USER-DRIVEN
INFORMATION SYSTEM
DEVELOPMENT

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INTRODUCTION

In data management, the needs of the underlying technology appear most demanding: choosing appropriate data formats, schema, or importing data from heterogeneous sources into consistent databases. However, in the best interest of the software provider, users can't be perceived as an inconvenience, as people who may enter incorrect or inconsistent data, and, therefore, should be protected against. A user-driven approach puts people at the heart of information system design. This is not just about the aesthetics of the screens of a nice interface for user, but it permeates every aspect of the design of a system.

In business information system domain, end-users have an opportunity to improve, modify, determine the final form of product in such a way that satisfies the needs and expectations. Open-sourcing is introduced as business strategy allowing for innovativeness dispersion. The information what end-users really need is very difficult to catch, therefore maybe it is more suitable to support them with appropriate work tools for their own activities.

So far, well-known information systems were developed in producer aspect and passively involved the user. However, nowadays, information technology enables support of end-user in the process of development of software application by them and for them. User participation in the information system designing was defined as user membership in design team, but user-driven development is considered as positive and cognitive thinking about user involvement in the design work. Many people suggest using some form of participatory design approach, where the end users are introduced into the design process and they are invited to become not just subjects to be studied by the designers, but they are considered as co-developers. This is very helpful, because the analysts and designers still need to use expert facilitation in order to uncover users' tacit knowledge. Therefore, this book is devoted to the considerations on different aspects of user involvement and usability of information systems. The book is expected to be helpful for software application providers to persuade them that users are creative and value generating team members.

The uncommon gratitude is expressed first to all the academicians who responded to the call for papers and offered their expertise and shared their findings with the research community. Finally, we are definitely grateful for all the input we received from the publishing staff during the realization of this venture.

Małgorzata Pańkowska

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PROSUMPTION IDEA CREATION IN DISTANCE LEARNING

Introduction

The topic of the paper is the promotion of prosumption through distant learning. The following research question has been formulated: Is it possible to pursue the idea of prosumption through distance learning? The research has covered the stage when students were given access to a computer game, which supplemented one of the modules within the program of e-lectures. The computer game belongs to the activation methods used in distance learning. Students were asked to share their experiences and opinions. The paper includes a summary of the research findings collected when delivering e-lectures under the econet project – virtual space of collaboration of universities of economics[*].

It has been assumed that any activation methods used in education, including computer programs or educational games, will be best adapted to the needs of their users i.e. students, if the users are allowed to participate in improvement efforts. Today's students have a clear understanding of what knowledge and experience they are most likely to need in the future. E-learning tools create an environment which enables students to have impact, in course of a learning process, on what they are actually learning. Their experiences may be drawn upon to improve the contents of lectures, teaching methods, computer programs and games, which can then be used when training other groups of students in the future.

Student as a prosumer

A student, when sharing his or her comments on the game, automatically becomes one of its creators and a co-author of its new or improved version. A consumer who is a producer at the same time is called a prosumer, based on the following formula:

[*] www.econet.pl – a platform for inter-institutional cooperation.

prosumer = producer + consumer

As a result, students who have actively participated in the improvement of a product, such as a computer game, may be referred to as prosumers.

The term 'prosumption' was coined in the 1970s. It is connected with a conscious use of consumers' knowledge when creating new products or services. According to D. Gach, prosumption may be manifested when designing new products or services, improving the existing ones, developing new working methods, searching for pioneer activities, devising promotional and other campaigns [Gach08, p. 57-60].

There are many examples of prosumption and it currently finds an increasing number of applications. The paper presents an example of prosumption in which consumers – students are involved in innovative processes at e-lectures. Prosumption provides an opportunity for introducing successful innovations as students explicitly define their needs and requirements concerning a computer program. For instance, during this research one of the students suggested that a source code for the game should be made accessible for analysis. Such an initiative seems to fall under customer made. A company comes up with a product or a service, which is subsequently modified by a customer to adjust it to his or her needs (selecting one's own car accessories, deciding about a credit card image, ordering a customised calendar, etc.).

Characteristics of a project *econet*

Econet is a joint university project, carried out by cooperation among universities of economics in Poland: University of Economics in Katowice, University of Economics in Cracow, University of Economics in Poznan, University of Economics in Wroclaw and Warsaw School of Economics (SGH). The project commenced in 2005. Its initiator and coordinator is CREN − The Centre for Development of Distance and Continuing Education in Warsaw. Every partner university has prepared a lecture which, as assumed by the authors, should be up-to-date, non-competitive against the lectures from the other universities and optional for students.

The *econet* project uses a CREN SGH training platform. Through this platform, lecture contents, students, lecturers and their mutual cooperation (communication) can be handled. Lecturers and students may communicate via a discussion forum, with a list of topic-based rooms, a chat and email. They have access to a notice board, a virtual gradebook, a notebook and a diary.

As a standard, the platform is developed in three directions [Hyla05, p. 67]: people, communication and knowledge. 'People' comprises tools used to manage courses, competences and skills as well as running testing activities and collecting feedback etc. 'Communication', aimed to improve the e-learning platform, includes e-mail, the discussion forum, the chat and the notice board. The solutions offered under 'Knowledge' concern the management of e-lecture contents.

For the *econet* project, the staff from the Informatics Department, the University of Economics in Katowice, have prepared a lecture on decision-making based on hybrid models (see [StPA05, p. 359-372]).

Characteristics of e-learning lecture implemented under the project *econet*

The lecture − Decision-making based on hybrid models – is divided into three units, so-called modules, which are equivalent to traditional meetings with students held every second week. The prosumption study has covered one of the modules included in the e-lecture program. The module is entitled "Business planning using an interface agent". The contents of the module deal with the rationale behind the use of a software agent in a decision-making process in business, for example when creating a business plan. The involvement of the software agent at the planning stage may help, due to a high number of parameters and the fact that they may be omitted in decision making. Furthermore, it may facilitate the data analysis, help to deal with the changing environment and possible limitations. In practical terms, every decision has to take into account certain barriers, which may affect the choices to be made. The barriers to making successful decisions are described in more detail by such authors as M. Romanowska [Roma08, p. 119-124], W. Walczak [Walc12, p. 35-45]. They distinguish competence barriers, organisational barriers and information barriers. Decision making is affected by numerous factors. Therefore, much importance is attached to the ability to collect, select and analyse vast amounts of information, which comes from various sources. The involvement of a software agent at the decision-making stage may help to do that.

