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ONTOLOGY OF FACTORS DETERMINING WEBSITE VALUE

Summary: Dynamic development of e-business creates many Internet initiatives, the market value of which is sometimes enormous (e.g. Google, E-bay, Amazon or Allegro). Such high results of market pricing are not consistent with the present methods of company pricing. The conclusion is then that there must be considered new factors determining website's value, which should be applied in more accurate pricing methods. The attention of this article is focused on classification of bases of pricing methods, in the form of identification and description of factors determining the value of Internet site. Due to complexity and multi-dimensionality of that problem the ontological attitude is proposed. There is built a prototype of ontology of website's value factors, which enables more "natural" mapping of real world phenomenon.

Keywords: ontology, factors of website value, website pricing.

1. Introduction

When surfing the Internet, we can find three main types of websites: strictly commercial, "non-commercial" (we think that someone is running this non-profit service, however his hidden goal is to get a profit) and truly non-commercial sites. We focus on the first two types, because even if a website has been started as a "non-profit" project and it is planned to be sold, then it becomes a commercial one. Those types are strongly correlated with business models created by electronic economy, such as brokerage model, advertising model, infomediary model, merchant model, manufacturing model, affiliate model, community model, subscription model or utility model [Afuah, Tucci 2003]. Websites, considered from the beginning as profitable business, are increasing their value by gaining revenue as, e.g., distribution channel or advertisement space. With time the site can become main asset of the company – for the on-line visitor there is no difference, which company acts "in the background" of Internet portal, as long as original service or product offered on this website is delivered to him. This is a reason why Internet sites became a good of multiple trade and are changing owners, sometimes with very spectacular prices. Considering willingness of selling or just pricing such a company, the market value must be determined. Pricing of such a website in case of direct connection with

revenue generation (e.g. electronic commerce) is rather simple. The problem appears when the role of Internet site or portal is not e-commerce but the purpose (sometimes very well hidden) is still to generate income for its owner.

An interesting issue in this process is the identification of factors (economic, technological or very often social) chosen by the seller and buyer to calculate the value of a particular Internet site. To determine even the initial price, some data must be prepared (collected or searched and analyzed). Statistical, performance or market information about specific website is gathered from the beginning of presence in Internet for marketing or development purposes. The range and variety of those data can be very wide. The multidimensionality of factors influencing the pricing process of website (identified and used factors can be somehow correlated, cross-classified and applied in several pricing methods) determined ontology as a tool for modeling this complex phenomenon.

2. Methods of pricing Internet site

Before we focus on factors which determine the value of a website, the good idea is to analyze methods which are practically used in the pricing process. As with traditional business, website business or even just a hobby site that brings in money is hard to determine in a real market value. The first issue for the seller is to consider, what is his fair price. Other variables that will come in to play are the industry the site operates in (competition too), how much labour and technical skill is required to manage the site, the costs (hosting, marketing, staff, etc.), whether the business is growing and how fast, the future potential and whether the industry is a buyers or sellers market (supply vs demand). The problem of calculating the market value of a website can be viewed from many points depending on its type or specific case. We use one measure or method for pricing Internet shop, which, except for e-commerce website, requires also a warehouse, business partners etc. and others in case of typical announcement service or information portal. Some experts would tell that on-line business should be sold for ten times its gross profit, or 5 times average revenue or 2 times last years total revenue. EBizBrokers consulting company dealing exclusively with small to mid-market Internet-based companies, states that generally an e-business website is worth three to six times earnings before interest and tax [iMerge Advisors... 2008].

However, in each case the website or Internet domain is an intangible asset the value of which is possible to calculate with some commonly used methods and techniques. On the basis of their differences and similarities we can distinguish three main methods of analysis and pricing intangible asset: cost method, market method (sometimes called sale comparing method) and income method. The first one, cost method, is based on the economic rule of substitution according to which the buyer is not paying more than the costs of similar investment realization characterized by the same benefits measured by e.g. usefulness or functionality. Market method is

based on economic rule which claims that on free, unrestrictive market supply and demand factors will establish the balanced price. The third method (income method) uses economic anticipation principle (sometimes called expect principle), according to which the value of investment object is equal to present value of expected income which will be gained after purchasing the object. As the method's name indicates, a buyer must anticipate in generating the economic income [Zarzecki 2000]. Following this attitude a website can be treated as an IT product and the most recommended method is the income method, then the market one, and the least recommended is the cost method [Smith, Parr 1994].

