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THE APPLICATION OF ONTOLOGY FOR INDEXING OF PUBLICATIONS IN THE LIFE SCIENCES

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Ontologies recently have important role especially in knowledge management systems dedicated for agriculture. In the paper, issues related to indexing documents against the ontology, are presented and discussed. Problems with indexing documents in Polish language which has an extensive inflection are described. There are presented and discussed examples of ontologies and thesauri in the field of life sciences, in particular possible to use to describe aspects of plant production. We have tested Agrotagger the existing tool for indexing agricultural texts with publication in Polish. Original software developed for indexing web pages in Polish against potato ontology is described. In the final part some conclusions and plans for further research are formulated.

Keywords: knowledge management, ontologies, text indexing, agriculture

1. Introduction

Nowadays access to information becomes of great significance. At the same time data production is growing much faster than ever before. It is necessary to find useful information from the growing data resources. An increasing role of many employees is collecting, organizing and utilizing information. Nowadays the vast majority of the information is in digital form and computers are used for the processing of information, but finally a man has to draw conclusions and make decisions. However, it is possible to use appropriate decision support software to

support the undertaking of a decision. Spreadsheet software is an example of commonly used application in many areas.

The subject of our interest, first and foremost, is searching of information from the Internet pages in order to indexation. Many scientific publications are available online, some of them, primarily research articles are usually described by keywords. Of course keywords make easier to find information, but they are not always sufficient. Moreover scientific papers are not currently the only source of information even in science. There is a growing amount of scientific information, such as measurement data, experimental data or statistical data described rather with their associated metadata than keywords. Many publications are a white papers, technical reports or descriptions of technology. Furthermore, the researchers, for sharing knowledge, use modern internet platforms like content management systems, blogs and social networking to present and discuss results before they are published in scholarly journals or after they have been published.

Our goal is to extract words from the content of the publication which may indicate that the publication concerns issues of our interest. To achieve the objective, it is necessary to define the vocabulary that describes the field of interest, in our case crop production and more general agriculture. Such methods and formats must take into account the context and semantics. On the other hand, it is necessary to prepare tools to analyze text in natural language taking into account the flexion. Since we are indexing texts in Polish it means that both a description and inflection analysis must be in Polish.

In the following chapter of this paper, we shortly present similar works. Next methods of text analysis taking into account the inflection will be presented. Then we introduce the methods useful for description of domain – agriculture and crop production; we will focus primarily on thesauri and ontologies. The fifth chapter presents existing solutions for indexing publications in the field of agriculture in English. Next chapter presents the concept of a prototype system for indexing publications in Polish language regarding the potato ontology. At the end conclusions and plans for the future will be presented.

2. Related works

The use of ontologies in the text analysis and processing has a fairly long history. One of the issues is the assessment of the similarity between documents and text document clustering. Hotho et al. [6] started from VSM (Vector space Model) for document and made concept selection and aggregation. On this basis ontology was constructed, and then they modified VSM measure between documents according to ontology. It means that ontology was constructed from analyzed documents. Comparing among vector representation approach, latent semantic indexing method and ontology based method was performed in [16]. Ontology based method

is that new resources registered within the system are linked to concepts from this ontology. In such a way resources may be retrieved based on the associations and not only based on partial or exact term matching as the use of vector model presumes. Authors concluded that the results were promising. In [7] it was studied similar clustering according to WordNet lexical database. Authors designed a new data model (considering the correlation between terms) on which the Euclidean distance measure can be used. Additionally modified measures taking account related concepts from WordNet with the weight 0.8 were used. In [8] a system for ontology based annotation and indexing of biomedical data is presented. The key functionality of this system is to provide a service that enables users to locate biomedical data resources related to particular ontology concepts. The system is integrated with NCBO BioPortal (http://bioportal.bioontology.org/annotator) and its objective is to annotate a large number of biomedical resources and to provide an index up to date of annotated resources elements. The system is based on a domain knowledge representation schema in form of ontology. The user can select multiple ontologies in different formats (OBO, OWL, etc.) in mentioned field. Authors noted that the system selects the appropriate terms in the given ontologies but detailed indexing algorithm has not been presented. Approach for indexing web pages using HTML tags are presented in [5]. The document is segmented due to the HTML tags <title>, <h1>, <h2>; weights are assigned depending on the importance of tags. Indexation is performed against concepts from Agrovoc thesaurus independently to every segment. The experiments demonstrated that the proposed approach was capable of automatically annotating segments with concepts that describe a segment's content with a high degree of accuracy. This publication is interesting because indexed text is in Arabic language. At the end of this short review we can conclude that we have a lot of work according to the English language, they are based on the traditional methods modified by the use of ontology. The works relating to other languages than English are quite rare.

3. Text indexing method and tools

Searching for information from text documents, have been the subject of research in the field of natural language processing (NLP) and, more recently, knowledge management (KM). We can specify that the main purpose of information retrieval system is finding material (usually documents) that meets our requirements information from large collections (usually stored on computers) [14]. Searching for information is depended on the document representation (flat files in many formats like text, pdf, Word doc; semi structured files like HTML, XML or documents in more structured forms in databases etc.) and the method of access to it. Text indexing is part of the process of information retrieval in a given context. Indexation process is generally the first step of the process; thereby the search-

ing/indexing system can select and rang documents according to the user's query. The main techniques used for indexing is a part of speech recognition and the core of word identification called stemming. There are many algorithms created to recognize the core of word, the best known are: Lovins algorithm [12] Paice/Husk algorithm [15] and Porter algorithm [17]; an extensive review of the literature can be found in the second chapter of the book [14]. We have to note that most of these methods work well in English, but not in languages with complex inflection like Polish. There have been many attempts to adapt mentioned methods to Eastern European languages for example [2] however, the results are not satisfactory. The part of speech recognition is another important technique and it is described for example in [13]. Today part of speech recognition for English texts is quite accurate. There are many other works of scientific information retrieval and indexing, devoted to specific issues [4].

In order to make indexing, it is possible to use existing commercial solutions such as Key Phrase Extractor by Sematext or service offered by AlchemyAPI. In the academic projects there are mainly used non-commercial solutions such as http://labs.translated.net/terminology-extraction/ or http://texlexan.sourceforge.net/. Such free available solutions are mainly prepared for English or very specific languages such as Catalan http: //www.uoc.edu/serveilinguistic/home/index.html. It is possible to develop own algorithms specialized for a particular purpose, and as is often done for a variety of issues.

4. Ontologies and thesauri in life sciences

Indexation can rely on selecting the most frequent words but generally it is not sufficient. It is necessary to define set of words related to the topic. To describe the fragment or whole domain we can use ontologies. The subject of ontology is the study of the categories of things that exist or may exist in some domain. Sowa [18] notes that without ontology, the terms and symbols are ill-defined, confused, and confusing. Definition of ontology used in computer science and in knowledge management, was formulated by Gruber: "An ontology is a formal specification of a shared conceptualization" [3]. This definition is very general and many types of domain description are included in it. A formal ontology should be specified by a collection of names for concept and relation types organized in a partial ordering by the type-subtype relation. An informal ontology may be specified by a set of types that are defined only by statements in a natural language. Taxonomies, controlled vocabularies and thesauri are examples of tools for less formal ontologies. They have been used for years in life sciences, librarianship or linguistics. It was necessary popularity to define appropriate standards for creating ontologies; nowadays most popular are the standards based on XML syntax defined by WWW Consortium - RDF (Resource Description Framework), OWL (Web Ontology Lan-

guage) which is an extension of RDF and SKOS (Simple Knowledge Organization System) designed for representation of thesauri which is based on RDF. More about thesauri and ontologies standards is presented in [9,10].

Ontologies are widely used in the life sciences, the most important examples of applications are given in the papers [9,10,11]. Ontologies help us to organize the knowledge contained in the publications and they are an essential component of knowledge management systems. In the domain of our interest very important are Plant Ontology (http://www.plantontology.org/) and Crop Ontology (http://www.cropontology.org/). The main goal of the Plant Ontology project is to provide controlled vocabularies for the plant-specific knowledge domains: plant anatomical entities and plant structure developmental stages. Anatomical controlled vocabulary describes plant's morphological and anatomical structures representing organ, tissue and cell types and their relationships. The second controlled vocabulary describes growth and developmental stages in various plants and their relationships, examples are germination, seedling, flowering, etc. The Crop Ontology current objective is to compile validated concepts along with their interrelationships on anatomy, structure and phenotype of crops, on trait measurement and methods as well as on germplasm with the multi-crop passport terms. Unfortunately both plant and crop ontologies do not have terms in Polish. Plant Ontology has only Japanese and Spanish version, Crop Ontology is only in English. For us this means that we can only follow those ontologies and, if necessary, create Polish versions. For our purpose more interesting is thesaurus Agrovoc - a multilingual glossary in SKOS format in the fields of agriculture, forestry, fisheries, food and other related fields developed by FAO [19], because it is available also in Polish.

5. Agrotagger and Annotator

In the area of agriculture most interesting initiative is Agrotagger developed by FAO [1]. It is a keyword extractor that uses the Agrovoc thesaurus as its set of allowable keywords. Agrotagger began as a collaboration with Indian Institute of Technology of Kanpur (IITK). Building on top of the popular Keyword Extraction Engine (KEA) the team created several versions, some based on a reduced subset of Agrovoc and others using the full set of Agrovoc concepts. MIMOS in collaboration with IITK and FAO produced an interesting application on top of the IITK tagging service by storing the generated keywords as RDF triples and building from this a tag cloud showing the most commonly extracted keywords. In addition, FAO has collaborated with the Metadata Research Center of the University of North Carolina who include Agrovoc along with a host of other thesauri in their indexing and browsing tool known as HIVE.

We tested all mentioned versions of Agrotagger. For the test, we used an article in Polish with English summary "Information system for acquiring data on

geometry of agricultural products exemplified by a corn kernel" (*Jerzy Weres: „Informatyczny system pozyskiwania danych o geometrii produktów rolniczych na przykładzie ziarniaka kukurydzy". Inżynieria Rolnicza. 2010 Nr 7*). In practice, Agrotagger (IITK) has taken into account only English words those encountered in the abstract and bibliography. There are: Image processing, Kernels, Triticum aestivum, Engines, Wheats, Models, Wood, Fruit, Processing, Drying. Similarly, Agrotagger in the version of MIMOS produced the same output (Fig.1).

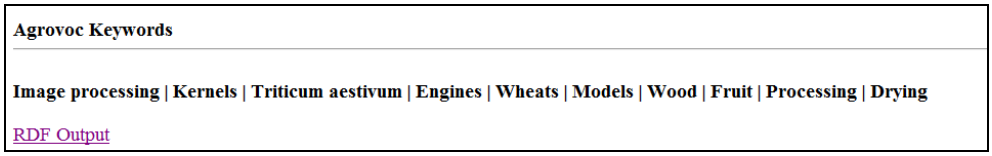

Figure 1. Result of Agrotagger indexing

Additionally this version made possibility to download result in RDF format (Fig.2). It should be noted that numbers in RDF output, for example mytermcode=25387, mean the indexes of concepts in the Agrovoc thesaurus (25387 is the code of Kernels concept).

Figure 2. Agrotagger indexing result as RDF file

Last tested tool, HIVE indexer, produced as result: Zea mays, Triticum aestivum with bigger font and Image processing, Kernels, Maize oil, Soft Wheat, Models, Maize, Wheats, Engineering (Fig.3).

Figure 3. HIVE indexing with Agrovoc result

The results are slightly different than in Agrotagger, which means that the HIVE indexer used semantic relationships (in this case synonyms) from Agrovoc during indexing process. At the same time, this means that although Agrovoc comprises semantics both Agrotagger versions did not use this. Moreover HIVE indexer presented results in the form of cloud tags, it means that more frequent concepts were written in bigger font.

We have to note that all three mentioned services in recent months were unavailable although links to them are available from AgroTagger page (all presented tests were made on April 2013). At present (November 2014) available is only version of Agrotagger (IITK) with reduced vocabulary named Agrotags (http://agropedialabs.iitk.ac.in:8080/agroTagger/index_PDF.jsp). Agrotags is the subset of Agrovoc. Agrovoc has about 40,000 agricultural concepts and Agrotags has only around 3057. The same publication gives the following tags: processing, data processing, plant products, plant oils, productivity, layering, agricultural products, drying, agricultural engineering, engineers. The result is different from the previous but the cause is the limited version of the thesaurus. Finally, within the context of the agINFRA project, FAO assembled an Agrovoc-based indexing package using the Maui indexing framework. There is information on FAO web pages that source code can be accessed at GitHub. Application is available to download as command line application under UNIX operating system.

An interesting tool for us is, mentioned earlier, BioPortal annotator (http://bioportal.bioontology.org/annotator) which uses, among other, Plant Ontology and Crop Ontology. Because the testing texts in the Polish language was meaningless we tested only English abstracts of papers from Agricultural Engineering (*Inżynieria Rolnicza*) against mentioned ontologies. The results were rather not interesting but allowed us to get an idea how Annotator uses ontologies.

In conclusion of this part we can say that, although Agrovoc is a multilingual thesaurus presented indexation process is conducted only in English and in its current form is not very useful for publication in Polish. The second conclusion is that searching algorithms are not documented, results for different versions differ. It means that constructing new algorithms is reasonable and testing them on wide variety of texts is necessary. Additionally it was found that indexing texts in Polish language requires ontologies prepared in Polish.