A lecture has a multi-level structure. It is composed of: an introduction, the main content of the module, a summary and a check part which uses the activation methods. The activation methods incorporated into the lecture module include crosswords, test questions, online forum discussion questions, exercises and extra resources. An extra resource added to the lecture is the computer game. Students have access to a document template to help them collect results ob-

tained during the game. Students are asked to present their views and rationales for their results and fill them in the document template. A game prototype was created by a student of the university for the needs of his own Master's thesis. It requires some further development though. The operation and reliability of the game, which depend on the technology employed, need to be improved, as well as its graphic design. The incorporation of the game into the lecture brings a not of advantages. First of all, it motivates and involves learners, making the learning process more attractive. The game differs from traditional methods of delivering lectures. It may also serve as an opportunity to carry out the other, undisclosed objective of the training – to check whether students are going to take part in the game improvement process.

Analysis and evaluation of student activity

The lecturers, as an experiment, provided the students with the document template where they could fill in their results. Furthermore, they published some questions on the discussion forum, encouraging the students to share their reflections about the game (their comments and suggested improvements). Using the time comparison method, the results given in Table 1 were obtained.

Table 1

Evaluation of the computer game by the students registered for e-lectures

	Criteria for evaluation			
Year	**Functionality**	**Computer graphics**	**Information technology and tools**	**Sum**
2006	19	4	4	27
2007	1	0	0	1
2008	6	2	3	11
2009	4	1	1	6
2010	9	3	2	14
2011	1	0	1	2
2012	3	1	1	5
Sum	**43**	**11**	**12**	**66**

The students could share the experiences from the game, using the reports based on the available template or publish their views on the discussion forum. Totally, 43 comments published on the discussion forum were collected – 16 were given by the female students and 27 by the male students. The comments mostly concerned the improvements in the game operation but there were also some suggestions of changes in the graphic design or the technology applied. An

advantage of the discussion forum as a means to collect and communicate the knowledge is the fact the other students belonging to the same group could also see the messages. The other users were able to analyse, compare and comment on the replies.

Within the lecture, the knowledge of a specific community of students, who were interested in further development of the existing game or creation of its new version, was compiled. Therefore, we can say that some consumer potential was used here. About the promotion of consumer innovativeness via e-learning. The students, who previously used to play the roles of consumers and recipients of lecture contents, were drawn into the participation in a productive process – checking whether the game runs properly, verifying its graphic design, process and technical requirements and suggesting some ways to improve the game. The most common method for summing up a simulation is a meeting of all the group participating in the task in order to discuss the exercise. The requirement was satisfied here by means of the discussion forum. Not only did the students share their experiences and practical reflections but they also referred to, and commented on, what the others said.

Based on the number of replies collected in Table 1 it may be concluded that the students were eager to share their experiences and give their comments on the computer game available in the module. Decision making with an interface agent. The students' involvement may mean that the simulation decision-making game is an attractive teaching method. The discussion forum archives of the econet platform made it possible to collect the data. When summing up the study, it turned out that the group of students included some people who had had some previous experience from using other decision-making computer games. Apart from their reflections on the game itself, the students also expressed their views on other games and business plan generators. They presented their opinion on the reasonability of a software agent's use in a decision-making process.

The students' views may be grouped in the way shown in Figure 1. These views result from their previous experiences with other games and/or the observations made during the game available in the e-lecture module.

