Information Technology Meets Management in Knowledge Economy

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Preface

In their seminal paper, Walter W. Powell and Kaisa Snellman state that „the key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources" [4]. This observation is of central interest to scientists and practitioners of both management and information technology. Management has to move its focus and change its ways. Information technology has to provide tools and methods adequate to new information processing challenges.

This monograph spans across various topics, covering recent developments in IT and management that address the emergent problems of knowledge economy. It starts with a high note, presenting breakthrough results obtained by Tomasz Zdziebko and Piotr Sulikowski in the area of customer shopping preference identification based on indicators derived from implicit feedback. This is a model example how IT can support progress in management by establishing new sources of data and providing methods to handle it.

Roger Bivand in his early paper on Open Source software called it "a challenge to all organisations […] that are at the heart of the emerging knowledge economy" [2]. Cezary Orłowski, Bartosz Chrabski and Kamil Dowgielewicz contribute to solution of this challenge with their concept of an inference engine of a reference model for the development and selection of Open Source tools, described in chapter two.

The third chapter, by Tomasz Klasa, takes on another important aspect of a knowledge economy, that is the security of its crucial resource: information. He proposes a new method, capable of providing an answer to a question whether specific organization's information system as a whole is secure or not, with the focus on virtual organizations.

In the following chapter, Krzysztof Bartczak brings forth another interesting notion – of business process management effectiveness, discussing related issues and expected benefits.

A famous catchphrase, popularized in Poland by Zdzisław Szyjewski [7], says “you can't manage what you can't measure”. Already in 1978 Shahid L. Ansari and Diana Flamholtz identified the purpose of Human Resources Accounting as to “provide concepts and measurements to facilitate the effective and efficient management of human resources” [1]. In chapter five, Arkan Thomas Klozy builds a new level of abstraction upon it, by proposing a model for measurement of Human Resources Accounting itself.

The increasing economic importance of knowledge redefines the links among education, work and learning [5]. The following two chapters are devoted to solutions addressing this situation. In chapter six, Aneta Poniszewska-Marańda and Marta Chruściel describe the concept of Internet treasure hunt as a new approach in learning digital skills by seniors, which is very consistent with the notion that knowledge economy made education a lifelong process more than it had ever been before [3]. In chapter seven, Jan Zych focuses on the power of contemporary IT systems in simulating real-world environments, by providing an example of a computer war game: the GAMBLER and describing a number of crucial structural elements of that system.

The GAMBLER is a good example of a serious game. As much as serious games can be useful for training, a much more convenient vehicle for building intrinsic motivation among employees is gamification, which uses selected game design elements in non-game contexts [6]. The final chapter, by Kinga Gruszecka, gives vivid insights on how a boring job can be turned into exciting fun.

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Chapter 1

Customer shopping preference identification with classification trees

1.1. Introduction

Dynamic development of recommender systems in e-commerce is connected with the need to sell more on the one hand and the need to buy the right product fast, on the other hand. The role of the systems is to provide customers with product or service recommendations. It is well known that best recommendations are those suited to individual customer needs. In order to deliver appropriate recommendations prior identification and observation of customers is necessary as well as further modelling of their behaviors.

According to R. B. Allen a model of a user is a description of them, created or selected by a system to ease interactions between the system and the user [1, 511-543]. M. Próchnicka defines user modeling as a process leading to building an "image" of a user [14]. A digital representation of a user model is a user profile, which reflects their preferences [12]. User modeling utilizes relevance feedback techniques, which can be performed in a direct or an indirect manner (explicit and implicit feedback).

Direct preferences observation consists in enquiring users about them. According to J. Nielsen, it is the users who usually know better about their own preferences, needs and goals [13]. Explicit feedback on preferences can be obtained e.g. via quick product satisfaction surveys or by collecting textual comments on products. In most cases, however, interrogating the users about their preferences is either impossible or undesirable. For example in online sites users would prefer to achieve their ultimate goals as soon as possible and may not be interested in an additional communication burden. According to some research, asking users about the preferences interferes with the realization of tasks or even irritates [10, 168-175]. The users are unwilling to take extra actions if they (in their view) do not bring them extra benefits [7, 35-92]. It often leads to resignation from expressing opinions on browsed products [2, 40-88].

Thus, direct user preference collection in practice does not bring satisfactory results and implicit feedback techniques are often used instead. It means secret observation of user interactions with the system, such as a website. Data gathered during such observation are used in the inference process and the underlying interests and preferences may be discovered. Although usually less precise [16, 55-60], the implicit techniques are devoid of grave disadvantages of the explicit techniques since preference discovery takes place in a transparent way, invisible to the user, who is not being distracted or requested to perform extra tasks.

Data registered during observations may be used to establish various indices describing multiple aspects of interactions with a website. There is a certain set of indices which may be used to infer about user interest in a product or service. However, researchers differ in terms of particular meaning assigned to a behavior. For instance, some authors claim that total distance of horizontal scroll of page content is positively correlated with the level of user interest, while other authors do not confirm that. The differences may result from the fact that the analyzed phenomenon is a complex one and there may well not be one best modelling approach. There research in the field is scarce, which is confirmed by D. Kelly [11, 169-186], J. Goecksa and J. Shavlik [6] as well as G. Velayathan and S. Yamada [15].

Obtaining real-life data on user behavior constitutes a great challenge since they are guarded by e-commerce companies as a crucial marketing asset. There are some works [3] where authors monitored real user behaviors during visits to various website, not necessarily e-commerce ones. They showed modelling approaches based on correlation analysis or classification trees. They do not take into account, however, the specificity of e-commerce websites.

Recommender systems, like other data mining related systems, may use a number of modelling methods, such as KNN, genetic algorithms, decision trees, association rules, grouping, regression, Bayes networks, neural networks, rough sets etc. Since there is no single best one of them, in each modelling scenario the choice of method should take into account the details of the analyzed problem. For a classification problem, considered in this paper, the goal of classification, the data structure and the characteristics utilized were considered [8, 523-541].

1.2. Scientific study procedure

In order to gather a rich set of data concerning behavior of e-customers we have built ECPM – E-commerce Customer Preference Monitor – an extension for Firefox browser. This technology was chosen due to its popularity and numerous possibilities. ECPM allows monitoring of various user interactions with a website by utilizing DOM (Document Object Models) events model. Participants willing to take part in our study only had to install the ECPM extension.

ECPM was instrumented to actively monitor user's activity on product pages for five major Polish online stores: Merlin.pl, Agito.pl, Electro.pl, Empik.com and Morele.net. After a few simple modifications ECPM may be used to monitor behaviors on any website.

ECPM unobtrusively monitors interactions only with selected online stores. In case of privacy concerns, participants could disable the extension or check the dataset collected during the study. ECPM collects data on visited product pages and user interactions with them. Our extension registers numerous parameters describing physical attributes of the page and the interactions.

Additionally, in order to measure user interest in viewed products, every time a user leaves a product page, an interest evaluation pop-up window containing two questions is displayed. The first one asks how much a certain product is of interest to the user. It allows the user to express their explicit interest in the product on a five-point scale. The second question checks if the user has been familiar with the product before the study (on a Boolean scale). After filling the form the answers are stored so that if the user revisits the product page, the form displayed upon leaving will already contain previously selected answers.

Apart from non-relative indices, derived directly from user behaviors, several relative indices taking into account inherent webpage characteristics were also constructed. A complete list of all indices and parameters of visited product pages is presented in Table 1.1.

Table 1.1. Parameters registered by ECPM

Parameter	**Description**
Mark	Product interest assessment

Familiar	Familiarity with the product
Parameters describing product page attributes	
document_length	Number of characters within all texts on the page
desc_length	Number of characters within product description
review_length	Number of characters within product reviews
recommend_length	Number of characters within other recommended products section
image_number	Number of product images
page_height	Page height in pixels
Parameters describing user interactions times (in ms)	
page_time	Time between page load and page unload
tab_activ_time	Time while tab containing particular page is active
user_activ_time	Time while user is actively interacting with page (generating keyboard or mouse events)
prod_desc_time	Time while mouse pointer is positioned over product description
prod_recommend_time	Time while mouse pointer is positioned over other recommended products section
prod_review_time	Time while mouse pointer is positioned over product reviews
prod_image_time	Time while mouse pointer is positioned over product images
prod_other_time	Time while mouse pointer is positioned in other sections of the webpage
Parameters describing user behavior	
mouse_distance	Total distance (in pixels) of mouse pointer movement
horizontal_scroll	Total distance (in pixels) of horizontal scroll of page content
vertical_scroll	Total distance (in pixels) of vertical scroll of page content
mouse_clicks	Total number of mouse clicks regardless which mouse key is pressed
lb_mouse_clicks	Total number of left mouse button clicks
rb_mouse_clicks	Total number of right mouse button clicks
mb_mouse_clicks	Total number of middle mouse button clicks
copycut_action	Total number of copy/cut actions performed via keyboard shortcut
select_action	Total number of page content selection actions

select_text_size	Total number of selected characters
keydown_single	Total number of key single pressing events
keydown_repeatable	Total number of key repeatable pressing events
find_action	Total number of find actions performed via keyboard shortcut
print_action	Total number of print actions performed via keyboard shortcut
bookmark_action	Total number of bookmarking actions performed via keyboard shortcut
save_action	Total number of save actions performed via keyboard shortcut
resize_action	Total number of page resizing actions performed via keyboard shortcut
search_referral	Boolean value indicating whether search result page was source of visit on product page
Relative parameters describing user behavior	
rel_page_time	page_time / document_length
rel_user_activ_time	user_active_time / document_length
rel_tab_active_time	tab_active_time / document_length
rel_prod_desc_time	prod_desc_time / description_length
rel_prod_recommend_time	prod_recommend_time / recommendation_length
rel_prod_review_time	prod_review_time / review_length
rel_prod_image_time	prod_image_time / image_number
rel_mouse_distance	mouse_distance / page_height
rel_vertical_scroll	vertical_scroll / page_height
rel_horizontal_scroll	horizontal_scroll / page_width

1.3. Results

1.3.1. Statistical analysis

During the study, which lasted 7 months, 85 participants volunteered. They rated 1396 products in total. Their interaction with visited product pages was monitored as proposed in the previous chapter. Minimal number of products rated by user was 1 and the maximal 116, which shows great disproportion between user engagement. The mean number of products rated by one user was

16,42. About half of the participants rated fewer than 7 products while upper quartile of users rated more than 20 products.

Due to significant differences in user engagement we have decided to build models on two datasets. One set contained data collected for all participants, whereas the other set included data for most active participants, who had rated at least 30 products each. The most active group rated 494 products in total. Distribution of product ratings of all participants shows that mainly higher marks were provided (Table 1.2).

Table 1.2. Product ratings distribution

Rating	Number of ratings
1	130
2	180
3	325
4	346
5	415

Users rated the highest number of products in merlin.pl store – 454 product pages were visited. In Komputronik.pl, Morele.net, Agito.pl and Electro.pl users rated 267, 238, 218 and 205 products, respectively. Users tended to give higher ratings to products known before the study (Figure 1.1).

Product interest ratings were additionally transformed from the 5-point nominal scale into the binary scale. Values 1 and 2 were transformed into binary value 0 meaning total lack of or very low interest. Values 3, 4 and 5 were transformed into binary value 1 meaning interest in product. This transformation was motivated by the type of input commonly required by recommender algorithms.

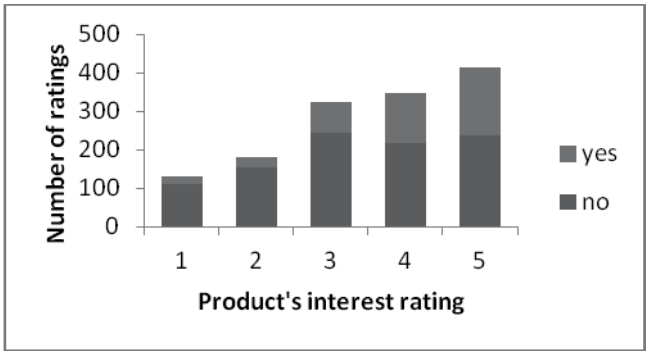

Figure 1.1. Ratings distribution and product familiarity (yes – product known before, no – product not known before).

1.3.2. Classification trees construction procedure

In the process of selecting variables for the classification models, we used the Kruskal-Wallis test and the analysis of Kendall rank correlation coefficients. On the base of this analysis the following variables have been selected for decision tree building: *desc_length*, *keydown_single*, *lb_mouse_clicks*, *mouse_clicks*, *mouse_distance*, *page_height*, *page_time*, *prod_desc_time*, *prod_other_time*, *prod_recommend_time*, *rel_prod_review_time*, *search_refferal*, *tab_activ_time*, *user_activ_time*, *vertical_scroll*.

The classification model of product interest was built with SAS Enterprise Miner (SAS EM) software. As the criterion for selecting best models the misclassification rate has been chosen. We have applied 10-fold cross validation method. As the stop criterion preventing over-fitting of the tree we used the minimal leaf size – 20, and maximal branch number – 3.

An equal number of cases in each predicted class (rating) were selected for the purpose of the tree learning procedure. This type of selection allowed us to assess predictive capabilities of the model for each class. From the whole dataset where interest was expressed on the nominal scale, we have randomly chosen 650 cases, that is 130 cases per class.

1.3.3. Classification tree models for all participants

As a result of applying the above procedure for the whole dataset we managed to build a tree whose misclassification rate was equal to 59,2%. It means that this tree has a better predictive accuracy than a random model with a misclassification rate of 80%. The confusion matrix (Table 3) shows that the best predictive accuracy is achieved for ratings 5, 2 and 1. Most cases have been classified to rating class 2 and 5. Analysis of distance between real and predicted values proves that the tree has a good potential for predicting user interest since the nominal mean error rate equaled ±1,22. The most informative variables turned out to be: *vertical_scroll*, *prod_other_time*, *page_height*, *mouse_distance*, *prod_desc_time* and *tab_active_time*.

Table 1.3. Confusion matrix for the classification tree for all participants (interest on the nominal 5-point scale)

		Predicted interest					Classification Accuracy
		1	**2**	**3**	**4**	**5**	
Real interest	**1**	54	30	11	11	24	41.5%
	2	21	69	15	14	11	53.1%
	3	16	40	34	14	26	26.2%
	4	18	31	15	38	28	29.2%
	5	7	29	15	9	70	53.8%
Sum		116	199	90	86	159	

Another tree model was built for all participants dataset where interest was expressed on the binary scale. Misclassification rate of 31% confirms good predictive quality of this model. The resulting tree was characterized by very good parameters (Table 1.4): the Area Under the Curve (AUC) of 0.735, the sensitivity of 0.742 and the specificity of 0.636. The most significant nodes in the resulting tree this time were: *vertical_scroll*, *page_time*, *user_active_time*, *search_referral* and *tab_active_time*. The last three indicators proposed by us also show a direct positive correlation with user interest.

Table 1.4. Parameters of the classification tree for all participants (interest on the binary scale).

False negative	True negative	False positive	True positive	Sensitivity	Specificity
80	197	113	230	0.742	0.636

1.3.4. Classification tree models for most-active participants

We have also built tree models for most-active users dataset only. The first tree where interest was described on the nominal scale had the misclassification rate of 58.9 %, which is very similar to the equivalent model for all users. This model seems most suitable for predicting real interest on the following levels: 2, 4, 3, 5. Much worse predictive accuracy was achieved for modelling the lack of interest. Nominal mean error rate equals to ±0,91 which means that this tree performs better in predicting real interest than the tree built for all participants dataset.

Table 1.5. Confusion matrix for the classification tree for most active participants (interest on the nominal 5-point scale).

		Predicted interest					Classification Accuracy
		1	**2**	**3**	**4**	**5**	
Real interest	**1**	8	19	8	9	4	16.7%
	2	8	35	13	12	4	48.6%
	3	6	30	50	24	10	41.7%
	4	1	17	28	55	17	46.6%
	5	5	9	34	33	55	40.4%
Sum		**28**	**28**	**110**	**133**	**133**	

The tree built for most active participants dataset where interest was expressed on the binary scale had the misclassification rate of 17.3%, which confirms good predictive quality of this model. The resulting tree was characterized by very good parameters (Table 1.6): AUC of 0,796, sensitivity of 0,9359 and specificity of 0,492. The tree shows very good quality for predicting interest better than predicting lack of interest or very low interest. The most significant

nodes in the resulting tree this time were: *vertical_scroll*, *page_time*, *user_active_time*, *search_referral* and *tab_active_time*. The last three indicators proposed by us also show a positive correlation with user interest.

Table 1.6. Parameters of the classification tree for most active participants (interest on the binary scale).

False negative	True negative	False positive	True positive	Sensitivity	Specificity
24	59	61	350	0,9359	0,492

1.4. Conclusion

In this paper we have presented results of a customer preference study utilizing implicit feedback technique and classification trees. Model parameters for both binary and multivalued logic of the decision variable were presented. The most important results of analyzing behaviors of the most active study participants were pointed out. Further research is planned to develop a more universal approach to recommender systems in e-commerce.

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Chapter 2

The concept of building the inference engine of a reference model for the development and selection of Open Source tools

2.1. Introduction

The IT service provider's selection of tools is usually preceded by subjective evaluations by the project manager and the programmers involved in the project. Usually, either the most well-known or the most available tools are selected. For this reason, the majority of IT service providers make use of Open Source tools. They are not, however, as advanced (in the number of functionalities) as commercial tools. Therefore, IT service provider organizations which want to use Open Source implement several different types of these tools to fulfill the set of requirements regarding the functionalities [1] [10] expected by organizations. Often such actions entail the duplication of tool functionalities and problems with their integration [12] [13]. The interest in Open Source tools is also a consequence of the licensing costs of commercial tools, the frequent problems with the integration of tools with other portfolios and the high costs of support.

The problem of the IT market is its lack of standards for the development and integration of Open Source tools [3]. Therefore, the authors undertook the task to build a reference model for the development and selection of IT tools. They selected a group of tools to assist in obtaining requirements and also suggested the possibility of verifying the developed reference model during the processes of obtaining IT project requirements.

2.2. The concept of a reference model for the development and selection of IT tools

The concept developed by the authors focuses on formal support for directions for the development of IT tools used by IT service provider organiza-

tions (the selection of tools or the expansion of already existing ones). While constructing the concept of the inference engine of the reference model, a number of tool providers were analyzed. The results of reports by the Gartner analytical and consultancy group as well as Ovum dating from 2008, 2010 and 2012 were taken into account as they indicated the directions for the development of the manufacturing environment to support the software development cycle [9]. The results of these analyses indicated the need to take into consideration IBM Rational products for the concept proposed in this work (to construct a reference model and support its use with an inference engine). Thus, a decomposition process of the functionalities of IBM Rational products (supporting the processes of obtaining requirements) was conducted for the reference model.

The decomposition was carried out due to a detailed analysis of these tools and through direct communication of the authors with those responsible for the products (Product Managers) at IBM. The process of the decomposition of the tools for obtaining requirements revealed limitations of the reference model being constructed at the initial stage of research. Relying only on the functional decomposition of tools, it becomes impossible to assess their impact on the organization of the IT service provider. From such a perspective, the construction of the reference model makes the functionalities of tools independent of the established formal process or the agile management of the organization. From this perspective, the reference model can be used both for organizations applying heavy methodologies by choosing a larger scope of functionalities, or for those which lean towards light methodologies (Scrum, EclipseWay) [2]. It can therefore be used in any organization regardless of the implemented process, only taking into account the expectations of the organization regarding the processes of the selection/development of the applied tools.

In the construction of the reference model, the authors decided to apply the concept of architectural perspectives. The use of perspectives allowed for easier management (also from the perspective of stakeholders) of the multilayer architecture of the reference model. The concept developed by P. Kruchten [8] was used for this purpose. Within this concept, five perspectives are introduced (called the 4 +1 Architectural View Model), which refer to different views and viewpoints of the developed reference model. Such perspectives were developed as: functional, business processes, the logic of tools, organization infrastructure and the internal structure of IT tools. The use of per-

spectives for the construction of a reference model allows for the cooperation (in the process of IT tool development) of many stakeholders in the project. It also allows the identification of those perspectives/components of perspectives which are most important in the development process of a reference model. The structure of the reference model proposed in this work is dynamic and allows a free choice of perspectives, thanks to which a more or less detailed process of tool selection/development can be achieved.

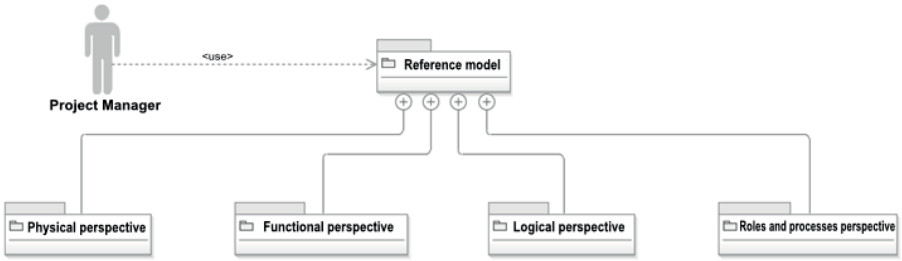

Figure 2.1. Structure of the reference model for the selection/development of tools in the software development cycle.

For the specification and implementation of the proposed perspectives, elements of modeling language notations in UML 2.4 have been applied in the reference model in the form of diagrams showing use cases, deployment, packages and components.

Having a reference model for the selection/development of tools to support the software development process, inference and the presentation of certain relationships between the elements of the model should be used (in the case of a large number of functionalities decomposed into five separate perspectives). It appears that the development of inference rules can decide about the suitability of the developed model reference. It does not seem probable that, in the case of a large number of functionalities, the analyst responsible for the selection/development of Open Source tools would search through appropriate perspectives and associate them with one another.

The authors developed two examples of direct inference using the developed reference model of the selection/development of tools. The developed inference engine allowed for the verification of the reference model. The current version of the inference engine is not a product which could help a company in making decisions. In order to apply the inference engine to support decision-making, it must be equipped with an advanced inference algorithm. To specify

the inference algorithm, the input and output elements of the algorithm would have to be specified.

In the case of supporting the selection of Open Source tools, the input data includes, among other things, elements of the engineering of requirements posed in the manufacturing of the product by the person using the inference engine, as well as the possibility of integrating the currently used tools, and the company's capabilities in terms of resources, experience, etc. Whereas, the output data includes suggested functionalities or tools which fulfill those functionalities and which best meet the required standard. The process of selecting requirements for the inference engine is one of the stages of the authors' research. The testing of inference algorithms should be based on conclusions drawn from carrying out actual projects in large companies. The authors have the opportunity to test the engine in such an environment. Having experience in software development, they want to expand the inference engine, while implementing various inference algorithms and testing their applicability in the inference process.

2.3. The tool selection model in the process of software development

Figure 2.2. shows the concept of the inference engine proposed in this paper for the reference model for the selection/development of IT tools. The knowledge base module (left side of the figure) includes decomposed functionalities of both Open Source tools as well as the model tool (in the analyzed case of IBM Rational) supporting the process of software development.

The requirements module contains all the input parameters for the inference engine: the IT tools used in the IT service provider organization, the applied organization management methodologies, IT resources, infrastructure and functional requirements for software developed by the organization, etc. The requirements module has been parameterized (for entering data about any organization). The authors gathered knowledge about the parameters through surveys used to gather requirements regarding IT service provider organizations.

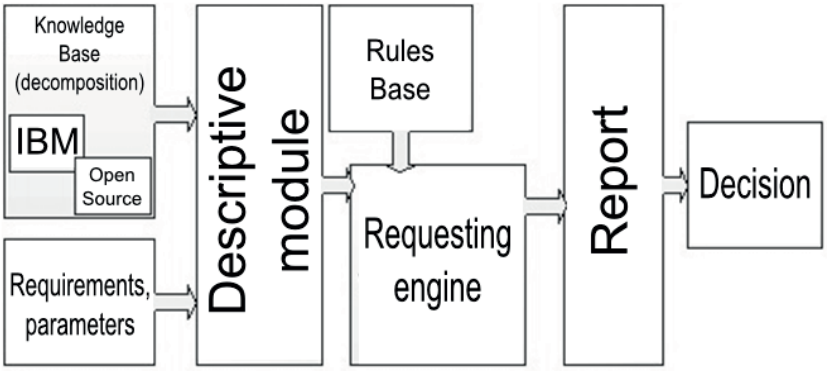

Figure 2.2.Concept of an inference engine on the basis of a reference model of tools.