6. Prototype indexing system in Polish

Conclusions from the previous part of our paper justify the need for preparing indexing system for Polish language, because in the field of agriculture, multiple publications are in Polish. The main objective of prototype indexing system in the Polish language was to index web pages relative to the sample ontology. In our system indexing is made according to terms of potato ontology prepared in OWL. This prototype potato ontology is described in [9], it is important that ontology is designed in Polish language. Ontology is small and does not include synonyms and broader concepts. In the current version document is not segmented due to the HTML tags. Text is only filtered, which means that all tags and JavaScript codes are removed. To support inflection we used dictionary of Polish language http://www.sjp.pl/, which contains the inflected forms of Polish words. This dictionary of Polish language was useful but there are some specific terms that are not in it, like "rizoktonioza" (this concept has inflected forms in Polish and additionally may appear in Latin form: "rhizoktonioza"). In such situation we prepared set of ontology concepts inflected forms and attached this set of inflected forms for all concepts occurring in the ontology as fixed file. It is reasonable because ontology is not changed during indexing. As a consequence in our system filtered text is not transformed according to inflection. We have to note that indexing system for texts in Polish was presented in [20]. In mentioned system the concepts from text are dynamically transformed into basic forms during indexation process, according to Polish language dictionary. Our approach is enough because there are only a few important classes in potato ontology: potato (*ziemniak*), component (*składnik*), product (*produkt*), disease (*choroba*), pest (*szkodnik*), disease protection product (*środek chorobobójczy*) and insecticide (*środek owadobójczy*). In addition only potato class name is strictly connected with our issue, other class names are more general. For this reason, we have to search in the indexed text only instances (individuals) of those classes. It means that we do not search word component but rather words water (*woda*) or (*skrobia*) which are instances of component. As a basic measure of correspondence we took frequency of words in a text. Additionally weights were connected with every word: 1 for potato and its individuals; 0.5 for component, product, disease or pest individuals; 0.25 for disease protection product and insecticide individuals. An example results are presented in table 1.

The results show that popular sites about the potato have the highest compatibility with the potato concept. Web pages of research institutes and pages with professional knowledge about potato have less compatibility. Web page of deputy named Ziemniak has a relatively low compliance with our issue.

Table 1. An example results of page correspondence with potato

WWW page	Correspondence (in promiles)
http://groole.pl/o-ziemniakach	80,64516
http://www.polskiziemniak.pl/	64,03941
http://www.ihar.edu.pl/ziemniak.php	34,95935
http://pl.wiktionary.org/wiki/ziemniak	51,09489
http://agricopolska.pl/index.php/odmiany/jadalne	22,38254
http://www.ziemniak.pl/	9,02935

7. Conclusions and future work

FAO on the portal of the Agricultural Information Management Standards presents an AgroTagger, tool for indexing documents in the field of agriculture, which is designed for the English language. Tests have shown that in such form a tagger is unsuitable for indexing documents in Polish language. Agrotagger uses only the Agrovoc thesaurus. BioPortal Annotator indexes against many ontologies but also is useless for Polish texts. In this paper we presented an approach for ontology-based indexing for web pages in Polish. The first results of the prototype indexing application are interesting however, it is necessary to perform a more systematic study of web pages related to agriculture. On the basis of bigger set of examples it will be possible to improve the weights assigned to the concepts connected with main concept. Ultimately, it is necessary to prepare the corpus of texts in html format for systematic testing, which would allow further improvement of the system. The first extension can be segmentation page content due to the HTML tags <title>, <h1>, <h2> and assign weights depending on the importance of tags. It seems reasonable combination of our system with the web crawler to index the linked page groups. On the other hand, we have to prepare the interface for documents in format other than HTML, in the first place in doc/docx and PDF formats. Although it is used only ontology for one vegetable the proposed approach enables to adapt the system to new ontologies. In the future it is planned extension of the ontology with additional concepts. In parallel Agrovoc thesaurus will be used in order to complete the concepts with broader and narrower terms. After such improvements the application can be practically used for automatic indexing of texts.

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SECURITY MECHANISMS FOR DATA ACCESS IN ASPECTS OF TOOLS AVAILABLE IN .NET FRAMEWORK

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Software solutions are nowadays commonly used in business. More and more transactions are conducted on-line as well as more and more critical information is being kept on local or remote servers in huge databases. The purpose of presented paper is to analyze and propose the solutions used for the security of sensitive personal data and access to such data provided by the platform chosen for research with respect to the real-life needs of the developers and end-users. The main focus are put on the solutions provided by the .NET platform which next to Java is one of the most commonly used programming environments for both web page and desktop applications.

Keywords. security mechanisms, data security, data access, .NET platform

1. Introduction

Together with the rapidly evolving environment of technological advances which aim to simplify and accelerate the business and production processes, an increasingly important issue becomes the development of appropriate security measures which would provide essential protection of intellectual property. Software solutions are nowadays commonly used in business. More and more transactions are conducted on-line as well as more and more critical information is being kept on local or remote servers in huge databases. The increased availability of information as a whole became a threat for confidential information and that is why the necessity to assure the security of sensitive data became undeniable. Develop-

ers of information systems put more and more stress on the aspect of security, as they have to ensure that their product will comply with international and local standards of personal data protection and it will guarantee the customers safe storage and use of data. On the other hand the platform providers try to equip their software designed for developers with built-in security mechanisms and frameworks in order to facilitate the process of software production [1].

The purpose of presented paper is to present the solutions used for the security of sensitive personal data and access to such data provided by the platform chosen for research with respect to the real-life needs of the developers and end-users. The main focus will be put on the solutions provided by the .NET platform which next to Java is one of the most commonly used programming environments for both web page and desktop application projects. .NET framework offers the possibility to use several programming languages and approaches for creation of Internet applications, web pages and desktop programs [2]. The amount of sensitive data such as names, addresses, passwords, credit card numbers, which flow through the net, is enormous and constantly exposed to falling into the wrong hands.

The paper is structured as follows: the first part presents the security mechanisms of .NET environment contributed to establishing fixed and stable position of .NET as a platform for Web application development. The second part deals with the used security mechanisms and their effectiveness in data protection, presenting the recommendations regarding the choice of .NET environment security solutions.

2. Security mechanisms of .NET framework

.NET framework is equipped with mechanisms giving the possibility of applying numerous techniques and a significant number of security name-spaces in order to enable the developer to build a secure program both in case of desktop and Web applications. The largest pressure is put on the Web application security solutions as these are those more liable to threats and violence of data and data access security rules. .NET framework distinguishes between two types of security connected with application design [3, 4]:

- user security (role-based security) and
- code security (code access security).

Both these types of application security are vital. The order of their importance is determined by the purpose which the application serves as well as the user requirements. User security aims to provide a managed access to application resources and operations available to the end-users basing on their privileges. On the other side there is code security which is similarly responsible for resource access and availability of operations but this time the application controls the code

which requests the permissions to these actions. This prevents untrusted pieces of code coming from suspicious sources to be granted access to application interior [7].

User security and code security are not excluding – they may be applied elementarily providing the application with doubled security of different kind. In short one may notice that user security corresponds to the identification of the end-user and answers the question who is using the application and which operations he can perform (Fig. 1), whereas code security tries to determine where did the code trying to gain access come from, who wrote this code and what operations can this code perform (Fig. 2). In case of code security it does not matter who uses the application and what type of account does he have. Code security is based on authorizing the application access to system resources, file system, registry, network, services and databases. The identity of the user is authenticated in the case of user security and permissions are authorized and granted basing on this authentication.

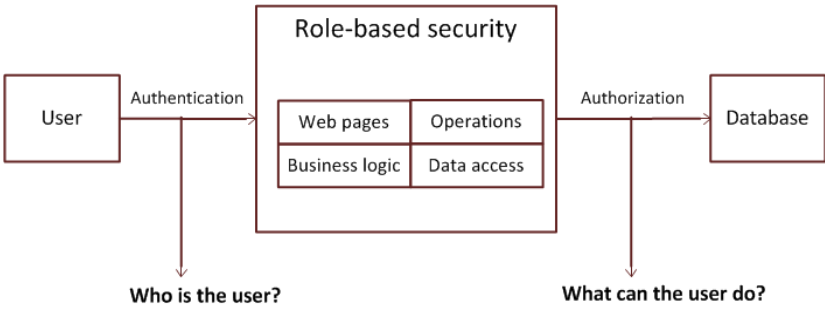

Figure 1. Schema of role-based security

2.1. Role-based security

As mentioned earlier the role-based security refers to the aspect of who can access application resources and which operations he can perform [5, 6]. This type of security is specifically used to authenticate and authorize the users basing on the roles assigned to the user accounts. The roles are determined basing on the business application of the program and they are specified particularly for the domain in which the program is used [7].

The *Principal* and *Identity* objects play the key role in this type of security for .NET platform. The *Principal* object is the reflection of the identity of the user and its membership to the roles. The interactions and principles of behavior of the *Principal* object are based on the *RolePrincipal* and *GenericPrincipal* objects. Major functionality of *Principal* object is that it stores the information about the user roles which determine the user permissions therefore it is attached to every request issued by the user to the Web application. This object can be retrieved using *HttpContext.Current.User* property.

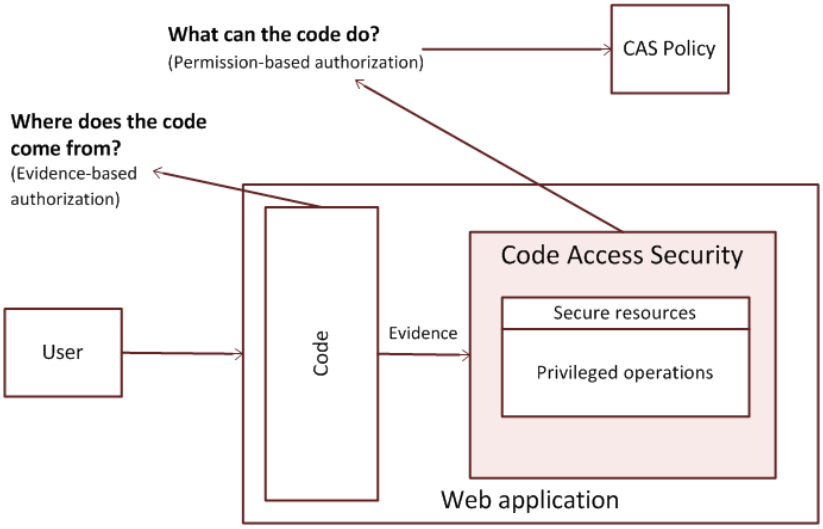

Figure 2. Schema of code-based security

The *Principal* objects store as a property the *Identity* objects. *Identity* objects are responsible for storing the user name, authentication type flag and authentication success or failure flag. Thanks to this information, the *Principal* objects are able to tell between authenticated, non-authenticated and anonymous users [7].

Another type of objects taking part in secure role-based authorization are *PrincipalPermission* objects. They specify the identity and role that the user has to possess in order to perform certain operation.

2.2. Code-based security

Beside the most common mechanisms of managing a user access basing on credentials authentication and resource access restrictions, another perspective needs to be taken into consideration as far as a security is concerned. This perspective embraces the code security as the protection of original source code of the application from the malicious software that this source code is vital for the correct operation of application and security of data it contains. The role-based security mechanisms do not correspond to threats which the application code faces. That is why another type of security based on the code access permissions needs to be applied.

.NET framework provides special mechanism called *Code Access Security (CAS)* which disables the code from unknown sources to penetrate and interfere with the application in an undesired manner [7, 8]. CAS is also helpful when it comes to dealing with the vulnerabilities and errors located in the source code itself. In order to create the applications complying with CAS standards the develop-

ers need to acknowledge and obey certain rules regarding the code composition. These rules refer to writing verifiable and type-safe code, using proper security syntax and secure class libraries.

CAS security means that runtime environment allows the code to perform only those operations it has permissions. The configuration of permissions granted to different parts of code enables to establish a security policy characteristic for every separate application. Security policy refers to a set of rules which can be configured and customized by the application developers. These rules enable the *Common Language Environment* to distinguish between parts of code of varying trust levels and assign appropriate permissions to these parts of code. The parts of code are called *code groups* and the entire code of the application may be divided into code groups according to different categories like for instance original URL addresses, publishers or digital signatures.

Describing the security for .NET platform in terms of CAS the concept of *Security-Transparent Code* arises. Security transparency means that the code should be divided into two separate isolated parts – the part which runs as *application* and the part which runs as its *infrastructure*. This enables to grant permissions to some pieces of code which is the so called *critical code*, which will be able to execute privileged actions such as calling native code, and other pieces of code which will not have such permissions.

3. Security mechanisms of .NET environment for Web applications

The security mechanisms available in .NET environment are commonly used in Web applications [7, 8, 9]. The example application – Internet portal created to analyze such mechanisms was written in ASP.NET technology.

The application, created in the framework of the presented works, was written using the combination of ASP.NET and C# language. It incorporates most commonly used security mechanisms available in these technologies. The crucial security aspects implemented in the application include user authentication mechanism realized by means of registration and login forms, authorization for resource access based on different roles assigned to users and sensitive data encryption using the chosen standards. The major focus was put to the user security as code security is a built-in feature realized equally in every .NET application.

The application is equipped with basic functionality characteristic for web applications, however the main focus was put on the implementations regarding the security issues. Applied security mechanism include the authentication and authorization mechanisms realized by means of login and registration forms, encryption of data and restricted access to the portal resources and operations.

The created application was designed to operate as a client-server application. The users would be able to send requests from their client computers to the host

located on a remote server where the application core and database would be stored. The system should be able to authenticate the users, authorize an access to the application resources, display the data using graphical interface and process an input given by the users.

From the point of view of the system and its administrators the vital aspect of the application is the insurance of security of stored data especially sensitive personal information such as name, personal number, address, card ID, PIN-code, and photograph to any unauthorized unit. It is also crucial to determine the acceptable response times of the system and security policy.