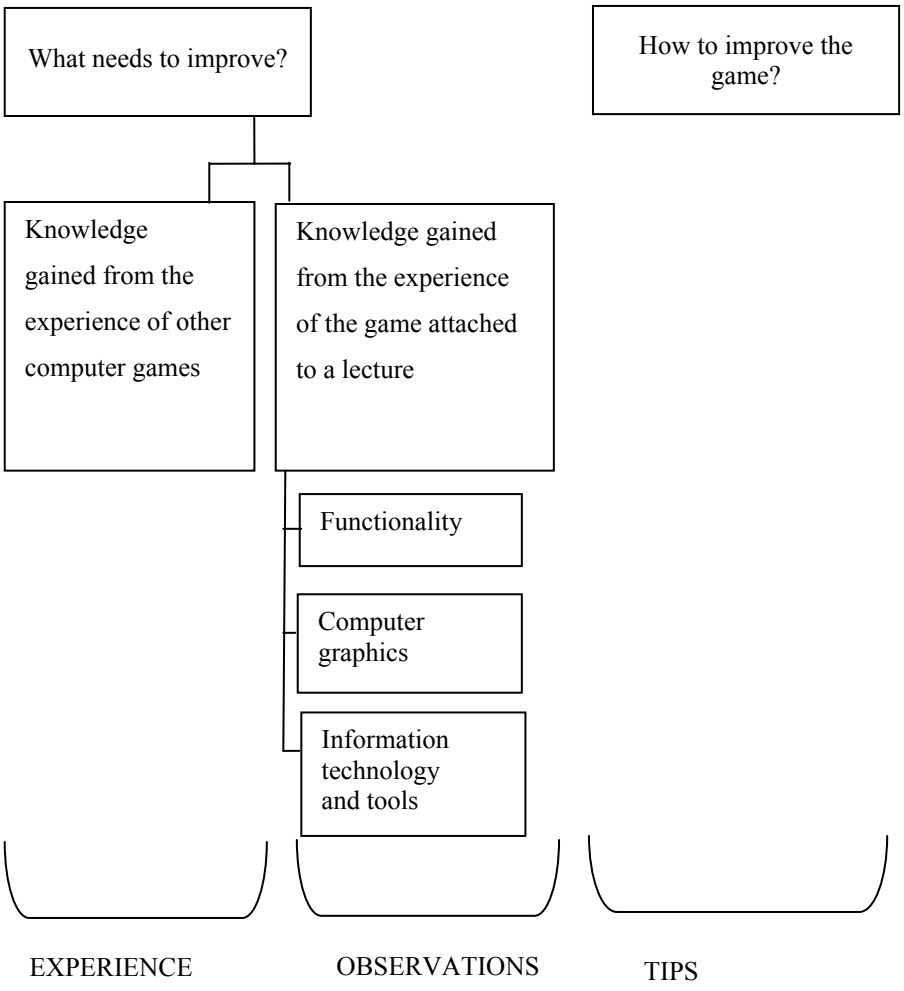


Fig. 1. Systematization of knowledge about computer game

The students shared their reflections because, on one hand, they were motivated to earn points for active participation and, on the other hand, they were affected by the contributions and involvement shown by their peers. There were also some comments provoked by the technical defects found in the game. However, according to Ł. Gajewski [Gaje09, p. 21-25], a dissatisfied individual is a creative individual. All the responses were equally relevant. They may now be used to work on some new, innovative solutions or to remove the faults.

The involvement of recipients in the creation of innovations is a new approach to this process. In case of our experiment, the recipients were the students. The students took active part in the creation of innovation, although it was much easier for them to criticise the shortcomings than to suggest improvements. Therefore, a computer game may be a tool to identify consumer needs and expectations. The experiment as such may be classified as an example of prosumption.

Knowledge acquisition from students

Prosumption involves a conscious use of customers' knowledge. On one hand, dispersed knowledge of individual customers may be gathered and, on the other hand, collective knowledge may be used. During the experiment it was observed that there were some students who had their reflections about the game, there were some students who agreed with others and the ones who first listened to other opinions and then came up with better solutions. To illustrate this point, a number of students' replies are given below as examples:

- male student: "The game improvements I would suggest are: an option to make more than 2 products, prolongation of a decision period to more than 2, an option for a player to have influence on e.g. costs of transport, a choice of alternative sources of funding",
- female student: "The improvements suggested by Bartek and Monika would make the game easier",
- female student: "I agree with him – I think it would be helpful to give access to the assumptions during the entire game",
- male student: "As every decision generates subsequent decisions, the best solution would be to write down the assumptions made at the beginning and, based on that, take appropriate decisions".

The discussion forum for the lecture, where students posted their opinions, gives an opportunity for students to communicate with one another. In a way, they become a certain society or a creative community (see [Gach08, p. 60]). Everybody has a voice and may present their ideas. It should be noted that the attendees come from different parts of Poland as the students from various universities of economics in Poland participate in the lecture.

The concept of knowledge-based customer relationship management was already addressed in 2003 by A. Tiwana [Tiwa03]. He presented the KCRM (Knowledge Customer Relationship Management) systems, where knowledge management and customer relationship management complement each other. Currently the SCRM (Social CRM) systems, which are aimed at using social

networking media to make consumers involved in a certain issue, problem, product or service, are gaining importance. As stated by A. Tiwana [Tiwa03, p. 35], knowledge from a company's customers' heads (human capital) should be skilfully transformed into either practical skills/customer experience (structural capital) or relationships/collaborations (relationship capital).

The knowledge of crowds may then be used in order to improve a product, a service or a skill, to find new applications for them or to develop new products or strategies. The company may also focus on building creative communities – network forms of cooperation between people working as one organism. Under the wisdom of crowds concept/crowdsourcing, a group (a community) has broader knowledge than an individual. The point is to create appropriate conditions so that a crown (a group) could turn into a group of researchers (see [Gaje10, p. 60-67]).

Summary

The paper gives an example of how prosumption may be used to develop consumer innovativeness. The prosumers were involved in the innovative processes by presenting some ways to improve the computer game which was available as an e-lecture component. In a way, the students participating in the experiment became 'partners in business', partners in a computer game improvement process. Thereby they were no longer just passive recipients of lecture contents but turned into active consumers. There are usually two reasons why consumers – prosumers are willing to share their experiences with producers: a rise in dissatisfaction or a decrease in satisfaction with a product. The students' dissatisfaction concerned the game operation, its interface, graphic design and the IT technology employed in the game.

When summing up a few years of the research (e-lectures have been offered since 2005), a conclusion may be drawn that the students have participated in the creation of prosumption. Prosumption:

- is an opportunity to come up with innovative ideas,
- it contributes to the success of such innovations (in our case − the creation of a new or improved version of the game) as it makes products tailored to consumers' expectations,
- contributes to so-called co-creation,
- emphasising a higher importance of an individual as a discoverer, instead of an expert, as it was the case before.

As stated by B. Quain [Quai08] we are living in the era of the so-called "prosumer era".

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KREOWANIE IDEI PROSUMPCJI W ZDALNYM NAUCZANIU

Streszczenie

W artykule przedstawiono przykład wykorzystania prosumpcji w rozwijaniu konsumenckiej innowacyjności. Prosument (student) został włączony w procesy innowacyjne polegające na przedstawieniu sposobów udoskonalenia gry komputerowej udostępnionej jako jedna z metod aktywizujących wykładu e-learningowego. Artykuł zawiera podsumowanie wyników badań prowadzonych od 2005 roku. Łącznie za pośrednictwem platformy econet zebrano 43 komentarze. Podczas wykładów zgromadzono wiedzę studentów zainteresowanych problematyką rozwoju dotychczasowej gry lub stworzenia jej nowej wersji. Podsumowując, można stwierdzić, że istnieje możliwość kreowania za pośrednictwem e-learningu konsumenckiej innowacyjności. Prosumpcja jest szansą na kreowanie innowacyjnych pomysłów. Stwarza szansę powodzenia innowacji (w przedstawionym eksperymencie powstania nowej lub poprawionej wersji gry) dzięki lepszemu dopasowaniu produktów do oczekiwań konsumentów. Sprzyja również tzw. współtworzeniu, ponadto wzrostowi znaczenia już nie eksperta, a człowieka odkrywcy.