Dynamic development of business activity in Internet exposed many defects of previously presented methods – reasonable simplicity of e-business does not reflect specificity of electronic economy. The first commonly used method of calculating the value of website was based on netto income multiplier in form of ten times annual netto income generated by the website. Of course the value of multiplier was strongly discussed reaching sometimes even the level of 15. However, the method became very popular and was used to quickly calculate approximate value of a website.

The second method, which became very popular in first years of the 21st century, is based on the number of unique visitors of a website and pricing of one unique visit. The valuations were very different: from a few to even several dozen USD for one returning unique visitor or from a few to even several dozen US cents for one page view. For the current crop of Web 2.0 websites, the kind of multiples being paid to buy companies is around \$30-40 per unique visitor. (Note that unique visitors should be counted over a period of one month, usually the most recent). The very often quoted article from November 2005 establishes an average of \$38 per unique visitor based on a range of different website sales [Malik 2005]. Those methods used by analytics from Wood&Co in 2000 for pricing Polish portals gave very optimistic results: Onet – 2 billion PLN, Wirtualna Polska – 1.5 billion PLN, Interia – 0.9 billion PLN, Gazeta.pl – 0.9 billion PLN. However the market has verified those calculations – just after accessing the stock market real price for shares where much below those expectations [Grochowski 2008]. Present log data gathered by top Polish portals indicates 9.75 million users of Onet.pl, 8.22 million of Wirtualna Polska and 7.43 million of Interia.pl. The number of page views measured in the period of one month points to Onet.pl as the leader with 4059 million, both Wirtualna Polska and Interia.pl reached approximately 2050 million. Among business portals there are two leaders: Money.pl and Bankier.pl with more than 2 million of users and over 50 million of page views [Satalecki 2008].

Presented disadvantages encouraged researchers to add other features into pricing process such as: “brand” of website, number of users (unique, registered), website subject, wellness of target user, diversification of income sources, development potential or competitiveness to similar website [Maravilla 2006, Speedtest.pl 2010]. This expanding list of crucial factors caused creation of many Internet sites where you

can price any on-line address e.g. <http://www.websitevaluecalculator.com/> or <http://www.speedtest.pl/wy-cena.html>. However, the algorithms used during calculation process are confidential. Those methods do not enable users to check what wages were used for specific factors or if there is any diversification algorithm concerning website's subject etc. That is why these tools seem to be useless and should be treated as a curiosity. Exemplary pricing done by one of such an on-line calculator valued Google.com for 20 554 181 076,00 PLN, youtube.com for 9 295 753 701,00 PLN or Microsoft.com for 1 594 591 869,00 PLN [Speedtest.pl... 2010].

An interesting method of pricing big Internet websites or portals was presented by M. Prys. This technique is also based on the "user-concentrated" philosophy but an interesting issue is the usage of original "penetration level" of target web users. As the author claims, when the value of factor will reach 80-85% the website will not develop anymore – it has reached its optimal development level and in future it must add extra services for identified, new target group of users. Additionally the maximum time period of income (value) prediction should not be longer than three years [Prys 2008].

Table 1. Applications of pricing methods

Pricing method	Application
Cost method	Pricing new Internet sites with low number of unique users, pricing community sites
Market method	Pricing websites which develop extremely dynamic, big e-commerce sites and portals
Income method	Pricing e-commerce sites, portals with small and middle number of unique users
Netto income multiplier method	Very subjective method (because of multiplier value) used to value any type of Internet site
Number of unique user based method	Pricing e-commerce sites, portals with middle and big number of unique users
Complex (hybrid) method	Pricing any type of Internet site varying the influence of different factors (wages) depending on specific case
On-line value calculators	Lack of access to calculation algorithm what causes very unclear justification of pricing result

Source: own study.