The major concern regarded the storage of user personal data. This aspect refers to almost any application having access to database and requiring authentication. .NET Framework developers identified the need to automate and unify the process of authentication and authorization and they introduced the so called *Membership* framework which is responsible for managing user accounts and roles. However, Membership framework provides only basic functionality and it has to be extended in order to comply with specific assumptions of the application.

Membership framework uses a pre-defined provider model in order to customize database features to a standardized programming interface. In order to adjust Membership framework features a custom provider was defined. The framework serves two built-in types of providers – *ActiveDirectoryMembershipProvider* and *SqlMembershipProvider*.

As the purpose of presented paper was to investigate the available solutions in field of .NET framework security mechanisms, the created example web application incorporates several mechanisms responsible for guaranteeing security and proper resource access to application users. The security policy is realized basing on the options referring to the most commonly applied security methods:

- authentication of registered users,
- authorization of access to resources and operations basing on privileges,
- sensitive data encryption,
- code access security.

3.1. Authentication

Authentication is the process of validating user credentials and assigning privileges basing on those credentials. Authentication takes place every time the user sends the request for protected resources or operations to the application server. The way the server authenticates users depends on the pre-defined configuration stored in *Web.config* file. The configuration takes place by specifying mode attribute of the <*authentication*> tag:

```
<authentication node = "Forms">
<forms loginUrl = "~/Account/LogIn"
timeout = "3000"
```

```
cookieless = "UseCookies"
protection = "Encryption"
requireSSL = "true"/>
</authentication>
```

The created web application uses the traditional *Forms authentication mode*. Configuration of features available in this mode is realized by defining the attributes of the <*form*> tag. Forms authentication is based on assigning the tickets to users who have been successfully identified. These tickets are sent to the application server each time the user sends a request for resource. Having valid ticket the user is perceived as logged in.

Tickets are most frequently stored in the cookies collection of a Web browser. It is also possible no to use cookies and to store ticket information in the URL. This is defined by setting the *cookies* attribute of <*forms*>.

Tickets are generated and issued to the user by the methods of *FormsAuthentication* class being a part of *System.Web.Security* name-space. The cookie containing the ticket is included in the header of any request sent to the server (Fig. 3). Another class of *System.Web.Security – FormsAuthenticationModule* is responsible for examining the header of each request in search for a cookie containing a valid ticket. In case no such cookie is found the module return a message with HTTP 302 Redirect status meaning that the user cannot access the resource because he is not logged in. In such case the user is redirected to the login page. Otherwise the authentication is confirmed and further check for authorization privileges takes place.

The above description implies that there exist three possible scenarios for a user trying to access a protected resource (Fig. 3). Either the user has a valid ticket so the authentication will be successful or he will be redirected to the login page where *FormsAuthenticationModule* will generate a valid ticket. The third option refers to the situation when the user login will end in failure.

Because of the fact that tickets are stored in cookies there comes the notion of timeouts. The cookies lose their validity after some time and so do the tickets contained in them. To define the time after which a ticket will become invalid one has to specify timeout attribute in the <*forms*> tag. This will increase the security of the application because a user will not stay logged in for indefinite amount of time which will prevent unauthorized units from using his accounts.

Other parameters specifying the security features are *protection* and *requireSSL* attributes. Boolean value of *requireSSL* indicates whether secure SSL connection is necessary during the authentication process. *Protection* enables to select type of security measure used to protect the ticket in the cookie. This attribute indicates how the ticket will be sent – either in plain text or using encryption. Encryption may be done in two ways. Either by sending encrypted ticket to the server or by generating *message authentication code (MAC)*. MAC is a special representation of data contained within the ticket. In case of using this type of protection both ticket – sent as plain text and MAC are included in the header of the request.

The server compares the received MAC with the text that came in. If the data correspond to one another than the server knows that the cookie was not modified.

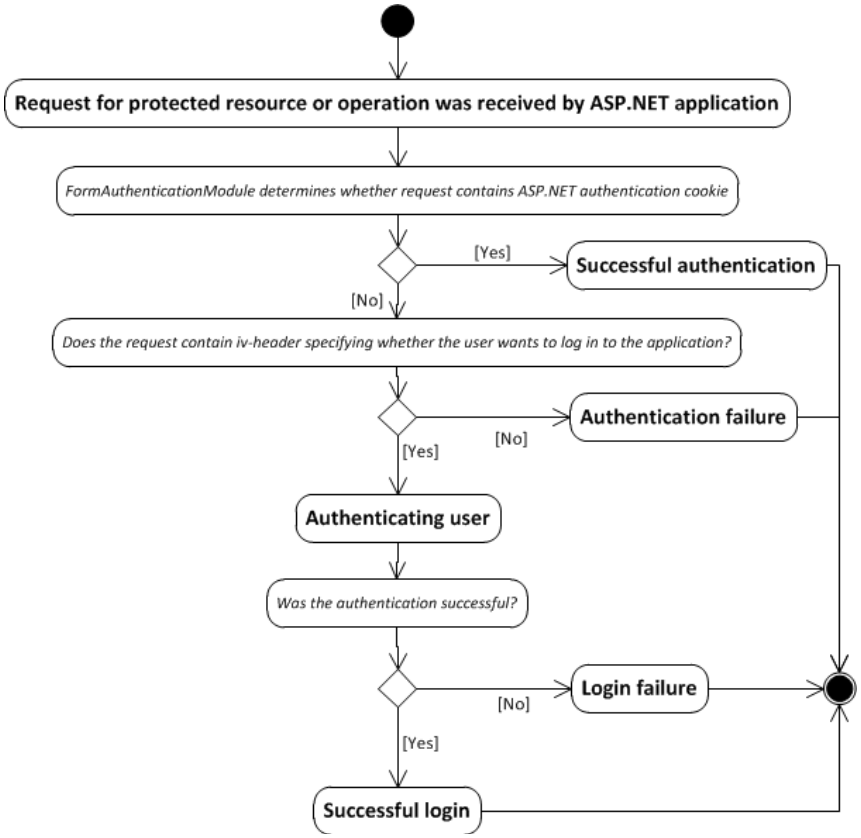

Figure 3. Activity diagram of authentication process

Authentication enables the server to tell authenticated users from guests and on this basis the authorization of access to resources and operations is granted.

3.2. Authorization

Authorization is the process of assigning the privileges to specific users, groups of users or actions. Basing on the user membership to defined the roles it is possible to determine which resources and operations he can access.

System.Web.Security name-space contains a series of classes responsible for the role managements. The core class *Roles* provides an interface for adding, deleting roles, assigning users to roles, retrieving all roles the user is assigned to, etc.

The *RoleManagerModule* is a class responsible for creation of *RolePrincipal* object during the authentication process and attaching this object to the context of the current user. Thanks to *RolePrincipal* object which is another security class, it is possible to extract information about roles the user belongs to by using *IsInRole()* method:

```
<roleManager enabled="true" defaultProvid-
er="SubsciptionPortalSqlRoleProvider" cacheRolesCook-
ie="true">
<providers>
<clear/>
<add name="SubsciptionPortalSqlRoleProvider"
type="System.Web.Security.SqlRoleProvider"
connectionString-
Name="SubsciptionPortalConnectionString"
applicationName="/" />
</providers>
</roleManager>
```

Another way to determine the user roles in runtime is to specify that role names for a user could be cached in a session cookie. This improves the performance of an application and can be done by setting the *cacheRolesInCookie* attribute of the *<roleManager>* tag. Similarly as in case of membership provider the *<roleManager>* determines the schema for managing roles. If we want to use a role-based authorization in our application the role manager ought to be enabled and added to the role providers list. Role provider refers to the database schema for managing the roles:

```
<location path="Customer/Basket.aspx">
<system.web>
<authorization>
<allow roles="Standard, Premium"/>
<allow users="*"/>
<deny roles="Distributor"/>
</authorization>
</system.web>
</location>
```

Authorization may be defined either in local *Web.config* files defined on the package level or specified globally in the configuration file which was used until now. The authorization may be defined at any level of resource complexity. It can be specified for entire application, for separate packages or single resources like web pages. To determine who is allowed to use the selected resource the properties of *<authentication>* tag need to be set. These properties allow and deny the attributes which are given one of three additional parameters: users, roles and verbs.

Users enable to define specific users which can or cannot access resource. *Roles* parameter allows restricting access for entire groups of users and *verbs* gives the possibility to choose one of the three values: "GET", "POST" and "HEAD" in order to restrict performing certain request. The *verb* parameter has to be always accompanied by users or roles unless we want to restrict operations for all users – which happens almost never. The parameters take user names or role names as values, however there is additional option to indicate all users by writing "*" or only anonymous users denoted by "?":

```
<location path="Customer/Discounts.aspx">
<system.web>
<authorization>
<allow roles="Admin, Premium"/>
<deny verbs="POST" roles="Standard"/>
<deny roles="Distributor"/>
</authorization>
</system.web>
</location>
```

The specification of resource we want to authorize is done by modifying the path attribute in <*location*> tag. The value of an attribute may be an address of a particular page or entire package. If particular user or role is neither denied nor allowed an access to the resource by default such access is granted:

```
<location path="Administration">
<system.web>
<authorization>
<allow roles="Admin"/>
<deny roles="Distributor, Standard, Premium"/>
</authorization>
</system.web>
</location>
```

The process of authorization is a simple one and occurs after sending request to the server. It results in one of two actions – either an access is granted or it is denied (Fig. 4). The authentication ticket stored in the header of a request either already contains user role or the server performs a check basing on obtained user identity.

If the user is anonymous and the page requires authentication because it is a protected resource, the user is redirected to the login page. This results from the *FormAuthenticationModule* default behavior which returns HTTP 402 Redirect status. In case of authenticated users the *AuthorizationModule* checks the user roles and the resource permissions and returns a successful authorization result by redirecting the user to desired resource or returns HTTP 302 Error status indicating that the user does not have adequate privileges.

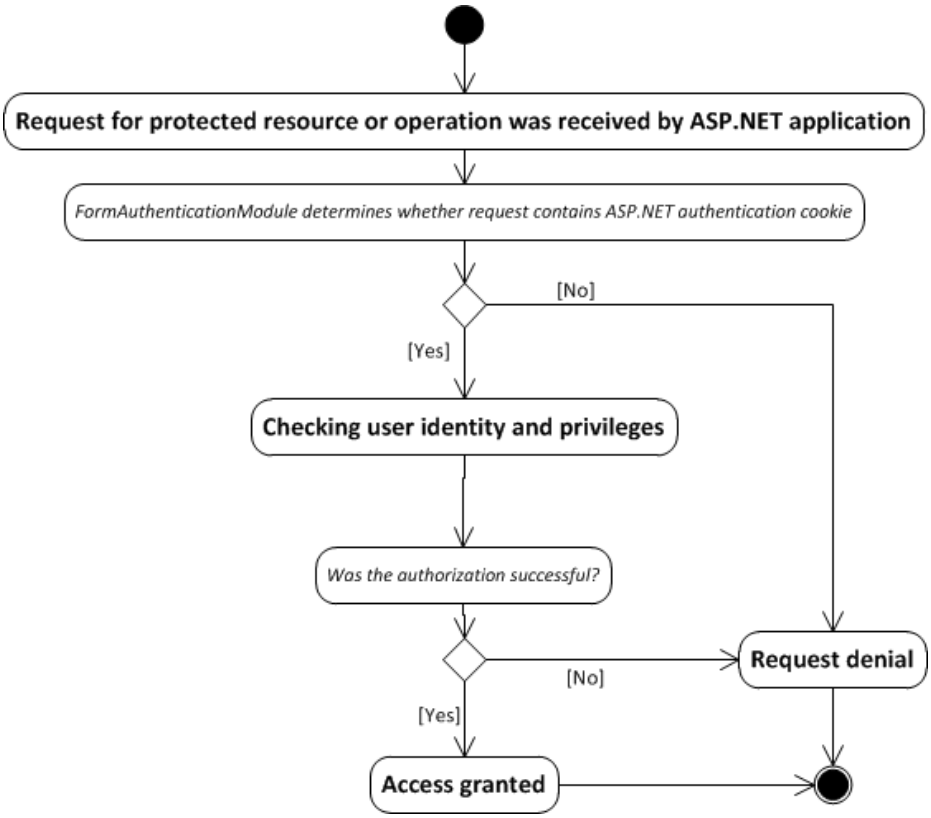

Figure 4. Activity diagram of authorization process

The authorization process is vital when it comes to managing the application resources in web application. It enables to distinguish between different types of users who are allowed to perform and access only these operations they should.

4. Conclusion

The main focus put on the solutions provided by.NET platform which next to Java is one of the most commonly used programming environments for both web page and desktop application projects. The above description demonstrates how to secure the application with basic security mechanisms in a simple and efficient manner. The implemented functionalities provide valid fundamentals for building a web application which would be resistant to the invalid user operations, provide effective distribution of tasks which depend on the user roles and privileges as well to the external attacks aiming to capture the sensitive personal data.

The authentication process which takes place every time is issued to the server allows validating the source of the request and its credibility. The built-in code access security mechanisms remain alert to the violation of the internal structure of the application and will not allow any untrusted piece of code to penetrate inside the application core. The unauthenticated user will not be allowed to get into privileged sections of the application. Moreover, the authorization process prevents the users from performing actions they are not allowed to perform and to access the resources which are beyond the scope of their rights. This ensures that sensitive data will only be visible to those for which they were designed for.

Basing on the conducted research referring to the security mechanisms for .NET platform it may be concluded that the tested environment provides the software developers with reliable tools for software protection offering a board variety of features which can be adjusted for the specific application purposes. It is recommended to study the requirements for the developed system in order to select the most suitable authentication and authorization methods as well as to include data encryption in every case where sensitive user information might be liable to any potential threat. It should also be remembered that user security should go hand in hand with code security as only the combination of these two will make the application reliable, efficient and resistant to accidental and deliberate violations of the security policy.