The descriptive module is the subject of the current research of the authors of this paper. Each of the input/output parameters has been described in a qualitative manner due to the way these parameters are used by the inference engine. For the development/modification of the descriptive module in the analyzed cases, the authors used Java and Business Intelligence and Reporting Tools (Birt), as well as direct inference mechanisms. In the examined case, the qualitative module did not play a significant role because the relationships between data in the knowledge base were not taken into account. In their model, the authors plan to implement more advanced inference algorithms (fuzzy values, SI algorithms). They plan to take into account, for example, the degree of membership of the functionality of an Open Source tool (x1) with the degree of membership of a functionality (y1) of a reference tool. In other words, it must be determined whether the degree of membership of functionality x1 is identical with the degree of functionality y1 or the extent to which the functionalities (based on the analysis of the degree of membership) are identical (1).

$$(\forall x \in X)(\exists y \in Y)(x \cong y). \quad (1)$$

The descriptive module also contains a query language for the inference engine. The authors have adopted the principle of generating a query language based on a similar principle which prevails in database environments (SQL performs a query on a set of data - the knowledge base, the input/output parameters). The rule base is created by an expert.

The aim of the inference engine is to make inference based on the parameters from the knowledge base, the parameters module and the query lan-

guage from the rule base. The activity of the inference engine is subjected to a qualitative description (transformation) for the data presentation module. The concept of the inference engine shown in Figure 1 does not assume that data will be submitted to a qualitative description in the inference engine.

The result of the activity of the inference engine is presented in the form of a report (PDF/Word document). This report summarizes the searched for and required parameters of IT tools and the proposed selection of the required functionalities. On the basis of this report, an analyst can make decisions on the development/selection of IT tools. If the outcome of the inference engine activity is not satisfactory, the analyst can change parameters or rules in the rule base and run the inference process again.

2.4. The implementation of an example model

In order to verify the proposed solution (the application of the inference engine to analyze the reference model), the authors used Birt [7] and Java [11] to implement the inference rules in the inference engine.

Birt is an Open Source tool allowing the transfer of data sets (e.g. XML) into their graphical representation in the form of a report. In the studied case, the authors have created a number of reports (based on separate XML files) which allow for obtaining information about the functionalities provided by a tool which the organization takes into account and for classifying the tool as one which is capable of development. The analysis of examples of the selection/development of IT tools on the basis of the developed concept of the inference engine and its implementation based on Birt confirmed the possibility of inference based on the reference model.

Writing a program in Java was another example of implementation. The authors created an inference mechanism identical to the one used in Birt. This approach was to confirm the possibility of building an inference engine regardless of the technology. The program written in Java takes the parameters of the IT tools from the reference model and treats them as input parameters for the inference engine. Then it returns a result by suggesting functionalities suitable for the development of tools existing in the IT service provider's organization.

In the analyzed case, a simple inference engine was created. This approach was adopted in order to test whether, in the future, it is possible to build an inference engine on the basis of a reference model and advanced inference algorithms.

2.5. The development of inference rules

The proposed inference concept (needed for the construction of the rule base of the inference engine) involves an analysis of the relationship between the functionalities of Open Source tools and the functionalities derived from the decomposition of the reference tools contained in the reference model. On this basis, a query to the knowledge base is created and, as a result, a forward inference process is initiated (to find out whether a relationship between the functionalities exists). Relying on the developed inference process, the inference engine provides reports based on one of four sets:

- functionalities supported by the tool – set 1

$$(y \in Y). \tag{2}$$

- functionalities supported by the client – set 2

$$(x \in X). \tag{3}$$

- functionalities required by the client and supported by the tool – set 3

$$X \cap Y = \{x : x \in X \wedge x \in Y\} \tag{4}$$

- functionalities required by the client and not supported by the tool – set 4

$$x \neq y \rightarrow X \cap Y = \emptyset. \tag{5}$$

Then, the inference engine makes a random classification of the tool applied in the IT service provider's organization and puts it into one of three groups:

- A – no possibility to enhance the tool with the functionalities from set 4
- B – possibility to enhance the tool with only one functionality from set 4
- C – possibility to enhance the tool with all the functionalities from set 4

On the basis of forward inference, the authors estimated that the output of the inference engine would be correct for a closely specified query (type and parameters). It turned out that the outcome of the inference, on the basis of two completed sessions with the inference engine, gave only general information

about the relationships in the knowledge base (the available functionalities). The lack of information on all the tools supporting the software development cycle (in the analyzed case of supporting the requirements process) proved to be an important factor. Therefore, work aimed at decomposing Open Source tools in order to complement the reference model is still to be carried out. Moreover, processing problems were encountered in the Birt environment during the creation of rules. It turned out that the set of functionalities of the Birt environment does not provide the possibility of a reference search after new functionalities are added to the reference model.

In view of the above inference limitations (when applying Birt technology), the authors are planning to implement artificial intelligence mechanisms in the inference engine in order to create a descriptive module for all the inference engine parameters. It should also be noted that, in this study, the decomposition of the functionalities of the elements in the knowledge base, and on this basis the creation of relationships in the knowledge base, relies on expert knowledge. This means that a qualitative comparison of the reference functionality with the decomposed one is also on the part of the knowledge expert.

In the carried out research, it was also determined that the descriptive module should clearly describe both the performance of requirements and the rules of the knowledge base. If the authors use fuzzy logic, for example, it will result in a mathematical description of the inference engine parameters (it will order the unambiguity). Therefore, ongoing research is focused on implementing inference rules in the form of a query language and treating them as an input parameter for the inference engine. In this approach, a query language could be generated, for example, by an external expert system.

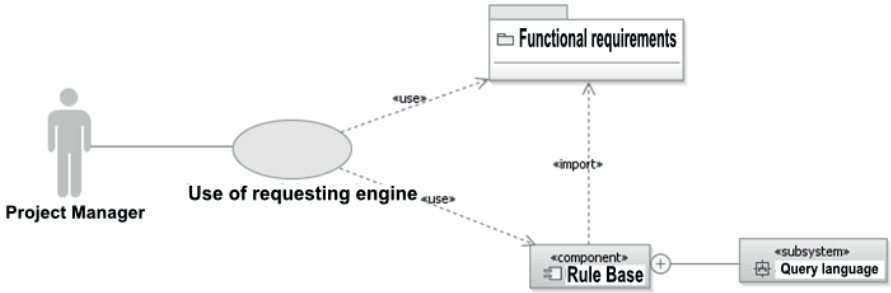

Figure 2.3. Diagram showing the application of a query language as an input parameter for rule base of the inference engine.

2.6. The verification of the method in a project environment

The effectiveness of the inference engine was verified by comparing the results of its operation with the results of RSA (Rational Software Architect) diagrams, the Topic Diagram [5] and the Browse Diagram [6]. Java and reports compiled on the basis of Birt were applied in the verification processes. In both cases, the functionalities/new tools were selected on the basis of data referring to the IT tools of the IT service provider organization. To present the application of the reference model, in the case of RSA diagrams, the following reports have been developed:

- Functional comparison
- Implementation of designated functionalities

Analyzing the obtained results led to the discovery of convergence on the functional and integration levels. The cost of developing tools which may play an important role in the selection of functionalities was not analyzed. The authors assumed that from the perspective of the development opportunities and the realisation of business needs, they are of secondary importance.

The proposed method will be tested in the environment of large companies in the IT industry. At the same time, further work on enlarging the knowledge base with other Open Source tools and decompositions of their functionalities will be carried out.

2.7. Conclusion

This paper presents the concept of using an inference engine for the selection and development of Open Source tools on the basis of a reference model for the management of requirements to benefit the IT service provider organization. Model applications meeting the requirements and needs of clients were presented. The authors decided that IBM tools are exemplary solutions (on the basis of reports from consulting firms).

As part of the study, simple rules of forward inference were implemented on the basis of relationships in the created reference model for the development/selection of IT tools. The result of the work is the creation of an inference engine on the basis of Birt reports mechanisms and an application in Java technology used for the inference engine. The development of the inference engine allowed the suitability of the reference model to be verified. The inference engine has a modular structure so that it can be freely adjusted to the needs of any inference method.

This paper presents the general concept of applying the inference engine for the selection and development of tools to support software development processes. Relying on examples of the engine's application, the authors demonstrated its usefulness in practice and the possibility of its evaluation.

The analyses carried out by the authors also showed that there is a possibility of using other inference mechanisms in the inference engine. The authors believe that this approach will contribute to a more precise determination of the direction for the development of Open Source tools, and thus will streamline the process of selecting IT systems by IT service provider organizations.

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Chapter 3

Global state of information system security in virtual organizations

3.1. Introduction

Because even seemingly unimportant local event can have significant impact on the whole system, it is important to monitor and analyze security of the system as a whole, not of its individual components only. Comparative analysis of chosen methods of risk evaluation, applicable in information security management, shows CRAMM [11] as the least flexible solution. At the same time the biggest range of adjustment to requirements of the organization is provided by EBIOS [15]. A significant disadvantage of compared solutions is very weak support of automation – gathering data relies on auditing and questionnaires, with no standardized communication protocol nor data model. As a consequence, although at least some of compared methods are rather widespread and common (especially CRAMM [11] and MEAHRI [24]), none of IT systems' components is prepared by default to supply data required by the method. In the case of a distributed environment this becomes a significant limitation of application for any of them.

Virtual organization as a term in management appeared in the 1980's, however a few organizations with similar approach to management were present in early 1900's. An example of such an organization is Reuter press agency, which took advantage of spreading communication means and built an international network of agents providing news almost instantly when they occurred. This formed a company with hundreds of employees, most of whom never paid a visit in formal headquarters. At the same time, a fundamental part of company's appraisal was based not on machines and buildings, but immaterial assets – information passed on to Reuter's office. There are two levels of virtual organizations.

Virtual organization level 1 [2], [8]:

• has decentralized structure that consists of many distributed units, co-operating with the help of IT tools,

• does not exist in a single location,

• all its units have physical locations with virtual connections,

• has flat organizational structure – with more independent units and partly independent teams.

Virtual organization level 2 [2], [8]:

• has no physical location – exists only formally, usually joining companies or people to achieve business goals,

• exists only to reach specific goal, not to keep the organization running - reaching the goal may mean closing the organization.

A key difference between those two types of virtual organizations is that level 1 describes a separate being, while unit 2 is an artificial form created to join assets and help achieve common goal. Reuter is an example of virtual organization level 1, while a typical example of level 2 is a consortium created for R&D project.

Other typical characteristics of virtual organizations [8], [16] have influence on information security too. It is caused by a specific combination of properties that individually appear in numerous traditional organizations and are quite easy to maintain with the help of a standard security management process. Unfortunately, when combined, those properties cause additional complexity in security management, especially in the case of monitoring.

Due to described nature of virtual organizations, two basic groups of threats countermeasures can be distinguished in virtual organizations [6]:

• provision of physical, technical and information security,

• provision of technical and physical protection of communication.

While first group describes static security, the second one contains exchange of information and data between units of the organization. Because virtual organizations rely on distributed structure and immaterial assets like information, exchange of messages becomes fundamental from the perspective of VO survival. No matter which group a given event belongs to, it becomes important in security monitoring usually when it does not comply with expected or

typical behavior of the system. This means that while monitoring security, it is necessary to identify anomalies – moments, when things do not go according to the plan.

3.2. Anomaly detection and reasoning state of security

There are numerous ways of anomaly detection. Based on the previous research and comparative analysis it is possible to distinguish solutions based on [1], [5], [10], [18], [23], [26]:

- data classification
- multifactor models
- statistical analysis
- formal models

Solutions based on data classification include neural networks and genetic algorithms [3], Bayes networks, SVN, sets of rules [10]. Because rules can describe expected (normal) state or any known scenarios violating secure state, they can have a form of:

- control lists
- fault trees FTA
- event trees ETA
- FMEA
- security frameworks

One of the most basic disadvantages of solutions based on FTA, ETA or FMEA is difficult modelling of complex anomalies, with multiple reasons or dependent to event context. For instance, higher user activity at workday noon is nothing extraordinary, but at Sunday noon or during a month long leave definitely is not normal. Modelling such dependencies with the help of ETA/FTA trees or FMEA characteristics is possible, but undoubtedly time consuming. A natural solution in such a situation is application of one of multifactor methods, relying on analysis of a number of parameters. There are many multifactor methods of different application – reasoning about state of security can be categorized as an example of choice and hierarchy selection, with examples like in [5]:

- AHP, e.g. in [20]
- ELECTRE I/III, e.g. in [27].

Another approach to multifactor analysis relies on utilization of fuzzy logic, like in [14], or rough sets theory. Differences between AHP, Electre and fuzzy logic are discussed in comparative analysis of chosen multifactor methods applied in investment projects - AHP and ELECTRE provide similar results but are time consuming, while fuzzy logic is much simpler to prepare [19].

A completely different approach is anomaly detection on the basis of statistical analysis, typical values analysis or trend analysis – e.g. like in the case of network traffic [21]. As there is no need to define patterns, such approach became widely used in IDS/IPS systems, as a supplement of solutions based on patterns. Unfortunately, statistical analysis can be done only for each of the parameters separately. This means that it can help identify anomalies on the level of a single parameter, but not to aggregate such results or conclude on the basis of the state of multiple parameters. Detection of anomalies based on multiple criteria still requires creating patterns, as described earlier. Rules required in anomaly detection can also come from security models, which are subject of numerous research. Two basic approaches can be distinguished in this area:

- Formal models
- Frameworks

Formal models usually are an attempt of modelling system or subsystem as a whole, in mathematical form, including dependencies between its components. This allows anomaly identification on the basis of analysis of various parameters, not just a single one.

At the same time frameworks provide an operational image of information or IT system (subject to solution) by defining protocols, algorithms and data types. On the basis of such pattern it is easy to identify and interpret values exceeding allowed limits or incompatible with a chosen model, as is done in research of [7], [12], [25], [28], [31], [32]. This allows an easy identification of local anomalies. However, in the case of more complex anomalies, deduced on the basis of multiple factors, level of complexity and amount of time required to model anomaly is comparable with preparation of the ETA/FTA analysis. The same situation is in the case of reasoning the state of the whole system – creating complex framework including sophisticated patterns requires significant effort.

Considering characteristics of virtual organizations, with special attention to their dynamic nature, usually distributed structure with high ratio of immaterial assets, selection of reasoning method is not simple. Due to complexity of model construction, including necessary calculations, reasoning based on traditional multifactor analysis (AHP, ELECTRE) is too troublesome. Similar situation is in the case of trees ETA/FTA and FMEA tables – creating them for all known threats and later updating them after changes occur within the organization, is very time consuming. Statistical analysis and trend analysis require quite big amount of historical data. Although it is not a big issue in traditional organizations, in the case of frequently adapting virtual organizations a problem of insufficient quantity of data used in analysis becomes a serious threat. It is simply difficult to mark typical values on the basis of data gathered in short period of time, because that period could be abnormal as a whole in fact. Formal models either focus on static description of secure state or they have limited scope of application (e.g. matrix model and Wood's model does not support mandatory access control, supporting confidentiality or integrity) [9], [29].

Because of time and ease of model creation, the best choice in the case of virtual organization (out of analyzed groups of solutions) is anomaly detection based on fuzzy logic or rough sets, combined with aggregation on the level of assets, business processes and security objectives.

3.3. Proposed model of anomaly detection and aggregation

The whole process of anomaly detection and aggregation can be divided into two steps:

• Identification of local anomalies and concluding about the state of assets.

• Aggregation of local results to the level of information system as a whole.

For the purpose of identification of local security issues, an approach based on linguistic knowledge base and rough sets was chosen. A function WL – influence of changes on local grade of security was defined as:

$$WL = f(x1, x2, x3, x4, x5, x6, x7) \quad (1)$$

Parameters used in formula (1) stand for:
x1 – importance of associated business processes,
x2 – number of associated business processes,
x3 – asset recovery time,
x4 – dynamics of parameter value change,
x5 – scale of parameter value change,
x6 – available time,
x7 – influence of environment

Each of the parameters was assigned linguistic and discrete values:

- x1 – importance of associated business processes: key, ordinary
  - PZ – ordinary process: importance ~0%
  - PK – key process: importance ~100%

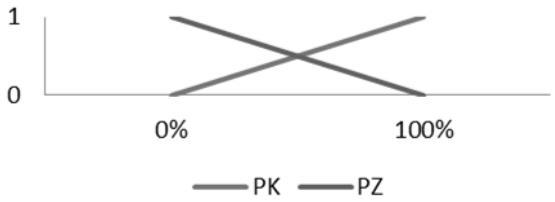

Figure 3.1. Variable x_1 – importance of associated business processes

- x2 – number of associated business processes: few, average, numerous
  - M – few: ~0% of all processes of the organization
  - Ś – average: ~10% of all processes of the organization
  - D – numerous: ~30% and above of all processes of the organization

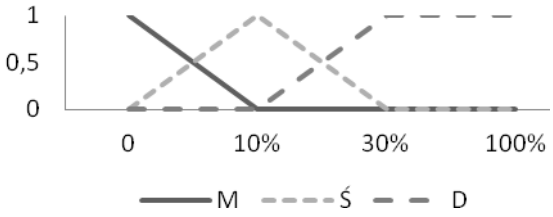

Figure 3.2. Variable x_2 – number of associated business processes

- x3 – asset recovery time: instant, hour, day, two weeks
  - N – instant: ~ 0min
  - G – hour: ~60min (1h)
  - D – day ~500min (~8h/1 working day)
  - 2T – two weeks ~5000min (~10 working days)

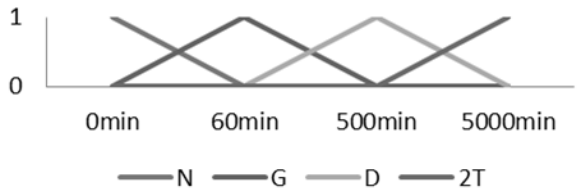

Figure 3.3. Variable x_3 – asset recovery time

- x4 – dynamics of parameter value change: slow, rapid
  - P – slow: ~0%
  - G – rapid: ~100%

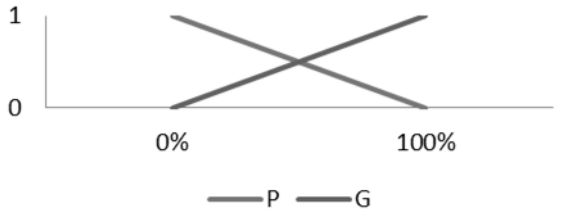

Figure 3.4. Variable x_4 – dynamics of parameter value change

- x5 – scale of parameter value change: small, medium, big
  - N – small: ~ 0%
  - Ś – medium: ~10%
  - W – big ~30% and above

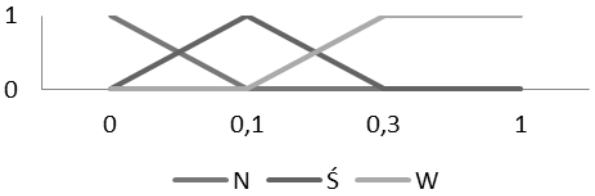

Figure 3.5. Variable x_5 – scale of parameter value change

- x6 – available time: none, hour, day, two weeks
  - B – none: ~ 0min
  - G – hour: ~60min (1h)
  - D – day: ~500min (~8h/1 working day)
  - 2T – two weeks: ~5000min (~10 working days)

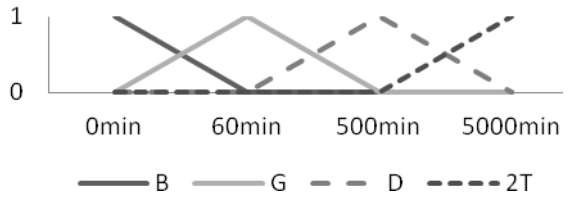

Figure 3.6. Variable x_6 – available time

- x7 – influence of environment: supporting, neutral, aggressive
  - S – supporting: ~ -100%
  - NE – neutral: ~ 0%
  - NI - aggressive: ~ 100%

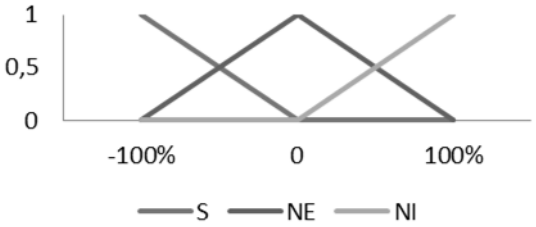

Figure 3.7. Variable x_7 – influence of environment

- WL – influence of changes on local grade of security
  - No influence: ~0%
  - low influence: ~20%
  - medium influence: ~50%
  - high influence: ~75%
  - critical influence: ~100%

Figure 3.8 presents decomposition system of linguistic knowledge base for variables introduced above.

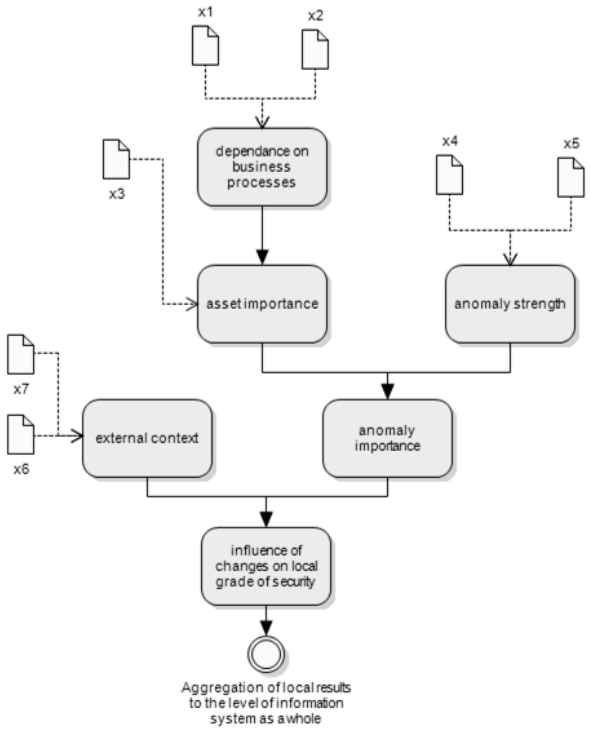

Figure 3.8. Decomposition system of linguistic knowledge base

Importance of associated business processes is evaluated on the basis of influence (direct or indirect) on company's business goals or lethal requirements – some of available methods to choose from are Omega8 [13], Six Sigma [17], RAPID RE [22]. As one asset can be used in many business processes, the value of variable x1 is determined as an average importance of associated assets. The number of associated business processes (variable x2) is determined as a ratio of processes associated with a given asset to a number of all business processes. As a result it becomes clear if a given asset is widely used within the organization, or not. This, then, induces the scale of influence in case some threat for a given asset actually occurs.

Table 3.1. Dependence on business processes deduction

Dependence on business processes [ZPB]		
x_1 x_2	PZ	PK
M	M - low	Ś - average
Ś	M - low	D - high
D	Ś - aver-age	D - high

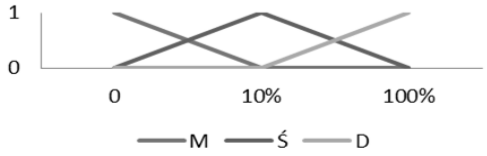

Figure 3.9. Dependence on business processes - variable

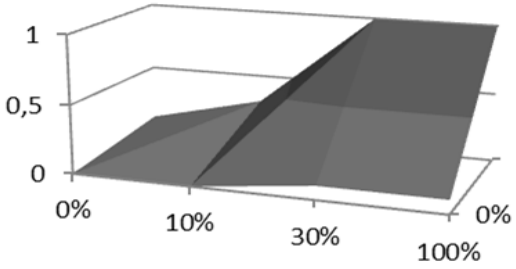

Figure 3.10. Dependence on business processes – deduction chart

Asset recovery time (variable x3) is time required to fully recover its expected operation. It is a period of time when services (processes) are unavailable due to unavailability of that asset, while it is being recovered.

Parameters x1 – x3 together show the results of improper operation of a given asset, classifying it either as a key asset (ZK) or common asset (ZZ). The more important or numerous business processes are bound with a given asset and the more time is required to recover it, the higher is asset importance IZ.

Table 3.2. Asset importance deduction

Asset importance [IZ]				
x_3 ZPB	N	G	D	2T
M	ZZ	ZZ	ZZ	ZK
Ś	ZZ	ZZ	ZK	ZK
D	ZZ	ZK	ZK	ZK

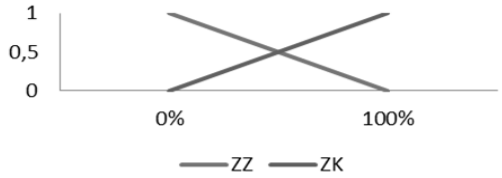

Figure 3.11. Asset importance – variable

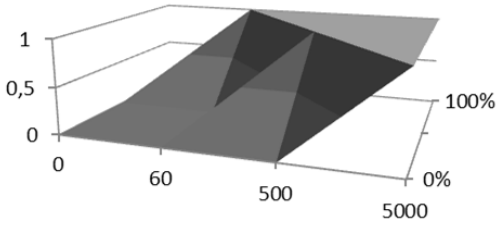

Figure 3.12. Asset importance – deduction chart

Dynamics and scale of assets parameters' changes define (accordingly) the speed and strength at which recorded values differentiate from normal, expected state. This divides anomalies into two groups: weak (AS) or severe (AP). Assignment of parameters to assets is a part of a separate process – monitoring scope definition, which is performed before monitoring is executed. Now, during concluding process, that assignment is recalled.

