrastructure provides a selection of interfaces for the servers to be accessed via secure authentication and authorization channel by execution, directory, and the network services.
    d. In order to access the servers, the technical services should be authenticated and authorized.
    e. All the technical components including services, storage, servers and the devices are connected through a secure local or wide area networks
    f. The database server provides the database services including accessing and retrieving data from HR database, data analysis, storage, data manipulation and archiving.
    g. Web server hosts the e-HR web application and processes all requests via hypertext transfer protocol (HTTP).
    h. The application server provides middleware services for security and state maintenance along data access and persistence. Additionally, it serves business logic to e-HRM application through any number of protocols.
    i. The storage server is connected to an e-HR network that provides a location for shared disk access, such as documents, sound files, images, databases, etc.

j. Backup server – this server is responsible for backing up and restoring files, folders, databases and hard drives on the e-HR network in order to prevent the loss of data in case of a hard drive failure, user error, external or internal disaster or accident.

k. The designed e-HRM system can be accessed through a browser, mobile device or tablet. All requests go to the webserver via a secure network infrastructure.

2. Data center – the data center is considered as a facility to house computer systems and associated technical components such as telecommunications and storage systems to organize, process, store and disseminate a large amount of data.
3. Local office – any organization can have multiple local offices, where the local offices are the e-HRM service consumer.
4. Firewall and Virtual Private Network (VPN) as network security system that monitors and controls the incoming and outgoing network traffic based on pre-determined security rules.

In order to define infrastructure layer elements table 10 is created.

Type	**Element**
Technology Services	Infrastructure Services
	Execution Services
	Directory Services
	Network Services
	Management and Monitoring Services
	Print Service
Node	Virtual infrastructure
	Servers
	Firewall
System Software	Database Server
	Application Server
	Web Server
	Storage Server
	Backup Server

Communication Network	LAN/WAN
Devices	PC
	Printer
	Web/Mobile/Tablet
Technology Interface	Port
Path	Site-to-Site VPN Connection
	Active Directory Synchronization
	Distributed DNS

Table 10. Infrastructure Layer Elements (Nina Khomeriki)

5.3 Conclusion

In this chapter, the third research question was fully answered.

RQ.3 How to rapidly deploy a strategy-matching e-HRM system that predominantly uses open-source software, while the remainder should be populated with commercial software solutions? The answer to this research question consisted of two parts. First part identifies factors influencing adoption of e-HRM as the main goal of the chapter is to deploy the designed e-HRM system.

a.What are the factors influencing adoption of e-HRM?

- Considering the fact that this thesis takes a strategic approach, two factors were discussed that can influence adoption of e-HRM. These factors are organizational and environmental. First, underlines the importance of HR competences and its usage in e-HRM. The size of the organization, as well as the degree of centralization within organizational management practice, can influence e-HRM. It is clearly outlined that staff training is needed for e-HRM on both operational and strategic levels. Environmental factor showed that government as an external actor can have a big impact on promoting HRIS and legal standard for HRIS can give the main direction for the management. Cultural and social aspects along with a level of IT literacy within the organization needs to be considered in e-HRM.

b. What is the proposed deployment model for the designed e-HRM system?

- Enterprise architecture modeling is chosen to deploy the designed e-HRM system. The architecture is introduced on business, application and infrastructure layers, which are interconnected. In business layer, e-HRM system business services, business functions, business interfaces and business actors were identified in detail. In application layer applications are connected to the corresponding elements shown in the business layer as well as infrastructure layer. As for the infrastructure layer, it provides infrastructure services, which is divided into the data center, provider, and local office. In infrastructure layer, technology services, node, system software, communication network, devices, technology interface and path are shown in depth. These three layers are connected in a way, which makes it possible to deploy the designed e-HRM system.

Chapter 6 Conclusion

This chapter provides summary of research findings (6.1), concludes the answers for the proposed research questions (6.2), states the limitations of the study (6.3) and addresses future of the designed e-HRM research (6.4)

6.1 Summary of Findings

This thesis investigates possibilities to achieve strategic integration of electronic human resource management. After mapping the existing open-source and commercial solutions to e-HRM requirements it was found that there is recruitment requirement, employee performance monitoring requirement and performance evaluation requirement, training requirement and payroll requirement, which all have general requirements.

It was found that e-HRM system should be modular by nature. e-HRM system functional requirements was divided into a basic module (foundation software), performance appraisal module, a selection module, training and development module, payroll module and evaluation module. These modules are integrated and function separately at the same time depending on the strategic needs of the organization.

Conceptualization of the e-HRM for strategic integration of e-HR resources was proposed because there was a need for expanding already existing e-HRM architecture in several settings. A conceptual architecture for strategic integration of human resources showed that government and job applicant as external actors, while within organization strategic framework and operational system are divided. e-HRM starting point is setting HR goals, which derives from organizations strategy. HR policy and its goals and objectives need to be harmonized with the latter. HR, Business and IT knowledge is needed to perform efficient e-HRM. e-HRM is divided into three categories. First is relational where selection module, training and development module and performance evaluation module are found. Second refers to operational e-HRM, where basic module and payroll module functionalities are performed. Lastly, transformational e-HRM is expanded, which helps to carry out the strategic framework of the organization and is linked to reporting module.