Other attitude, which is sometimes used especially in case of highly branded Internet domains, is called Value of Specific Intangible Assets. It can be considered as a part of traditional cost method, however, in some cases it is the only appropriate approach that will result with success in a determination of the website value. The approach is based upon the costs of buyer's purchase of a wanted intangible asset versus the cost of creating it. Many times buying can be a cost-efficient and time-

saving alternative. Considering highly recognized Internet domains the buyer is usually completely uninterested in the original website content, background software, etc. – he focuses only on the name.

Internet is a business environment which develops very dynamically – competition can appear any time and take over significant number of website users. Technological evolution must be also considered. Those factors cause Internet business to be very severe and risky with one important question to answer – what data shall I focus on to maximize the value of my on-line business.

3. Factors influencing website value

As presented in previous point, there are many ways to price an Internet-based business. However, the list is not closed. Observing the rapid development of almost each type of e-business, we must be aware of new factors, and new methods, which will help us to make better calculation on such an investment. The recapitulation of factors which are used directly or indirectly in presented methods is presented in Table 2. As we can see, there are groups of financial, technological, marketing, market, and social data which must exist or be calculated if we want to use a specific method.

Running a standard company there is no problem to call past financial data which present cost structure (investment – past and present, variable and fixed charges, etc.) for estimation substitute investment. Then we can convince potential buyer that it is cheaper to buy our company than start everything from scratches. The same situation is with income data – past and present information is available in seconds, however, for full calculation we need some forecasts. In that moment some uncertainty and risk appear, which in such unstable environment as Internet can be a big problem to calculate. Similar problem can appear with technological matter. The risk of growing old is extremely high and even just after purchase it can appear that whole Internet service needs complex rebuilding (re-programming) and huge investment. To be at least partly sure of data and calculation we need to base our opinion on expert analysis and reports. More optimistic situation we find in marketing and market data – this information can be found in open (free) reports (e.g. <http://royal.pingdom.com/>, <http://www.internetstandard.pl/>), national statistic office or the research can be done by the buyer himself.

Social factors are more complex – some data can be easy retrieved from e.g. database of registered user but nowadays the main problem is something which is crucial but extremely hard to predict – customer preferences. This factor decides whether our brilliant idea for Internet business will be huge success or total failure. But the customer behaviour is a main unknown – we can try to analyse data, built model or sometimes even control customer actions but until the final result like on-line product purchase or website visit we cannot be sure of anything. The meaning of that problem can be proved by the Google latest investment – purchase of the

Table 2. Factors applied in pricing methods

Factors \ Methods	Cost method	Market method	Income method	Netto income multiplier method	Complex user based methods	On-line value calculators
Internet application costs	X					
Maintenance costs	X					
Marketing costs	X					
Purchase offers		X				
Stock/share value		X				
Patents value	X		X			
Market potential			X			
Present income value			X			
Future income value			X			
Unique visitors number				X	X	X
Unique visitor value				X	X	X
Website “brand”						X
Number of registered users				X	X	
Target user wellness				X	X	
Number and structure of income sources				X		
Competitive Internet services					X	X
Page rank (Google based)						X
Target market penetration level					X	

Source: own study.

company named Recorded Future. Technology created by that company for future trends prediction connected with Google “user question” database can give some interesting results in connecting a chain of customer activities: search, get own opinion, action [Idg.pl, 2009].

Complex list of variables which determine a website value was presented by Toad Malicoat (Figure 1).

As we can see, the factors are focused on the same areas as presented before, but the difference from previously presented pricing methods is that they are all used in calculation (of course with proper wages depending on website type). To reflect the complexity of that list with additional features, which are results of constant e-business development and research, the ontology is proposed. This attitude enables natural presentation of the problem with minimum simplification and information loss.