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USABILITY AND RELATIONAL FACTORS IN USER-PERCEIVED QUALITY OF ONLINE SERVICES

Introduction

The intensive development of information technologies related with economic applications of the Internet has brought about the widespread of e-commerce and online services.

From the point of view of online service providers it is essential and important to identify determinants of consumer-perceived usability of online service websites and factors building the loyalty of consumers expressed by their willingness to return to the e-service and to recommend it to others.

The above issue is an interesting research problem, frequently dealt with in the literature on e-marketing, e-commerce system design and human-computer interaction. Results of empirical research available in this area concern first of all the Internet banking [JuSh01], travel [FlGG06] and e-commerce services [PeMR06].

The procedures of measuring consumer-perceived online service quality have been derived:

- partly from research methods used in the field of human-computer interactions (user interface optimization, investigations of e-business system usability, *User Experience* analysis),
- partly from methods used in e-marketing (questionnaire surveys, analysis of consumer behaviour, relationship management).

The mechanisms of influencing the customer by the use of the Internet communication channel are becoming increasingly complex. Apart from the online service ergonomics, also the impact on customers' emotions, appealing to

their psyche, to feeling part of a defined social group and making use of economic factors which shape buying behaviour are considered. At the same time, technologies of information solutions putting e-business objectives into practice are also becoming increasingly complex. They involve not only automatic mechanisms of tracking and analysing customer behaviour in the service website, but also agent systems or artificial intelligence algorithms suggesting offers which refer to former behaviour.

In view of the above, the user-perceived service website quality surveys embrace several methodological groups:

- evaluation of user interface ergonomics and analysis of website usability [Siko12; DFAB04; Niel00],
- analysis of user's impressions and experience [TuAl08],
- measurement of e-customer loyalty [Amir08],
- enhancement of the user's participation in the service design process [ScSt11].

In this paper we deal with the following research questions: what are the relationships between usability factors of on-line services and the customers' willingness to return and recommend the website

Consequently, the objective of the present study was to determine relationships between user-perceived characteristics of online service website usability and the willingness to return and to recommend the website to others. The following issues were also raised:

- the assessment of the structure of factors building up customer-perceived online service quality,
- determination of relationships among usability factors of these websites.

The study was performed on a group of Polish online service users and, in majority, concerned websites of Polish service providers.

Apart from identification of factors building up the user's opinion on the quality of selected online services, the survey was intended to indicate determinants of the website's development potential in the scope of advancement in relations with customers by the use of the Internet communication channels.

1. Methodology of survey and data analysis

The survey was performed on a group of customers already experienced as online service website users. It was assumed that participants of the survey should meet the following criteria:

- be experienced in making use of online banking, travel or health services,
- be experienced in using social networking services.

Overall 87 extramural students of the Faculty of Management and Economics of Gdańsk University of Technology responded to the recruitment questionnaire. Finally, a test group of 15 persons, 9 men and 6 women, who met the above criteria and declared participation in the examination was appointed. Seven persons were under 25 years of age, six were 26-35 and two were 36-45 years old.

Websites were chosen from among those popular in each category of services (i.e. financial, travel or health online services). Moreover, in order to facilitate identification of potential determinants of willingness to establish relationships, in this survey expressed as the declared readiness to use the service website once more, it was assumed that each of the services would be studied in two variants, selected by an expert method within the framework of an earlier research stage [SDGR12].

Three categories of online services and two services from each category were selected for the study:

1) financial service – two banking websites (*mBank.pl* and *pekao.pl*),
2) travel service – two hotel booking websites (*accorhotels.com* and *booking.com*),
3) health service – two websites of non-public medical facilities (*luxmed.pl* and *swissmed.com.pl*).

The tasks prepared for the users consisted in solving a problem defined generally as a choice of the best offer based on information acquired on the website. For example, the choice of a hotel in a defined location, satisfying pre-set requirements, or finding the most advantageous loan offer for buying a car, supported with a simulation of the size and schedule of loan payments.

Each task required the use of specific website functions by the user, acquisition of appropriate information and, to some extent, economic thinking, directed towards balancing diverse profits and risks perceived as effects of possible acceptance of the offer submitted on a given website.

After having completed each task, the participants were asked to fill in a questionnaire for the measurement of usability and relational factors.

Based on an earlier analysis of factors shaping the perceived website quality and satisfaction of the user, a list of nine main evaluation factors affecting the user experience during and after the use of the service website was compiled. The considered usability factors of web services and their illustrative items were the following:

1. Visual clarity (e.g. clear menu and navigation, clear division of the screen).
2. Ease of use (e.g. low mental and manual effort).

3. User guidance (e.g. immediate display of results).
4. Information content (e.g. reliable and exhaustive descriptions).
5. Interactivity with provider (e.g. diverse forms of contact, prompt reaction).
6. Personalization (e.g. history of activity in the web service).
7. Service demo (e.g. display of the price, possibility to test the service).
8. Recommendations (e.g. making opinions available, possibility of giving recommendations).
9. Customer care (e.g. visible attention to perfectionism and expression of empathy to the customer).

The items were evaluated using a 6-point Likert scale, where 1 is the lowest and 6 the highest rating. Each factor consisted of three items. Coordinates of a given factor were determined by summing up points obtained for constituent items. The scale ranged therefore from 3 to 18 points.

Apart from the evaluation of functional features described above by the nine factors, the participants of the survey were asked about two relational factors which resulted from the use of a given website.

1. The level of *willingness to return* to a given website.
2. The level of *willingness to recommend* the website to a friend.

The items were evaluated using a 6-point Likert scale, where 1 was the lowest and 6 the highest rating. 15 survey respondents have made 90 evaluations of six service websites.