Table 3.3. Anomaly strength deduction

Anomaly strength [SA]		
x_4 x_5	P	G
N	AS	AS
Ś	AS	AP
W	AP	AP

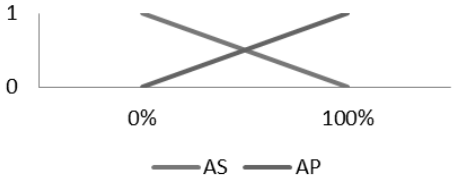

Figure 3.13. Anomaly strength - variable

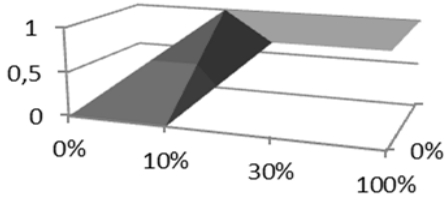

Figure 3.14. Anomaly strength – deduction chart

By combining anomaly strength (SA) with asset importance (IZ), at which a given anomaly was observed, anomaly importance (IA) is given. It shows how significant a given anomaly is: unimportant (AN), average (AŚ), or critical (AK).

Table 3.4. Anomaly importance deduction

Anomaly importance [IA]		
SA IZ	AS	AP
ZZ	AN	AŚ
ZK	AŚ	AK

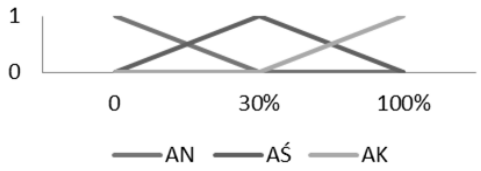

Figure 3.15. Anomaly importance - variable

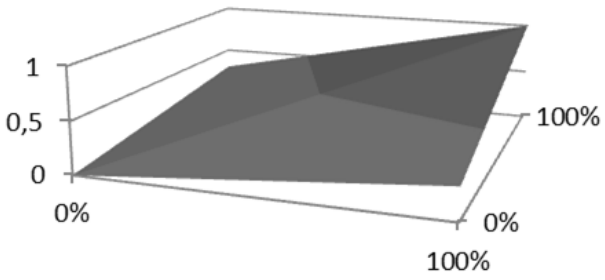

Figure 3.16. Anomaly importance – deduction chart

As a last step, an external context of the event is applied. On the basis of available time (that can be used on recovery without risk for business continuity) and current influence of the environment, the context is defined as positive (KPOZ), neutral (KNEU), negative (KNEG) or critical (KKRYT).

Table 3.5. Event context deduction

Event context [KW]				
x_6 x_7	B	G	D	2T
S	KNEG	KNEU	KNEU	KPOZ
NE	KKRYT	KNEG	KNEU	KNEU
NI	KKRYT	KKRYT	KNEG	KNEU

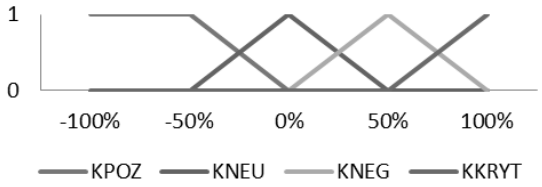

Figure 3.17. Event context - variable

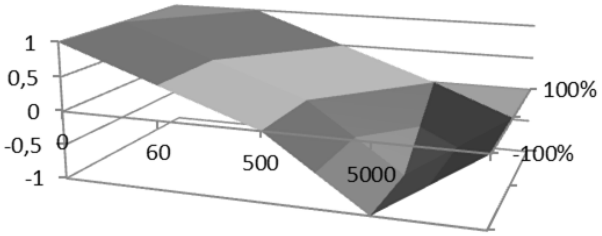

Figure 3.18. Event context – deduction chart

This prevents from raising an alarm for the whole organization when current situation (internal and external) provides conditions allowing safe removal of the anomaly without further consequences to operation of the organization, especially its business goals.

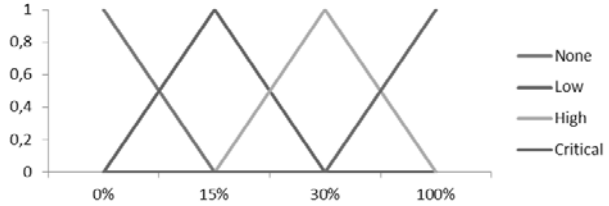

Figure 3.19. Influence of changes on local grade of security - variable

But, if the situation does not give a chance to solve the problem without harm to business continuity (e.g. providing tax statement or release of a new product to the market on time), the weight of observed anomaly is raised.

Value W must be estimated for all assets. Then, once value of influence on local grade of security is calculated for all assets, it should be aggregated to get an image of the influence on the whole system. Because during first part of concluding assignments between assets and business processes were analyzed (including their importance), a simple aggregation mechanism can be applied. For instance, it can be a simple scheme that was originally created for aggregation of risk in project management [30].

Table 3.6. Influence of changes on local grade of security deduction

Influence of changes on local grade of security [W]				
KW IA	KPOZ	KNEU	KNEG	KKRYT
AN	None	None	Low	High
AŚ	None	Low	High	Critical
AK	Low	High	Critical	Critical

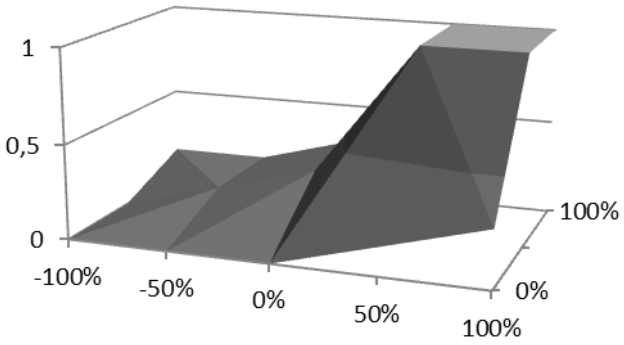

Figure 3.20. Influence of changes on local grade of security – deduction chart

It was adapted in such a way that value of risk was replaced with value W and total risk from original solution was replaced by an information system as a whole. According to that proposed scheme of aggregation, a tree is formed that

consists of security objectives on the first level and assets assigned to them, forming second level of the tree.

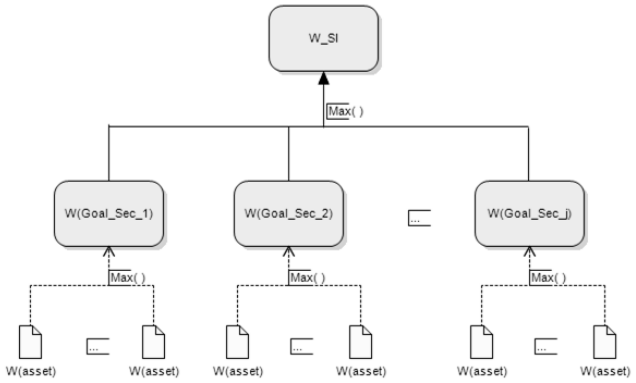

Figure 3.21. Aggregation scheme

Because assets can be grouped, the tree may have more than two levels, with individual assets always on the bottom level of the tree. If assets are to be grouped by business processes where they apply, it is required to modify earlier described scheme of concluding in such a way that it is performed separately for every pair (asset, business process), not all business processes connected with a given asset at once.

For every node describing asset, value W, calculated earlier, is assigned. Every other node (describing non-asset) is assigned the highest value W out of all its child nodes.

As a result (taking level 0 as root of the tree, representing security of information system as a whole), if a node on level n is described by value W:

- at least one of its child nodes on level n+1 has value equal to W
- none of child nodes on level n+1 is higher than W
- all child nodes on level n+1 except of at least one have value smaller than W
- value on level n-1 must be not smaller than W

Then, starting from the deepest level of the tree, the highest value W from all child nodes with a common parent is propagated towards the root of the tree.

Proposed model of aggregation is very simple, combines analytical side of FTA with synthesis of the ETA – in some way it is similar to a tree representation of the FMEA. Because attention of security administrator and board of management is focused on those anomalies that caused the biggest deviation

from the state defined as safe, it is easy to define priority of anomaly handling or to correct identified weaknesses in an iterative way.

3.4. Proposed model verification

Initial verification of the model was done on the basis of data gathered during the Tik?-Tak! 2015 IT contest for primary and secondary schools students. The competition, organized by Polish Information Processing Society for the 5th time, was divided into three parts. First two of them took place within a dedicated web-based IT system, designed and implemented especially for Tik?-Tak! 2015. Figure 22 presents simplified structure of information system behind Tik?-Tak! 2015 and four parameters assigned for monitoring the most critical assets, according to risk analysis taken.

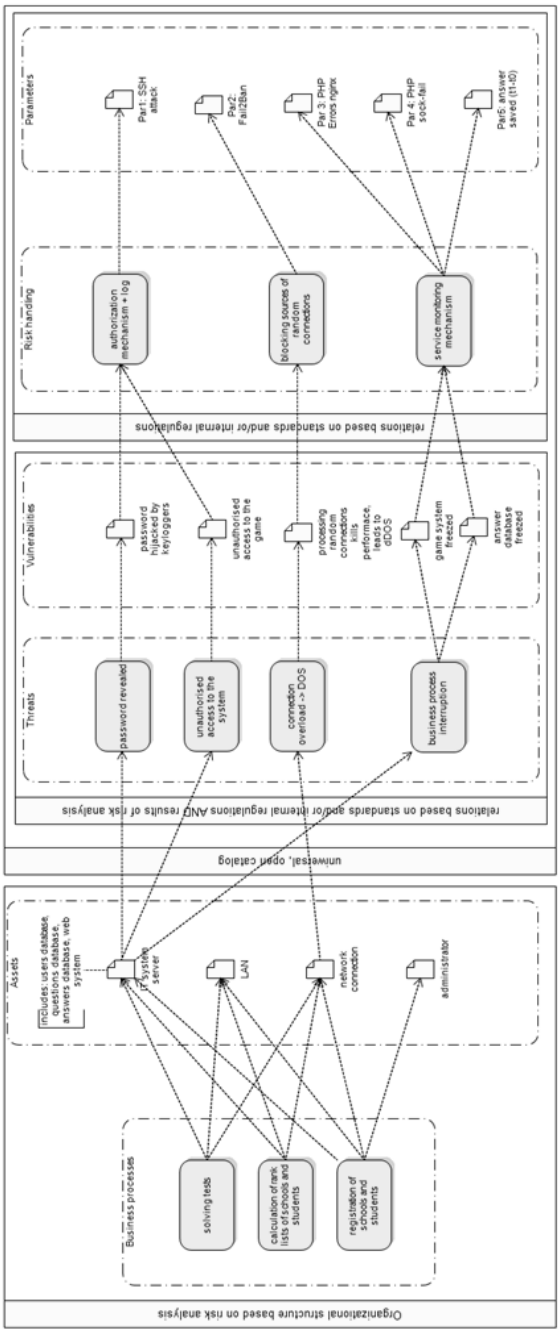

Figure 3.22. Monitoring plan scheme, source: own elaboration

At first, importance of each of the assets was estimated according to the model, based on their relation to business processes and asset recovery time, as is shown on Figure 3.23.

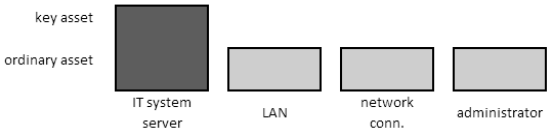

Figure 3.23. Assets estimated importance, source: own elaboration

Then, strength of local anomalies and anomaly importance was calculated and combined with influence external environment. In this particular case, the influence of environment was set as critical, because due to problems in the past, there was a significant pressure of schools and students for the system to work without problems this year. Moreover, as answers were collected and verified on-line and student had limited time and single attempt only, any malfunction of the game system would mean that a number of games results would be influenced. Either in a form of data loss or in a form of allowed repeated attempt, leading to potentially repeated questions and thus corrected answers.

A L	IT system server	Critical	Critical	Critical
S E	LAN	OK	OK	OK
S V	network conn.	High	High	High
E E	administrator			OK
T L				

Figure 3.24. Results aggregated to asset level, source: own elaboration

		Influence of whole system's security:		Critical
		solving tests	calculation of rank lists of schools and students	registration of schools and students
BUSINESS PROCESS LEVEL		Critical	Critical	Critical
		solving tests	calculation of rank lists of schools and students	registration of schools and students
A L	IT system server	Critical	Critical	Critical
S E	LAN	OK	OK	OK
S V	network conn.	High	High	High
E E	administrator			OK
T L				

Figure 3.25. Results aggregated to business processes level, source: own elaboration

		Influence of whole system's security:	Critical	
		service monitoring	authorization mechanism + log	blocking with FAIL2BAN
		RISK HANDLING LEVEL:	Critical	Critical	High
		service monitoring	**authorization mechanism + log**	**blocking with FAIL2BAN**
ASSETS	**IT system server**	Critical	Critical	
	LAN			
	network conn.			High
	administrator			

Figure 3.26. Results aggregated to risk handling solutions level, source: own elaboration

		Influence of whole system's security:	Critical		
		Objective 1	Objective 2	Objective 3	Objective 4
		SECURITY OBJECTIVE LEVEL:	Critical	Critical	Critical	High
		Objective 1	**Objective 2**	**Objective 3**	**Objective 4**
RISK	**service monitoring**	Critical	Critical	Critical	
	authorization mechanism + log				
	blocking with FAIL2BAN		High		High

Figure 3.27. Results aggregated to security objectives level, source: own elaboration

Finally, obtained results on the level of individual parameters were aggregated to provide influence on assets (see Fig. 24), business processes (see Fig. 25), risk handling solutions (see Fig. 26) and security objectives (shown on Fig. 27). Thus, it is easy to notice which areas of the system are influenced indirectly by security issues in some other places. For instance, a problem identified on the level of asset IT system server propagates to all business processes that require it to operate properly. Because of that it shown clearly how far the consequences of a single, as it seemed local, issue reach.

3.5. Conclusion

The test was repeated for various sets of data gathered during the contest. All tests confirmed that local anomalies were correctly propagated through the system according to the scope of utilization (and thus influence) of the asset where problems occurred. Further tests are planned on other organizations to verify, whether the model applies correctly to various types of virtual organizations.

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Chapter 4

The effectiveness of business process management (BPM)

4.1. Introduction

4.1.1. Governance definitions, process and business process

While characterizing the most important issues concerning the management of business processes (*Business Process Management*, or BPM) the basic terms associated with this concept must be first explained, and these undoubtedly include management, process and business process. Without this, it will be not possible to understand the essence of this management as well as discuss various matters relating to it.

When it comes to managing, according to A. Czermiński, M. Grzybowski and K. Ficonia, it should be considered, taking into account two points of view - institutional and functional. Institutional management is an activity of superior, which can be a supervisor, boss or manager, causing a subordinate to behave in accordance with the definite intention. Importantly, management is apparent from the hierarchy that exists in given organization and in which the superior exercises specific organizational authority over subordinates, whereby between him and the staff there are certain feedbacks which are, for example the commands of superior [1].

Management in terms of functionality is, according to these researchers, a sequence of identified steps that are necessary to perform specific goals and tasks facing the organization. Typically, it includes processes such as planning, stimulation, coordination and control [1]. It should be added that in the present study, the functional approach, which is related to the nature and purpose of BPM will be primarily taken into account.

The term, which needs to be explained is the process. According to M. Porter it is a value chain in which, thanks to the implementation of individual tasks, the scope of the commitment to the organization and its individual employees in the creation or delivery of a particular product or service increases.

E. Skrzypek stressed that the process is a logical sequence of consecutive or simultaneous performance of activities that lead to fulfilment of customer expectations by providing them with products or services entirely in line with their needs and requirements. This researcher noted that the process can also be understood as an interaction of men and machines, as well as methods of operation in order to produce a certain product or provide execution of servic [11].

Business process in turn is, according to M. Żytniowski and P. Zadory, *a set of interrelated structured actions or steps that serve a specific purpose, eg. delivery* [12]. In this case, each business process is characterized by:

- a clear definition of measurable objective, relative to which the process is formulated,
- defined entrance and exit, which implies that the process has both the supplier and the recipient,
- that the results can be measured by a specific measuring devices and indicators,
- repeatability,
- that is implemented by certain sequence steps,
- generating added value,
- that it always has an owner,
- possibility to extend outside certain organizational units within an enterprise[1].

4.1.2. The definition of BPM

Business Process Management is certainly dealt with in many different ways. It can in fact be understood as one of disciplines of management, technology or one of the processes. At the same time it should be noted that it is usually referred to the general definition of process management that addresses all the processes in an enterprise, including those that have business character and are associated with the BPM concept. In this way, it is reasonable to present precisely these definitions.

Overall, according to S. Nowosielski, process management can be seen in the broader and narrower sense. As part of this first approach that the process management is *relatively comprehensive (covering not only the company but*

also its contractors, suppliers and customers), continuous (repeated over time) and systematized (conducted according to certain rules and procedures) application of appropriate concepts, methods and tools (techniques) to influence the processes in the organization (enterprise, institution), aiming to achieve the objectives of the organization and how to best meet the needs of its external and internal customers [2]. In the narrower sense, process management entails *planning changes to streamline business processes in the enterprise and control the degree of their implementation. It is primarily aimed at analysing the company's strategy, evaluation, shaping (streamlining), steering and control of value creation processes in enterprises and between enterprises* [1].

On the other hand, according to P. Grajewski process management is an activity that involves optimizing the structure of individual components of the organization and for the pursuit of such a situation in which, in said structure there will be the largest possible number of elements that add value, while minimizing the share of inefficient operations. Process management, including BPM, is a search for the structure of the constituents of individual processes occurring in organizations, which in a maximising way would be set to create added value for both, the entire organizational system and its parts [3].

Based on the above definitions relating to the process management it can be concluded that BPM is a sequence of actions, whose primary objective is to improve and optimize the different business processes within the enterprise so as to enable them to create added value, as well as effective and proper responding to any requirements and customer needs.

4.2. Review of key issues related to BPM

4.2.1. Description of key issues related to BPM

BPM is inextricably linked to the development of a process approach to management. Hence, it is worth to describe this development. It is presented in Table 4.1.

Table 4.1. Development of a process approach [1].

Stage	Basics	Objectives	Methods
I wave of 1920s of twentieth century	Frederick Taylor's management theory	- better use of working time - reduction of production costs	- division of processes into simple steps - elimination of unnecessary steps
II wave, 80s – 90s of twentieth century	BPR (*Business Process Reengineering*)	- focus on added value - the desire to redesign the processes	- reduction of resources used - *outsourcing*
III wave, the end of the 90s	BPM	- enabling the implementation of changes by eliminating the gaps between IT and business solutions	- a holistic approach to the organization - process as the key point of reference

The basis for the development of a process approach were ideas of Frederick Taylor, which is the creator of the scientific theory of management. In his theories, he sought to define the most optimal method of work, and therefore one that will lead to a reduction of costs incurred in connection with the execution of the manufacturing process, as well as more efficient use of working time. This was to be achieved, inter alia, by eliminating unnecessary steps and rationalizing the use of necessary activities [1].

A further step in the development of a process approach was the concept of BPR, which involved the use of large-scale reengineering. It involves a radical redesign of processes that occur in companies, which is designed to achieve specific results, such as cost reduction, quality improvement and increase of efficiency of implementation of individual actions. The concept of BPR stipulated the necessity of a complete break from what previously functioned in the organization and implementation of organizational and management changes [4].

The last stage of the development process approach was the emergence of BPM, what happened in the late nineties of the twentieth century. It had related to that while recognizing that systematic improvement of the organization it is impossible to do it without the use of computer systems. Hence, rather than

implementing sweeping changes that focus on *reengineering*, they began to improve management by making full use of these systems [1].

4.2.2. The structure and elements of BPM

The structure of BPM is practically the same as in the management of non-business processes. It has been illustrated in Figure 4.1.

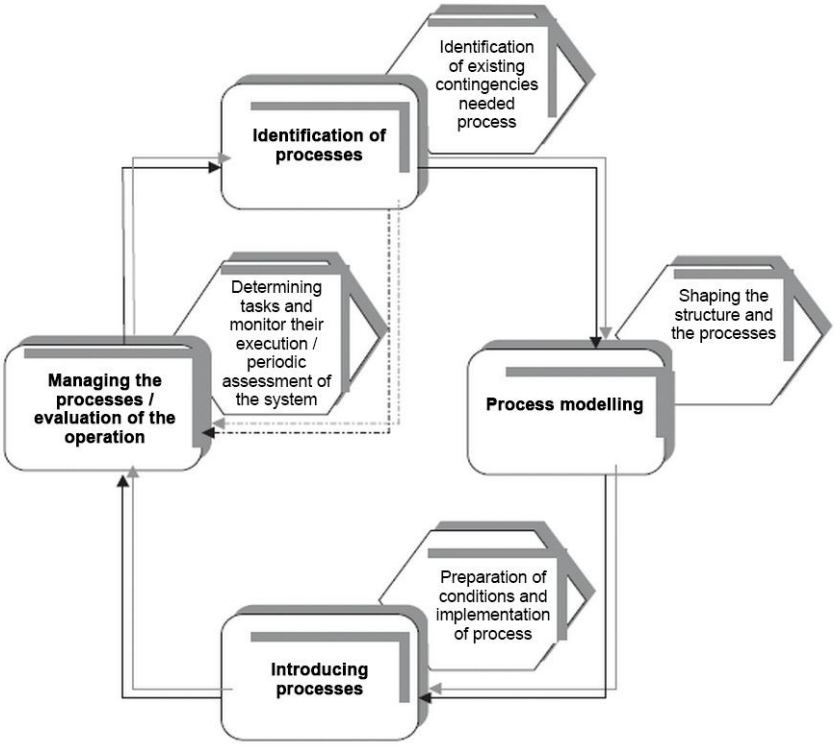

Figure 4.1. Structure of Business Process Management [8]

The first element of the BPM structure is to identify problems, but the paramount importance during this identification is to determine which of the processes are required for specific businesses, so that customers receive products or services which comply with their requirements. Subsequently it comes to modelling, so to determine how these processes should look like to meet the objectives of both companies and individual clients. The introduction of proc-

esses includes their implementation into the organization, as well as adequate preparation of employees. Managing processes and evaluation of the functioning of BPM takes place within the *controlling*, which provides constant monitoring of underlying processes [1].

It should be added that, according to A.G. Rummler and A.P. Branche BPM process management includes the same elements that are noticeable in relation to the management of the organization. These include:

- management of objectives - to include the formulation of sub-targets relating to particular activities carried out within the processes and objectives of individual functions,
- resource management - leads to providing the resources necessary to carry out processes such as financial resources or employees,
- Performance Management - applies to collecting and analysing customer feedback on the results of the processes and verification of the effectiveness of these processes,
- management at the interface between departments - concerns the management of the operations which are carried out in the various departments of the company [10].

4.2.3. Information technology systems supporting BPM

As it was mentioned before, business process management is based on information technology systems. Generally BPM systems are the systems that support the analysis, modelling, coding, implementation and testing of business processes. These systems broaden systems that manage the workflow with the functionality connected with information technology systems integration within the organization. Moreover, these systems give the possibility of communication with the processes that are done outside the organization through the use of network services [7].

Fig. 4.2 shows how BPM information technology systems support the business processes that are realised in enterprises.