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RISK ASSESSMENT FOR ERP SYSTEM IMPLEMENTATION

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In this article, based on the results of questionnaire sent to 50 companies with different employment size, events affecting the failures of the ERP system implementation were identified and their risk level as well as additional costs related to preventive actions (reducing the probability or effects of the problem occurrence) were investigated. To evaluate the risk values of chosen ERP system implementation tasks, PMI (Project Management Institute) standard was applied.

Keywords: ERP implementation system, risk value, risk assessment

1. Introduction

Information systems suppliers, in particular ERP (Enterprise Resource Planning) systems, avoid clearly in their presentations risk analysis of the system mainly for two reasons: the first is the lack of or limited knowledge regarding the risks in individual sectors of the economy, while the second reason is related to sales and marketing. Risk has always aroused panic among both customers and retailers offering the system. Disclosure of threats by the supplier in the first steps of the sale may be subject to conflicts of interest. One general principle that is in force is that the risk in the first stages of the project is a forbidden word. Unfortunately, in the next stages of the system implementation, it becomes the not needed word and for its analysis is too late, it remains only mitigate the impact of rising incurred costs. This article presents, a sample list of risks for typical ERP systems implementation and the risk assessment calculation method, that can be

useful running own risk implementation analysis, especially for medium and small enterprises (MSP).

According to Lyytinen [7], there are two essential areas in which risk of the information system project can arise [2]:

- The development of the system, where risks arise from user objectives definition, the incorrect conceptualization of the system, the incomplete view of the organization and the difficulty to predict the impact of the system, the inability to create complex solutions for given specific industry, etc.
- Use of the system, in which the risks include inability to create or use appropriate technical solutions , to collect and maintain relevant data, a negative impact on working conditions, changes (authority, qualifications or scope of the work).

A special case of projects are the ERP implementation projects, which are subject to adjustment previously produced software to the specific conditions of the company in order to achieve certain benefits. Risks in these projects arise on each stage of the implementation of the ERP system [4]. According to report (Business Software Report, Management Institute of Warsaw, 2001) and analyzing the implementation management system suppliers methodology [8], the implementtation of a ready system is usually implemented in five phases:

- preparation of the organization for change – work out a project organization and the rules for its implementation,
- determination the business concept - elaborate a list of business processes that will be implemented by the system,
- implementation - development of a prototype solution ,
- preparation for work in the target environment - installation, launch (test integration of the prototype, user training, data transfer , preparation of the working environment) and transmission system operation,
- start and supervise the work of the system in the real environment.

In the following article, based on the results of surveys sent to 50 companies with different employment structures, we identified events affecting the information management system implementation failures that occur at every level in the life cycle implementation project. These events are grouped in categories and on their basis, an estimated level of risk and additional costs that will be incurred with the launch of tasks related to actions that reduce the probability or effects of the problem, will be adopted.

2. Factors affecting the risk

The main impacts of risk found in the literature [2] are: over budget, time overruns, cancelled prior to completion, unsatisfactory business performance, insufficient system stability, weak or less than the required features and functions, a low degree of integration, failure to achieve strategic goals and inadequate financial and economic results. Identifying sources and risk factors requires an understanding of their causes and mechanisms by all participants of the implementation team. Gaining this awareness is a condition to work on identifying the risks in order to eliminate, reduce and control the risk intentions. The identification of potential risk factors, is one of the essential elements of the risk management process. Errors made at this stage of the analysis may adversely affect the credibility of risk assessment [10]. The identification, which results will be the final specification of risk factors must be carried out very honest and reliable. Omission of potential threats which are important for the project implementation, may reduce the effectiveness of risk analysis, and even undermine the legitimacy of the project management. Unfortunately there is no universal method of identifying key risk factors which guarantees reaching established goals. A good rule is to use own experience and the information delivered from the institutions that collect statistical data, suggestions and opinions of experts in a given field, own practical experience and theoretical knowledge. Quantification of risk factors, ie, its quantitative indication is not only important but also very difficult element of the project management. Most analysts and theorists engaged in risk analysis "run away" from the problems of quantification. They lead arguments about the risks and make only superficial qualitative analysis. Unfortunately, this leads to control the risk, and do not manage what can be described quantitatively.

In this article, to identify the implementation project key risk factors, we asked both customers and experts in the field of ERP systems implementation to indicate repeated and common in their opinion, implementation failures factors. Participants in the study indicated more than 42 different problems occurring during the implementation of the ERP system. In this study only 25 of them have been identified as having a negative impact on the time, budget of the project and product conformity with the project objectives. To evaluate the risks first for each event, the number of problems indicated by the study participants are summed. Then an importance of validity, according to the methodology in Section 3, was adopted. Table 1 shows the critical risk factors ranked by the number of reported problem.

Table 1. Types and quantities of identified problems

Id	Critical risk factors	Number of reported problem
1	Lack of Top Management commitment and support	20
2	Poor project management team	19
3	Lack of Departmental cooperation	19
4	Unclear goals and objectives	18
5	Incorrect project management	18
6	Ineffective communications	17
7	Improper management of expectations	17
8	Incompetent project leader	16
9	Lack of vendor or supplier support	16
10	Improper change management, risk and scope of the project	15
11	lack of knowledge of their own business processes	15
12	incorrect system selection	12
13	Analysis and data conversion	12
14	Limitation in resources	12
15	Insufficient training of end-users	10
16	Lack of new business processes familiarity	10
17	Non-acceptance of organizational structure change and business processes	10
18	Poor integration of the infrastructure systems	9
19	Poor conflict management	9
20	Using tools supplier	8
21	Ineffective project cost and time management	6
22	Lack of metrics for evaluating project efficiency and benefits	6
23	Lack of competence of ERP's consultants	5
24	Data losses	2
25	Insufficient testing phase	2

3. Project methodologies

The probability value estimation and consequences of risk occurrence consist in identifying project implementation tasks at risk of failure implementation. Next one should find answers about the impact of threats on one of completed tasks as well as to whole project (schedule, budget, quality, ect). In order to carry out a comparative analysis, each problem has been prescribed a certain value on a scale of 1 (least important) to 5 (the biggest problem). The final value of each problem is the sum of all values fulfilled by various participants in the interview. Since the

determination of the probability is done intuitively and based on PMI standards [9], the intuitive probability scheme is defined as presented in Table 2.

Table 2. Likelihood Value Guidelines

Range	Likelihood	Designation	Interpretation
1 - 4	0,1	very low	Very unlikely
5 - 8	0,3	low	Probably will not occur
9 - 12	0,5	medium	Equal chance of occurring or not
13 - 16	0,7	hight	Will probably occur
17 - 20	0,9	very high	Very likely to occur

Please note that there are no verifiable method that will accurately determine the threat likelihood therefore, the only attempt was to determine the range to which the likelihood belongs. Each risk is assessed for its impact and a response plan must be generated to avoid the risk or take advantage of an identified opportunity. To achieve determined project objectives a degree of risk impact should be defined. The following sizes, as presented in Table 3, indicating risk impact on project tasks realization are taken into account.

Table 3. The degree of risk impact

Points	Risk impact	Degree of the impact on the project / task description
0,05	very small	Need to change tasks plan (problems with the implementation are important only for task manager)
0,1	small	Increase of task time and cost (problems with the tasks implementation are taken into account by the Project Manager). Delays in the implementation do not affect project date realization or budget.
0,2	medium	Tasks project time and cost will increase and then will force a change in project schedule or budget. Tasks will be not achieved and a correction of the project plan will be necessary.
0,4	critical	Project goal is not achieved. An arrangement with the sponsor is needed. Project time and cost increases
0,8	dangerous	Negative effects on the design environment (the whole company, processes, systems, ect.). Effects exceed the expected project benefits.

Based on PMI Methodology [9], the risk weight is calculated as the product of the risk likelihood value and the degree of risk impact, please see Table 4.

Table 4. The matrix of the likelihood and impact of risks in the project for a given risk tolerance

Likelihood						
0,9	Very high	0,045	0,09	**0,18**	**0,36**	**0,72**
0,7	High	0,035	0,07	0,14	**0,28**	**0,56**
0,5	Medium	0,025	0,05	0,10	**0,20**	**0,40**
0,3	Low	0,015	0,03	0,06	0,12	**0,24**
0,1	Very low	0,005	0,01	0,02	0,04	0,08
		0,05	0,1	0,20	0,40	0,80
		Very small	Small	Medium	Critical	Dangerous
		Degree of the impact on the project / task (Time. Cost, quality				

Survey participants filling the questionnaire do not need to be familiar with risk management, it is sufficient that they present significant implementation threats in their opinion. The grouping and the formalization of the risk list is made by an expert in this area. In this article and in order to group different implementation tasks, a risk categorization has been provided:

1. Organizational **(O)** – subcategories include (top management, business processes, strategy, employment policy, company culture, process planning, finance, staff).
2. Project **(P)** – subcategories include (project management methods, quality and implementation team, business development, project integration).
3. Technical and technological **(T)** – subcategories include (system functionality, support, critical IT infrastructure,).
4. External **(E)** – subcategories include (legislation, the economic situation, exchange rate, competition, lobbying ....).

After summing up indicated scores and assigning ratings to each risk factor, it is necessary to evaluate its effects in order to apply any simplest strategies for its elimination or restriction by adding an appropriate cost estimation (to handle emerging problems) to estimated before schedule "margin of safety".

4. Application of risk assessment method on the example of Sap Sprint implementation

The scope and cost of the proposed example is specified using SAP Business All-in-One the Configurator (http://www.sap.com/solution/sme/software/erp/all-in-one/buy/rds.html), enabling the calculation of the predicted and the estimated SAP Business All-in-One rapid deployment solution price including hardware, software and system implementation (without software maintenance cost).

SAP Business All-in-One is a complex, integrated ERP solution, prepared by SAP partners for medium-sized companies. Implementation scope for a typical enterprise SMEs (Small and medium-sized enterprises) adopted in this example includes the following areas: activities related to logistics process in terms of sales, distribution and invoicing including , offer to the customer, customer contract, customer order, sales, refunds and claims adjustment.

Activities related to process of ensuring supply including: warehouse management, purchase offer, a supply contract, batch management, stock transfer, inventory and purchase settlement.

Financial Accounting and Management which includes: general ledger, accounts receivable and suppliers, liquidity management, accounting and reporting of fixed assets for finance.

The following assumptions and cost estimation are adopted: total number of employees 100, number of users 20, licenses cost 214 200 PLN, services 300 000 PLN, total solution cost 584 200 PLN.

After working out an implementation timetable for the adopted case, which established the duration and the resources assigned to the project tasks, the next step focus on tasks identification that are risky during their implementation and then assign each of them to adopted in Table 2, range of risk allocation. Examples of risky tasks for the adopted implementation are shown in Table 5.

The risk analysis purpose is to determine the quantitative value and identified risks impact on the project implementation. All data are collected in a risk register and updated with score risk value and measurable financial and non-financial consequences reducing identified risks. Ending risk factors analysis, we are able to a risk response planning. In general, risk response plan means a plan which aimed at minimizing the project risk and maximizing its positive effects. When planning risk responses, one should indicate person or group of persons, responsible for implementation tasks and associated with them risk factors management. Among risk handling strategy, we distinguish the following risk management approach: risk avoidance (eg. limitation of the project scope, increasing resources or avoiding unknown subcontractors), risk transfer of (insurance or guarantee transfer), risk minimization (eg. use of less complex processes, making prototyping, ect.) and risk acceptance which means conscious decision of not taking activity associated with risk management, eg. due to low influence of the identified risk factors. In the adopted example, we use a technique that avoid risk by making changes in the initial stage of the project, clarifying requirements and obtaining additional information, expertise and internal training in order to eliminate the risk and protect the project objective. Table 6 shows risks and costs of introducing preventive actions of grouped project tasks.