In the process of data collection, there were data missing within scales used to measure usability factors. This occurred in 5 items, 1 lack (1%) and in 2 items, 2 lacks in each (2%). In the whole pool of answers the lack of data constituted 1% (11/2430), which is an acceptable level. The missing data were replaced with an arithmetic mean calculated for a given respondent based on answers to the remaining points of the scale.

The data were analysed by different statistical methods. Reliability of usability factor scales was assessed using Cronbach's alpha coefficient. It was assumed that the acceptable value of the coefficient for each scale would exceed 0,7 [Kaci92, p. 61]. An arithmetic mean was used to evaluate usability and relational factors. Student's t-test for dependent samples was used to compare the differences of the means among the factors. Pearson's linear correlation coefficient was used to find correlations between usability and relational factors, as well as between usability factors. The Bonferroni adjustment was taken into account. The assumed significance level was divided by the number of simultaneous statistical tests, thus enabling the limitation of type I error [Hoch88].

2. Results

2.1. Opinions about online service websites

Structure characteristics

Table 1 summarizes descriptive statistics and reliability of scales for individual usability factors characteristic of online services.

Table 1

Descriptive statistics and reliability coefficients – general opinions about websites (N = 90)

Factor	*M*	*SD*	Me	Min	Max	Skewness	Kurtosis	Reliability
Visual clarity	13,84	2,48	14,00	7,00	18,00	-0,47	-0,22	0,71
Ease of use	13,60	2,81	14,00	5,00	18,00	-0,61	-0,13	0,83
User guidance	13,01	3,36	14,00	4,00	18,00	-0,55	-0,64	0,86
Information content	12,81	3,02	13,00	4,00	18,00	-0,31	-0,47	0,82
Interactivity	13,27	2,93	13,25	5,00	18,00	-0,52	-0,03	0,76
Personalization	12,44	3,16	12,00	3,00	18,00	-0,21	-0,46	0,87
Service demo	11,90	3,39	12,00	3,00	17,00	-0,67	0,19	0,81
Recommendations	8,78	3,99	9,00	3,00	18,00	0,23	-0,65	0,93
Customer care	12,42	3,24	13,00	3,00	18,00	-0,51	0,08	0,82

The results ranged from 3 to 8 points within each factor. Distributions of results for individual factors satisfied the criteria for the normal distribution (skewness and kurtosis from –1,0 to 1,0). The reliability measured with Cronbach alpha was good for individual factors (above 0,7), the lowest for the *Visual clarity* factor and the highest for *Recommendations*.

Estimates for usability factors and differences between them

Average estimates of individual usability factors are shown in Figure 1. The assessment of the *Recommendation* factor was the lowest, next was *Service demo* followed by *Customer care*, *Personalization* and *Information content*. *User guidance*, *Interactivity*, *Ease of use* and *Visual clarity* were the highest ranked factors.

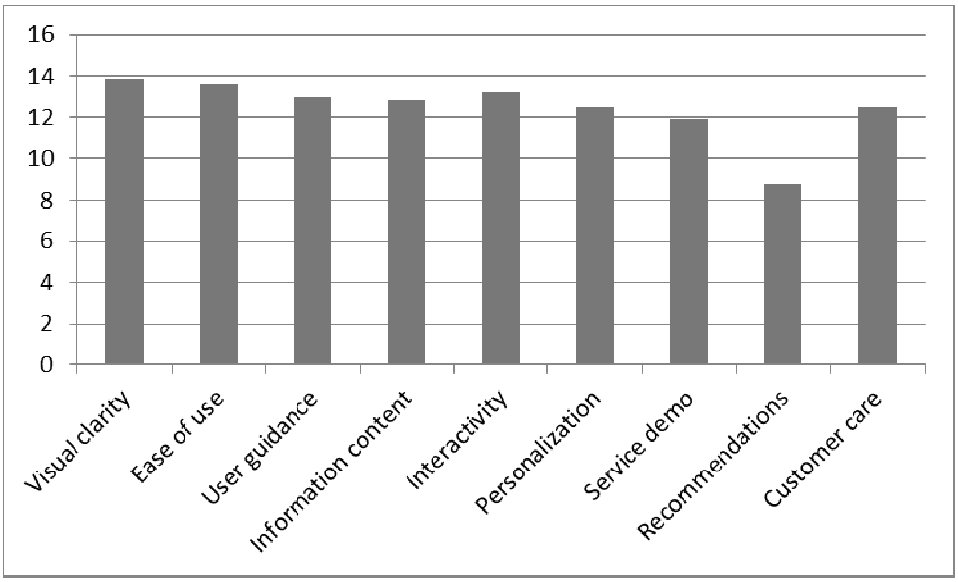


Fig. 1. General estimates of website usability factors

Taking into account the Bonfferoni correction, statistically insignificant differences (0,05/9 = 0,006) were found for:

- *Visual clarity* and *Interactivity*,
- *Ease of use* and *User guidance*,
- *User guidance* and *Personalization*,
- *Interactivity* and *Customer care*,
- *Personalization* and *Service demo*.

The above results imply that, first, *Visual clarity* was evaluated significantly higher compared with the majority of factors, apart from *Ease of use* and *Interactivity*. Similarly, *Ease of use* was also ranked significantly higher, except the *User guidance* factor. *Recommendations* and *Service demo* were evaluated significantly lower than other factors, that latter, however, with *Personalization* excluded.

Second, considering the estimates of website quality factors, none of them was ranked at a low level (i.e. in the interval from 3 to 8). Medium estimates (from 8 to 13) were assigned to five factors: *Information content*, *Personalization*, *Service demo*, *Customer care* and *Recommendations*, whereas high estimates (from 13 to 18) to *Visual clarity*, *Ease of use*, *Interactivity* and *User guidance*. *Visual quality* was ranked at the highest level and *Recommendations* at the lowest.

Correlations between usability factors

Pearson's linear correlations between usability factors considered are presented in Table 2.