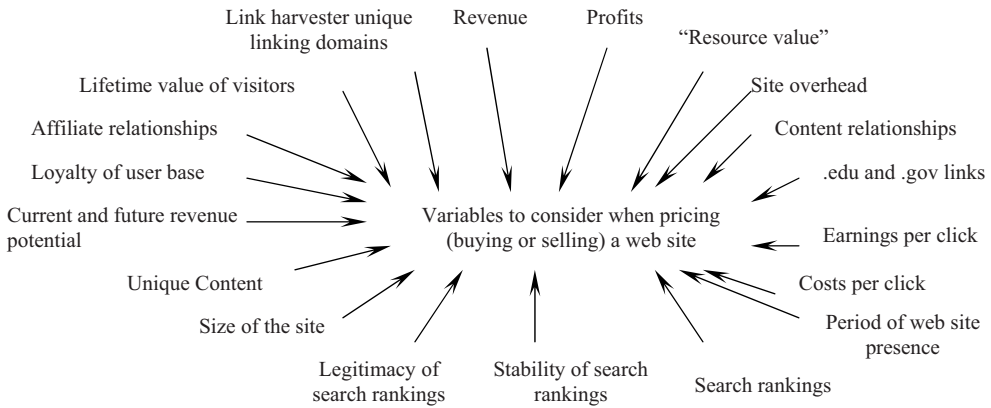


Fig. 1. Factors determining a Web site market value

Source: based on [Malicoat [2007].

4. Ontology as complex description method

According to W3C Recommendation (February 10, 2004) an ontology defines the terms used to describe and represent an area of knowledge. Ontologies are used by people, databases, and applications that need to share domain information. Ontologies include computer-usable definitions of basic concepts in the domain and the relationships among them (note that here and throughout this document, the definition is not used in the technical sense understood by logicians). They encode knowledge in a domain and also knowledge that spans domains. In this way, they make that knowledge reusable. The word ontology has been used to describe artifacts with different degrees of structure. These range from simple taxonomies, through metadata schemes to logical theories. The Semantic Web needs ontologies with a significant degree of structure. These need to specify descriptions for the following kinds of concepts:

- Classes (general things) in the many domains of interest.
- The relationships that can exist among things.
- The properties (or attributes) those things may have [I-sklepy.pl... 2010].

Universal character and flexibility of reflecting real world issues made ontologies very popular. Several languages (from RDF, XML to OWL) and universal ontologies and editors were adopted or developed and are constantly improved. The list of applications which can help in building an ontology divided into subcategories is presented on Michael Bergman website [Bergman 2010].

Due to international researches concerning domains like gene, geography, etc. some methodologies of ontology building were identified. The most popular are:

On-To-Knowledge, MENTHONTOLOGY, Uschold and King's, CYC, Gruninger and Fox's, DILIGENT, KAKTUS, SENSUS, Noy and McGuinness.

However some researches show that in almost 60% of cases when an ontology is built no methodology is used. The whole process is based on expert knowledge of analyzed domain, his intuition and several prototypes of prepared ontology [Soares, Fonseca 2009]. The usual steps of creating new ontology are: identification of ontology scope, capture phase, encoding phase, ontology integration, ontology evaluation and finally ontology documentation. They are built for specific applications like problem solving methods, domain-independent applications or software agents.

Ontologies can be specified at different levels of formality – the same classification can be expressed in natural language (highly informal), structured form of natural language (semi-informal), formally-defined language (semi-formal) and formally with theorems and proofs (formal). WEB 3.0 assumes semantic WEB to be the future of the Internet.

5. Ontological description of factors determining website value

The research work was organized as follows:

- 1) analysis of domain of the problem, which short revenue was presented in previous points of that article,
- 2) identification of suitable ontology editors,
- 3) building the ontology of factors determining the website value,
- 4) ontology tests and corrections.