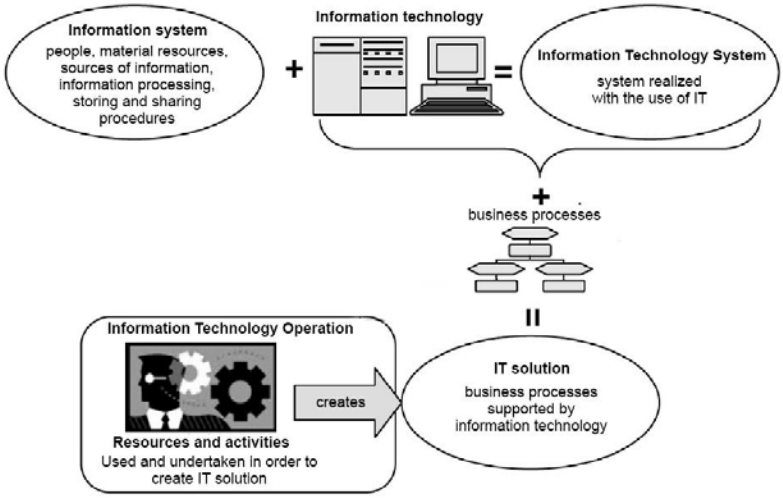

Figure 4.2. The relation between information technology systems and business processes [9]

Thus the integration of business processes with information technology systems leads to the state where these processes are supported by information technology on the large scale. It is worth adding that various information technology systems supporting the BPM concept are used nowadays. The issues concerning their development and their effectiveness will be described in the next section of this study. At this point it is worth mentioning that among such systems that are especially popular are the following:

- ARIS (*Architecture of Integrated Information Systems*) – the main aim of this system is organizing and amending, as well as implementing specified processes, which is achieved with the use of, among other things, testing the so called chain of processes, which is the image of business processes that are realized in enterprise,
- iGrafx – it is a set of graphic programs that are used to model or analyse the business processes and to maintain records connected with them,
- ADONIS – it is used mainly to optimize the business processes, which means their constant improvement, as well as to control and manage the quality, risk and information [1].

4.3. Usefulness of the BPM concept for the functioning of enterprises

4.3.1. The effectiveness of BPM information technology systems

As indicated above, BPM information technology systems support the realization of business processes in an enterprise. It is useful to take a closer look at this issue and try to describe the issues that answer the question: how effective is the use of BPM concept and the information technology systems connected with it?

At first, it is valuable to present the development of BPM class systems.

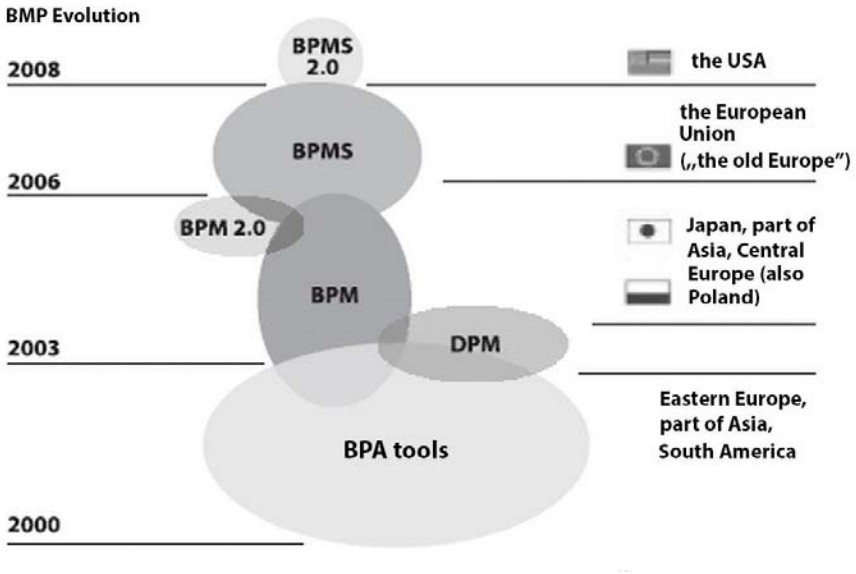

Figure 4.3. The development of BPM class systems [1]

The intensive development of BPM systems occurred between the years 2000 – 2008, while consecutively, within the BPM concept, systems and BPA, DPM, BPM and BPMS tools started to be used. SOA and BAM systems should also be included in the list of these systems. Their short characteristic with the description how they contribute to the introduction of improvements in enterprises, is presented in table 4.2.

Table 4.2. The characteristic of BPM class systems [1]

Name	Characteristic
BPA – *Business Process Analysis*	- it enables to analyze the business processes through defining these processes, describing them, analyzing the actual state and modelling
DPM - *Document Process Management*	- it enables to manage the documentation in a complex way
BPM – *Business Process Management*	- this system provides the complex management of processes together with monitoring and managing them
BPMS – *Business Process Management Suite*	- it is a package of information technology systems, within which not only BMP tools are integrated, but also other independent applications and programs
SOA – *Service Oriented Architecture*	- it regards business processes as a set of services that are linked together, enabling effective integration of various data and applications, also including these that come from external companies
BAM - *Business Activity Monitoring*	- it provides data concerning the most important business indicators in real time

The above described BPM class systems are undoubtedly highly effective and they contribute to the fact that the particular enterprises function more efficiently. First of all, this means that the subsequent business processes are integrated with each other, which in turn ensures that they are realized much faster than before and with a lesser extent of employment (the total automatization of BPM systems enables the reduction of the number of employees), which at the same time has an effect on the reduction of own costs paid by the enterprise. Undoubtedly the effectiveness of business processes increases, because they are systematically modeled and controlled. In case of any abnormalities or elements that could be an obstacle for the proper functioning of an enterprise, a desired state is restored in a fast way. Moreover, due to the fact that BPM provides actual information on the progress of business processes, the improvement of effectiveness of the enterprise's operational activity becomes possible. What is more important, the BPM class systems enable the integration of data and applications used not only within the given enterprise, but also with these which are in the possession of its contractors, that is the suppliers or distributors. This

in turn enables to strengthen the degree of connection between the particular participants of the supply chains.

The BPM class systems are undoubtedly effective, which is confirmed by the data in table 4.3. This data concern the values introduced as a result of the implementation of BPM in one of the enterprises functioning in the insurance industry in the USA.

Table 4.3. Values introduced to the exemplary company as a result of implementation of BPM system [9]

Assumptions	
The number of front office / back office employees	500 / 250
The percentage of employees incorporated to BPM system	25%
Annual human resource costs of a front office and a back office worker	30 000 dollars
License costs for the user of BPM system	1 000 dollars annually
The expected savings connected with the increase of the rate of handling of cases via telephone channel and connected with the reduction of front office and back office personnel	20%
Calculation	
The total cost of BPM system implementation	1 375 000 dollars
The annual costs of maintaining the BPM system	375 000 dollars
The savings connected with increasing the productivity of front office / back office personnel	750 000 dollars / 750 000 dollars
The total annual amount of savings	1 125 000 dollars
Return on investment (the measure of financial benefits, which have been obtained by the enterprise within one year in return for the implementation of BPM system)	63%
The period of total return of the investments involved	14 months

The above data point out that BPM systems are highly effective. They enable to generate large amount of savings in the enterprise where one of these systems has been implemented. However, one should emphasize that the financial resources that were invested in this system were returned to this enterprise after merely 14 months from the time of its purchase. This undoubtedly points to the great effectiveness of BPM systems.

4.3.2. The benefits from the implementation of the BPM concept

In the previous section it was noted that the BPM concept may lead to specified benefits for the functioning of enterprises, such as the reduction of costs or the integration of business processes. However, it should be emphasized that there are many more of these benefits. They are characterized below.

Generally, following Ł.Osuszek, direct and indirect benefits should be distinguished. According to Ł. Osuszek the direct benefits are:

- Centralization of procedures and politics that are for instance connected with issues concerning safety,
- The improvement of operational structure of an enterprise, which is possible thanks to total automatization of BPM tools,
- The improvement of flow of information between business owners and IT department and enabling to achieve a direct contact between them,
- The reduction of interruptions of work resulting from, for example, malfunctions,
- Implementation of optimized employing model, which is achieved thanks to BPML modeling (*Business Process Modeling Language*), that is one of the languages used to describe processes,
- The reduction of the degree of risk connected with business process management, which is possible thanks to performing strict and systematic control and monitoring of these processes,
- The reduction of time that is needed for performing inspections or audits,
- The reduction of costs that is a result of reduction of employment [1].

On the other hand, according to the mentioned author the indirect benefits include:

- The reduced costs incurred by the enterprise in relation to the change of IT system, which is influenced by the fact that BPM systems have standardized development methods,
- Ensuring the complete consistency of company's documents with legal and fiscal requirements [1].

While discussing the issues concerning the benefits related to BPM implementation it is worth having a closer look at the results of some of the studies

on this subject. One of these studies was carried out by Ipsos in year 2006 on the group of 206 big enterprises that work, among others, in the telecommunications, industrial and banking sector. The respondents were asked about these benefits during this study. The results and answers to this question are presented in the table 4.4.

Table 4.4. The most important benefits from using BPM (in %) according to the respondents of the study performed by Ipsos in 2006

Benefits	Generally	Industry	Banking	Telecommunications
The improvement of processes	18	15	17	31
The reduction of costs	9	7	9	6
The improvement of access to information and documents	9	13	4	13
Time savings	6	6	4	13

As it comes to the benefits from the use of BPM, apart from the optimization of business processes and the reduction of costs, the respondents in 2006 mentioned the improvement of the degree of accessibility to information and time saving.

On the other hand figure 4.4 presents the results of a study that was carried out in 2011 in the United States and in Europe, specifically in France, Great Britain and Germany among 348 enterprises.

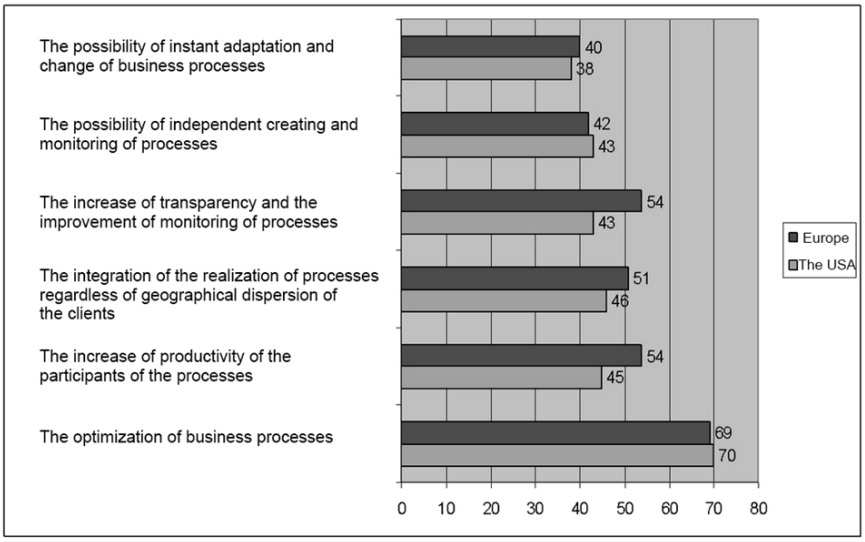

Figure 4.4. The results of the study concerning the benefits from implementation of BPM that was carried out in 2011 in the USA and in the chosen European countries [1]

According to the above mentioned studies, the use of BPM contributes mainly to the optimization of business processes, the increase of productivity of particular participants of the processes, mostly the employees, the integration of these processes, as well as the possibility to create and implement these processes independently in an efficient way.

4.4. Conclusion

The concept concerning the business process management (BPM) becomes undoubtedly more and more popular. Although the first BPM systems were created only at the turn of the 20th and the 21st century, it has to be stated that many enterprises have been already using them. A decisive factor is that these systems are highly effective, because they enable to generate large amount of savings. Moreover, the total repayment from the investments carried out in relation to the purchase of these systems, can be seen even after about one year from the moment of their implementation. The use of BPM leads to various

benefits obtained by enterprises. These benefits include especially optimizing and integrating the business processes, saving time, the improvement of the information flow, as well as the increase of productivity of the participants of these processes. In this way one should regard as true the statement of A. Bitkowska, who stated that *business process management becomes a more and more popular concept of management used by enterprises in the recent years. In this new approach one can perceive the possibility to improve the activities of an enterprise, to increase its effectiveness and thus to increase the chance to survive in a competitive environment that is making ever higher demands*.

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Chapter 5

Human resources accounting: A suggested model for measurement and valuation

5.1. Introduction

Barcelona could lose Lionel Messi , Luis Suarez or Neymar because of their wage demands, claims club economic vice-president Javier Faus.

While considered critically important by owners and managers, the process of organizing, identifying, measuring, directing and controlling the human resources of an organization remains a difficult task for managers. Previous attempts to find tools and techniques to identify and disclose the real value of human resources as firm assets to the organization have been problematic, despite the clear dependence of an organization on its human capital for revenue creation, whether through intellectual endeavors or via physical effort. It is widely acknowledged that human resources are keys to the success or failure in any firm. Human Resource Accounting (HRA) helps management frame policies for human resources especially where it is necessary to identify measure and disclose data about the people within an organization, where they are recognized as an accounting resource. It involves two areas of measurement: first it measures the cost incurred by an organization to recruit, select, hire, train and develop human assets, and secondly, it involves calculating the economic value of people to the organization... Usually firms who apply HRA concepts in their accounting systems situate this information in a separate section of their annual reports, and provide a detailed account of their human resources. While physical assets such as plants machinery, buildings etc. are necessary for any organization, they are largely static and unproductive and require a decision in order to be initiated. A decision inevitably made by a human, one who performed, or managed some task within the organization. Clearly, the profitability, productivity, solvency and efficiency of any organization depend largely upon the activities of human resources. Reporting on human assets usually includes a profile of human assets, the compensationpattern, training and development events

and policies, human asset productivty, human asset value, and the total wealth of the organization.

The concept underpinning HRA is that the people in a company (the human resources) represent a certain value that can be compared to other resources [16]. HRA implies accounting for people as human assets where it can be used as a tool to measure human resources and as a management tool [16]. The concept of considering human beings as an asset is an old phenomenon and it goes back to the labor theory of value where pioneering economists argued on firm value creation via labor,. For example, Paton [34] casts doubt on the credibility of a balance sheet without the presentation of the loyal personnel. In the mid 1990's accounting for people had greatly been improved, leading to the phrase 'our people are our greatest asset'.

The major tenet of HRA is that it involves accounting for the company's management and treats employees as human capital that provides future benefits. For example, expenditures related to human resources are reported as assets on the balance sheet as opposed to the traditional accounting approach which treats costs related to a company's human resources as expenses on the income statement that reduce profit. Traditional accounting also involves sophisticated calculations requiring all manner of estimations, assumptions and variables that need to be factored in. HRA instead focuses on the accounting of costs associated with acquiring personnel along with the programs adopted to enhance personnel efficiency. Traditionally in financial statements it is tagged as human capital or intellectual asset accounting and usually labeled as investments made in the Human Resources of an organization. Human capital refers to a set of knowledge and competence, skills and training, innovation and capabilities, attitudes and skills, learning ability and motivation of the people who form the organization. It is argued that quantifying the value of Human Resources helps management to cope up with the changes in its quantum and quality so that equilibrium can be achieved between the required resources and the provided human resources. According to [35] there are two reasons for including human resources in accounting. Firstly, people are a valuable resource to a firm as long as they perform services that can be quantified. Secondly, the value of a person as a resource depends on how he is employed. So management style will also influence the human resource value. Drawing from previous work this paper focuses on HRA as an information system relevant to organizational usefulness,

decision- making, valuation and related issues, where 3 main goals are achieved, namely:

- The provision of objective and quantitative data relating to the total cost, total revenues and the value of human resources of the organization;
- Working within a theoretical framework that guides decisions regarding cost effectiveness in the acquisition, development and maintenance of human resources; and
- Encouraging and promoting decision-maker's interest in human resources and considering their perspectives.

5.2. Early Development of Human Resource Accounting Concepts.

Early interest in HRA came from several sources, such as the economic theory of human capital, where the first attempt to value the human beings in monetary terms was made by Sir William Petty as early as 1691. Sir Petty was of the opinion that labor was the father of wealth and it must be included in any estimate of national wealth. Further efforts were made by William Far in 1853, followed by Earnest Engle in 1883. Flamhotz [36] state that some theorists like Scot [37] spoke about treating people as assets and accounting for their value in the beginning of the twentieth century. However, the most productive period of research of human HRA started in the beginning of the 1960s and was strongly influenced by the disciplines of sociology, industrial psychology and economics [19]. Research in 1999 by Flamholtz, Pylet and his team at Michigan University generated a chronological history of the development of Human Resources Accounting depicted by five stages as shown in Table 5.1 below. Each of these stages is discussed in more detail overleaf.

Table 5.1. Historical development of HRA. Source: [38] and further developed by Author.

Stage :1 1960-1966	The origin of Human Resources Accounting with theories, representing inference of the basic concepts (primary) of human resource accounting.
Stage :2 1967-1970	The first basic academic formulation of some measuring models
Stage :3 1971-1977	Rapid increase in interest levels in Human Resources Accounting
Stage :4 1978-1980	Static academic interest level and emphasis on fixed assets in organizations led to reduction of interest in HRA in the level of organizations and universities
Stage :5 1981-1990	Resurgence of international interests in theories and jobs in Human Resources Accounting.
Stage :6 1990-now	Development of concepts, models, approaches, disclosure, accounting standards and treatment, generating soft information.

The first stage: The interest to the human resources accounting began in this period. A number of theorists such as Scott [37] and Peyton have supported the idea of considering human resources as its asset and valuation. Also, organizational psychologists like Likert believed that human resources were considered to be in default as the valuable resources of organization. Hermanson [21] presented a model for human resource valuation to financial reporting of external organization. He identified that human resource accounting was primarily used as a managerial tool, instead of as a way to value people as assets.

The second stage: This stage coincided with the formation of university research teams to develop and evaluate the validity of the historical cost determination model and the value of human resources. In this period, researches were conducted to determine the current and future applications of human resource accounting as a tool for managers and financial information users. This means applying of researches for formulating of potential. In early 1967, research team including Likert, Bromet, pile and Flamholtz has conducted plans to develop the HRA concepts and methods. The result of this research was pub-

lished by Bromet and colleagues [4], the term human resource accounting was used for the first time. They investigate the objections relating to the expense of human cost considering as an asset rather than its calculation.

The third stage: In the 1970s, interest in human resource accounting grew rapidly and involved a lot of academic research throughout the world, while at the same time interest grew at the organizational level... In this period a lot of research into the application of HRA theory within organizations occurred. The American Accounting Association established a committee to oversee the development of human resource accounting [16]. Several authors reported that human resource accounting had an impact on decision making, including Tomassini [39] whose findings showed that the HRA data can be effective for management decisions relating to the employees' prioritization at retention and selection of employees. Flamholtz [40] conducted a research to study the effect of figures related to the value of human resources on official accountants' decisions. The results of this study showed a significant statistical difference between the decisions based on figures calculated on traditional methods of personnel selection, and those figures based on the value of human capital including monetary and non-monetary items. In this period Flamholtz [13] presented a model based on the premise that the value of individual is based on the services that he/she will provide to the firm.

The fourth stage: Starting in 1977 until 1980, some decrease in interests in Human Resources Accounting was noted. Flamholtz and Ansari [41] proposed the use of HRA as a managerial tool for use in management science... One of the reasons for the reduction of interest to the HRA was that the previous preliminary studies that were conducted in relation to the HRA were relatively simple while the remaining studies were highly complex... Moreover it became apparent that research into the application of HRA required the interest and cooperation of organizations and also cost money to conduct. Funding expensive research where there was no guarantee of benefit to the organizations meant that organizations were not willing to implement it [12].

The fifth stage: Commencing in 1981 this stage included a revival of interests in the practical application of Human Resources Accounting. The real reason behind this renewed interest was economic development and transition from a production-driven economy towards a service-oriented economy, and some part of a knowledge-based economy. The application of HRA principles

made it possible to understand the important importance of human resources for organizations and supported the emergence of intellectual capital over and above physical assets. In this new framework, the future success of the organizations was affected by intellectual capital rather than the physical capital (i.e. total human capital and intangible assets). Before, accounting was unable to respond dynamically to changing conditions because of a fixed focus on static physical assets... In the present era companies need information to come through that can continuously evaluate individuals' skills and abilities. This information providing tool about human capital is the same fundamental aspect of HRA [16]. Some authors argued that human resource accounting had failed because of a lack of practical use [19], however others defended the status of HRA by highlighting a lack of new researchers in this area [19]. Unfortunately the lack of quantitative results to prove the influence of HRA on decision-making has hindered the establishment of a specific, measurable impact [42].

The sixth stage: During this period the focus of human resource accounting changed from measuring human resources and providing hard accounting information, to a method which focuses more on providing soft information [19]. Most recent article concentrates on the use of human resource accounting as a managerial tool. Despite that all the research, there is still no solution to the challenges of the practical application of human resource accounting.

5.3. An Analysis of Human Resources Accounting: Definitions and Conceptual Development.

Tracing the historical development of the conceptual and philosophical framework for HRA reflects clearly the development in the definition of this branch of accounting over the years. Interestingly, the Dictionary of Economy [43], defines HRA as "all human, material, real and monetary elements that can be drawn and used in the production of economic goods to satisfy social needs". Professionally, the American Accounting Association [2] defined HRA as "the process of identifying, measuring and communicating information about human resources in order to facilitate effective management within an organization". For the first time recognition and the quantification of human resources for the purpose of assisting the effective management of an organization and to other parties as a key part of the HRA process is introduced. However it is argued that

this definition is unformed as it is not specific as to what constitutes the human resources expenditure and how it is to be recognized. From an academic perspective a more specific definition of HRA is the one given by Flamholtz [17], which refers to HRA as "the process which involves measuring the cost incurred by business firms and other organizations to recruit, select, hire, train and develop human asset". For the first time, the relationship between the expenditure on human resources and its role in valuation and reporting is recognised.

At the corporate level, Woodruff [44], the Vice President of R. G. Batty Corporation, defines HRA as "an attempt to identify and report investments made in human resources of an organization that are presently not accounted for in conventional accounting practice". In this definition Woodruff posits that HRA is the systematic accumulation of information about changes in investments made in human resources and reporting back that information to operating managers in order to assist them to make better decisions than they would have been able to make without such additional information. The importance of management decision-making is introduced and a concept of strategic thinking can be seen to emerge.

In terms of revenue generation, Bullen and Eyler [45], state that HRA involves accounting for expenditure related to human resources as assets, as opposed to traditional accounting, which treats these costs as expenditures that reduce profit. While Ross et al., [46] state that human capital can simply be explained as the potential of the employees to generate more wealth for organizations in future. Though it is not owned by the organization, standard human capital management practices determine how well the tacit knowledge of the employees is transferred to the explicit and how well the intellectual capital of the firms is levered so that human capital is transferred to more explicit structural capital. In a similar future-orientated approach, Newman [47] regards HRA as referring to the measurement of the abilities of all employees of a company, at every level (management, supervisory and ordinary employees) to produce value from their knowledge and the capabilities of their minds. This definition considers the current growth in the service industry where the knowledge and intellectual capabilities of employees are the key for success.

Finally, Friedman and Lev [48] and Lau and Lau [49] introduce measurement into HRA by describing it as a method for systematically measuring both the asset value of labor and the amount of asset creation that can be at-

tributed to personnel activities. This definition incorporates the economic benefit attributable to the human resources in addition to recognizing their cost implication.

By drawing together these various definitions and concepts of HRA, and overlapping them with global trends and economic markers, it is possible to describe the following key characteristics and features of Human Resource Accounting:

1. A definition of the core concept of human resources accounting.
2. The measurement and valuation of human resources.
3. Recording of measurements and valuation in the books of account.
4. Disclosure of the recorded information in the financial statements.
5. Communication of financial information to decision-making parties, supported by different tools relevant to their decisions.
6. Planning the investments in human resources.
7. Planning, controlling and monitoring the changes in operations and value of human resources.

5.4. Challenges of HRA: Concerns from the Profession.

Some professional accountant and researchers (see Gates [50] and Akinsoyinu [51]) argued against HRA with objections that included:

(a) Sensitive Data not something that can be shared externally. The main obstacle for reporting human capital externally is that the information reported could be sensitive to the reporting companies and regarded as something that should not be shared externally.

(b) Measurement Not First Priority for the Company: Companies do not attach first priority to the measurement of human assets; rather they face more urgent issues like human resource requirement and allocation.

(c) Not Enough Time and Resources: This is closely related to the hitherto problem of not attaching priority to the measurement aspect of the Human Capital, where the Human Resource Manager does not give enough importance to the concept of HRA.

(d) Human Resource Professionals Unaware of Value/No clear Return on Investment.

(e) Lack of Clear Guidance and Universal Practice: the lack of universal approach to its reporting thereby defining the standards that would allow for valuable and meaningful comparisons. There is a current absence of universal definition, which does not assist the companies that are proactive enough to measure.

(f) Global and Group Issues: The issue of autonomy in global and group companies poses another problem in the application of HRA. Differences in valuation of human resources across the countries and overlaid with different levels of salaries or value from same specific man skills, different measurements and different disclosure may create more complex problem in harmonizing the international accounting standards.

(g) Awareness and Acceptance: The level of awareness and acceptance of HRA is still low as many companies take little initiative to make the information available to the shareholders despite having the data available.

(h) Lack of an Industry Standard: The absence of an industry standard means that every company has to evolve its own standard, which can become a tedious process considering that most of them are still involved in improving their business.