Table 2

Correlations between factors – opinions on websites in general (N = 90)

Factor	1	2	3	4	5	6	7	8	9
1. Visual clarity	1,00								
2. Ease of use	0,75**	1,00							
3. User guidance	0,71**	0,74**	1,00						
4. Information content	0,58*	0,59*	0,61*	1,00					
5. Interactivity	0,58*	0,66*	0,74**	0,71**	1,00				
6. Personalization	0,52*	0,53*	0,67*	0,58*	0,70**	1,00			
7. Service demo	0,56*	0,57*	0,77**	0,59*	0,70**	0,75**	1,00		
8. Recommendations	0,11	0,22	0,31	0,21	0,15	0,22	0,32	1,00	
9. Customer care	0,52*	0,55*	0,64*	0,63*	0,55*	0,57*	0,67*	0,36	1,00

Note: * $p < 0,01$; ** $p < 0,001$ (the Bonferroni correction 0,05/36 = 0,0014).

High correlations, above 0,7, significant following the Bonfferoni adjustment, were found among the following factors:

- *Visual clarity*, *Ease of use* and *User guidance*,
- *Interactivity*, *User guidance* and *Information content*,
- *Interactivity*, *Personalization* and *Service demo*,
- *Service demo* and *User guidance*.

The above values of correlation factors show that the coefficient of determination calculated for these factors exceeds 0,49.

Weak correlations (up to 0,4) were found between *Recommendations* and the remaining factors, thus evidencing that another aspect of online services is expressed by this factors compared with the other ones.

There are no statistically significant correlations between the following factors:

- *Recommendations* and *Visual clarity,*
- *Recommendations* and *Information content,*
- *Recommendations* and *Interactivity.*

The remaining correlations were moderate in the interval 0,4-0,7.

To sum up, *Visual clarity*, *Ease of use* and *User guidance*, next, *Interactivity*, *User guidance* and *Information content*, then, *Interactivity*, *Personalization* and *Service demo*, as well as *Service demo* and *User guidance* should be treated as strongly convergent factors, whereas *Recommendation* in relation to *Visual clarity* and *Interactivity* are suggested to be totally uncorrelated factors.

2.2. Willingness to return and to recommend the service versus usability factors

The potential to shape the relationship between the user and web service provider was diagnosed using two relational factors: *Willingness to return* and *Recommendation*. The values of descriptive statistics of these variables are given in Table 3. They imply that both variables satisfied the parameters of normal distribution.

Table 3

Descriptive statistics of relational factors

Factor	*M*	*SD*	*Me*	Minimum	Maximum	Skewness	Kurtosis
Willingness to return	4,27	1,38	4,50	1,00	6,00	-0,60	-0,45
Recommendation	4,30	1,41	4,00	1,00	6,00	-0,58	-0,31

According to Table 3, the values of the means of both variables are similar. Taking into account the scale range from 1 to 6, the level of this estimate may be regarded as moderate. This reflects a possibility to develop online service websites on account of such features which shape the relationships with users.

Next, correlations between each relational variable and factors characterizing the usability of web services were considered (these so-called functional factors are summarized in Table 1). Correlation results are presented in Table 4.

Table 4

Correlation coefficients between usability and relational factors (N = 90)

Factor	Willingness to return	Recommendation
Visual clarity	0,68	0,67
Ease of use	0,66	0,63
User guidance	0,76	0,73
Information content	0,68	0,71
Interactivity	0,64	0,62
Personalization	0,56	0,59
Service demo	0,70	0,75
Recommendations	0,37	0,33
Customer care	0,73	0,71

Note: all correlations significant at the level $p < 0,05$, following the Bonferroni correction (0,05/18 = 0,0027)

Based on data in Table 4 it may be found that *Willingness to return* was correlated:

- strongly (correlations above 0,7) with *User guidance*, *Service demo* and *Customer care*,
- moderately (correlations from 0,4 to 0,7) with *Visual clarity*, *Ease of use*, *Information content*, *Interactivity* and *Personalization*,

- weakly (correlations below 0,4) only with *Recommendations*.

However, the factor *Recommendations* was correlated:

- strongly (correlations above 0,7) with *User guidance*, *Information content*, *Service demo* and *Customer care*,
- moderately (correlations from 0,4 to 0,7) with *Visual clarity*, *Ease of use*, *Interactivity* and *Personalization*,
- weakly (correlations above 0,4) only with the factor *Recommendations*.

In conclusion, correlation coefficients were very similar for both relational variables, usually strong or moderate. These variables reached the assumed level of statistical significance. The weakest correlation was found between the factor *Recommendations* and each of the relational variables (below 0,4).

3. Discussion and conclusion

As regards the usability factors of service websites considered, the factor *Recommendations* was ranked lowest, whereas *Visual clarity*, *Ease of use*, *User guidance* and *Interactivity* were ranked highest.

Following are the differences in the estimate level of individual factors: *Visual clarity* was evaluated significantly higher than the rest of the factors, apart from *Ease of use* and *Interactivity*. *Ease of use* was also ranked higher, apart from *User guidance*. Significantly lower estimates were found for *Recommendations* and *Service demo*, that latter, however, with exception of *Personalization*.

As regards correlations among the factors, it was found that those between *Visual clarity*, *Ease of use* and *User guidance*, next, *Interactivity*, *User guidance* and *Information content*, then, *Interactivity*, *Personalization* and *Service demo*, as well as *Service demo* and *User guidance* should be treated as strongly convergent factors, whereas *Recommendations* in relation to *Visual clarity* and *Interactivity* are suggested to be totally uncorrelated factors.

The estimates of relational variables of websites, *Willingness to return* and *Recommendations*, were moderate, thus reflecting a possibility of further shaping the service websites by paying special attention to the creation of market relationships. However, correlations between each relational variable and the usability factors were very similar. Each variable was strongly correlated with *User guidance*, *Service demo* and *Customer care*, while the factor *Recommendations* was additionally strongly related with *Information content*. Weak relationships occurred between relational variables and one factor only, i.e. *Recommendations*. Other correlations between relational variables and usability factors were moderate. The relationships revealed reflect a moderate or strong influence

of the usability factors of service websites on relationships with users, evidencing a relatively high potential of the development of usability characteristics in relation to the building and maintenance of market relationships.