Table 5. Types and risk values of selected tasks in the different phases of the adopted SAP project implementation

Nr	Tasks	Cat	Critical risk factor	(P)	(I)	RS
1	Strategic Analysis	O	Unclear goals and objectives, lack of Top Management commitment and support.	0,9	0,4	0,36
2	Preliminary project plan	O	Unclear goals and objectives, lack of Top Management commitment and support.	0,9	0,4	0,36
				0,9	**0,4**	**0,36**
3	Pre-implementation analysis including modeling	P	Incompetent project leader, lack of Departmental cooperation, lack of knowledge of their own business processes.	0,7	0,4	0,28
4	Business processes modifying according to accepted company needs.	P	Non-acceptance of organizational structure change and business processes, lack of new business processes familiarity.	0,5	0,4	0,2
				0,60	**0,40**	**0,24**
5	License purchase	Z	Delay of license delivery.	0,1	0,4	0,04
6	Needed shopping and infrastructure preparation	Z	Lack of co-operation with supplier, delay of devices delivery.	0,5	0,4	0,2
				0,3	**0,4**	**0,12**
7	Installation and Technical Configuration	T	Poor integration of the infrastructure systems.	0,5	0,4	0,2
8	Installation and functional configuration – Logistics	T	Lack of dedicated resources, module is not in time.	0,5	0,2	0,1
9	Installation and functional configuration - Materials Management	T	Lack of dedicated resources, module is not in time.	0,5	0,2	0,1
10	Installation and functional configuration- Financial Accounting and Management	T	Lack of dedicated resources, module is not in time.	0,5	0,2	0,1
11	Administrators training	T	Delay in training, lack of competent trainers.	0,5	0,4	0,2
12	Training users with regard to purchased modules	T	Insufficient training of end-users.	0,5	0,4	0,2
13	Data migration	T	Lack of prepared appropriate forms, lack of supplier tools for data conversion , loss of data.	0,3	0,4	0,12
14	Data input	T	System not ready yet, lack of data prepared.	0,3	0,4	0,12
15	System performance testing	T	System not ready yet, ineffective project time management, lack of metrics for evaluating project efficiency and benefits.	0,1	0,4	0,04
16	System testing in terms of system functionality including interfaces	T	System not ready yet, lack of all functionality system testing.	0,1	0,8	0,08
17	Technical support during system startup	T	Lack of supplier support , lack of competence of ERP's project team fine-tunes.	0,7	0,4	0,28
				0,41	**0,38**	**0,16**

P – likelihood, I – impact, RS – Risk Score

Table 6. Risk and costs of introducing preventive actions

Nr	Preventive actions	Cost	(P)	(I)	RS	Cost	(P)	(I)	RS
1	All stakeholders identification. Kick-off.	5000	0,5	0,4	0,28	5000	0,3	0,4	0,20
2	Internal training, coaching	3000	0,5	0,4	0,28	3000	0,3	0,4	0,20
			0,5	**0,4**	**0,20**		**0,3**	**0,4**	**0,12**
3	High power decision for PM. External consultants support, Process modeling training	3000	0,5	0,4	0,20	3000	0,3	0,4	0,12
4	Collecting supplier references	---	0,5	0,4	0,2	2000	0,3	0,4	0,12
			0,5	**0,5**	**0,20**		**0,3**	**0,4**	**0,12**
5	Collecting supplier references. Early orders and transfers in time.	---	---	---	---	---	----	---	---
6	Additional technologies testing before implementation work.	---	0,5	0,4	0,12	---	---	---	----
			0,3	**0,4**	**0,12**		**0,2**	**0,4**	**0,08**
7	Determine the necessary time dedicated for project implementation. Provide separate room.	---	0,5	0,4	0,12	---	---	---	---
8	Determine the necessary time dedicated for project implementation. Provide separate room	---	0,5	0,2	0,06	---	---	---	---
9	Determine the necessary time dedicated for project implementation. Provide seperate room	---	0,5	0,2	0,10	---	---	---	---
10	Collecting supplier references. Client management support and co-operation with supplier .	---	0,5	0,2	0,10	---	---	---	---
11	References and trainers certificates		0,5	0,4	0,20	1000	0,3	0,4	0,12
12	References and trainers certificates. Additional targeted training		0,5	0,4	0,20	2000	0,3	0,4	01,2
13	Collecting supplier references. Request data migration methodology	---	---	---	---	---	---	---	---
14	Determine the necessary time dedicated to preparation and data input	---	---	---	---	---	---	---	---
15	Making simulation tests	---	---	---	---	---	---	---	---
16	Functionality testing in particular phases of the project	---	---	---	---	---	---	---	---
17	Collecting supplier references. Request additional consultancy or support	2000	0,5	0,4	0,28	2000	0,3	0,4	0,12
			0,4	**0,38**	**0,15**		**0,26**	**0,38**	**0,10**

A summary of measured key risk indicators shows table 6. The proposed preventive actions reduce the risk score - in case of acceptance a risk reduction cost at level 12 000 PLN. (which represent 4% of the implementation budget). In this case the total project risk likelihood (calculated as ratio between total risk likelihood and total tasks number) is reduced from 0,55 (high) to 0,42 (medium level) and the Risk Score is reduced from 0,22 to 0,17. When the preventive actions value increases to 16 000 PLN which represent 5,2% the whole implementation budget, then total project risk likelihood is reduced from 0,55 to 0,27 (low level) and the Risk Score from 0,22 to 0,11 (acceptable).

Table 7. Risk indicators for the implemented case

Lp	Risk indicators	Initial	Cost = 12 000 PLN	Cost = 16 000 PLN
1	Risk likelihood	0,55	0,42	0,27
2	Risk impact	0,40	0,40	0,40
3	Risk Score	0,22	0,17	0,11

According to risk management theory [5], the risk owner decides how to deal with risk. If the threats reduction cost does not exceed 5% total implementation budget, which represent in most cases an acceptable risk level, the project is realized without any corrections. In the adopted example, additional cost of 16 000 PLN reduces the ERP system implementation failure probability by 2 levels and increases the system implementation budget by approximately 5,2% of total implementation cost.

5. Summary

Successful management systems implementation is dependent on many factors related both to the type of activities carried out by the company, and the way of managing project and in particular the selection and use of risk management methods. There are no verifiable methods that will accurately determine system implementation failure or success likelihood, but we can determine the interval in which the success/failure likelihood of each task is located. Risk assessment according to adopted in this paper method for risk assessment consist in the identification of risky tasks that can lead to implementation failure. Next for each of them a range of risk value was adopted. Since the risk score determination depends on risk impact value, based on the experiences and statements of specialists in one hand, and applying PMI standards on the another hand, appropriate values of risk impact were pointed for each task. According to problem likelihood appearance, risk impact on the task realization

and finally depending of Risk Score value, an appropriate preventive action was taken. These steps shows that adopted risk assessment for ERP system implementation method can be appropriate.

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INFORMATION SYSTEMS IN MANAGEMENT

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TAKING ADVANTAGE OF CUSTOMER PARTICIPATION IN THE PROCESS OF DESIGNING COMPUTER-BASED SERVICES

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The present model of providing services has evolved as a result of the use of the IT tools and systems. It is a noticeable trend that the customer participation in the design process is an added value in design of IT systems or the services themselves. It is precisely the customer participation in designing of IT systems that is of crucial importance for meeting the expectations of the end-user. This article presents the ways in which advantage can be taken of the added value created due to the customer participation and how to use this participation in the designing process.

Keywords: service design, services, client participation, IT systems

1. Introduction

We are surrounded by numerous services in the contemporary world. It is just nowadays that more and more services are provided through the electronic channels or based on modern IT systems. We can see examples of such services on a daily basis when we have to use them in order to function properly. In the course of the approximately three last decades it has been observed [4] that the IT projects which were carried out by experienced persons – ended up in a failure. Despite immense expertise of the project managers, the target was not achieved. One of the reasons of failure was, among others, neglecting the aspect that is present in the process of designing services nowadays – namely the customer participation. When it comes to the projects of today, the challenge consists in meeting the

expectations of the customers and the end users of the final services or supplied IT systems. As the research carried out in 2011 [2] proves, it is a contemporary practice to include the customer in the process as an actor who introduces innovations and improves the existing services or processes. The author points out that still a part of the IT sector companies do not take the advantage of the knowledge and the information coming from the end users of a given service. Olszański and Piech [7] maintain that 'Almost every type of product can be converted into a service and an attempt can be made to provide it with the use of the Internet'. This observation serves as the departure point for the author to investigate the subject matter and he will attempt to describe how to take the advantage of the added value brought by the customer.

2. Customer – service provider relationship

According to Sikorski [5], when carrying out the IT projects nowadays it is assumed that the most appropriate starting point of the project aimed at ensuring the highest functional quality is to recognize the final context of the user, and that iterative arriving at best solutions with the participation of the future users is also crucial and that they should participate in a large part of the design process. It is precisely the relationship between the service provider and the end user that has the largest impact on the possible success of the process of designing services based on the IT systems. As Hippel, Ogawa and de Jong maintain [2], it is exactly in the customer-service provider relationship where a new innovation paradigm is created. Due to the introduction of such relationships in the IT projects, we obtain ideas for service providers for innovations in the processes, whereas the cooperation with the client in the scope of design and improvement of services can become a source of inspiration or even provide us with ready prototypes of solutions.

As Figure 1 shows, the customer participation in the relationship with the service provider is a crucial factor. It is precisely the relationship between the user and the person designing a given system or a solution that allows for discovering innovations.

During the first decades of using and carrying out IT projects the view on the known customer-service provider relationship was limited to the Customer Relationship Management (CRM) systems, whereas at present these systems serve to stimulate building of stronger relationships between the producer and the end-user of the system. In the current approach it is crucial to build and maintain a positive relationship between the customer and service provider in any project carried out, regardless of whether it is an IT project or a management project. The cooperation

with the customer during the designing phase may make it possible for us to Carry out the project and achieve its goals. As a result of these positive relationships it will be possible for the projects carried to fully meet the design intentions and, consequently, the services will meet the requirements of the customers or the end-users.

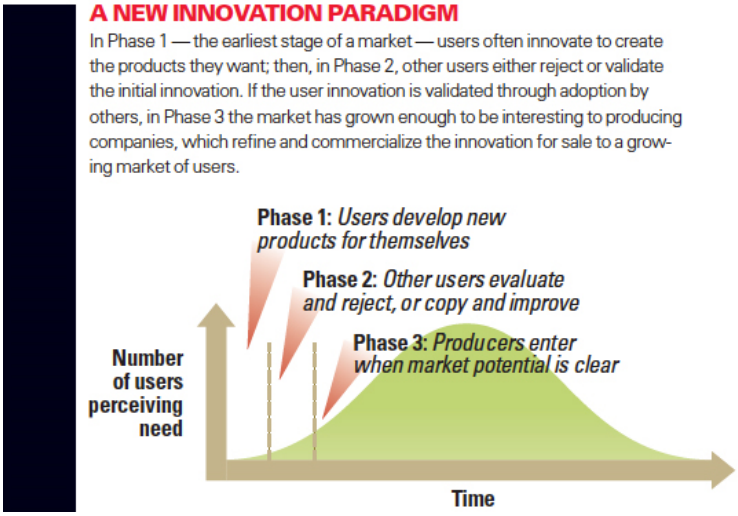

Figure 1. A new innovation paradigm. Source: Hippel E., Ogawa S., de Jong J. (2011) The Age of the Consumer-Innovator

3. The significance of customer participation in designing IT systems

It can be currently observed that carrying out IT projects without customer participation is not possible. The managers who endeavour to carry out project without participation of the end-users find out too late – when the project has already turned out to be a failure – that the decisions they made were erroneous. The first study on the subject was presented in 1996 by Damoradan [4], who presented the role of the users of the systems in IT projects as well as the way in which they influence the junior and the senior managers. Beginning with the 80s, the significance of customer participation began to be recognized. Sikorski [4] presents in Table no. 1 the evolution that occurred over the last two decades in user participation in IT projects.

It can be seen in the presented Table no. 1 how quickly the changes in perceiving the role of the end-user in the system or in the application took place, and how the role of the user evolved in the direction of increased customer participation in designing process and project management.

Table 1. The timeline of user participation in IT projects

Years	Design Focus	Design Perspective	Design Paradigm	End-User Role in the System	End-User Role in the Project
1980s	Software technology	Early software engineering	Sequential (waterfall-like) process	None	None
Early 1980s	Functionality	Mature software engineering	Spiral development process	Operation (routine tasks)	Acceptance final testing
Late 1980s	Usability	User interface design	UCD (User-Centred Design)	Operation maintenance	Usability requirements, usability testing
1990s	User Experience	Interaction design	Cross-discipline design	User-consumer	Expressing emotional expectations
Late 1990s	Customer relation-ship	Customer loyalty	E-marketing, agile development	User-consumer	Revealing shopping behaviour
2000s	Value-oriented design	Value for customer lifecycle	Value marketing	Customer	Revealing individual lifestyle habits
Late 2000s	Software apps as services	User-centred services	Service design, service thinking	Value co-creator	Revealing social lifestyle habits
2010s	Digital services in everyday life	Services-oriented architectures and systems	Service co-design	Services co-designer	Cooperation in service design across its lifecycle

Source: [4] Sikorski M. (2014) *Evolution of End User Participation in IT Projects* DOI: 10.4018/978-1-4666-4313-0.ch004

4. Customer participation and agile methodologies in IT project management

Numerous IT projects are currently carried out with the use of agile methodologies for project managements such as e.g. SCRUM or Extreme Programming. Agile methodologies are close to design with customer participation. As new methodologies they discover the opportunities that are related to the cooperation with the customer at the level of project implementation. Project implementation within the framework of agile project methodologies is not an easy task. It must be remembered that agile methodologies require large involvement. What is important is that agile methodologies are flexible and can be adjusted. Taking advantage of customer participation can be achieved in a number of ways, however, it is most

important to get the customer involved in carrying out of the project. Especially agile methodologies provide for such a possibility due to their non-formal formula of conducting a project. Koszlajda's written opinions [3] should be remembered here, that it is precisely the agile methodology of the Scrum type that while 'providing a specific and coherent solution to how IT projects should be carried out, they simultaneously leave much freedom so as to the way of implementation in a specific organization'. This flexibility described by Koszlajda (2010) provides great possibilities of using a large number of tools and methods, which will help to get the customer involved and to use his participation with the aim of delivering a service or a product meeting the customer's needs.

5. IT projects and the beginnings of the User-Centred Design approach

The origins of IT projects date back to the 80s when first personal computers were built. As IT technologies developed, numerous systems appeared, which supported activities of large enterprises and organizations. With time these systems became generally available for end-users or other people. Gradually, ergonomics of the designed systems started to be analysed and studied, and attempts were made to develop software and systems using the User-Centred Design (UCD) approach, which is based on cooperation with the user during iterative design process. Before the UCD approach started to be used, the process had been based on ISO 9241-210 norm and the earlier ISO 13407 norm [6]. The UCD approach is focused on ensuring ergonomics and on the user interface - and its purpose is to deliver systems of high usability. The enterprises that deal with design, in order to understand the contemporary end-user of the IT system, must make use his expectations related to the system. Due to the fact that the designers noticed that the iterative design process that uses User-Centred Design approach does not fully meet the expectations of the customers, solutions to this problem started to be sought. The UCD approach is based on the necessity of the user participation, but only during the iterative (spiral) design of the user interface solutions. The current problem consists in the lack of permanent customer involvement in service design process. And what lacks most is collecting information from the customers regarding their expectations towards the designed or improved service. As a result, the UCD project approach evolved into the Service Design approach, which the author of this article would like to present in its subsequent parts.