Deployment of the designed e-HRM system should be implemented considering the requirements derived from the business, system application, and system infrastructure perspectives.

Based on the above-mentioned findings, this master thesis was able to achieve its goal and reach the strategic integration of e-HRM.

6.2 Answers to Research Questions

This master thesis main research question, on which other research questions were based, was how to achieve strategic integration of electronic human resource management. This question was answered by means of the conceptual architecture of e-HRM as a reference model, which was deployed later on. The conceptual architecture divided all the external and internal actors and entities in the process of strategic integration and narrowed it down to e-HRM system design.

In order to fully answer the central question of the thesis three research questions were formed.

RQ.1 how to determine and organize requirements for integrated e-HRM?

The answer to this research question was built on existing open-source and commercial solutions for e-HRM system. Recruitment, performance monitoring, performance evaluation, training, and payroll were identified as the requirements, which were unified under general requirements. The latter includes compliance with legislation and best practices, system privacy and security considerations, system administration and interoperability. Conceptual domain modeling, using agent-oriented approach, showed the system goals, roles, organization and domain modeling in the investigated field. After that, functional requirements of the e-HRM system modules were identified, where unified modeling language was used to fully display the functionalities. Basic module carries out the administrative functions of the system, which includes maintaining organizational information, position cards, employee individual cards, system users and views system logs and activities along with granting/revoking privileges. For performance appraisal module management by objectives and 360 degree appraisal methods were chosen. Selection module, which deals with recruitment, adopted test formation and administration, scoring and reporting the test results functionalities. In training and development module management of training courses are developed. It is possible to create training, recommend and enroll employees

into the chosen training. This module is capable of scheduling and reserving training inventory, assessing trainers and generating all relevant statistics for strategic development purposes. Payroll module calculates gross and net salary and generates financial reports. Evaluation module store all the reports retrieved from the remaining modules to help organization's top management deal with strategy modifications in HRM and raise its voice to make all the necessary progressive changes for organizations competitiveness on market.

RQ.2 how to design an integrated e-HRM system so that it is strategic?

In order to answer this research question platform-independent computational design, using agent-oriented modeling, was adopted. Interaction models were developed for recruitment, appraisal and training and payment, which was followed by knowledge model. System design layer displayed all the activities and actions related to goals that were formed after answering the first research question. Depending on relevant legislation, organization's policies and role models rules, perceptions and agents interactions were shaped. On the other hand, domain entities lead to developing knowledge items in e-HRM. Performance appraisal business process steps were described both for employee performance and structural unit's performance, for which business process modelling was proposed. Employee, evaluation council, head of the unit and appeals commission is involved in step by step performance evaluation process that was designed for organization. For each module pre-conditions for their functioning was determined and categorized. All the study outcomes that were gathered in second, third and fourth chapters was mapped onto the conceptual architecture of strategic integration of e-HRM. Reference model creates a vivid picture for both academic and practitioner e-HRM researchers regarding the ways of achieving strategic integration of the system. Within the organization, there is a strategic framework and operational system. HR goals lead to HR policy with its goals and objectives and with the help of necessary procedures e-HRM is formed. It is important to understand that, HR knowledge, business knowledge, and IT knowledge are needed for the efficient and effective e-HRM. e-HRM is divided into relational, operational and transformational management. Relational e-HRM gathers all the functionalities with corresponding actors and entities of selection, performance evaluation, training, and development module. Operational e-HRM adopts Basic (administrative function as a foundation software) and payroll module functionalities referring to all the actors involved. Transformational e-HRM is concerned with strategic redirection and renewal, cultural change

and management development. This conceptual architecture managed to bring conceptual domain modeling and platform-independent computational design altogether to draw a clear picture how strategic integration of e-HRM should be perceived.

RQ. 3 How to rapidly deploy a strategy- matching e-HRM system that predominantly uses open-source software, while the remainder should be populated with commercial software solutions?

In order to come up with a clear answer to this question, it was necessary to first analyze factors influencing adoption of e-HRM in an organization. The study showed that there are organizational, technical and environmental factors influencing the whole process. In organizational factors, the main focus is put on taking the fullest advantages that human resource competencies can offer. It is very important that staff and top management is trained for efficient e-HRM deployment. Training has a big impact on gaining benefits of e-HRM. The size of the organization and the level of centralization of the top management can have an influence as well. Regarding environmental factors, legislation and strategy framework plays an important role. However, cultural and social aspects are seen as influencers on e-HRM too.

Enterprise architecture modeling is used to deploy the designed e-HRM system. The architecture is shown in business, application and infrastructure layers, which are interconnected to provide rapid deployment of the designed e-HRM.

6.3 Research Limitations

The number of existing solutions for HRIS that was investigated in this master thesis is limited to ten open-source and one commercial system solution.

6.4 Future Work

There are several directions for the future work that can be outlined for the designed e-HRM. The system's functional requirements can be expanded by adding pension administration, information about health and safety (data on the accidents, health/safety complaints, resolutions and related forms) and displaying labor relations (information on seniority lists, union membership, grievances). Additionally, evaluation measurement criteria can be developed based on the goal model created for conceptual domain modeling. Further empirical research in real life scenario about system's effectiveness based on the criteria is encouraged.

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