Limitations in the research conducted concerned, first of all, the following aspects:

- the way of selection and size of the sample,
- the choice of service websites,
- construction of tasks and the way of performing them.

In conclusions, despite of such limitations, the results of the research performed may be found valuable, since our knowledge has been enriched as to:

- usability factors shaping perceived quality of online services in selected categories,
- relational factors shaping perceived quality of online services in selected categories,
- relationships between usability and relational factors in selected categories of services,
- perceived quality of service websites chosen for the survey.

The present study is one of few such experimental surveys of domestic online web services. Arbitrary expert opinions prevail in majority of previous studies. Empirical investigations on online services involving Polish users are scarce and their results are published even more rarely.

Acknowledgement

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CZYNNIKI UŻYTECZNOŚCIOWE I RELACYJNE W KSZTAŁTOWANIU JAKOŚCI POSTRZEGANEJ USŁUG ON-LINE

Streszczenie

Celem niniejszego badania było określenie związków pomiędzy głównymi czynnikami kształtującymi postrzeganą przez klienta jakość usługowych serwisów WWW i ich wpływu na potencjalną lojalność e-klienta, wyrażoną chęcią powrotu i polecania innym. W tym badaniu doświadczalnym zostało wykonanie nagranie wideo piętnastu użytkowników podczas korzystania z finansowych, turystycznych i zdrowotnych usług on-line. Po wykonaniu zadań przez użytkowników zebrano wypełnione kwestionariusze odnoszące się do dziewięciu głównych czynników oceny. Wysokie korelacje (powyżej 0,7) zostały stwierdzone dla czynników:

- klarowności wizualna, łatwość obsługi i prowadzenie użytkownika,
- interaktywność, prowadzenie użytkownika i zawartość informacyjna,
- interaktywność, personalizacja i demonstracja usługi,
- demonstracja usługi oraz prowadzenie użytkownika.

Ponadto została oceniona statystyczna istotność różnic w jakości postrzeganej dotyczącej badanych usługowych serwisów WWW.

Stanisław Drosio

University of Economics in Katowice

THE USE OF AN EXTENDED DATA-DIALOG--MODELING PARADIGM IN THE PROCESS OF BUILDING DECISION SUPPORT SYSTEMS FOR END USERS – THE EXAMPLE OF COMARCH FACTORING FRAUD PREVENTION

Introduction

Almost thirty years ago, Sprague and Carlson described their data-dialog--modeling paradigm in a book titled *Building Effective Decision Support Systems*. It represented a pioneering attempt to offer a universal approach to deploying decision support in different environments [SpCa82]. The paradigm was a true milestone that has revolutionized the way decision support is addressed to different decision makers. Decision support system (DSS) architectures that have sprung up from that seminal concept provide a widely accepted reference framework for most contemporary DSS designers [TwSW11].

The Extended Sprague-Carlson paradigm

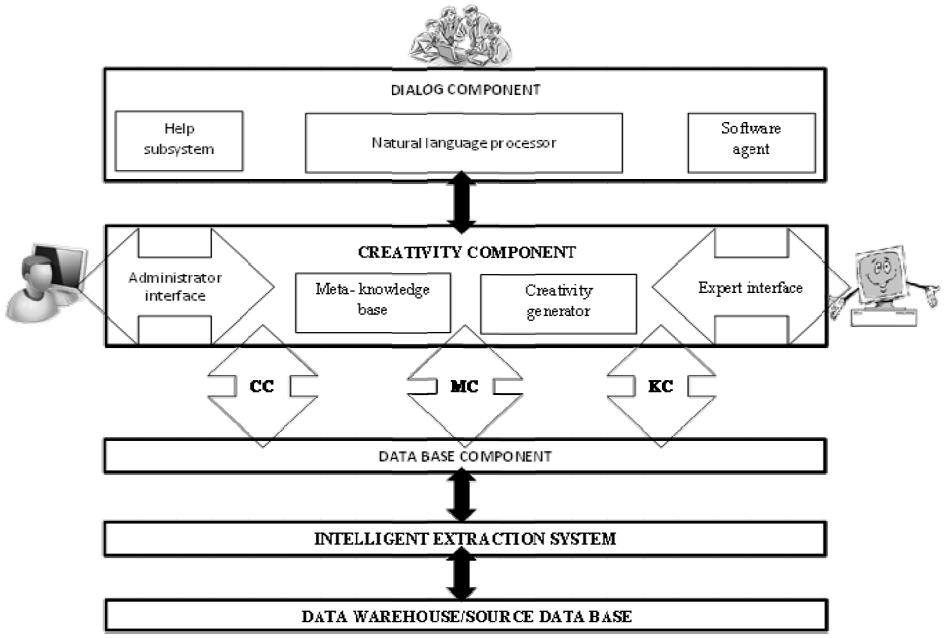
In 1999, a team headed by Prof. Stanisław Stanek proposed the inclusion of additional elements to the classical Sprague-Carlson paradigm. They chose to pursue three new strands of research [Stan99]:

- communication,
- knowledge,
- creativity.

The three new elements were appended in response to the rapid growth of new technologies used in decision support – the new information era seemed to call for modifications of the Sprague-Carlson triad to make it better suited to the evolving

needs of designers and their customers. These needs are broadly reflected in current DSS classifications, which differentiate between systems oriented on data, dialog, modeling, knowledge, communication or, just recently, creativity [StST06].

The complete paradigm in its extended form, including the new elements, is shown in Figure 1. The diagram visualizes the placement of the particular elements within the context of a sample decision support system.



Key:
CC – Communication Component,
MC – Modeling Component,
KC – Knowledge Component.

Fig. 1. The Creative Decision Support System architecture

Source: [Stan99].