6. Tools and methods for customer participation in IT w projects

Due to the fact that the customer-service provider relationship evolved over the past decades (as Table no. 1 shows), it incurred the necessity to develop the

tools and methods, which would support the use of the customer participation in IT project implementation. As Sikorski [4] presents in Table no. 2, numerous methods and tools were developed, which facilitate cooperation with the user in IT projects. Particular attention should be paid to the quantity of tools listed in the last column, i.e. Service Design. It is exactly the Service Design approach which significance increases in the currently conducted IT projects. As Pucher and Nowak describe [1], a dynamic increase can be observed in the application of the Service Design techniques for process design in web and mobile retail trading. Using the tools listed in the Table no. 2 below allows for adjusting the designed services and process so that they meet the expectations of the end-users.

Table 2. Main Methods and tools for user participation in IT projects

Software Engineering	Functionality	Usability	User Experience	CRM	Value	Service Design
- Identifying requirements	- Teamwork on a QFD method: correlating user requirements and technical features	- Context of use analysis - Task analysis - Personas - Prototyping - Usability testing - Surveys, interviews and questionnaires	- User workshops - Focus groups - Observational studies - Verbal protocols - Wizard of Oz - Ethnographic research - Psychometrics	- Analysing customer activities on the Website - Customer profiles - Customer satisfaction surveys - Interviews - Customer lifetime value analysis	- Analysing customer activities on the Website - Value mapping - Value for customer analysis - Service value chain analysis - E-service development analysis - Customer lifecycle maps	- Service blueprints - The Five Whys - Cultural probes - Mobile ethnography - Expectation maps - Service safaris - Service prototyping - Service value co-creation - Business model canvas

Source: [4] Sikorski M. (2014) *Evolution of End User Participation in IT Projects* DOI: 10.4018/978-1-4666-4313-0.ch004

In the above Table no. 1 we can find a number of tools and methods that are used in IT projects. Many of these elements can be used in design of services which are not directly connected to IT technology. It must be remembered to use only those tools and methods that can help us to achieve the intended goal. The analysis of some areas can be made only and exclusively with the end-user.

If we fail to get the customers deeply involved while examining their expectations, we shall not be able to create an ideally suited product or service that we want to sell.

7. Service design not only in IT projects

Methodologies of e-business projects come down to perceiving the created product from the perspective of generally available services. In the case of IT projects we take the customer into account. It is the customer or the end-user of our solution who is the key person in project. The Service Design Approach is a relatively new term, because it uses some of the earlier known methods, which evolved from other design methods [6]. As Sikorski describes (2012), it is in the Service Design methodology that the users under the supervision of the project manager analyze and assess the concepts and solutions created by the designers. The Service Design approach is aimed at involving the customer in such a degree that he formulates the expectations that were not articulated before and which concern the customer-service provider relationship. The SD approach allows to create and mention the values resulting from customer participation in service design. In each designed service we shall find many interactions, which form a specific part of the experience related to the provided service [6].According to Sikorski (2012), Service Design approach completes the 5 existing project perspectives recognized by the customers, which influence shaping of service quality:

- Technical and functional approach,
- Designing interactions and functional quality,
- Designing user experience,
- Customer satisfaction-centred perspective,
- Building of trust and relationship with the customer.

Service Design is the approach, within the framework of which service design with the use of customer participation provides numerous possibilities while the information technology aspect of the venture carried with the use of this approach allows for discovery of many new innovative solutions, which will meet the expectations defined by the customers of the designed service.

8. Conclusion

This article is intended to present the characteristics of service design and of IT systems, which may take the advantage of the priceless information coming from the end-users, that is the recipients of the service or the system. Moreover, a

number of arguments proving the significance of customer participation in the process of carrying out an IT project. Many of the mentioned aspects relate not only to IT projects, but also to process design or the services themselves. As author said as result of the positive relationships (end-user and service provider) it will be possible for the projects carried to fully meet the design intentions and, consequently, the services will meet the requirements of the customers or the end-users.Taking advantage of customer participation can be achieved in a number of ways, however, it is most important to get the customer involved in carrying out of the project. The described methods and tools show that the Service Design approach is needed and will be used in carrying out of projects. The number of tools created, which support the process of customer participation in design of traditional services or e-services is so large that the subject matter described in this article will be continuously developed improved in the implemented IT projects.

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INFORMATION SYSTEMS IN MANAGEMENT

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MODELLING OF AGRICULTURAL IMPORT DEMAND IN UKRAINE

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Based on the monthly data from four aggregated agricultural sectors for the 2001−2014 period, this paper investigates the determinants of demand for agricultural imports in Ukraine by using the time-varying parameter technique (the Kalman filter). The outcome suggests that the real exchange rate depreciation contributes to a lower demand for meat, fish and dairy products; vegetable oil and foodstuffs, while not affecting demand for wheat and vegetables. Domestic industrial output correlates with a higher demand for all four groups of agricultural imports. Import substitution effect of domestic agricultural production is found for three out of four groups of agricultural imports, except meat, fish and dairy products. Following an increase in international prices, there is a decrease in demand for wheat and vegetables, as well as for foodstuffs, while there is an opposite effect in demand for other groups, i.e. meat, fish and dairy products and vegetable oil.

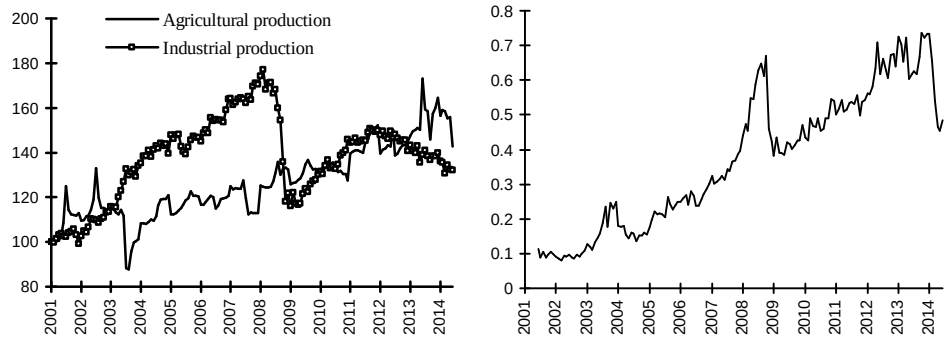
Keywords: agricultural imports, the Kalman filter, exchange rate effects, price and income effects

1. Introduction

A dynamic increase in the agricultural production in Ukraine over the last decade has not hindered demand for agricultural imports (Fig. 1). As of 2013, Ukrainian imports have more than tripled in less a decade with meat, fish and dairy products, vegetables and foodstuffs showing the fastest import growth. The value

of agricultural imports had decreased in the wake of the 2008–2009 financial crisis due to income reduction and expenditure-switching effects, then recovered in the following few years, with a new drop in demand for imports since the beginning of 2014 following the banking crisis and depreciation of the *hryvna*. Rapid reduction in the amount of agricultural imports in the first half of 2014 can be explained by a mix of income-reducing and expenditure-switching policies. The pattern of demand for agricultural imports is further complicated by the volatility of world agricultural commodity prices.

Determinants of agricultural imports are important in the assessment of trade liberalization effects, productivity growth, sectoral spillovers and resistance to international price shocks. In a wider context, estimation of import demand functions is motivated by the preoccupation of policymakers with the persistence of trade deficits, volatility in exchange rates, and the desirability of effective trade policies [13, pp. 43–53]. For practical purposes, a log-linear specification is regarded as an adequate approximation of the functional form of the import-demand equation [12, p. 5]. Most of empirical studies of import demand functions report that the price elasticities of agricultural commodities and processed goods tend to be way below unity, while income elasticities used to be above unity [10]. For informative studies on agricultural import demand functions, see [5, pp.22–44], [10], [13, pp. 43–53], [14, pp. 155‑169].



a) output (index, 2001=100); b) agricultural imports (USD bn);

Figure 1. Ukraine: selected macroeconomic indicators, 2001─2014
Source: Ukraine's State Statistical Committee

The purpose of this paper is to empirically estimate the determinants of demand for agricultural imports in Ukraine. Our main empirical result is that the real (nominal) exchange rate depreciation contributes to a lower demand for two out of four groups of agricultural imports. It is also found that domestic industrial output

contributes to a higher demand for all four groups of agricultural imports, while domestic agricultural production is of an opposite import-substitution effect.

The remainder of this paper is structured in the following way. A brief survey of theoretical and empirical issues is provided in the next section. Data and statistical model are presented in the third section. The empirical results are explained at length in the fourth section, followed by the conclusions in the fifth and final section.

2. Literature survey

It is common to assume that demand for imports is a function of domestic income and domestic prices relative to the price of import substitutes. Following Santos-Paulino [10], the import function can be written as:

$$M = \left(\frac{EP^*}{P} \right)^{\psi} Y^{\gamma}, \quad \psi < 0, \quad \gamma > 0, \tag{1}$$

where Y represents domestic income, P and P^* are domestic and foreign price levels, respectively, E is the nominal exchange rate, ψ is the price elasticity of demand for imports, and γ is the income elasticity of demand for imports. The price elasticity of demand for imports is expected to be negative, while the income elasticity is positive (it is assumed that imported agricultural commodities and products are not inferior goods).

Taking logs of equation (1) and differentiating with respect to time, the growth of imports can be presented as follows:

$$m = \psi(e + p^* - p) + \gamma y. \tag{2}$$

Assuming partial adjustment of import dynamics, the actual growth of imports is represented as:

$$m_t = \alpha_0 + \alpha_1 m_{t-1} + \psi q_t + \gamma y_t + \varepsilon_t, \tag{3}$$

where q_t is the growth in relative prices, and ε_t is the error term.

According to (3), import of agricultural goods is inertial, being dependent on its lagged value, and it is boosted by domestic income, while being depressed by the depreciation of the nominal (real) exchange rate. Empirical studies used to reveal that the price elasticities of agricultural import tend to be low, in most cases significantly below unity, while income elasticities used to exceed unity. It means that an increase in income more than proportionally affects demand for the imported agricultural goods, revealing rather high consumer preferences for these

items. On the other hand, observed weakness of relative price effects can be explained by the lack of import-substitution effects, at least in the short run.

The importance of relative prices and domestic income as determinants of demand for import of agricultural commodities and products is found for France, Italy, the Netherlands, the U.S. [13, pp. 43–53], Japan and Mexico [9, pp. 6–23], the BRIIC group of countries [1], China [14, pp. 155–169], Japan [11, pp. 585–602], Venezuela [8, pp. 351–358]. Compared to other middle-income countries, demand for agrifood products seems to be more income elastic in China, Russia and Brazil, but it is not the case in India [3, pp. 1–14]. For a sample of African countries, it is found that import demand appears to be more elastic in sectors that have relatively high levels of domestic production or exports [6]. As mentioned by Song [12], by estimation of import demand elasticities for agricultural products in both aggregated and disaggregated levels it is possible to predict the plausible effects of trade liberalization on agriculture. For South Korea, it is established that the more agricultural import is disaggregated, the higher the import demand elasticity is.

Among transformation economies, the value of price and income elasticities within the range usually reported in the literature on this subject is found for the Czech Republic [5, pp. 22–44]. A high GDP growth and the exchange rate appreciation are referred to as two main causes of the rise in Russia's agricultural imports [7, pp. 43–49]. Using aggregated data of Ukraine's agricultural trade, Ivaniuk [14] found weak evidence that agricultural exports and imports are neutral in respect to the real exchange rate. Higher wages contribute to an increase in agricultural imports. As higher agricultural production is associated with lower import growth, it is possible to argue that there is an import substitution in Ukraine's agriculture.

3. Data and statistical model

The data includes the period 2001M6:2014M6, using monthly series of the four agricultural import groups and the set of independent variables, as it is implied by the equation (1). Real industrial output is used as a proxy for the domestic total expenditure, as a more direct measure, gross domestic product, is not available at the monthly frequency. The data is available from the Ukraine's State Statistical Committee (www.ukrstat.gov.ua). The exchange rate variable is proxied by the real effective exchange rate (REER). As a measure of the international commodity price, indices of agricultural raw materials and food prices are used. Agricultural import series in constant dollars, deflated by the U.S. Consumer Price Index, were taken from the Ukraine's State Statistical Committee. All other data are obtained from the International Monetary Fund (IMF) International Financial Statistics

online database. Since production and import variables reveal a marked seasonal pattern, the series are seasonally adjusted by the X11 procedure.

Our focus on disaggregated agricultural imports is motivated mainly by possible heterogeneity in import demand elasticities across particular groups, with clear policy implications for trade and exchange rate policies to be outlined. Also, it is of interest to compare results in both disaggregated and aggregated levels, as it is obtained by Ivaniuk [14].

The stationarity of variables in the model (1) is tested using the ADF unit root test procedure (Table 1). According to the MacKinnon critical values, for all series, the null of unit root cannot be rejected at 1 and 5 percent statistical significance level for their levels, while it is the case for first differences.