(i) Extensiveness of the Research Involved: Another aspect working against the acceptance of HRA is the need for extensive research that it entails. Many companies do not want to go into the intricacies of finding the value of their human resources. While it may be affordable for most big companies to dwell into such best practices, it is likely not going to be an economically viable option for small and medium size companies.

(j) Dynamism of Some Industries: Certain industries, like the information technology, are very dynamic due to frequent discoveries and technological advancement. In these types of industries, it is very difficult to predict as to what is going to be the future requirements and how technology is going to shape in the near future.

5.5. Further Limitations of Human Resources Accounting.

There are a lot of other limitations and criticism of HRA. These include the dehumanization of people where they cannot be viewed like physical assets, or where their value might be publicly perceived to be low with serious psycho-

logical consequences. Similarly there is a political reason for labor to remain without absolute value as this might generate claims and higher rewards for work with different skill levels. Here it is prudent to question how one amortizes the value of an employee. Does it increase or decrease over time? .And in certain industry sectors, the effort to conduct HRA might be questionable amid high staff turnover rates especially in volatile markets. From a process point of view, the lack of a clear-cut procedure in allocating costs and value, the lack of empirical evidence to support its use as a management tool, and some vagueness regarding exactly how the value should be presented in the financial statement all represent significant problems for its wider adoption.

Legislatively, it is not clear how tax laws recognize humans as assets, not is there an accepted method of valuation, confounded further by the abstract, qualitative nature of people where bias might influence objectivity and preciseness that cannot be viewed in monetary terms. These process and professional practice issues are addressed below.

5.6. Human Resource Accounting and International Accounting Standards.

Since the 1960's, HRA has been dominated by two main questions. Firstly, how could human assets be defined as assets on the balance sheet and secondly, can it be valued in a satisfactory way? According to International Accounting Standard 38 (IAS 38)) this section covers the treatment of intangible assets. IAS 38 regards intangible assets as non-monetary assets without physical substance which must be identifiable [23]. In order for an intangible asset to be identifiable it shall be separable and arise from contractual or other legal rights [23]. However, it shall only be recognized if expected to generate future economic benefits and if the cost of the asset can be measured reliably [23].

Wyatt (2008) places intangible assets into six specified categories. These include:

1. Technology resource. Contain Research and Development (R&D) expenditures and related Intellectual property (IP Human resources).
2. Human capital Production resources
3. Advertising, brands and related IP

4. Customer loyalty
5. Competitive advantage
6. Goodwill

In order to define an intangible asset, one has to consider different criteria. Each criterion should be identifiable, which means it must be separable from the entity through sale, rent, transfer or exchange and arise from contractual or other legal rights. Also, the entity must control the asset - in this case have the power to obtain future economic benefits (usually originating in legal rights) [23]. Future economic benefits can be revenue or cost savings. In order to recognize an intangible asset it must first meet the definition criteria and secondly, meet the recognition criteria [23] which are divided in two main parts [23]:

1. The cost of the asset could be measured reliably.
2. The intangible asset will probably generate future economic benefits to the entity.

In order to assess the future economic benefits, the firm shall use reasonable and supportable assumptions representing management's best estimate of the economic conditions during the useful life of the asset on the basis of evidence available at the time of initial recognition [23]. Usually, the cost of an acquired intangible asset can be measured reliable, especially .when there is a fee in form of cash or other monetary assets [23]. The cost comprises of its purchase price and costs of preparing the asset for use [23].

5.7. Quantifying Human Resources: Measurement and Valuation Models.

Early HRA research involved the continued development of concepts and models for measurement, valuation and accounting for human resource cost and value, with several models emerging... But each has its own limitations and no one model has proved to be more valid than other. The table below illustrates the key valuation models and approaches to HRA, where each approach uses different types of methods to determine the value an employee [10].

1- ECONOMICS MODELS (Value approach)

A- Non-purchased goodwill model (Hermanson model)

B- Competitive bidding model (Hikimian & Jones)

C- Present value of future earnings model (Lev & Schwartz model)
D- Economic value model (Pyle and Falmholtz model)
E- Future compensation (rewards) valuation model (Stochastic Model) (Flamholtz model)
F- The relationship between cause, intervention and the end result model (Likert model)
G- The five dimensions model (Mayers & Flowers model)
H- Present value of net benefits obtained model (Morse model)
I- The discounted net certain benefits model (Ogan model)
J- The methods of adjusted present value (Hermanson model)
K- The changes in value of human resources model (Likert model).

2- MEASUREMENT MODELS ACCORDING TO COST APPROACHES

A- Historical cost model (Flamholtz model)
B- Replacement cost model (Likert and Flamholtz model)
C- Opportunity cost model (Hekimian and Jones model)
D- Government contribution model

3- MULTIPLIER METHOD APPROACHES

Below the discussion of some important models:

1-Historical Cost Approach (Flamholtz model): The historic cost method is one of the more popular methods because of its similarities to normal accounting procedures. The model calculates an employee‘s worth using the total historic costs associated with obtaining and hiring the employee [10]. This model is closest to the conventional accounting concept, which derives the costs from transaction data and thus measures the investments in human resources [4]. A key factor here is that human resources have to be depreciated when their value declines [52]. Under this method capital expenditure on human assets are amortized over an expected life of human assets. When an employee is leaving early, any unrecovered expense will be treated as a loss and charged to profit and losses account. However it is difficult to find out the effective life of human assets and fix the rate at which cost will be amortized. Actual cost incurred for

recruiting, hiring, training and developing those human resources of the firm are divided into Revenue (expense) and Capital (asset) components.

This cost may be classified as follows:

1. Acquisition Cost containing (i) Recruitment Cost(ii) Selection Cost(iii) Placement Cost(iv) Campus Interview Cost
2. Training (Development) Cost includes the following costs (i) Formal Training Cost (ii) On the Job Training Cost (iii) Special Training (iv) Development Programs.
3. Welfare Cost include the following costs (i) Medical Expenditure (ii) Canteen Expenditure (iii) Specific and General Allowances (IV) Children Welfare Expenses (v) Other Welfare Expenditure.
4. Other Costs include the following (i)Safety Expenditure(ii) Ex-gratia(iii) Multi-trade incentives (iv) Rewarding Suggestions

This method has the following advantages:

(i) The method is simple to understand and easy to work out.

(ii) The method follows the traditional accounting concept of matching cost with revenue.

(iii) The method can provide a basis for valuing firm's returns on its investment on human resources.

Also this method suffers from the following limitations:

(i) The method takes into account only a part of acquisition cost of employee. It does not consider the aggregate value of their potential services.

(ii) It is difficult to estimate the period over which the human resource will provide service to the organization. It thus creates problems in determining the amount to be amortized over the year,

(iii) The value of human assets according to this method goes on decreasing every year due to amortization.

However, in reality, the value of human assets increases over time on account of people gaining experience.

There are several limitations and dis-advantages to this way of valuing human resources [53]:

1. Employees can improve their skills as a result of experiences occurring outside their work. These experiences do not cost the company money and will not be taken in consideration when valuing employees.
2. People who experience the same training will profit differently from this training
3. Employees can develop patents or processes which are worth far more than the historical costs would imply.
4. An employee can be disturbed by sensitivity training which can harm the company instead of strengthen the company.
5. Another weakness of this model is the possible absence of a connection between the book value of the human assets and the actual or market value [52].
6. For this is the difficulty of calculation depreciation. Employees may leave the company sooner or later than expected and grow at different rates [53].
7. It takes into account only acquisition costs and does not take into account his potentiality.
8. It is not clear when or up to how many years the amount should be amortized
9. Amount to be amortized is not fixed.
10. Capital cost decreases with amortization.

2-Replacement cost model (Likert and Flamholtz model). This is a measure of the cost to replace a firm's existing human resources. Human resources are to be valued on the assumption that a new similar organization has to be created from scratch and the cost to the firm is calculated if the existing resources were required to be replaced with other persons of equivalent talents and experience. Likert suggests that the cost of employee should be valued based on what the organization would have to sacrifice to replace an employee if he/she leaves the organization. This includes the cost attributable to the turnover of a present employee, as well as the costs of acquiring and developing a replacement.

The limitations of this approach are described as:

1- There may be no similar replacement for certain existing assets

2- The replacement value is affected by subjective considerations and therefore the value is likely to differ from one another.

3- It is against conventional accounting practice.

3-Opportunity cost model (Hekimian and Jones model): This model is also known as "Market Value Method". This is a method of measuring the value of human resources based on the economist's concept of 'opportunity cost', where opportunity cost is the value of an asset when there is an alternative opportunity of using it. In this method there is no opportunity cost for those employees who are not scarce. As such only scarce people should form part of the value of human resources. Opportunity costs are considered as an asset value when the target is of an alternative use. Only scarce human resources would have value at any particular point of time. Opportunity cost is calculated on the basis of efforts made by several organizational units, profit centers or departments [52].

The limitations of this approach are:

1. The total valuation of human resource on the competitive bid price may be misleading and inaccurate. A person may be a valuable person for the department in which he is working and may have a lower price in the bid when viewed by other departments.
2. Only scarce employees are included in this method and as a result other employees may lose their morale, as they are not ever counted.
3. It would be difficult to identify the alternative use of an employee in the organization.

4-Present Value of discounted future earning Approach (Lav and Schwartz Model): In this model, developed by Lev and Schwartz [25] the future earnings of various groups of employees are estimated up to the age of their retirement and are discounted at a predetermined rate to obtain the present value of future earnings used in the case of financial assets. It is the present value of future earnings. To determine this value, the organization establishes what an employees' future contribution is worth to it today. That contribution can be

measured by its cost or by the wages the organization will pay the employee. The organization does not benefit by monitoring the efficiency of its investment in employee development because the investment has little or no impact on the present valuation of future earnings. According to this model, the value of human resources is ascertained as follows:

(i) All employees are classified in specific groups according to their age and skill.

(ii) Average annual earnings are determined for various ranges of age.

(iii) The total earnings which each group will get up to retirement age are calculated.

(iv) The total earnings calculated as above are discounted at the rate of cost of capital.

The following formula has been suggested for calculating the value of an employee according to this model.

$$E(V_y) = \sum_{y=1}^{T} P_y(t+1) \sum_{y=1}^{t} \frac{I_I}{(1+y)^{t-y}}$$

Where:

$E(V_y)$ = expected value for human resource for a person his/her age Y and pension age T.

$P_y(t)$ = probability of death.

I_I= expected earning for a person in period I.

Y=specified discount rate for a person.

This method has several limitations:

(1) A person's value to an organization is not entirely determined by the salary paid to him. A person may like to work at a salary which is less than what he actually deserves. Moreover, salary does not remain constant over a period of time. They tend to change in response to social, political and economic conditions. Hence, they cannot be predicted with precision and accuracy.

(2) The model ignores the possibility that an individual may leave the firm for reasons other than death or retirement. Thus, it overstates an employee's expected service life and his future earnings. This model implies that the

future work condition of the employee will not change over the span of his working life, but will remain the same as at present.

(3) The model does not take into account the changes which people make during their career, from one role to another, at one or more times within the organization itself. This may result in the changes in their expected future earnings and ultimately the value of human resources. It ignores the variable of the career movement of the employee within the organization. While an engineer might be an engineer throughout his career in the organization this model does not take into account the role changes of employees, where for example a Personnel Manager may become Chief Legal Officer.

(4) The model also ignores other considerations such as seniority, bargaining capacity, skill experience, etc., which may result in payment of higher or lower salaries to employees. Thus, the salaries paid to employees may not really represent the employee's real worth to the organization.

(5) This method does not give correct value of human assets as it does not measure their contributions to achieving organizational effectiveness (Scarpello, 1989).

5-Future rewards valuation model (Stochastic Model) (Flamholtz model): This model has been suggested by Flamholtz [13]. This is an improvement on 'present value of future earnings model' since it takes into consideration the possibility or probability or an employee's movement from one role to another in his career and also of his leaving the firm earlier than his death or retirement. According to this model, the ultimate measure of an individual's value to an organization is his expected realizable value. Expected realizable value is based on the assumption that there is no direct relationship between cost incurred on an individual and his value to the organization at a particular point of time. An individual's value to the organization can be defined as the present worth of set of future services that he is expected to provide during the period he remains in the organization.

The model suggests a five step approach for this purpose.

Determination of the period for which a person is expected to serve the organization.

1. Identification of service states (i.e. roles or posts) that the employee might occupy during his service career including the possibility of him/her leaving the organization.

2. Estimation of the probable period for which a person will occupy each possible service state (i.e. posts or roles) in future in the organization.
3. Estimation of the value derived by the firm when a person occupies a particular position.
4. The total value of the services derived by the organization by different employees or group of employees is determined. The value thus arrived is discounted at a pre-determined rate to get the present value of human resources.

This model is formulated in this equation:

$$E(RV) = \sum_{i=1}^{n} \left[\sum_{i-1}^{m} \frac{Ri - P(Ri)}{(1+R)^k} \right]$$

Where:
Ri = value of R group of human resource.
P(Ri) = probability that a person will occupy specific statues.
t=time.
n= case of leaving work.
R= relevant discount rate.

Limitations of this model are that it suffers from nearly all the same drawbacks as the present value of future earnings models... In addition, it is difficult to obtain reliable data for determining the value derived by the firm during the period a person occupies a particular position. The model also ignores the fact that individuals operating in a group may have a higher value for the organization as compared to individuals working independently.

6-Present value of net benefits obtained model (Morse model): This model has been suggested by Morse [54]. According to this model, the value of human resources is equivalent to the present value of net benefits derived by the firm from the service of its employees.

$$A = \sum_{i-=}^{N} \int_{y}^{T} \frac{I_i(t)}{(1+r)^{t-y}} dt + \int_{y}^{T} \frac{X_{(t)}}{(1+r)^{t-y}} dt$$

Where:
A = value of human assets to a formal organization.
N = number of individuals currently employed by the organization.
y = current time.
T = highest time at which an individual currently employed leaves the organization.
$I_{i(t)}$= net value of the services rendered by individual *i* at time *t* to the organization.
R=time value of money.

The method involves the following steps.

1. The gross value of services to be rendered in future by the employees in their individual as well as their collective capacity is determined.
2. The value of future payments (both direct and indirect) to the employees is determined.
3. The excess of the value of future human resources over the value of future payments is ascertained.
4. The present value of the net benefit is determined by applying a pre-determined discount rate (generally the cost of capital). This amount represents the value of human resources to the organization.

7-Certainty Equivalent of Net Benefit Model (Ogan model): This model has been suggested by Pekin Ogan [28]. This is essentially an extension of the "net benefit approach" as suggested by Morse. According to this approach, the certainty with which the net benefits in future will accrue should also be taken into account, while determining the value of human resources. The approach requires determination of the following:

1. Net benefit from each employee as explained under 'net benefit approach'.
2. Certainty factor at which the benefits will be available.

3. The net benefits from all employees multiplied by their certainty factor will give certainty equivalent net benefits. This will be the value of human resources of the organization

$$K_{kj} = \left[\sum_{i=1}^{n}\sum_{k=t}^{l-t}\frac{1}{(1+r)^k}\right].V_{aj}$$

Where :

K_{kj} = total adjusted net present values of human resources in a Professional service organization

V_{aj} = certainty-equivalent net benefits

L = finishing the time of existing person in the firm.

I= chain of existing the worker in the job 1, 2, 3…n.

V_{aj} = Net certain benefits created from existing human resource in firm.

Accountants differ among themselves when it comes to accounting treatments and investment in human resources. They also differ on types of disclosure in the financial reports. Two distinct trends in thinking are evident. Firstly, the traditional point of view supports accountants in addressing the costs of investment in human resources earning expenditures, and they disclose it in financial reports as an expense. This approach is defended by accountants for the following reasons:

1- Adherence to conservative accounting principles which rejects any accounting procedures that increase profits or increase assets. This inhibits its acceptance of viewing investments in human resources as assets because it will have the effect of increasing profits in the short term versus an expected losses in the future if any human resources left the firm.
2- Human resources may have value from the point of entity view, but may not be have any market value if the unit has decided to dispense from the work.
3- The expansion of the disclosure to include the disclosure of investment in human resources may lead to achievement of the benefits to the firm , but at same time the expansion of the disclosure will be at a high costs which may exceed the benefits expected of it.

4- Other reasons that inhibit valuing human resources as assets relate to the survival of the human resources function in a firm because if their functional performance is calculated as costing the organization money, their continued existence inside the firm will be compromised.

The above reasons and arguments prompted some accountants to block acceptance of the idea of addressing the investment costs in human resources and disclosed as assets. But the outlook has changed to include the provision of potential future economic benefits of economic unity. Moreover with increasing acknowledgement of the importance of HR capabilities that enable them to acquire and maintain tangible assets that help achieve the goals of the firm, the recent trend of accountants have adopted a more contemporary view of accounting. This adoption refers to treating investment in human resources costs as one element of assets elements and disclosed in the financial reports. Supporters of this trend argue that human resources is one of the most important resources available to the unit, and as long as the human resource produces goods and provide services that we can measure its costs, there is no reasons to prevent accountants from measuring HR value and cost. They can also disclose it as assets to support the interests of the various stakeholder parties within the firm. Some other recognizes that human resources represent economic benefits to the firm that are reflected in increasing production, profitability, growth and competitiveness. Considering human resources cost as expenses rather than assets, means canceling out any future economic benefits. In this context, some may criticize the level of uncertainty about the contribution of HR in achieving future economic benefits for the firm. This criticism can be analyzed by using a real life case study involving a sports club, where players contribute directly to the success of football and thereby enable the club to continue operating. Thus they contribute directly to the achievement of future economic benefits for the club. Players sign a legally binding contract with the club which gives the club legal rights to retain their services. In addition Players can only leave the club or play for another after obtaining the approval from the mother club. Another reason underpinning a growing contemporary trend in HRA is the increasing technological complexity of modern business environment, and the increase in time required for human resources to gain experience. In some way it can be regarded a barrier to entry and will make human resources realize the im-

portance of the integrity of resources in the long term. Carper [55, p. 4] recognizes how business acquisitions are being made on the basis of the target company's human resource skill level amongst managers, engineers and IT specialists, not on the physical plant or equipment. Finally the contemporary trend towards matching expenses and revenues for same financial year is predicated on the belief that expenses underpinning the revenues and the investment costs in human resources contribute to achieving revenues for several years and not one year. Logically then, human resources should be treated as assets, where yearly efforts are represented by costs amortized over several years. In addition the principle of disclosure of useful information should be made available for planning, controlling and performance evaluation. For example Professor Chakraborty has suggested that 'human assets' should be shown under the heading of Investments in the Balance Sheet of an organization. He has not favored its position under the heading fixed assets since it would cause a problem of depreciation, capital gains and losses, in the event of the human resource exit. Similarly, he has not favored their inclusion in current assets on the ground that this will not be consistent with the general meaning of the term.

5.8. Suggested model: Historical cost adjusted with discounted present value of extra non-ordinary earnings

As number of models have been developed to value human assets. In addition, there are two types of expenditures that could be set:

(1) Capital Expenditure: Acquisition, Development, Retention, Update or up-grading and Hiring cost, Recruitment & Training cost.

(2) Revenue Expenditure: Wages, Salaries, Bonus, Commission, prerequisites, allowances and short term motivation & efficiency maintenance cost. Also there are expected benefits that the entity may earn from acquiring these human resources that exceed normal earning, or compared to non-acquiring this employee or in comparison with other entities.

The proposed calculation of future capital expenditure did not take into consideration the initial cost that would be amortized over the years. Also previous models did not take into account the probability of two important factors:

1- The probability of resigning, accidents or death.

2- The probability of getting benefit from acquiring specified extra benefits from spending on this human asset.

Given the previous attempts at developing a HRA model it is clear that it is not an easy task. Even highly developed models such as Stochastic model have limitations which are yet to overcome. It is also important that a model is based on a measure for which enough data is available. For example the reliable and verifiable cost information beside the predicted data for future benefits has to be determined via reliable and accurate methods, and in addition the correlation between the measure and the value of human resources has to be strong. The business environment also has to be more sympathetic to human resource accounting. It is important that more research is done about the net benefit of human resource accounting and also about practical application in selecting the right measures.

The proposed model is built on an assumption of merging the initial historical cost of human resources (as explained previously) and the expected, extra non-ordinary future benefits from acquiring this specified human resource asset, discounted with a proper discount rate, while taking into consideration the probable likelihood of achieving this change of earning or benefit. To satisfy the needs of the conservative accounting policies and to include a matching principle between the earnings and cost in same financial year, the model also factors in the probability of that person leaving the firm or resigning or dying.

The model could be formulated as:

$$\boldsymbol{HR.E(V) = \sum C(q_z) + \left[P(\pi_{tx}, \pi_{tn}) . \sum_{i=1}^{t} \left(\frac{\pi_{tx} - \pi_{tn}}{(1+r)^t} \right) \right] . p(\varepsilon)}$$

Where:

$HR.E(V)$: are the expected value of human resource at point of acquisition.

$\sum C(q_z) = (q_1 + q_2 + q_3 + \cdots q_n)$: are the historical cost functions.

$P(\pi_{tx}, \pi_{tn})$: are the probability of attending the amount of extra-ordinary earning or net benefits.

π_{tx} : are the amount of extra ordinary benefits or earnings correlated with existing of specified HR.
π_{tn} : are the amount of ordinary benefits or earnings correlated with absence of specified HR.
$P(\varepsilon)$: are the probability of death, accident or resigning the job.
t : the time line of contract.
r : discount rate for year t.

Any future capital expenditure requires re-evaluation of human assets in order to recalculate the amortization amount for the next years. The amortization amount per year will then be calculated according to the equation

$$Amor_t = \frac{HR.E(V)}{N}$$

Where:
$Amor_t$ = amortization for the year t.
N = years of contract.

This amount of amortization closed yearly in profit and losses account for matching of the earning recognized by certain HR assets.

5.9. Conclusions

1- Failure to recognize the value of HR in financial statements led to a number of misleading results such as (i) Reducing the value of assets where potential investors will certainly want to know the value of human resources in the organization, and where analysts want to calculate the best investment returns if it has all the accounting assets to hand, including human capital, (ii) Reducing the value of income, as enormous expenditures of recruitment, training and human resources development, will inevitably reduce the income.

2- It is important to ensure the availability of criteria necessary for recognition of human resources as an asset. To recognize human resources as assets in the financial statement of financial position, depending on the definition of asset, which is an economic resource controlled by an entity as a result of past transaction, and the criteria of recognition related to probability of inflow bene-

fits from the assets to the entity, and possibility of reliable measurement to these benefits.

3- There are several models and approaches that measure the value of HR and suggest how to disclose it in the financial statements. Though the different model and methods have already been proposed for HRA, it is still extremely difficult to determine the actual value of the human resource of the firm. The non-recognition of human resources as assets creates difficulties and limitations of using and applying previous models and approaches, leading to the low levels of credibility of each model and its ability to reflect the value of human resources logically and reasonably.

4- This paper suggests a model that would overcome some of the problems inherent in previously discussed models by taking into consideration the current benefits and future benefits from human resources and distributing it over the years of an employment contract. The proposed module for measurement of human resources also factors in, estimated employees' benefits that are included in the budget when acquiring a human resource, which are calculated for continuous years for budgeting purposes.

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Chapter 6

Attractiveness of seniors learning improved by concept of Internet treasure hunt

6.1. Introduction

For many years, the continuous, dynamic development of information technology can be observed. Initially, computers and software were used mainly as separated units, so the complexity of the created systems was relatively small. With the appearance of Web network the technology development has been focused on the examination of the possibility of building the software that not only uses the network resources, but also becomes their part and co-founder of the Internet. Currently, the universality of network technologies has led to the creation of a huge number of applications and materials. Such a large amount of information can be accessible by different users of different age.

The seniors on the one hand have special needs for working with ICT (Information and Communication Technologies) and on the other hand have to be motivated in order to get involved in the topic of ICT. It will be a key competence for social inclusion in the future. For such reason, the research realized in different European countries tries to make the contact with technology for adults easier, through the use of its innovative methodology [1], [2], [3].

Current statistics show that the number of ICT users and Internet users is increasing in all age ranges in the European societies. However, the seniors are still less represented than other age groups. Moreover, the rates for participation in using the ICT and Internet are different in different European countries. The percentage of the +55 group is now representing a significant part of society in different European countries, what reflects the necessity of keeping them involved actively in the modern everyday life which is very much related to ICT. This fact is also respected by legislation, government recommendations and programmes related to seniors and their education which can been found in each European country.

The paper presents some results of i-Treasure project [12] that has been

developed by a consortium of partners of various institutions: adult education centers, universities and ICT research centers from some European countries: Spain, Germany, Romania, Poland, Greece and Turkey. The main purpose of i-Treasure project is to help the seniors in learning new ICT. The main products of this project are based on the senior learners' needs as well as their expectations that were discovered during the first phases of the project with the means of surveys in all project countries.