In the second stage of the research several options were checked and tried (open source and commercial) and the final set, which was examined more carefully, was: OntoStudio, Swoop, Protégé from 3.1 to 4.1 beta version. According to trial ontologies building the most friendly solution was OntoStudio, however, the 3-month evaluation period was not enough to complete planned research. In the future (in case of given research grant) a purchase of this software is predicted. Because of the financial reasons Protégé platform in version 4.1 was chosen. For the consistency check there were installed and tried several reasoners, like HermiT, Fact ++, Pellet, which current versions are compatible with chosen Protégé platform.

The next step was identification of factors determining website value, which were classified in hierarchical list of options. This stage was based on literature studies and analysis of several pricing methods.

Finally the list was implemented in Protégé platform as a set of classes and subclasses in domain of website value. The reasoned confirmed ontology consistency. An example code in RDF/XML is presented below.


```

<!-- http://www.semanticweb.org/ontologies/2010/11/Ontology_of_Factor_determining_website_value.owl#DemographicalType
-->
<owl:Class rdf:about="&Ontology_of_Factor_determining_website_value;DemographicalType">
  <rdfs:subClassOf rdf:resource="&Ontology_of_Factor_determining_website_value;WebsiteValueFactorsTypes"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;hasFactorExampleOf"/>
      <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_value;WebsiteTargetUserAge"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;hasFactorExampleOf"/>
      <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_value;WebsiteTargetUserSex"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;hasFactorExampleOf"/>
      <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_
value;WebsiteTargetUserEducationLevel"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;hasFactorExampleOf"/>
      <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_
value;WebsiteTargetUserNationality"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

The next step was creation of a set of website value factors. Due to performed tests on the future functionality of designed ontology the examples of identified factors were implemented as classes with specified individuals. One of them is presented below.

```

<!--http://www.semanticweb.org/ontologies/2010/11/Ontology_of_Factor_determining_website_value.owl#WebsiteStructureOfIncomeSources -->

  <owl:Class rdf:about="&Ontology_of_Factor_determining_website_value;WebsiteStructureOfIncomeSources">
    <rdfs:subClassOf rdf:resource="&Ontology_of_Factor_determining_website_value;WebsiteValueNamedFactors"/>
    <rdfs:subClassOf>
      <owl:Restriction>
        <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;isTypeOf"/>
        <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_value;FinancialType"/>
      </owl:Restriction>
    </rdfs:subClassOf>
  </owl:Class>

```

For the future research development in direction of website value expert system some defined classes (enabling mixing of defined factor's types – reflecting natural process) were created. There were also some trials in SPARQL usage but it required conversion of designed ontology for Protégé 3.4 requirements and caused some problems. An example code of defined class is presented below.

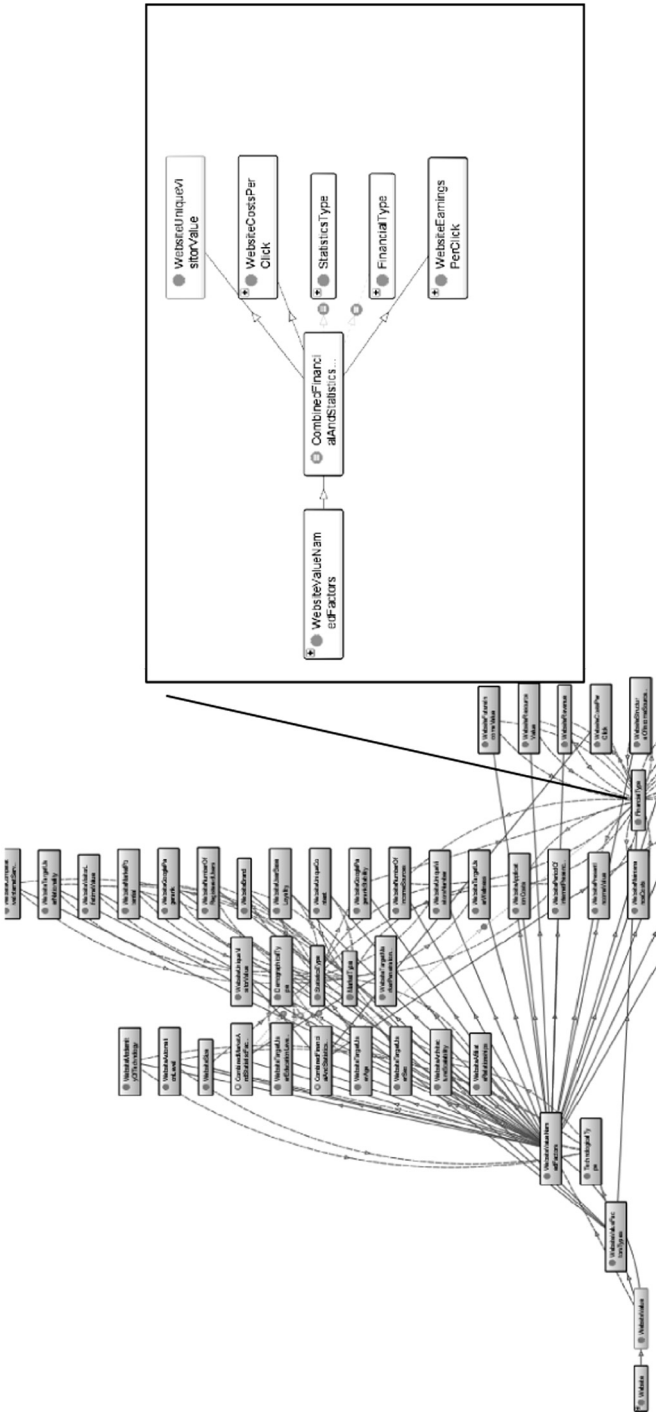


Fig. 2. Part of designed ontology of website value factors
Source: own study.