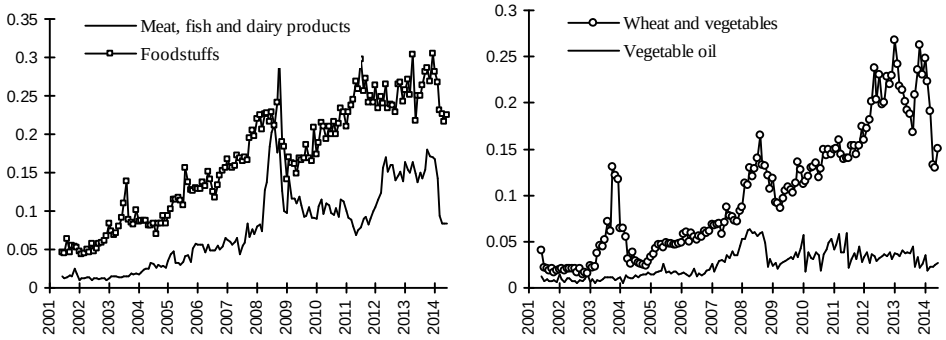


Figure 2. Ukraine: disaggregated agricultural imports (USD million), 2001–2014
Source: Ukraine's State Statistical Committee

Table 1. Unit Root Test for agricultural imports

Lags	Agricultural import groups							
	Meat, fish and dairy products (I)		Wheat and vegetables (II)		Vegetable oil (III)		Foodstuffs (IV)	
	L	FD	L	FD	L	FD	L	FD
3	–1,54	–6,76*	–2,44	–5,16*	–1,93	–8,14*	–2,06	–7,73*
6	–1,38	–5,95*	–2,43	–4,62*	–1,94	–5,04*	–2,02	–4,80*
9	–1,89	–3,58*	–2,05	–4,94*	–1,92	–4,89*	–2,66	–3,79*
12	–2,21	–3,32**	–1,41	–4,88*	–1,75	–3,44**	–2,45	–4,11*
15	–2,16	–3,34**	–1,01	–4,61*	–2,01	–3,81*	–2,53***	–3,92*

Note: * null hypothesis of a unit root can be rejected at 1 percent level of confidence (** at 5 percent level of confidence, *** at 10 percent level of confidence); L and FD stand for levels and first differences, respectively. Source: own calculations.

As income and price elasticities of export demand can change over time (Abler 2010), the choice of time-varying parameters (TVP) technique which allows the coefficients to vary over time seems to be reasonable, in addition to more traditional estimation methods. In order to analyse whether some significant variation in the estimates of coefficients does occur (especially, in the context of significant world price instability since the middle of last decade), the TVP estimator (the Kalman filter) is used. For this purpose, statistical model can be defined in a state space formulation:

$$X_{i,t} = \mathbf{Y}_t \beta_t + \varepsilon_t, \quad (4)$$

$$\beta_t = \beta_{t-1} + \xi_t, \quad (5)$$

where equations (4) and (5) are respectively the measurement equation and transition equation.

The vector of time-varying coefficients β_t is formed through a stochastic generating process, with priors β_0. For the purposes of our study, the recursive procedure is used. Besides the magnitude of a particular effect, it is possible to trace whether any significant variation in the estimates of the coefficients occurs.

The vector of the determinants of agricultural imports $\mathbf{Y}_t$ includes the real effective exchange rate (REER), industrial and agricultural output, international agricultural raw materials and food prices. In respect to the Ukraine's economy, price and income responsiveness in demand for agricultural imports might be expected to reveal some instability in the wake of the 2008–2009 financial crisis, which had been marked by a steep depreciation of the *hryvna*. Another large exchange rate depreciation has occurred in the spring of 2014, with further weakening of the currency to take place in the following few months.

4. Empirical results and discussion

Our TVP estimates are reported in Fig. 3–6 (the estimates were obtained with EViews 6.1 program). Autoregressive coefficients are negative for all four groups of agricultural imports, with a rather stable pattern over last few years. The magnitude of the autoregressive coefficient is somewhat higher for import of vegetable oil (Fig. 5) and foodstuffs (Fig. 6). For meat, fish and dairy products (Fig. 3), there is a gradual decrease in the value of autoregressive coefficient since 2007. Also, a change in the trend of the coefficient on the lagged value of import of foodstuffs since 2009 can be mentioned. As all autoregressive coefficients are negative (for import of meat, fish and dairy products it is observed on a statistically significant level since 2008), it means that there is a correction of the amount of

agricultural imports, with no sign of inertial behaviour, and this constraint is most bounding for vegetable oil imports.

Depreciation of the REER contributes to a lower demand for meat, fish and dairy products (Fig. 3) and foodstuffs (Fig. 6) since 2009, while being neutral in respect to imports of these two groups for the previous years. The opposite developments are identified for the import of wheat and vegetables (Fig. 4), which is not affected by relative prices over last few years though demonstrating a negative effect of the REER depreciation over the 2004–2008 period. A similar pattern of time-varying coefficients is demonstrated by the estimates of REER effects on the import of vegetable oil, but in this case a weak negative impact is observed during the 2006–2010 period (Fig. 5). Similar results are obtained by using the nominal effective exchange rate (NEER) as an alternative to the REER. In general, our results do not contradict those ones obtained by Ivaniuk [4] for aggregated agricultural imports, as the price sensitivity of demand for imported agricultural goods does not seem to be strong enough on the whole. Except vegetable oil, there is a clear structural break in the price-related (expenditure-switching) demand for import of other three groups of agricultural imports around 2008, which can be regarded in connection with the financial crisis that struck the Ukraine's economy in the wake of such unfavourable external shocks as stagnation

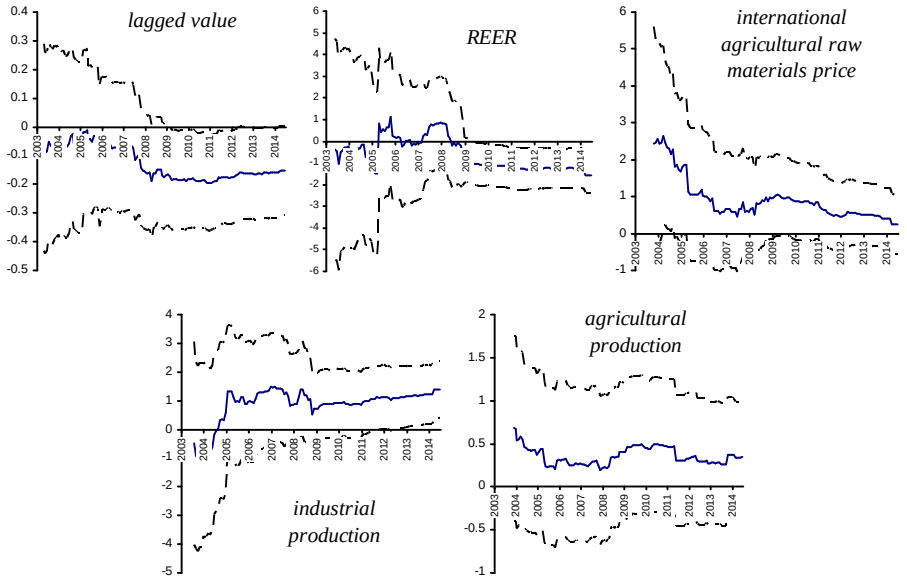


Figure 3. Determinants of demand for import of meat, fish and dairy products
Note: the solid line is the point estimate here and hereafter, while the dotted lines represent a two-standard error confidence band around this point estimate.
Source: own calculations

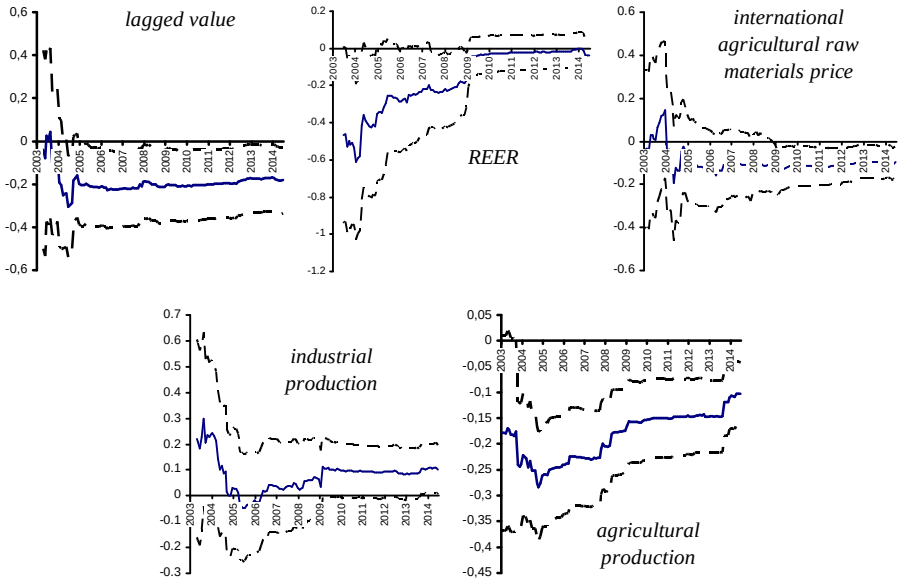


Figure 4. Determinants of demand for import of wheat and vegetables
Source: own calculations

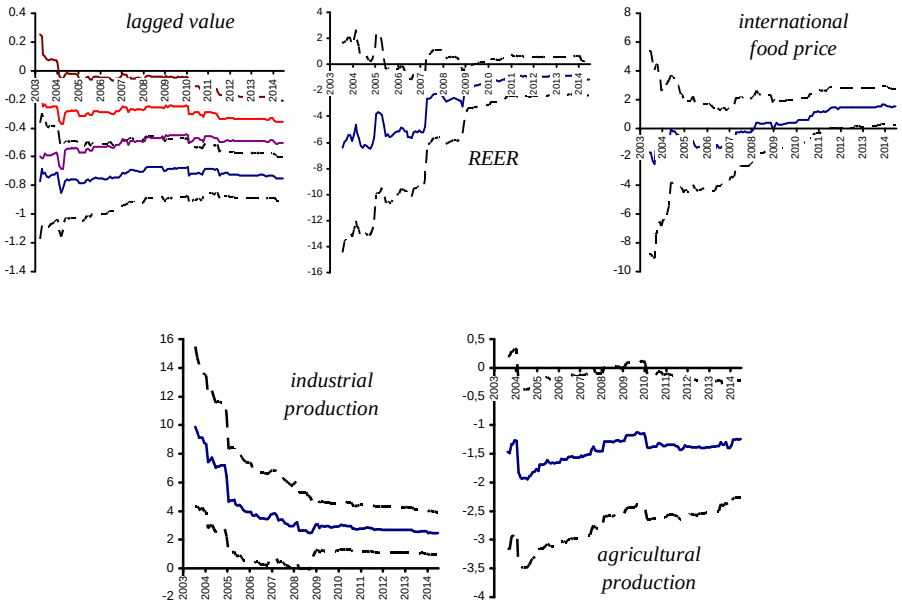


Figure 5. Determinants of demand for import of vegetable oil
Source: own calculations

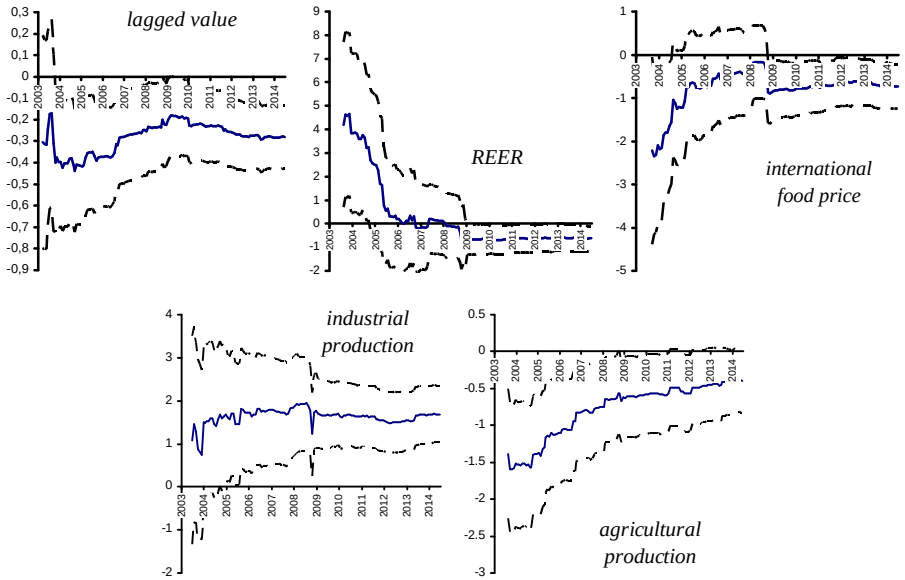


Figure 6. Determinants of demand for import of foodstuffs
Source: own calculations

of demand for traditional export of steel and chemical products and 'sudden stop' in capital inflows.

International price effects are quite heterogeneous. For two groups (meat, fish and dairy products, as well as vegetable oil), there is an increase in the value of imports following an increase in the international price, while the opposite effect is observed for other two groups (wheat and vegetables, foodstuffs). Rapid increase in values of (negative) international price sensitivity for foodstuffs since 2008 can be attributed to the growing food-processing industry in Ukraine and its side-effects on the demand for import of processed goods.

Domestic income, as measured by the index of industrial production, is a factor behind higher demand for agricultural imports. The magnitude of this effect is weaker for wheat and vegetables, with a structural break in 2008. Income-induced demand for vegetable oil and foodstuffs has been quite stable over the post-crisis period, while a weak upward trend is observed for meat, fish and dairy products.

Except meat, fish and dairy products, there is a similar declining trend in the values of domestic agricultural output effects. It can be explained by import substitution in the Ukraine's agricultural sector, but this feature has been weakening over last decade. Although no particular structural breaks have been noticed in the link between domestic agricultural output and demand for imports of vegetable oil and foodstuffs, there is a sign of rapid reduction in the import substitution for wheat and vegetables since the end of 2013.