This project provides a new approach in learning digital skills through an innovative methodology of learning technologies for practical exercises, supported by a "Treasure hunt" game: some clues are hidden into websites and devices [13], [14]. The user has to discover all clues while using all these technologies. The purpose of playing the "treasure game" by seniors is to learn both some ICT and Internet tools. Training courses and practical exercises focus on teaching the technologies at a basic and advanced level.

The paper is structured as follows: section 2 gives the outline of the situation of seniors learning in Poland, section 3 presents the identification of needs of two target groups (seniors and their trainers) from the point of view of ICT learning received in the questionnaires realized in different European countries. Section 4 describes the methodology of Internet treasure hunt concept while section 5 deals with the implementation of this methodology in i-Treasure approach.

6.2. Situation of seniors learning in Poland

In Poland, the total number of population is over 38 500 000 (statistics were updated on 31th December 2012 and have been extracted from GUS – *Glowny Urzad Statystyczny, Main Statistical Office* [11]). In Poland, the total number of seniors is almost 11 million. It gives 28.5% of seniors in total population.

6.2.1. Legislation, government recommendations and programs related to seniors and their education in Poland

The Council of Ministers of Poland approved the “Government Programme for Senior Citizens Social Activity” for the years 2014-2020. The aim

of this comprehensive programme is to improve the quality of life of older people through social activity and allow Polish society to benefit from the vocational potential of the elderly.

With a total budget of 280 million Zloty (approx. 66.7 million Euros) non-governmental organizations, social cooperatives, sports clubs and associations of local governments are invited to benefit from this program, consisting of two main components:

1. The creation of a long-term policy towards seniors, based on interministerial cooperation and with expert organizations involved in projects with the elderly.
2. A short-term policy, based on specific activities to be carried out by participating stakeholders. The projects to be funded by the program should take into account the priorities outlined by Ministry of Labor and Social Policy, among them:
   - Expand and improve the quality of life-long learning opportunities and reduce the level of e-exclusion.
   - Create the conditions for the integration of older people using the existing social infrastructure.
   - Develop different forms of social activity for the elderly, including the promotion of voluntarism, participation in decision-making processes in society.
   - Increase independent living of the elderly, improving the quality of social services and helping to promote self-help and self-organization.

The Program involves the activities in four areas covering the social activity of seniors. It is based on the following priorities:

1. Education of older people – includes activities aimed at the development of education addressed to seniors, to exploit the potential of mutual learning, the development of innovative forms of education, including non-formal and informal learning, the promotion of the so-called volunteering.
2. Social activities to promote the social integration within and between generations – assumes the development of various forms of active aging using an existing social infrastructure (such as public libraries, commu-

nity centers) and the inclusion of the younger generation in the joint action, in order to build mutual understanding and develop social skills.
3. Social participation of seniors – the activities to increase the participation of older people in public, social, economic, cultural and political life, which will contribute to the development of the civil society.
4. Social services for seniors – the activities to develop different forms of support by increasing the availability and improving the quality of social services for the elderly. It is crucial to create local support networks based on the activities of volunteers in order to create the environment of self-help.

6.2.2. Participation of seniors in trainings in Poland – forms, methods of trainings

The most popular form of trainings for seniors in Poland are the *Universities of Third Age* (*UTW – Uniwersytety Trzeciego Wieku*). This is a formula for educational activities, which contributes to meet such needs of seniors as self-study, learning about the environment, improving the knowledge and skills to perform socially useful activities, fill free time, keeping friendly ties, mental and physical stimulation, and sometimes even the teenage dreams.

Other objectives of the UTW are: development of intellectual, social, physical activity of older people, to support the expansion of the knowledge and skills of senior citizens, facilitating contacts with institutions, such as: health care, cultural centers, rehabilitation centers, engaging the audience in a sports activity and tourism and activity for the benefit of the surrounding environment. In addition, they have an important role to maintain the social ties and people-to-people communication among seniors.

UTW in Poland operate in diverse organizational structure:

- within and under the auspices of the universities,
- set up by associations, foundation,
- acting as government entities, for example by the houses of culture, libraries, social welfare centers.

From the Nationwide Federation of associations of universities of the third age and the National Agreement of universities of the third age, it appears that more than 450 universities of the third age operate in Poland, which deliver

classes and lectures for about 100.000 seniors. The educational offer for seniors includes various fields (ICT, health, law, economy) and motor activities.

6.2.3. Internet treasure hunt for seniors learning

The concept of Internet treasure hunt provides a new approach in learning digital skills through an innovative methodology of learning technologies for practical exercises. Its aim is to provide senior citizens with skills they need to remain active in society, and is focused on this main target group: retired adults. This concept, through the practical use of Web 2.0 technologies and the latest devices (smart phones, tablets, etc.), pays attention to their personal purposes and needs in the digital age and society. It is apparent that senior education cannot be focused only on professional education but it should be concentrated on personal interests. This aim was selected over others because of the lack of interest of seniors in ICT courses [3], [4], [5], [9].

Digital skills can be divided into two groups: digital technical skills and digital information processing skills. Digital technical skills include the ability to use digital systems and tools (computers and other hardware), select and use software applications, and apply security measures in digital environments (protect hardware, software applications, data and personal information). "Digital information processing skills include the ability to: determine information needs (recognize, define and articulate), access information (locate, select and retrieve digital information), assess information (judge the quality, relevance, usefulness, validity of information), integrate information (interpret, analyze, summarize, compare), apply information and communicate it (share digital information with others), create information (generate new digital content and knowledge by organizing, integrating, adapting and applying digital information), ...".

The objectives of i-Treasure are focused on two target groups, adults (senior learners) and trainers in adult centers:

- to extend learning throughout the life course,
- to increase the adult/senior participation in learning,
- to improve key competences of seniors in ICT according to digital skills,
- to respond to the needs of an aging population,

- to reduce the lack of interest in ICT courses and promoting learning in different countries with the same problem,
- to remain active in a society,
- to pay attention to seniors' individual social and personal needs to facilitate their full inclusion in the digital age,
- to incorporate an innovative teaching methodology in adult/senior learning, for trainers and also for adult education providers,
- to support modern teaching methods for trainers at European level,
- to improve the quality of seniors' teaching.

6.3. Identification of needs of two target groups (seniors and trainers)

The identification of needs of two target groups (seniors and trainers) was realized based on seniors' and trainers' questionnaires performed in the research phase of i-Treasure project in some European countries (Spain, Germany, Romania, Poland, Greece and Turkey). The survey shows that the percentage of the +55 group is now representing a significant part of society in all countries. It reflects the necessity of keeping them involved actively in the modern everyday life which is much related to ICT. Most of the seniors represented in the survey were aged 60-70 years. The group of ICT-Trainers shows their long-year experience in ICT courses for seniors.

To the question *"What seniors do/have?"* the following answers were identified:

1. 63% of seniors have their own device (computer, tablet or smart phone) or an access to one.
2. 66% of seniors use the device (computer, tablet or smart phone) in everyday life.
3. 45% of them used a device (computer, tablet or smart phone) everyday or almost everyday within the last 3 months.
4. 75% have an access to the Internet.
5. 35% of seniors use Internet in their everyday life – everyday or almost everyday.
6. 69% use the mobile phones.

7. 62% of seniors using Internet use mobile phones and portable computers to access it.
8. Selected computer related activities were carried out by the seniors: coping or moving a file or folder, duplicate or move information within a document, using basic arithmetic formulas in a spreadsheet, compressing or zipping the files, connecting and installing the new devices, transferring files between computer and other devices, creating electronic presentations with presentation software.
9. 60% of seniors know well or sufficiently how to use the computer and its devices (mouse, keyboard, printer, scanning machine).
10. 40% of them know well or sufficiently how to develop and edit text documents.

To the question *"What the seniors do not do / do not have?"* the following answers were identified:

1. 50% of seniors do not use a device (computer, tablet or smart phone) quite often.
2. 52% of seniors do not use Internet in their everyday life.
3. 34% of them do not use any mobile device to access the Internet.
4. Most of them never worked with the following computer related activities: creating electronic presentations with presentation software, installing a new or replacing an old operating system, compressing (or zipping) files.
5. 60% of them do not know how to develop and edit text document.
6. 50% of them do not know how to save, download/upload and edit photos.
7. 40% of them do not know how to write/ send/ receive an e-mail.
8. About 60% of them do not participate in social networks (creating user profiles, posting messages or other contributions to Facebook, Twitter, etc.).
9. Seniors do not use the on-line shopping (only 17% do it).
10. Seniors do not use the Internet banking operations (only 19% do it).
11. Seniors do not know how to listen to the virtual radio or how to watch web TV.
12. 55% of them have not carried out any public service activities on-line for private purposes (such as obtaining information from public

authorities' websites, downloading official forms, sending filled in forms).

13. 75% of them did not buy or order the goods or services for private use over the Internet.

To the question *"What are seniors interested in?"* the following answers were identified:

1. 51% in basic information about using computer and its devices.
2. 49% in searching for information (on Internet).
3. 47% in reading or downloading on-line news, newspapers, news magazines.
4. 41% in participation in social networks (with the use of Internet).
5. 39% in talking to people and seeing them at the same time (with the use of Internet).
6. 36% in photos uploading, saving, editing.
7. 35% in development and edition of documents.
8. 29% in selling of goods or services (e.g. via auction sites).

To the question *"What do the trainers want/need to do/have?"* the following answers were identified:

1. Different kinds of technological equipment available for seniors in training institutions: personal computers, audio equipment, learning management system (e.g. Moodle, WebCT), digital photo cameras, digital video cameras.
2. Different kinds of activities to help the trainers to increase the integration of ICT in their courses:
   - 51% – time to prepare, explore and develop,
   - 45% – training/courses in pedagogical use of ICT,
   - 44% – technological hands-on training/courses,
   - 39% – technological support,
   - 36% – pedagogical ICT-support.
3. Use of technology is important for the trainers to acquire the following activities:
   - 64% – preparing lessons,
   - 59% – organizing their work and keep records,
   - 59% – finding digital learning resources,
   - 59% – designing and producing own digital learning resources,

- 58% – to support seniors' creativity,
- 57% – to support various seniors learning styles and to personalize learning,
- 55% – communicating with senior.

According to the survey results reflecting the interests and needs of seniors the topics covered in the basic and practical exercises include: basic use of the computer (including use of mouse, keyboard, copy and paste, files and folders, download and storage), Google, mails, news, Facebook, dealing with photos, Skype, use of tablet. There is a special emphasis on freely available tools – it is not necessary for the seniors to invest in special software. Moreover, the survey results also confirm many of the key issues of senior learning which are focused on:

- possibility of repeating the exercises as many times as required,
- possibility of repeating the exercises at home,
- possibility of practice with real technologies everywhere,
- seniors' health problems with eyes, ears and coordination,
- connection of exercises to everyday life,
- step-by-step structure of learning,
- methodological instructions for teachers working with target groups of senior learners.

6.4. Methodology of Internet treasure hunt

Adult education is the general or vocational education provided for adults after initial education and training for professional and/or personal purposes to provide general education in particular topics, to provide compensatory learning in basic skills which individuals may not have acquired earlier in their initial education or training (such as literacy, numeracy) and to acquire, improve or update knowledge, skills or competences in a specific field. Learning at any age it not just a topic of modern education but it has been a key issue over centuries. The future adult education and any kind of training for seniors will become more and more important and at the same time relevant for the society, especially for the aging society in Europe.

The i-Treasure project sets a special focus on senior learners among the group of adult learners, in order to provide this group with the necessary

competences in ICT to make them able to participate actively in the modern society.

6.4.1. Characteristic features of seniors learning

Basically there are different types of education and learning [1], [5], [6]):

- Formal learning (initial education or regular school and university education) – education provided in the system of schools, colleges, universities and other formal educational institutions giving a full-time or part-time education for children and young people.
- Non-formal learning – any organized and sustained educational activities that do not correspond to the formal education; it may take place both within and outside educational institution and concerns the persons of all ages.
- Informal learning – education less organized and less structured and may include for example learning events (activities) that occur in the family, at work and in the daily life of every person.

Non-formal learning is quite common in order to acquire ICT skills and it can take place in adult education centers. Informal learning is very common within the context of ICT. Many learners, in particular adult learners, take up knowledge, skills and competences from their children or grand-children. The i-Treasure course was planned to be held at adult education center in the context of non-formal learning. However, by working with i-Treasure tools also at home, the learners will also be involved in informal learning processes.

Five types of adult learners were determined:

1. "theoretical" learner – person interested in learning content and in the wider context,
2. "application-oriented" learner – person interested in the practical use of learning contents for his/her daily life; motivated by doing practical exercises,
3. model student – person who prefers trainer-guided learning to learning by doing,
4. "unconcerned" learner – person who lacks personal motivation and learns just as much as it is necessary,

5. "tentative" learner – person afraid of learning and who needs to have some kind of pressure and understanding about the learning process in order to start with it.

The i-Treasure approach tries to meet the needs of types 1, 2 and 3, because the senior learners in the process of lifelong learning are individually responsible for their learning achievement and learn only for their own benefit:

- type 1 – "theoretical" learner: a set of different tasks with the learning process has to be provided and it is not enough to just explain the details, but they should also be explained in the wider context,
- type 2 – "application-oriented" learner: the exercises and adult trainers in teaching and learning process have to point out the link to real life and practical applicability in seniors' everyday life,
- type 3 – "model student": senior learners are often teacher/trainer-oriented and also highly motivated – the trainer has to be aware of his crucial role in this process and to provide many activities that help learners to complete their learning.

6.4.2. Motivation for seniors learning

It is important to be aware of the potential reasons why people opt for adult education offers on a specific topic. There are five main reasons for adult education [4], [5], [10]: insight that own qualifications are no longer sufficient to face the challenges of work, new function, key experience in personal life, interventions from contacts in the individual social network, individual desire for cultural or political education, for social communication and exchange of common interest.

The target group of 55+ in European countries is well aware of the fact that the future challenges in the modern digital society will be related to ICT. The research of i-Treasure gives the identification of main seniors' motivations for learning ICT:

1. I would like to feel better in my current activities thanks to a better ICT-knowledge: 43%.
2. I would like to get things done at the office, the doctor etc. without leaving home (make appointments, search for relevant contact numbers, office hours, fill out the forms, ...): 39%.

3. I would like to check the train/tram/bus timetable: 39%.
4. I would like to improve the quality of my life by ICT usage: 38%.
5. I would like to check the weather: 36%.
6. I am interested in not being excluded with respect to ICT: 35%.
7. I would like to have something in common with the youngest generation in order to improve the relation between us: 35%.
8. I would like to buy a train, plane ticket: 29%.
9. I would like to watch videos, culinary trainings, DIY trainings: 28%.
10. I would like to get in touch with old friends: 28%.

6.4.3. Context of treasure hunt methodology

The i-Treasure methodology with its "Treasure Hunt" game is based on WebQuests concept, developed in 1995 by Bernie Dodge with Tom March [7], [8], [13], [14]. It is based on inquiries in which most or all of the information used by learners is drawn from the Web. This concept focuses on using the information rather than looking for it and supports learners' thinking at analysis, synthesis and evaluation levels.

WebQuests concept is Internet-based research and allows the teachers or trainers to preselect the sources for information. It has six essential parts:

1. *Introduction* – presents the background information, like providing it with a role in the game.
2. *Task* – description what the learners have to accomplish with regards to new learning content and attractive for the learner.
3. *Process* – sequence of steps/tasks to be accomplished for succeeding with the task. It can be a set of tasks to be fulfilled by the learners in order to get the final clue of the game.
4. *Resources* – set of different resources that the learners should use when working on the tasks, e.g. specific instructions how the current task could be solved.
5. *Evaluation* – learners have to give a feedback that will evaluate their performance, e.g. the rule for each task is that it is possible to proceed when the last answer was correct.
6. *Conclusion* – might leave time for reflection and discussion.

The trainers in courses of all sectors of education, including the adult education can use WebQuests in order to help the learners to achieve the expected learning results, to encourage and motivate them [7], [8], [13], [14].

6.5. Implementation of treasure hunt methodology in i-Treasure approach

The treasure hunt methodology is based on the WebQuests concept and joined with Web 2.0 technology to teach the ICT in i-Treasure approach. Every senior can find an appropriate starting learning level according to their ICT competences and an alternative opportunity to access the adult education. The topics of i-Treasure are related to the seniors' everyday life, such as emailing, social networking, etc. These are thought to make seniors' future life easier, more independent from other persons and ensure the active participation in society.

First of all, all the information about seniors' needs and trainers' experiences are gathered. Next, a list of ICT technologies to focus on was determined and divided into two levels of difficulty: basic and advanced level (Fig. 6.1).

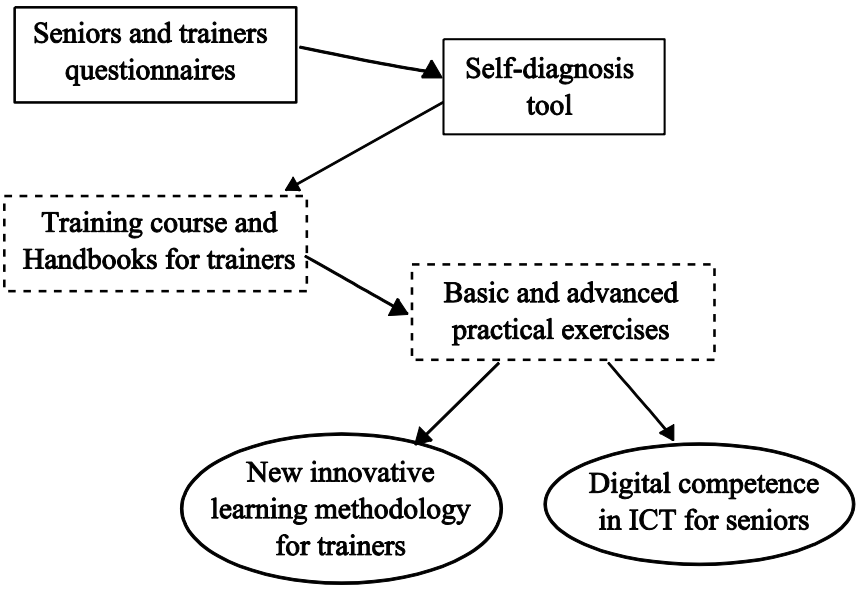

Figure 6.1. Scheme of i-Treasure methodology

Seniors can provide the information about their level of knowledge in these technologies through a self-diagnosis tool that consists of 30 questions (for basic and advanced levels). This tool allows to find out which level fits better the knowledge of each adult. The criterion to classify seniors by basic or advanced level was also determined and it can be used by trainer to classify the senior but it can also be modified by trainers to fit their specific circumstances or needs.

Next the practical exercises, including the treasure hunt game on the basis of WebQuests concept, were designed adapting adequately their degree of difficulty. These exercises were divided into a basic and advanced course (the courses are also explained in the appropriate handbook). The different stages of the treasure hunt game are represented by the clues necessary to find to reach the following stages. Stage by stage, the seniors discover the clues hidden into different technologies: web technologies like Gmail, Google Search, Facebook, Skype and devices like tablets.

According to the WebQuests concept all the game's exercises are wrapped in a story, in order to join them together and make the learning process more understandable and natural. The duration of practical exercises is 5 days per level with about 2-3 hours per each day (depending on the seniors' needs).

The learning process can be adjusted to special needs and possibilities of seniors, e.g.:

- some tasks can be repeated again and again at each level (basic and advanced),
- stages must be as simple as possible,
- only one or two technologies can be used every day, trying not to offer too much complicated stages; the last day stage is a mix of all offered technologies, trying to evaluate the global competences of the seniors,
- each day session should not be too long (at most 3 hours),
- trainer prepares his lessons individually (but can share the information with other trainers, e.g. using the collaboration platform), monitors the learning process and offers seniors his help when it is necessary.

The web platform for practical exercises is the technical infrastructure to support the learning process – it is an environment in which the game is per-

formed and all users can interact to proceed with it. Moodle software was chosen as such platform because it is user-friendly and on-line accessible. There are two roles defined to play in the created game:

- adventurer (story "hero") that is represented by each person who is attending the course and achieving the final certificate through all the game tasks and
- librarian, who is the near senior's assistant played by senior trainer doing the activities like offering its accounts to seniors (Gmail, Facebook and Skype) along the exercises and using the automatic responses (canned responses) to offer clues and information during the game performing.

The adventure part of the created game was divided by clues, attaching a question related with the story but also a new ICT technology. The senior learner has to read all the instructions and answer the questions, using different technologies to move up to the next clue and finally achieve the certificate which puts the end to the story. The trainers have to be active in this part, supporting their learners with all possible issues and making their corresponding role tasks.

Basic exercises The basic practical exercises are divided into 5 stages (one stage per day) and each of them is formed by several blocks with the instructions. The tasks in each stage cover the typical basic activities and tools dealing with the computers. They are useful for seniors in their everyday life and of course they should be explained by trainers when it is necessary. The topics covered by basic exercises include:

1. Basic use of computers (including use of mouse, keyboard).
2. Dealing with folders and files.
3. Dealing with copy & paste.
4. Browse on Internet.
5. Downloading the files.
6. Storage of files.
7. Use of USBs.

Advanced exercises The advanced practical exercises are also divided into 5 stages (one stage per day), about 2 hours per meeting. The seniors practice each day a different group of technologies, increasing little by little the level of difficulty. The tasks of each stage cover some basic tasks on most common and useful for seniors tools of current ICT technologies, such as:

1. Google, e.g. Google Maps, Google Search, Google Translate.
2. Facebook social network.
3. Skype tool with communication, calls and video-conferences.
4. Use of tablets with their basic mobile applications.

Up till now, more than 700 seniors attended the piloting of iTreasure solution – they tested the created products, i.e. exercises and game on the proposed platform.

6.6. Conclusions

The i-Treasure approach is developed to provide senior citizens with skills they need to remain active in society and it is focused on two main target groups: retired adults who have not been in contact with the technology for the last years or even who have never had anything to do with it, as well as adult education trainers. The i-Treasure is a new approach in which seniors acquire digital skills via a virtual treasure hunt game. This innovative methodology includes learning technologies with practical exercises in a game environment in which the clues are hidden in websites and devices.

The concept presented in the paper aims at training seniors to deal with useful technologies in their everyday life. Their needs and preferences to be covered by technology were specified in special created questionnaires, so considering this information i-Treasure approach offers the training courses and practical exercises to learn how to manage the current ICT tools. Presented methodology was based on the WebQuests concept due to its practicality, simplicity and traditional gaming aspect, called treasure hunt.

The future work will concentrate on the improvement of proposed solutions and adding new possibilities according to seniors' needs in different domains of their life.

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Chapter 7

The GAMBLER – an IT system for training officers of the Polish Air Force

7.1. Introduction

High level of know-how is included in the Polish training system, a war game, called the GAMBLER, which utilizes the game theory for modeling military missions. The GAMBLER uses sophisticated and advanced algorithms (time optimization) and mathematical methods, has a user-friendly intuitive interface, an editor for setting initial conditions, an AAR (After Action Review) function, and supports different modes of simulation. The system has been used for training in the National Defense University in Warsaw. Polish Air Force also use it for operational training of officers [3]. The GAMBLER is a computer-assisted simulation tool for tactical level of air operations used in service (Air Force and Army). Although GAMBLER's models have a broad spectrum of tactical aspects for air operations, they are used primarily for Ground Based Air Defense units training. Due to its detailed models of air defense assets and processes it is commonly used at Ground Based Air Defense (GBAD) units level (SAM – Surface to Air Missile systems, brigades, regiments and squadrons).

The main purpose of this chapter is to show the complexity of the training system developed as special IT system (war game / serious game). The important part of it is showing in detail examples of objects represented in the game. Each object participating in the simulation is defined by many parameters. Each simulation game gets these parameters, makes calculations in real time, and then visualizes the result on a computer screen. In addition, the chapter presents original user interface of the system (screenshots: 1, 2 and 3). Interested readers should also acquaint themselves with original screenshots that showing air force tactical situation maps (screenshots: 4, 5 and 6).

The GAMBLER models multi-sided air assets and Ground Based Air Defense (GBAD) forces along with defended assets and their respective logistical support. At the moment it is optimized for modeling two adversary sides (Blue,

Red) and one neutral (Green) [4]. While Blue and Red forces are able to conduct full spectrum of air operations, Green may be subject of air attack from any of the two adversary sides[5].

Table 7.1. Characteristics of war game the GAMBLER [7].