```

<!-- http://www.semanticweb.org/ontologies/2010/11/Ontology_of_Factor_determining_website_value.owl#CombinedFinancialAndStatisticsFactors -->

<owl:Class rdf:about="&Ontology_of_Factor_determining_website_value;CombinedFinancialAndStatisticsFactors">
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        <rdf:Description rdf:about="&Ontology_of_Factor_determining_website_value;WebsiteValueNamedFactors"/>

        <owl:Restriction>
          <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;isTypeOf"/>
          <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_value;FinancialType"/>
        </owl:Restriction>
        <owl:Restriction>
          <owl:onProperty rdf:resource="&Ontology_of_Factor_determining_website_value;isTypeOf"/>
          <owl:someValuesFrom rdf:resource="&Ontology_of_Factor_determining_website_value;StatisticsType"/>
        </owl:Restriction>
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>
</owl:Class>

```

The final shape of designed ontology is presented in Figure 2. The number of classes and sub-classes was limited for the purpose of this article giving just a prototype of final solution.

During the analysis and ontology implementation phases it appeared that one more main class creates a list of sub-classes which considered further were the beginning of another sub-class. The ontology was growing in geometrical progress. Future research plan is to develop this ontology in direction of pricing methods and website types. This will give a complex view of analyzed problem.

During implementation process some problems with chosen software platform appeared. The main inconvenience was met during data type restriction defining – there was a problem with numeric type recognition and it must be solved before project is continued. What is more, some options available in Protégé version 3.4 were removed and the author found them very helpful during individuals definition process (lack of forms in this specific case).

Ontology built for the purpose of this article is a third one based on Protégé platform. As conclusion, from the user point of view, this tool is extremely friendly, however, sometimes some unexpected problems appeared making the progress very slow. For these reasons for the following research experiments the commercial platform is considered.

6. Conclusions

The goal of this article was to prove usability of ontology as a way of natural presentation of the problem of website value factors. The problem of calculating proper price based on relevant data taken from different sources became very common. The increase of Internet sites value reflected on stock market or transaction

amounts makes a lot of researchers wondering what are the origins of this huge amount. Some examples of real market transactions, like Microsoft buying 1% of Facebook for 240 millions USD or wanting to buy Yahoo for 45 billion USD shows that proper data exist and calculations are possible. The list of factors, in those cases, which were included, was of course confidential. From the author's point of view, we should focus on information/data/statistics concerning the website and its environment. To understand the types of factors and their influence level, the ontology was proposed. The complexity of classification (multi-level and multi-dimensional nature of influence) makes database attitude (strict classification) rather unsuitable. Flexibility of ontological approach enables the analyst to reflect whole reality of that phenomenon.