5. Conclusions

Using the time-varying parameter technique (the Kalman filter), determinants of Ukraine's agricultural imports are estimated. It is established that the real (nominal) exchange rate depreciation contributes to a lower demand for meat, fish and dairy products (group I), as well as for foodstuffs (group IV), while not affecting demand for wheat and vegetables (group II) and vegetable oil (group III) imports. Except vegetable oil, there is a clear structural break for other three groups of agricultural imports around 2008, which suggests a causal link to the developments of the 2008–2009 world financial crisis. Following an increase in international prices, there is a decrease in demand for wheat and vegetables imports, as well as for foodstuffs (since 2008), while an opposite effect in demand for two other groups of agricultural imports, i.e. meat, fish and dairy products and vegetable oil, is observed. It is possible to argue that the realities of 2008–2009 financial crisis had created incentives for the Ukraine's food-processing industry, with an import substitution effects in the demand for processed goods to follow. As expected, domestic industrial output correlates with a higher demand for all four groups of agricultural imports. Import substitution effect of domestic agricultural production is found for three out of four groups, except meat, fish and dairy products. However, there is a declining trend in the values of coefficients on agricultural production, implying weakening of import substitution over time.

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„LIVING LEARNING" FOR OGRGANIZATIONS COLLABORATION

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The paper considers concepts of Living Labs and e-learning used as a main medium for organizations and individuals collaboration. A living lab is engaging users, companies, universities, governmental bodies in research and innovation a user-centered, open-innovation ecosystem. E-learning techniques, especially Learning Objects pay special role in such environments as they are able to collect and distribute information and knowledge. The paper considers diagrams showing information flow within Living Labs and internal structure of Learning Objects with more user centered approach.

Keywords: E-learning, Living Lab, Learning Objects, Knowledge Management, Collaboration among organizations

1. Introduction

Main hypothesis of the paper is: growing Living Labs need an information environment which could enhance knowledge flow between LL participants that come from different backgrounds as business, government, law, science etc. It could be compared to the concept of experiential learning, where users are immerged in a creative social space for designing and experiencing their own future (Crowd Wisedom, Delphi etc.). This leads to the concept of "living learning" which would use technology and methodology of e-learning in way that could be more productive in terms of dynamic change of the roles between 'teacher' and

'student'. Not only knowledge and theory but also practical education methods using case studies in an e-learning environment are necessary [6]. Key factor is proper identification and storage of knowledge and skills produced during LL activity. The modules that will organize the process are called Learning Objects. The question is what features and parameters make LO more efficient in above mentioned role. The paper describes the internal structure and outside relations of such object. The changing of this situation is possible by implementation of Business Intelligence (BI) technologies, and by introduction of new information and communications systems based on these technologies.

2. Learning Objects and Living Labs

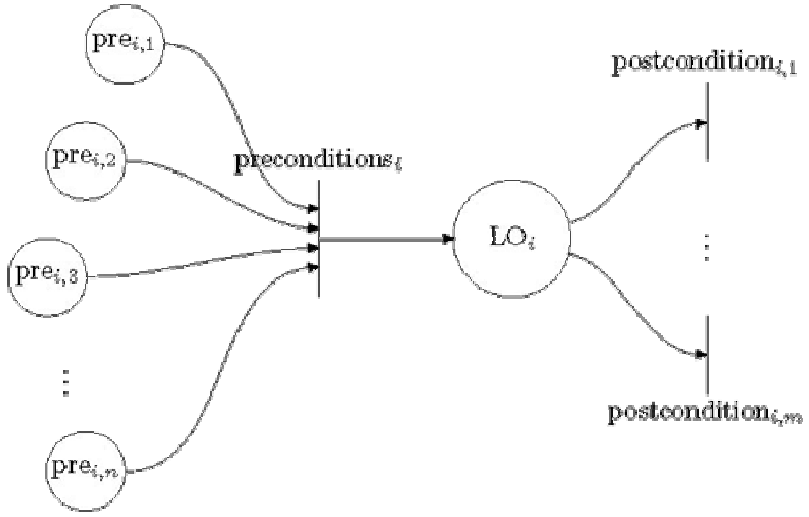

Figure 1. Learning Object in Petri Net notation
Source: Risse T., Vatterrott H.R. "The Learning Objects Structure Petri Net", EURODL 2004

E-Learning gradually matures from a monolithic technical solution to enhance learning with IT to be a technology integrated into E-Business value chains. To reach this goal, an open and interoperable architecture has to be introduced [5].

Motivation can be facilitated through the participation in online networks of practice, but in order to access and benefit from these networks people require a certain threshold level of technical relevant knowledge, which is the most easily generated in local communities of practice [7].

Living labs as open innovation platforms for user driven multi-stakeholder open innovation in complex public-private-citizen context create great opportunities for companies to experiment with various approaches in risk free environment (Fig. 2). Especially distributed innovation networks deliver a perfect playground for living lab collaboration. Various living lab actors can have partly diverse objectives and various levels of commitment and contribution to the collaboration, and thus the applied distributed innovation processes and earning logic must be clearly defined. The living labs concept is clearly positioned within the innovation process, whereas the innovation process itself is discussed on a very general level[3].

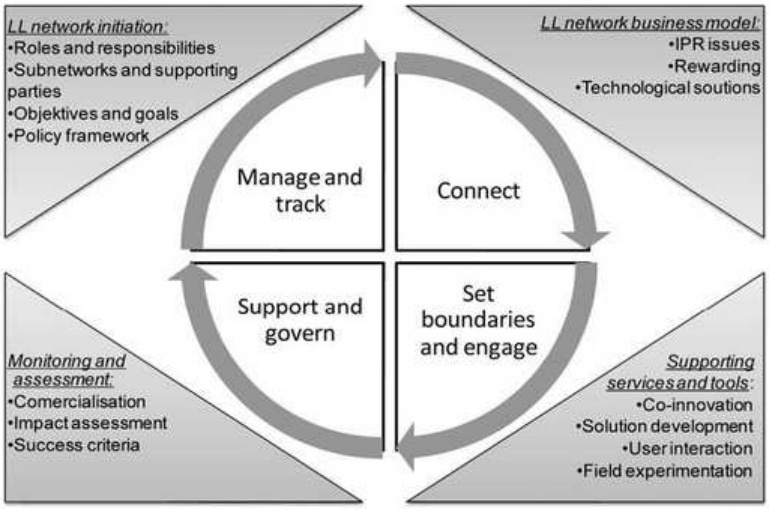

Figure 2. Living Labs structure
Source: Eschenbächer J. "Choosing the best model of living lab collaboration for companies analysing service innovations" in: Projectics 2010/2, 2010 De Boeck

The European Network of Living Labs (ENOLL) is a result of a long discussion in Europe to better institutionalise living labs. By doing both the institutionalisation and standardisation of methods, approaches, tools and software are the overall goal. In 2010, the network has been extended towards 212 living labs all over the world which offer a wide set of competencies, service offerings and ideas evaluation. Some examples:

1. NorthRULL is to offer a new, integrated, user-centered approach to innovative economic and social development, in order to efficiently tackle the central challenges to the vitality of the rural areas of the North of Finland, northern Scandinavia, and eventually the circumpolar regions. NorthRULL will proceed in two main areas of activity, (1) health-related e-services and (2) international tourism industry.

2. The Amsterdam Living Lab is based in a many previous and current projects already underway, like:

- Large scale mobility management by influencing drivers through information and pricing and thereby preventing traffic congestion,
- Better energy efficiency by creating more awareness with users on the use of energy through intelligent surroundings and ubiquitous feedback,
- The creation of change encounters between people living in the same city area and thereby re- enforcing the social fabric of society with the help of digital media and ubiquitous communication.

Important aspect is transforming the knowledge into reusable objects useful for all different kinds of LL users that do not share much common issues. They operate in very different ecosystems e.g. business and government, end users and science etc. The reusability of Learning Objects over different LL participants could be enhanced by object-oriented inheritance relationships.

Inheritance is a way to reuse information by creating collections of attributes and learning contents of learning objects which can be based on previously created objects. These can be defined by classes, which can inherit other classes. The inheritance relationship of classes gives rise to a hierarchy. Simply saying, development of new LO's could be improved thanks to inherited attributed generated by class.

It allows modeling the context of each learning object in terms of preconditions (prerequisites) and postconditions (learning objectives or learning targets). It is the property which makes re-use of learning objects in different courses and in different departments possible[1].

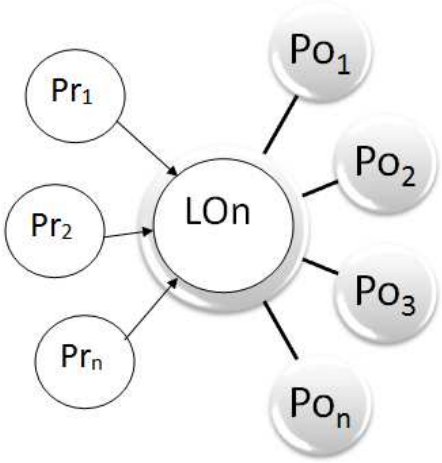

Figure 3. Learning Object structure

Once the metadata is available, it is relatively straightforward to use it. It is, however, much harder and more time- and resource-consuming to produce metadata in the first place. Even the quality of metadata generated by domain experts is subject to changes in domain knowledge. In practice, there are situations in which metadata are impossible to generate without an overall understanding of a large scale complex body of data [2].

In Living Learning concept LO's are almost any peace of content that could be considered as educational: texts, web pages, movie clips, voice, music, learning units, problems or exercises. Each LO is described by its preconditions and postconditions (Fig. 1 and Fig. 3). Preconditions are all requirements that have to be met to understand or solve the problems during LO utilization. In most cases this would be structurized list of knowledge skills that have to be obtained before completion of particular LO. The conditions can be subject of structurization by different levels of classes and inherited. The postconditions are skills and knowledge gained when LO is completed. The postconditions belong to the same structure as preconditions and actually can be also preconditions of different LO's.

The new paradigm of learning process is coming into view. Each user can check if the preconditions are met. If not, he could go back to track missing preconditions as postconditions of different LO. This trip ends when LO with all fulfilled preconditions is found. At the same time it is the beginning of the learning path or even learning multi-dimensional structure [1].

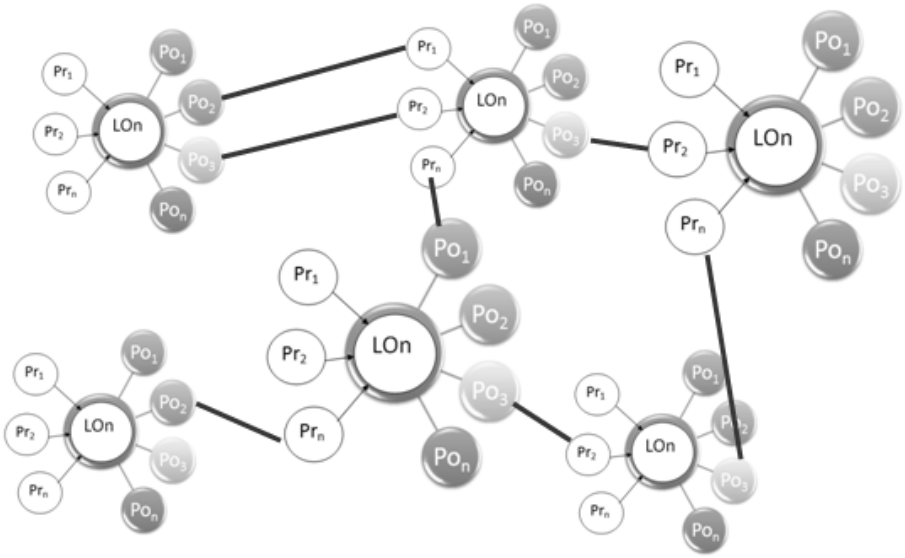

Figure 4. Learning paths based on connections by the preconditions and postconditions

The key feature of Living Learning is open database of all Learning Objects no matter what they contain or where they are located. It only takes to register specific content that should be available on line: a file, a web page, film, exercise etc. The only requirement is to add structuralized metadata mentioned above. The process would be mostly automated thanks to clear classes and inheritance structure. At this stage Living Learning system cannot evaluate the content. Its quality and validity of preconditions selected by user and inherited is the matter of further analysis of system. The evaluation of quality of LO's would be based on such factors as: number of visitors, time spend on it, number of relations to other LO's, users evaluation, exams passed ratio based on LO, preconditions to postconditions ratio, pass through ratio etc. The base for developing of Living Learning LO quality measure could be transformed Page Rank formula by Larry Page. PageRank is a link analysis algorithm, used by the Google Internet search engine that assigns a numerical weighting to each element of a hyperlinked set of documents, such as the World Wide Web, with the purpose of "measuring" its relative importance within the set. In LO case one could calculate *LORank*:

$$LOR(u) = \sum_{v \in Bu} \frac{LOR(v)}{C(v)}$$

The *LORank* value for Learning Object u is dependent on the *LORank* values for each Learnig Object *v* out of the set *Bu* (this set contains all Learning Objects connected to Learning Object *u*), divided by the number *C*(*v*) of connections from Learning Object *v*. Above mentioned formula needs to be tested and improved according to numerous factors that could be considered as a potentially valuable for *LORank*.

3. Conclusion

E-learning techniques, especially Learning Objects pay special role in Living Labs environments as they are able to collect and distribute information and knowledge. The concept of "living learning" uses technology and methodology of e-learning in way that could be more productive in terms of proper identification and storage of knowledge produced during LL activity. Living Learning consists of Learning Object structure, LO preconditions and postconditions in structurized hierarchy of classes, connections of LO's by conditions, learning paths and structures, LO evaluation based on algorithm similar to PageRank.

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