Basic information	
Supplier	Polish National Academy of Defense and Ministry of Scientific Research and Information
Security classification	*Unclassified*
Command level	*Tactical*
Subject area	*Air Operation Simulation, war game, decision game*
Tool description	
Description	*Computer assisted simulation tool for tactical level of air operations used in service (air force and army). It is used primarily for Ground Based Air Defense (GBAD) units training. Gambler models multi-sided air assets and GBAD forces and at the moment it is optimized to model two adversary sides (Blue, Red) and one neutral (Green).*
Main functions (modules)	*Gambler consists of 14 modules, part of them is dedicated to preparation of scenarios and others ones are primarily dedicated for playing simulation and debriefing.* ***Create scenarios:*** *selecting needed assets from GAMBLER respective databases and anchor them to select geographic coordinates.* ***Displaying information:*** *Pictograms, tabular information, colored zones (spheres) and lines along with maps are used to visualize elements of constructive simulation. Visibility actions in terrain (day and night conditions)* ***Playing simulations:*** *fully constructive or semi constructive with a human in the loop. Human players may take tactical decisions and send orders to constructive assets which will execute them taking into account technical and tactical conditions. During the simulation the coordinator may send messages to simulation players and receive messages from participating players.*
Standard	*real-time simulation*

Technologies	*SERVER – module used for viewing results of previously run and recorded simulation* *Databases: Aircraft, munitions and logistic support assets, Surface to Air Missile (SAM) and AAA assets, Air Surveillance and Control Systems assets, Electronic warfare assets.*
Dependencies	*GAMBLER consists of 14 modules, some of them are:* • *SCENARIO WIZARD - creates new scenarios and modifying existing ones,* • *COMMANDER - works with the simulation model by the commander of Blue or Red forces,* • *GBAD – used by the player of Blue or Red forces ground based SAM* Surface to Air Missile *and AAA assets who works on the simulation model,* • *AIRCRAFT - used by the player of Blue or Red forces for simulation model.*
Business model	
Military services	*Air Forces, Land Forces.*
Military organization	*GBAD unit level (SAM - Surface to Air Missile systems brigades, regiments and squadrons).*
Deployment	*GAMBLER modules work together via LAN or WAN.*
Notes and Comments	
Standing out features	*Depending on the asset to simulate there is a specific technical and tactical data that needs to be loaded to the databases*.

7.2. Components of war game GAMBLER

GAMBLER consists of 14 federated components/modules which may work together via LAN or WAN depending on user specific requirements. Some of the GAMBLER modules are dedicated to preparation of scenarios, while other ones are primarily dedicated for playing simulation and debriefing it.

1) SCENARIO WIZARD – a module used for creating new scenarios and modifying existing ones. This module is used by director of the exercise – simulation coordinator during simulation for controlling simulation and players,
2) COMMANDER – a module used for working with the simulation model by the commander of Blue or Red forces during the simulation,
3) GBAD – a module used for working with the simulation model by the player of Blue or Red forces ground based SAM (Surface to Air Missile) systems and AAA assets during the simulation,
4) AIRCRAFT – a module used for working with the simulation model by the player of Blue or Red forces offensive, defensive and support air assets during the simulation,
5) LOGISTICS – a module used for working with the simulation model by the player of Blue or Red forces logistics assets during the simulation,
6) RADIOLOCATION – a module used for working with the simulation model by the player of Blue or Red forces Air Surveillance and Control System (ASACS) assets during the simulation [2],
7) RETROSPECTION – a module used for viewing results of previously run and recorded simulations. Basically, it is a primary tool for debriefing of simulation players.
8) SERVER – a module used for communication of exercise director – simulation coordinator with players participating in simulation run,
9) AIRCRAFT DATABASE – a computer application used for creating and updating a database of aircraft used for GAMBLER,
10) DATABASE RESOURCE LOGISTICS – a computer application used for creating and updating a database of munitions and logistic support assets used for GAMBLER,
11) DATABASE GBAD – a computer application used for creating and uptading a database of SAM Surface to Air Missile systems and AAA assets used for GAMBLER,
12) DATABASE RESOURCE RADAR – a computer application used for creating and updating a database of ASACS assets used for GAMBLER,

13) DATABASE OF FUNDS OF INTERFERENCE – a computer application used for creating and updating a database of Electronic Warfare (EW) assets used for GAMBLER,
14) DATABASE OF AMMUNITION AND MEANS DESTRUCTION – a computer application used for creating and updating a defended assets used for the GAMBLER [5].

Databases of assets used in the GAMBLER simulation model may be loaded with real world weapon systems characteristics or artificial ones. Depending on the type of assets selected for a given simulation, a number of specific technical and tactical data areas are loaded to a database.

Aircraft tactical and technical characteristics include:

- name (or type) of aircraft,
- aerodynamic characteristics,
- fuel,
- combat payload,
- sensors,
- other data.

Screenshot 7.1. A user interface example – Aircraft tactical and technical characteristics form with COMBAT PAYLOAD data opened to add air to air missile AIM-9M.

Aerodynamic data for aircraft include: speed (maximum, minimal and vertical), ceiling and range. Aircraft characteristics include Radar Cross Section (RCS) and sensor detection range (visual, infrared, electronic and radar). Payloads are defined by types and numbers of air munitions (both standard combat

loads for air to air combat as well as air to surface attacks or specific combinations of munitions). Additionally, external pods (RECCE reconnaissance, ELECTRONIC WAR) are included in the description of aircraft. For transport planes weight and type of cargo is defined. For air to air refueling aircraft an amount of fuel to be offloaded along with AAR system (boom, basket) and number of stations are described. Times of rearming, refueling and offloading are included into description.

Surface to air missile systems (SAMs) data for GAMBLER simulation model are described by five broad categories:

- name (or type) of the system,
- technical and tactical characteristics,
- combat potential,
- mobility,
- camouflage.

Screenshot 7.2. A user interface example – SAM (Surface to Air Missile) system technical and tactical characteristics form.

Technical and tactical characteristics of SAM (Surface to Air Missile) systems include: capability of simultaneous engagement of multiple of air targets (number of targets engaged at the same time), number of missiles ready to launch, a maximum number of missiles in a single salvo, missiles range, velocity and probability of kill by a single shot. Characteristic of SAM (Surface to Air Missile) engagement envelope include minimal and maximal altitudes, at which aerial target may be engaged. Times of firing sequence, switching from march

to firing and back are included into description. Type of missile is imported from GAMBLER Munitions database. Description include also SAM range of detection for aerial threats and elevation of radar antenna above ground level.

Combat potential is measured by percentage, in which 100% means the system is fully ready to operate, and 0% means it is totally incapable of operating. This category defines percentage: which is needed for SAM system to retain capability to operate (minimum potential), which is needed to consider it destroyed, and time needed to restore 1% of combat potential (in minutes). The susceptibility to air munitions is also defined. Mobility of SAM (Surface to Air Missile) system is described by choosing category fixed or mobile, and then giving road march speed, emplacement and displacement times. Camouflage description for SAM system is described by its susceptibility to detection by optical, infrared and radio electronic sensors. Antiaircraft artillery systems description for GAMBLER simulation is similar to that of SAM (Surface to Air Missile) systems.

Screenshot 7.3. A user interface example – –Anti-aircraft artillery (AAA) system description.

Air surveillance and control systems (ASACS) data for GAMBLER simulation model are described by five broad categories:

- name (or type) of the system,
- technical and tactical characteristics,
- combat potential, mobility,
- camouflage.

Technical and tactical characteristics of ASACS systems include: characteristics of radar detection and tracking envelope including range, minimal and

maximal altitudes at which aerial targets of specific RCS may be detected and tracked. The time of switching on the radar when operations start is included in description. Description include also elevation of ASACS (Air surveillance and control systems) radar antenna above ground level.

Combat potential for ASACS (air surveillance and control systems) is measured by percentage, in which 100% means the system retains full operational capability and 0% means it is totally incapable of operating. This category defines percentage: which is needed for ASACS system to retain capability to operate (minimum potential), which is needed to define it destroyed and time needed to restore 1% of combat potential (in minutes). The susceptibility to air munitions is also defined as a coefficient (between 0.000 and 1.000). Mobility of ASACS system is described first as

a category: fixed or mobile, and then by system road march speed, emplacement and displacement times. Camouflage description for ASACS (Air surveillance and control systems) system is described by its susceptibility to detection by optical, infrared and radio electronic sensors.

Air Defense ground based electronic attack systems data for GAMBLER simulation model are described by five broad categories:

- name (or type) of the system,
- technical and tactical characteristics,
- combat potential,
- mobility,
- camouflage.

Technical and tactical characteristics of electronic attack systems include their effective jamming range against aerial systems as well as the range and percentage of reduction of jammed aircraft visual, infrared and electronic (radar) sensor performance.

Description includes also susceptibility of ground based electronic attack system to aerial attack by defining it as point, linear or area target.

Combat potential of ground electronic attack systems is described by percentage (100% – the system is fully operational and 0% – it is completely non-operational). Combat potential description defines also percentage: which is needed for ground based electronic attack system to retain capability to operate (minimum potential), percentage of potential needed to define the system destroyed and time needed to restore 1% of combat potential (in minutes). The

susceptibility to air munitions is also defined as a coefficient (between 0.000 and 1.000). Ground based electronic systems are described as fixed or mobile. For mobile systems, road march speed, emplacement and displacement times are defined. Camouflage description for ground based electronic attack system is described by its susceptibility to detection by optical, infrared and radio electronic (radar) sensors [6].

Munitions database of GAMBLER simulation model includes description of:

- air to air missiles,
- air to ground missiles,
- guided und unguided bombs;
- unguided rockets,
- aircraft onboard reconnaissance pods,
- aircraft onboard electronic warfare pods,
- SAM missiles and artillery rounds.

The munitions available to players are stocked in depots, in airbases or are organic to specific weapon systems (e.g.: number of SAM missiles on vehicles). Air to air missiles description includes:

- type of missile,
- maximum range of missile,
- effective engagement range,
- velocity of missile,
- probability of kill,
- range of missile guidance system,
- missile weight.

Air to surface missiles and bombs descriptions used in GAMBLER munitions database include:

- type of missile or a bomb,
- velocity,
- range,
- missile or bomb destructive power,
- radius of destruction,
- probability of direct hit,
- missile or a bomb weight.

Additionally, description of air to surface munitions includes the type of warhead:

- anti-radiation,
- general purpose,
- hard targets,
- runway blocking.

Reconnaissance pod for aircraft defined in GAMBLER munitions database are defined by:

- reconnaissance pod name,
- weight,
- range of its visual, infrared and electronic (radar) sensors,
- access time to RECCE – reconnaissance data (near real time or after landing, then in minutes),
- minimal and maximum altitudes of flights with RECCE (reconnaissance).

For electronic warfare pods, name, range and intensity of jamming as well as weight are defined. SAM missiles and artillery rounds are described by type and weight. Munitions database includes also descriptions of external fuel tanks and airlifted cargo. Defended assets database of GAMBLER simulation model includes description of ground based forces or objects that may be subject to aerial attack. Characteristics of a defended asset include:

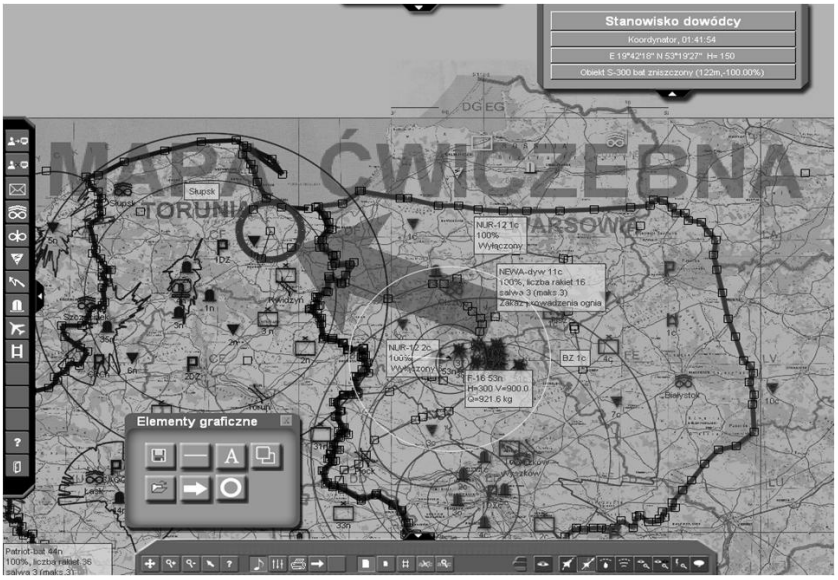
- category (divided further into fielded forces, bridge, logistic installations etc),
- initial combat potential,
- susceptibility to aerial attack,
- level of destruction needed to declare it not operable,
- level of combat potential needed for operating,
- march speed (if mobile),
- time needed to start march or combat operations,
- camouflage capabilities.

All systems, munitions and defended assets are described additionally by cost category. It defines how much it costs to use or lose a specific asset.

7.3. The mechanism of creating game scenarios

Depending on the objectives and scale of the simulation, different sets of assets may be included into a scenario. A basic way to create a new scenario is to select needed assets from the respective GAMBLER databases and anchor them to selected geographic coordinates. Logistic support for those assets need to be pre-programmed, so that combat units have sufficient fuel and ammo to start the simulation. For constructive players, rules of engagement are preselected, and tactical tasks are assigned. Operational time, tempo and meteorological conditions are defined.

For human players assignment of assets, tasks and chain of command are established as the starting point for playing simulation.



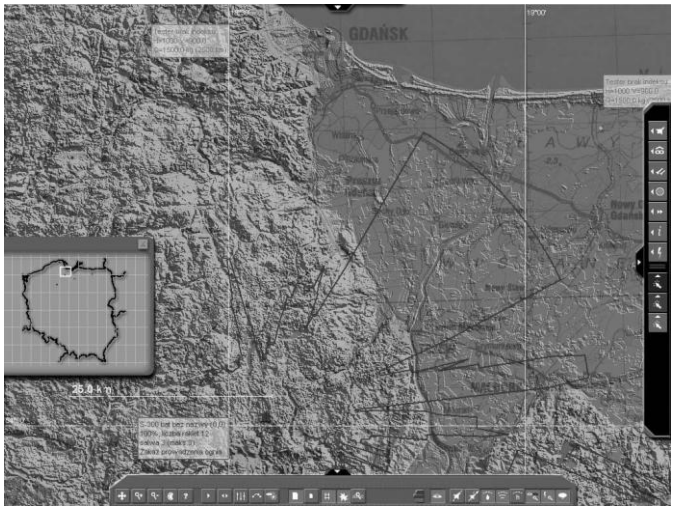
Screenshot 7.4. Initial setup of Red and Blue forces assets included in a GAMBLER scenario.

7.3.1. Displaying information

Data may be displayed for human players in different forms. Pictograms, tabular information, colored zones (spheres) and lines along with maps are used to visualize elements of constructive simulation. Depending on particular players requirements and their roles during simulation one or more means of visual-

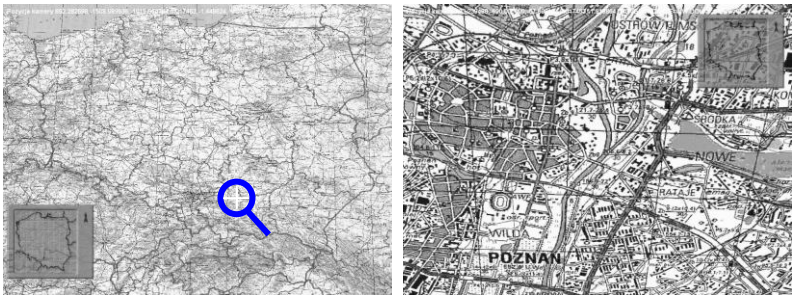
ization may be used at the same time. Left-click pops up information linked to pictograms of weapon systems, logistics or defended assets. The layers of visible information do not affect modeling tactical air operations [4].

GAMBLER synthetic environment takes into account visibility, terrain, day or night conditions. The model has built-in adjustments in ranges of visual, infrared and electronic (radar) sensors dependent on visibility conditions. That feature is clearly visible for modeling of SAM and ASACS (Air surveillance and control systems) operations, in which terrain obstacles influence size and shapes of radar coverage and SAM engagement zones.



Screenshot 7.5. Effects of terrain elevation and obstacles on radar coverage.

Depending on the simulation objectives and players the area displayed on computer screens may be switched from 640 x 480 to: 320 x 240, 160 x 120, 80 x 60, 40 x 30, 16 x 12, 8 x 6 or 4 x 3 kilometers. Thanks to that feature of GAMBLER, the situation displayed on players' computer screens remains detailed enough for different levels of GBAD command and control.



Screenshots 7.6. Changing the scale of displayed map.

7.3.2. Playing simulation

There are two modes of playing simulation with GAMBLER. Simulations may be fully constructive or semi-constructive, with a human in the loop. Human players may make tactical decisions during simulation and send orders to constructive assets, which will execute them taking into account technical and tactical conditions (fuel and munitions availability, range, time limitations etc). Rules of engagement for human players are set by simulation coordinator and Blue or Red air defense commanders. Rules of engagement for constructive players may be preprogrammed or changed during simulation. Types of missions defined for aircraft: RECCE (reconnaissance), air to air, air to ground, air to air refueling, air transport. SAM assets may be assigned a specific Weapon Control Status (Weapons Free, Weapons Tight, etc.) for a whole time or a specific period of constructive simulation. SAM may be preprogrammed for specific tactical behavior for engagement of aerial threats (engaging the most dangerous or the closest threat, etc). ASACS and EW assets may be programmed taking into account specific rules. Constructive players may be programmed to do exactly and only what tasked, to do what can be done within predefined tactical priorities, or to remain inactive do nothing. Complete replays of previous simulations or chosen parts of them may be conducted at various speeds depending on the specific requirements of the users.

During the simulation, the coordinator may send specific messages to the players and receive messages from them, control their status, modify weather conditions, and stop or change the pace of simulation. He or she may decide on restarting the simulation from any given point again. The coordinator is also responsible for saving simulation results in a file for further debriefing and re-

plays. Simulation players control their respective assets by assigning them tactical tasks, controlling the execution and receiving mission reports [8].

7.4. Conclusions

The need for computer assisted training environment is obvious for commanders of all ranks. What is more, users need to control their training process which creates a special relationship between users, software producers and developers. The systems can be further developed on the base of suggestions from competent users. These users will decide on further development of the system and its new functions [7].

The majority of complex processes in Military Forces are supported by IT tools. No matter how many computer tools to support will be developed, all of them should find applications, which are built according to the required standards. Overall evaluation of GAMBLER needs to take into consideration that it was created specifically to meet detailed requirements of target users. Being a computer-assisted simulation tool for tactical level of air operations used in Air Force service and its primary use is tied to Ground Based Air Defense units training. Thanks to the use of detailed models of air defense assets and processes GAMBLER is commonly used at GBAD (Ground Based Air Defense) units (brigades, regiments and squadrons).

One may assess high fidelity of GBAD (Ground Based Air Defense) operations at tactical level as GAMBLER most obvious capabilities. Combined with digital terrain maps GAMBLER offers state of the art radar coverage and fire envelope calculations. That specific feature is regularly used in training for deployment of GBAD (Ground Based Air Defense) units and creating MEZs (Missile Engagement Zone). GAMBLER is open for creation of new players outside conventional air threats spectrum. It allows creation of objects such as small UAV's (Unmanned Aerial Vehicle), terrorist airplanes etc. to play crisis response scenarios. It requires however a lot of effort and time to prepare an appropriate database for new scenario. This is the truth especially for new types of weapons or defended assets which needs to be defined prior training in order to be implemented into simulation model. Currently GAMBLER is optimized for a rather small number of airborne players. As it simulates every airborne threat with a large number of features against GBAD (Ground Based Air De-

fense) assets (with similar number of features), it usually makes sense to play rather tens than hundreds of aircraft and GBAD (Ground Based Air Defense) systems.

Air–land interface, that could be used for Close Air Support and combined combat operations is limited in GAMBLER, so it should rather be used for air defense or extended air defense scenarios than for combined operation battle simulation.

GAMBLER represents a type of modern and sophisticated simulation games considered to be the most effective and future-oriented training tools [1].

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Chapter 8

Management through entertainment

8.1. Introduction

In 1944 John Huizinga created the term *Homo Ludens*, Man the Player, to describe an ordinary man. In his book, published under the same title, he proved that play is present in everyone's life and nothing has changed since the Stone Age.

Huizinga even wrote that "Play is older than a culture". Moreover, even animals play and this act is essential on the path of socialization. He explains that play is more than a need to relax, it is also a training, an education path, for a young creature to develop certain skills and knowledge needed in future life [8]. More importantly, play is enjoyable, so why not use it for education? Especially, play has educational purpose itself, as it was explained. However, it might teach much more than social behavior. Also, it might be used to attract students to some areas. It may show that gaining knowledge might actually be fun.

Utilization of play, fun and games for educational purpose is called edutainment. Play may be used also in management, and such an example of usage will be explored further in this article.

The world of gamification

One often hears a word and repeats it without thinking what it actually means. A game or gamification is nothing more than creation of a new world. That is why it is important to understand its elements, not only the name. In this part of the chapter, the most often used elements will be described, as well as some distinction will be made for better understanding of the subject and case studies that are going to be presented next.

Play

Play is a part of reality, but not the reality itself. The borders must be clear. Although no instruction is written, the rules are unspoken and one learns them by experience. A player should not transfer rules or activities appropriate in play to other situations that are not play. One must differentiate between these two worlds. Play has its own time and place, as well as rules. However, one may transfer gained skills or knowledge from play to other situations and this is highly appropriate. Play is a joyful and, what is very important, voluntary activity that is motivated intrinsically and it is totally absorbing for the player [11]. One may use play to forget about ordinary problems, simply forget about reality that might be unsatisfactory. He or she may also develop a new role as a player, and this possibility is not brought by ordinary life, but teaches something new or fulfills one's needs. Furthermore, a need for competition and winning must be added to explanation of play. All of that leads to one conclusion: play serves something more than the play itself [8].

Huizinga pointed in his book that we can describe "play" by opposition to "seriousness" but that may cause misunderstanding that play is not serious, while it is a very serious activity with outcomes that influence one's identity or daily activities. Eric Berne, a Canadian psychologist, in his book "Games people play" explained that all human being interpersonal communication is a game. Not only flirting, which is a well-known game played by the society, but ordinary greetings are one too. The response is gratification, a gained point, one may say. A lack of response is the player's failure. However, those are not zero-sum games, which means one does not have to win at other's loss. The purpose of these games is adaptation to the society, and a role that one has in it, showing appreciation to others, which leads to being more accepted and popular in the group that one lives in [1].

The benefit is self-esteem (if one acts as the society expects, one is more liked and feels better about him/herself), an accountable reference group, and, to put it shortly, all psychological factors that make us feel good about ourselves and about people among whom we live. Both Berne and Huizinga highlighted the fact that play's purpose is not a material, tangible prize, but some internal outcomes (like the ones listed above). When play is structured and goal-oriented, we refer to it as a game.

A game

In the last couple of years, since 2010, utilization of games in enterprise got higher. Specialist, especially the one from marketing market, treat games and gamification as the right solutions to all problems. Academics from different fields proceed with research on games, trying to find out what the outcomes and mechanisms are, and what drives people into them. On the basis of their findings, we may point out a few key elements that create a game. However, firstly, a story should be told. In order to prove how powerful game elements are, Jane McGonigal, one of the most well-known game designers, recalls in her book "Reality is broken" a story from Herodot's "Historiae" about people of Lydia and the natural disaster of extreme famine that lasted for 18 years. This history is from the 8th century B.C. For all these years their lives were split between days they were looking for food and days they played. A day of play after a day of hunting. It is believed that the Lydian invented boarders and dices. When the time of hunger was over, another disaster came to these people, and it was drought. The tribe was then divided into two groups: one led by the old king, and the other by his son. The two groups competed to decide which one should go to look for a new place to live, and which group should stay. There was no fight in which brother had to kill brother, but a game tournament [11]. Highly civilized people, one shall agree.

What is actually a game? The explanation should begin with pointing a narration, a plot as the main characteristic. In the case of Role Playing Games (RPG), it is a well-built history with an explanation of who is who, and a description of different characters, their abilities, etc. It should be pointed out that RPG are not only video games, or card games. In the case of simple games, it is just a path of challenges, a mission which starts with a simple task, where a player might use his or her own skills and knowledge from his/her own experience, but the game teaches him/her also something new. However, all is kept simple. With each task becoming more and more complicated, new skills and knowledge might be acquired. This is called an activity loop [16]. The player must also show some manual skills or intelligence. To be able to do it, the player must be interested in playing. Biology helps here. Whenever one believes that something was gained by him/her and success was achieved, his/her brain produces the hormone dopamine which makes one want more. *Fiero* is an Italian

word that stands for something more than a pride, and describes well the moment of dopamine's explosion. This feeling also makes people pursue a task that one perceives as doable [11]. Such urges and games cannot be done without flow. This term was created by Mihaly Csikszentimihaly to stand for an emotion that is felt while performing a task one can use his/her already-gained experience, but also must learn something new, and not easy-new, since the task is a challenge, but also not as hard as to drop it. Flow is also about curiosity of exploring.