The further plan of research focused on designed ontology assumes expanding its range into two main domains: website types and pricing methods. The first one will try to present what factors are the most crucial for specific type of on-line business service. The second will be a trial of pointing suitable value measurement methods based on combination of website type and its crucial value factor. Both directions of course require additional research, identification, initial classification and finally ontology development.

References

- Afuah A., Tucci Ch., *Modele i strategie biznesu internetowego*, Oficyna Wydawnicza, Warszawa 2003.
- Bergman M., *The sweet compendium of ontology building tools*, <http://www.mkbergman.com/862/the-sweet-compendium-of-ontology-building-tools/>, 2010.
- Grochowski T., *Portal w potrzebie*, "PCKurier" 2008, vol. 10.
- Idg.pl, 2009, *Google inwestuje w przewidywanie przyszłości i płatności*, <http://www.idg.pl/news/358493/Google.inwestuje.w.przewidywanie.przyszlosci.i.platnosci.html>, 2009.
- iMerge Advisors, <http://www.imergeadvisors.com/>, 2008.
- I-sklepy.pl, *Jakie oprogramowania wybrać?* http://www.i-klepy.pl/sk.php?o=jakie_oprogramowanie_wybrac, 2010.
- Malik O., *The return of monetized eyeballs*, BUSINESS 2.0 Magazine, <http://money.cnn.com/magazines/business2/>, 2005.
- Malicoat T., *Website Value 101 – how to appraise a website*, <http://www.stuntdubl.com/> 2007.
- Maravilla N., *Thinking of selling your web site? How to determine your web site's value*, <http://Power-HomeBiz.com> 2006.
- Prys M., *Wycena strony internetowej*, <http://serwis.magazynyinternetowe.pl/>, 2010.
- Satalecki P., *Jak inwestować w firmy internetowe?*, <http://www.money.pl/>, 2008.
- Smith G.V., Parr R.L., *Valuation of Intellectual Property and Intangible Assets*, Second Edition, John Wiley & Sons, New York 1994.
- Soares A., Fonseca F., *Building ontologies for information systems: What we have, what we need*, http://ischools.org/images/iConferences/Soares_Fonseca_iConference09.pdf.
- Speedtest.pl, *Wycena strony internetowej*, <http://speedtest.pl>, 2010.
- Zarzecki D., *Metody wyceny przedsiębiorstw*, Uniwersytet Szczeciński, Szczecin 2000.

ONTOLOGIA CZYNNIKÓW DETERMINUJĄCYCH WARTOŚĆ SERWISU INTERNETOWEGO

Streszczenie: Dynamiczny rozwój e-biznesu internetowego skutkuje powstawaniem inicjatyw internetowych, których wartość określana jest czasem niebotycznymi kwotami (Google, E-bay, Amazon, Allegro itp.). Tak wysokie wyniki wycen rynkowych nie są spójne z dotychczas stosowanymi metodami określania wartości firmy. Nasuwa się w takim razie wniosek o konieczności wzięcia pod uwagę nowych czynników budujących wartość serwisu internetowego i zaimplementowania ich w bardziej trafnych metodach wyceny. W artykule skupiono uwagę na uporządkowaniu podstaw takiej wyceny, czyli identyfikacji i opisie czynników wpływających na wartość strony internetowej. Z uwagi na złożoność i wielowymiarowość zagadnienia zaproponowano podejście ontologiczne (budowę ontologii czynników warunkujących wartość serwisu WWW), które umożliwia „naturalne” odwzorowanie zjawisk świata rzeczywistego.

Słowa kluczowe: ontologia, czynniki wartości serwisu WWW, wycena witryny internetowej.