Points, badges and levels, as well as progress bars and leaderboards are the most often used symbols of one's progress and achievement in a game. Often they mislead professionals who only bother to use these five elements and call something a gamified system. It is just wishful thinking because PBL (points, badges, leaderboards) will not create a different world to which one can jump and separate oneself from daily activities. It might be motivating since competition takes over, but it is not a game, play or gamification. Nonetheless, transparent PBL is a very important part of it. It is also the way of giving a feedback to the player. As it was written already, the purpose of a game is to teach and without feedback one will learn nothing. Not less important part of the game is a prize. We can define an internal and external prize. Both drive players to play and are important. As internal prize we can list: happiness (also thanks to dopamine), pleasant feeling and self-esteem, socialization, affiliation, identity. External prize is tangible and visible for others. A badge might be one of it, privileges or a car [4].

Gamification

What does gamification mean? Kevin Werbach, a well-known researcher of this topic, explains it as utilization of game elements and mechanisms in activities that are not a game [16]. What is the difference? A game is an artificial world. It might be a video game, where the board is clear and one needs electronic devices, a computer or a game console to play. However, it may also be a card role playing game, where each player is playing a role, just like in theatre, in that case they do not follow the script, but rules from the manual and the master of the game. Gamification is play within daily activities. It may be used whenever some social behavior is planned to be changed. It also can rise com-

pany's profit. Loyalty points are often used as one of the examples, even though researchers and professionals often argue that it is not gamification. As it was mentioned in the introduction, gamification may be used at school as a teaching tool. A simple, but great example is dividing each subject into small task, providing points to students as constant feedback and creation of leaderboards. The prize is better than a grade. Students compete with each other but sometimes should also work with each other to get better results. This way classes are not that boring, students can learn in an easy and funnier way. Moreover, they acquire new skills that are brought by the game elements, like more problem solving set of mind [2]. Teachers are often disappointed by the lack of motivation and activities from students. Many factors cause it. Why not provide prizes and constant feedback instead of complaining and poor grades, which are not motivational? Research shows that human beings are more motivated when they can expect something good or help others. Moreover, a study conducted in the M.I.N.D. laboratory in Helsinki shows that if a game, or a gamified system, is well-built, negative feedback (e.g. a smaller amount of points, a lower badge) is not seen as something negative, and players have a combination of positive feelings occurring in that situation [11].

Gamification may be also used to teach more appropriate and expected social behavior. A great example here is a trash bin. People do not pay attention where they throw trash. In public places it can be a nightmare. So why not create a trash bin that would make a noise of falling into a deep gap when trash is being thrown into it. Thanks to this simple trick people would associate this boring activity with fun, and are more willing to do it. Another example are traffic lights. Many people are too focused on their need to be somewhere faster that they do not pay attention to, or simply do not care about them. That is dangerous and can cause not only deaths, but also traffic and communication problems. It is also cost consuming. In Lisbon, one of marketing agencies was asked to come up with an idea and change it. So they built a booth in one part of the city where everyone could come in and dance to the chosen music. Based on that, a simple animation was created and featured as red light [7].

Finally, gamification may be used in enterprises. Examples are various, and many of them might be listed; from recruitment activity, through making the company more visible, to the motivation of external and internal customers. There are a few categories of gamification used in companies. When it comes to

internal clients, one might distinguish the following categories: a gentle guide (the project is cut into small tasks and challenges, helps also to maintain focus without thinking about the larger picture that may be scary), a company collaborator (helps people to socialize within the team or firm, the main goal is better communication), company challenge (the simplest and most productive category, helps to reach the target, most often designed as two groups competing with each other) [4]. Since the subject of this article is management through entertainment, there is no need to go through the external enterprise gamification.

8.2. Management challenges

Even though a number of management masters or people that graduate from MBA studies is high nowadays, managers struggle with many challenges. Partly because the educational system is not adjusted to today's world, and partly because a manager is not always someone who majored in management. Companies, especially the big ones, prefer internal recruitment for the top positions, seeing a value in the deep understanding of the company and people working there. Often the problem also lays in personality. Today, management is not only about assignment assets to the task or project, but also about leading and persuasion. For the purpose of the article, managers from one of the most innovative, multinational IT corporations were examined to learn what kind of challenges they face. The interviewed managers are from the Czech Republic, Slovakia, Poland, Austria and Hungary, and are mapped as sales people.

8.2.1. A new generation

One of the listed challenges was the new generation of employees in the company. However, the problem is broader, and might be described as various generations in one group, expecting something different, yet having to communicate and cooperate with each other.

Not that long ago managers had to learn how to cooperate with the generation Y, and now digital natives, generation Z, came to the workplace. It may seem like just another letter in the alphabet, but it is much more. Firstly, it should be pointed out that while the new are coming, the old ones are still in the company and they all have different expectations and communication patterns.

While the old in the examined group, who will be called the old guards in this chapter for the lack of scientific name, are people more than forty-five years old. They, are often experts in the national market, they also want to simply be able to do their job. For them all is clear: there is a job to be done, so it should be done, the order or favor to do something, and the needed action. They already have families, traveled the world, they want to enjoy houses they live in. They are not looking for the fun or a path of development. Generation Y refers to people born during the 1980s and at the beginning of the 1990s. They are more technologically savvy, but also more focused on themselves. They have expectations and look for a place right for them. They are a more varied group, but what they have in common is the lack of loyalty. They do not expect to work in one company for all their lives, which also differentiates them from Generation X, the earlier one, but they will work in one place as long as they see a chance of development, and wages, although important, are not the priority. Generation X should be explained as well. X'ers are between first described group and Generation Y. They are the most self-oriented and the least concerned about the world around them. They are very pragmatic and like to be active when there is something out for them. Finally, Generation Z is the most diverse group that needs constant feedback and socialization. While growing up they have been bombarded with communication from the external world, such as billboards, commercials, people talking; they need constant change to stay focused. Since this generation is just coming to the workplace, there is not much to be said about their behavior as employees.

Companies have problem with not only how to attract those people, but also how to keep the best and diverse talents. The old guards have a task and do it, they do not need constant feedback, nor do they expect one. Generation X is focused on the work as well, however they want to have a development plan, a career path and clear rules. They want to also see the profit. Generation Y is more time-consuming for the manager. He/she should think not only about their enablement, but also about clearly saying what they do well or what may be done better. To make them productive, they should be assigned to the right project. Focal point reviews or evaluation meetings once a year may not be enough, especially when they just started. However, they do not like to feel pressured or distrusted. In the task they like to see a challenge. The members of Generation Z are often travelers, they traveled when they were children, their parents provid-

ed them with all goods, especially video games. However, they also grown up in the world of recession and war against terrorism. They are more tolerant, but they also have a need of communication like the one from video games: clear rules, clear roles, feedback, achievements, challenges and small tasks. They might have great minds of problem solvers, but in the big picture they may lose them. Only 3 out of 10 interviewed managers belonged to Generation X. The others are the old guards. All of them are male. Their understanding of younger generations is limited, they often asked for corporate guidance. This is also the way to see a leader who understands people better, thanks to intuition and experience, and this is how he/she can better communicate with younger generations, how he/she can lead them [3].

8.2.2. Red tape

All interviewed managers agreed that there are too many applications for personal development and people management. The problem is not only that many do not know which one to use and how to do it, but also that one is overladen with communication about courses, workshops, knowledge to gain, and one is not motivated to do it. Of course it is an inside problem for corporations, which is characteristic not only for this specific firm. However, it also shows lack of prioritization and clear expectations, or one should say goals.

The point made here is that there are many ways to develop own team member, but not enough time to think what that person may actually need. It is very rare for the company to create a development plan for each employee. Of course, managers when they see something that may be applied for their employees, offer it. All managers agreed that if someone came to them and asked for a development plan, they would take time to investigate possibilities and to think, and they were happy to do it. It takes a specific set of mindset from both sides. Only the best managers, while working with another person, think about where he/she can be in the future and what the added value is for the company.

During the day employees and their managers have many responsibilities, and among them the thought: where I want to be in the future, where I want that person to be is often lost. Sales people are achievers and hard competitors. They do not see much value in courses or development if that is not a direct target. Even when corporation's newsletters inform them about sessions or classes

thanks to which they can gain knowledge, they rarely take it. That applies to younger employees. The old guards and Generation X think broader. However, even though they seldom share with mangers the idea of taking some certificate which basically leads to assigning them other goals that might interfere with personal development. Red tape here stands for being crashed by possibilities and not using them.

8.2.3. Lack of motivation

In companies, there is a lack of motivation not only for self-development, but also to work. Studies show that almost 70 per cent of Americans think about themselves as neither engaged in nor attracted to their own job [5]. Research also proves that the gamified environment is more attractive to employees [12]. Meeting with customers is treated as a task that leads to something, rather than a boring duty. Examined company is recognized as an enterprise group which means great deals, the biggest clients, and abstract amounts of money. Money may motivate only to some extent.

To not be misleading: it is not like an employee will give up his/her salary or agree to smaller wages. No. He/she will fight to be paid well. As it was stated above, the interviewed managers were responsible for sales mapped people, who are a type of achievers. This group will always go for an extra per cent of the income. However, not everything may be achieved by an ordinary sales activity. To be a good sales person, one should consider a mentor, trainings, and coaching. Time for placement survey and better self-understanding should be taken as well. Those people are motivated to fight for the customer or a deal, but less motivated to, e.g. hone their skills or keep in touch with the customer that does not bring money right now to the company. Such people usually choose the easiest way, like inviting for the meeting technical specialist in case that customer asks, even the easiest, question on technology instead of learning something about the company's portfolio.

All of that is reflected in the company income. There is also an additional problem: managing people in the time of crisis. Keeping them motivated to work while their shares are smaller or must be cut, or when the target is set higher. The lack of motivation is not only present in the case of self-development but also in other activities required but the ones that do not bring

tangible results, like reporting. The company's income must be right with forecasting, but reports shall be filled as well. Only then, higher level managers, often outside of the country where the targeted people work, are able to see what someone is doing and on what he/she is spending company's money. The lack of motivation reflects on the poor quality of reports. Most often situation is: the average of opportunities is set and an employee indorses only as many opportunities (presentations, meeting with customers, pricing activities) to the system as it is set by the average. That means some of it is free creativeness and some chances are missed.

8.2.4. Stress

The interviewed managers also pointed out talent management which is not easy to do when not much can be offered, and stress in sales family job is high. A deal after a deal without time to relax may cause many problems. All interviewed managers emphasized how important it is to have a place and time to relax. It may be home, or a fun night out, something to restart.

These problems are related not only to health issues, such as high blood pressure, heart illnesses, sleep deprivation, but also problems with concentration, lower performance, problems with communication and the one in balancing life and work (more stress can cause transferring it to personal life, which causes more stress). Stress causes burnout which leads to mistakes, the lack of effectiveness or motivation to show up at work, which may even push one into faking medical records [15]. Someone who experiences burnout also feels depressed, disappointed and sees no perspectives. The manager of indirect sales hub in Prague agreed even on regular nights out for the whole team as a closing point of blizday. A day when new campaign for product is open, demand generation expectation are high and the same targets for all sales. During the entire work day his people call and introduce customers to new products. This day is also designed in the mood of gamification: small task, some fun, even a special color of a clothes is assigned to that day. All of that to motivate. Going out with your own team has another outcome: it helps with communication. The lack of formality and new situations, being out of the corporation structure bring people closer.

However, managers do not always have a budget for informal activities. That would be too perfect. Stress causes crises and does not help in people management. How to lead or manage a person that is not easy going due to a long period of stressful situation? This employee's mood is brought home and from home to work creating a vicious circle. Burnout also causes aggression and the lack of respect for customers and coworkers, which is dangerous for business, creates hostile atmosphere at work and influences others [10]. Sometimes a simple observation of team members helps, sometimes advice or showing appreciation. Moreover, not putting any extra pressure and manager's own self-esteem and confidence might be the blessing. However, that brings us to a point where simply not everyone can be a manager.

Some problems are caused by poor management or poor leadership. The lack of understanding or empathy is damaging not only in a workplace. People create companies. They are the core of each organization. That is why it is so essential to manage and lead them in a way that not only motivates them, but also empowers them.

8.3. Management through entertainment

Jane McGonigal in her book "Reality is broken" explains that comparing reality to a game (should be added, a well-designed game) is simply lame and inadequate. Games help us be better. It is because they bring more joy, happiness and hope. They are social and provide connection and relativeness to others. Activities there have a meaning, because a project is divided into small pieces. Moreover, games help us to show the best of our strengths. McGonigal writes: "Compared with games, reality is too easy. Games challenge us with voluntary obstacles and help us put our personal strengths to better use" and "Reality is unproductive. Games give us clearer missions and more satisfying, hands-on work" [11]. Goals or targets are not just a set of products that should be set or activities that should be done. It is something to look forward to achieving, something that brings hope of success, setting up a clear goal is the easiest way to boost one's productivity. Gabe Zichermann, a professional gamifier and researcher of the topic, says that employees want what games

have: fairness, transparency, feedback, trust, communication, engagement, productivity and education [17].

Taking into consideration work environment of the interviewed managers', transparency and fairness is clearly a problem, as it is in all huge companies. As it was already pointed out, the lack of feedback is a problem for the younger generation and causes poor performance and motivation. Trust and communication is always an issue when two people meet. Engagement and productivity, on the other hand, is a dream for managers. That is why games are perfect in a workplace. Even the old guards, the ones who do not need constant feedback, may take something out of it, because they will learn and communicate with other, socialize and belong to the group. Even though it is not the priority for them, it is hard to believe someone can say no to fun.

Coming to the point: in the next few paragraphs let's explore some examples of using fun and games in management, problem that it solved, and outcomes of it.

8.3.1. Case study #1: role playing workshop

Role play games may tell us something about our identity. They also teach us skills that we usually do not have a chance to explore. Moreover, because they are so entertaining, they may be used in a battle against illiteracy [14].

As it was explained before, managers have problem with the lack of motivation when it comes to other activities than taking care of customer's order or working on a deal. While other activities are needed for company's purpose, e.g. to control or budgeting, or to actually for employee's development to enable him/her to perform work in the best way. That is why some companies started to use role playing games to teach employees new skills, like negotiating, overcoming obstacles or even for recruitment. Most often professional coaches are hired to prepare a script and the narration of the game. Before that happens, it must be explained who will play, what kind of personality he/she has and what is the goal. When it comes to communication workshop, it is quite simple: one person is a customer, another is an expert from the company, and yet another is an observer. Roles change after one round. Everyone brings an extra mile to the

exercise, since they often meet with different customers and different questions addressed to them. By wanting to be tricky, they ask the hardest questions to the partner, and build a story that never happened. This way the competition is also brought to the exercise.

Moreover, sales people have the habit of talking a lot, like they want to outtalk the customer so that he/she does not want to raise any questions or doubts. Technical experts, on the other hand, are very niche-oriented. Role playing games help them to see how the other side feels and to learn from the experience of others, exchange the ideas and some hints. It also helps to gain self-esteem and knowledge of the product, especially when a new one is introduced. It is also a practice of communication: using the right words, correct sentences and practice. The best performers say it is all about practice. Communication, especially with the customer is also about prices. Coaches often point that the structure of sentence may cause doubts and confusion that is why it is so important to practice it in less stressful situations. This also shows that gaining knowledge may be fun.

8.3.2. Case study #2: Games

Games may be used to educate, not only in schools but also in business. HP TechTeam is a great example of it. Under this name a series of games was published on www.hppolskadlabiznesu.pl, a few levels on each business units, like networking, servers, storage. The goal was product placement and propagation of the brand. However, it was not all. A networking series was also designed to teach a specific methodology and a way of thinking for this type of technology, so that partners, who are the target of all series, learn how a given product works. This was possible due to a graphical interface. Furthermore, as gamers admitted, games influenced their will of exploring – they were willing to spend more time looking for the best solution, reading technical specifications or simply communicating with other gamers and sharing best practices. There is no doubt that a game is a much more pleasant way of introducing the product than a business presentation.

Another great and well-known example is the Microsoft Language Quality Game. Testers' work is very important for the quality of the product, but also tiresome. A routine is killing, especially when one has to do something effec-

tively. One must check the same looking parts or communication. That was the case in the Ross Smith's team, who is the head of Test Department at Microsoft. He knew that boredom caused by routine is an issue for his employees, and a new operating system was about to come out. This product is localized in real time, which means translations for all available languages must be ready from day one. The employees often missed mistakes while checking the communication. The solution was phenomenal. Microsoft created a game. Employees from different national branches could choose to take part in it and check communication, gain points, etc., or not. Afterward, the best national team was chosen and the prize went for charity. It also showed that letting people know they may change something in the life of others is more motivational that giving them something tangible. Many employees spend free, unpaid time just to make their company and the product more successful. Over 500 thousand communication screens were checked by over 4500 employees [4]. The job was done faster than expected. Is that not a dream of every company? Nonetheless, games are used in the business environment also in different cases. A great example is a card game, even the simplest one. A team is divided into smaller groups and the instruction of the game is provided to each group – one instruction per group. The most important rule is that communication within the group and between groups is prohibited, as well as any use of mobile devices. The time for learning the instruction is limited, then is the instructions are taken away and players should start the game. After one round winners and losers change the group. Communication is still not allowed. All players received the same instruction so everyone in a room should understand the game the same way. Quickly it can be observed that it is not the case. Players who change the group were trying to pursuit their own rules and play along, while others were confused. This game teaches one thing: each group may have its own rules. One believes the rules are the same and plays the best she/he can, but it is not enough, since he/she did not bother to ask about the rules. The manager can ask his team members many times: talk to people with whom you are going to customer what are the rules in case of this client and your relation, what are the expectations. Notwithstanding, not many pay attention to words. This game teaches it in a simple way. Since it was also creative and out of the box, each player remembers it and a chance that rule of asking and communicating, clearing the expectation, will be applied is higher.

Another game used broadly as a trick in business is the marshmallow challenge. Each team is given limited resources: eight minutes, one marshmallow, one yard of tape, one yard of string and 20 sticks of spaghetti. The task is to create a tower. This challenge shows that kids from kindergarten are better than MBA students or long-time managers. Why? Because this challenge is all about creativity and innovation. It is also recommended when one wants to bring a new point of view to the team and shows that structure and a well-planned project is not always the best and sometimes it is wise to bring something new to an ordinary task or a problem that should be handled by the team. A structured way of thinking and the lack of creativity is not only boring, but also common in big companies where there are rules and guidance for everything, except for solving unusual/atypical problems. It also happens to people who work in the same position for a long time.

8.3.3. Case study #3: competition and game elements

As it was mentioned, people are not motivated to work, which leads to poor performance. Implementation of game elements may solve that problem since it brings something new, social and fun.

An experiment, or one should say a gamified project, took place in one of the sales team: a huge map was hung in the main room. Each sales person had his/her own color of the flag that could be put on the map after meeting with the customer. The sales people quickly stopped thinking about these visits as a sad duty, but as a fun way of competing and taking over the map in order to show the others how good they are, as well as be transparent and recognized [9]. Of course, that is not the best example, because the number of meetings has nothing to do with the quality of them or deals made. It may also cause miscommunication or conflicts in the company. However, it worked. More meetings occurred since the map project was implemented/introduced.

By using such simple drivers as competition, managers decided to motivate their own teams to reporting. The goal was simple: which national team adds more opportunities and tasks to the system (SalesForce), wins. Weekly results were provided by emails. Leaderboard was transparent, rules were clear. Again, value won over quality. Game designers, or the ones who create gamified systems, presume people act in good faith. No doubts winning with

other national group is a good faith especially that one firstly think I am from this place, I'm local and there are the Others. Then another thought is that we all work in one company for that company. Either way gamers sometimes want to play the system. Animal instinct and competition took over. However, one of the outcomes of this competition was that the tool, SalesForce was known broader and people learnt how to use it. Without this gamified structure employees would probably procrastinate and learn this application later and not that well. However, if competition is the only mechanism used and there is no bigger picture, people simply get bored as well. There must be a higher goal to achieve to keep them performing. Shortly, competition is a short-term, very short-term, solution.

Another used game element is recognition. It may be as simple as "the employee of the month" board or prizes for the best talents, ideas that are very popular especially in American companies, and have been well-known for years. What underlies it is that all of us like to be recognized and appreciated. One often laughs at "shake hands with the CEO" but then it is rather jealousy than underestimating this handshaking, especially in large companies where the CEO often does not know his/her employees by name, only because there are too many of them.

Small tasks, challenges, feedback – this can also drive people to activities and motivate them. This is also the answer to problems that managers face nowadays. Another example is an actual competition. In Hewlett Poland partners account managers (PAM) were invited to a small performance. Each of them drew lots with a technical issue that had to be explained to the jury. PAMs are the first point of contact for partners and should be able to answer also technical questions or present the company's portfolio. It was arranged as a funny contest, but showed them that they should spend some time on learning, either with company's internal tool, HP University, or by asking a technical consultant for help and explanation. It was more motivational than a lost deal, because others saw the performance and the feedback was clear. While losing a customer or business is not that transparent, and may be the cause of some not fully transparent factors (like friend of a client's friend works for competition).

8.3.4. Case study #4: fun and relax

A case of blizday ending in the Prague's hub was described above. Managers, or CEOs, or MDs, shortly the ones who make decisions, often forget how blessed fun is. Putting it broader: people chasing daily activities forget to relax and restart. Fun brings people together. It is also a great way to handle stress. Silly tasks, a party, doing something together may have great outcomes for the team work.

Utilization of the companies' budget for integration is every year higher. This is a growing market and many event agencies took that chance. It is not important what the group does as long as they do it together. It is an extra benefit for employees. It is also a chance to bring company closer to its partners. A better understanding of that group is needed for well-structured communication and products. Only knowing one's way of thinking, a sales person can find a solution to their needs. In sales work, interaction and networking is the most important part of the job. All of that is caused by socialization and lack of formality. Moreover, nowadays more and more companies design playrooms, going after the example of Google, or a football table to give employees an excuse to relax, sometimes a short game is better than coffee and boosts morale. Doing something extraordinary also wakes parts of one's brains and helps to stay young.

However, a simple fun activity, the one that may be enjoyed by everyone, stand up joking or dancing is often, some silly task underestimated. It costs nothing but a few brave people and can bring laughter. Using an extreme example, laughter and relaxation were valued more in the past before we forgot how to do it and were brought even to funerals were people actually danced and joked for the sake of family in grief.

8.4. Conclusions

People are the most expensive part of every organization. They are also the most valuable assets. However, managing diverse, talented group is not easy. It comes down to gender diversity, age and experience. All of that brings an extra mile to the team. Studies show that gender diverse groups are better at handling crises, have higher income and are better at communication. Age di-

versity serves in more problem solving mindset, and with age comes experience, which helps to apply a new approach. The team may not have much in common. However, what all people have in common is play that is present in their lives.

Through the fun one can reduce stress and, what is more important, motivate his/her own team and teach them thinking outside the box. Furthermore, games may bring people closer and improve communication in the company. There is no other way to be innovative and productive than by mutual support and help. Bringing play to work teaches new skills and makes work more fun, more joyful. Thanks to that, employees are more loyal to the company and want to devote more time to its success. Change in one's mindset is in an idea that company is not about a structure but about people, and play helps to understand it. It should not be forgotten that using game elements like clear rules, transparency and feedback provides employees with something they need to be productive. Marta Gruszecka in her article "How to play to engage" explains in more details what companies can gain by using game elements: the knowledge of employees' and partners preferences, clear leaderboards always on hand and a variety of rankings, better motivation, higher revenue, better educated workers, invaluable tools for communication with the target audience, better communication in the work environment [6]. Putting is shortly: game elements are simply the answer to employees' needs.

Gamification is the creation of the world, where people are better, more motivated, where they help each other to be more productive. It is a perfect well-designed workplace. It does not solve all of the world's problems. However, it may solve most of managers' problems in leading people. Even though more and more companies decide to invest in role playing, games or gamified programs, it is still something new. Doing something new, going out of comfort zone or being forerunner is never easy, and it takes courage. However, not using it is acting against your own people and your own success. It is not about company's revenue, but about making people more content and, not to be trivial, happier in their lives. It is a false belief that employees are motivated by money. More often, especially in the case of younger generations, the atmosphere and people drive the company. Managers have tools and now it is time to use them.

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