Over the last few years, the software house CONSORG S.A. has successfully implemented several business intelligence systems whose architecture is aligned with this extended paradigm. The projects were conducted within the financial sector and involved strategic management of capital groups [TwSW11].

This paper also features a case study demonstrating how the extended Sprague-Carlson paradigm underpinned the development of an innovative decision support tool called Comarch Factoring Fraud Prevention. Within this system, support was deployed to the decision making process as well as to risk management and data monitoring, hence each of the components – data, dialog, modeling, communication, knowledge and creativity – was instrumental [WWW1].

The basic characteristics of the Polish factoring market

Factoring is a rapidly growing class of products in the financial services market, perceived as an increasingly attractive alternative to traditional overdrafts. This financial tool can be seen as bridging the equity and the market information gaps and as an important financing instrument for operating activities. Thus, in many cases it can be essential to the survival of entities concerned. This characteristic accounts for the potential of the factoring market, which, even in developed economies such as Germany's, experiences dynamic growth at an annual rate of 30% (37% according to the Polish Factors' Association) [Bakk04]. Overall, since this service was first launched in Poland in 1995, the Polish factoring market has grown by more than 900%. Understandably, with entrepreneurs' increasing awareness of the opportunities offered by factoring, more and more companies are interested in using this instrument. Joachim Secker, a spokesman for the Board of Deutscher Factoring-Verband [Krec10], argues that the trend is sustainable largely due to the fact that customers who have benefited from factoring during the financial crisis will maintain a good opinion of this product and are likely to continue using it. This rising trend is evidenced in Figure 2. The data used in plotting it have been supplied by a scholar from the University of Warsaw and are based on annual reports by the Polish Factors' Association [Krec07].

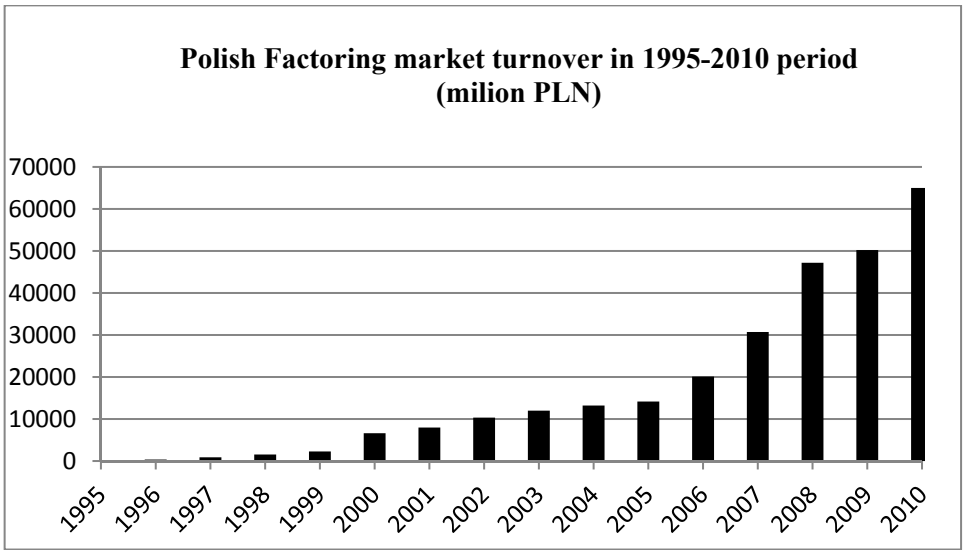


Fig. 2. Turnover in Poland's factoring market in 1995-2010

Source: [Krec07].

The Origins of Comarch Factoring Fraud Prevention

Responding to the market demand which has been indicated above, one of the largest Polish software companies COMARCH S.A. developed a support system solution for factoring transactions. While performing the first implementations throughout 2010, COMARCH engineers conceived a number of innovative enhancements to it. One of those was a solution addressing risk management in factoring transactions. As a result, tools were created that actually lie on the borderline between Business Intelligence and decision support systems and illustrate an interesting approach to support for factoring business processes*.

Risk management in factoring processes – problem definition

Like any other credit business, the factoring process is associated with the lender risk [Krec10]. However, in the factoring business most risks arise at the debtor's end or pertain to relations between the client and the debtor. This is a consequence of the very nature of factoring transactions, where the contractor is liable for the debt. It could be therefore stated that the credit risk allocation implies the risk of factoring [Krec07]:

1. Limited opportunity to examine the adequacy and reliability of the subsequent payer – at early stages of collaboration, the factor has to solely rely on documents supplied by the contractor-client.
2. The possibility of a contractual prohibition on receivables assignment to the factor; limitations of this sort have a similar effect as in 1 above – the need to trust the client's assertions and representations.
3. Risks associated with the assessment of a debtor's creditworthiness and credibility due to limited access to documents describing the debtor's standing or credit history.
4. Risks associated with companies that appear in different roles under various factoring contracts provided by the same factoring company or bank.

Support for these issues requires cooperation among factors in exchanging information about dishonest contractors or any incidents that may affect the competitive position of individual enterprises/banks performing factoring services. Factoring businesses should implement active risk management through [Krec07; Krec10]:

– risk identification,
– risk measurement,

* The author works as Business Solution Manager in COMARCH S.A. and is responsible for the Comarch Factoring products portfolio.

– risk control,
– project risk assessment.

The above analysis shows that, within the factoring process, factors must deal with two principal aspects of risk management:

1) no authorization to sign contracts that are too risky from the viewpoint of recovery,
2) ongoing monitoring of the entire portfolio of transactions passing through the transactional factoring system.

Given the wide range of transaction information to be handled, the portfolio should encompass the following [Bind97]:

– requesting the original copy of any invoice presented for purchase by the client,
– retrieving information from debtors on receivables assigned to other parties,
– notifying the debtor of any changes to the account number for receivable payments,
– document verification (including invoices),
– analysis of factoring contracts,
– building (a methodology of) indicators to track incidents that are likely to influence client behavior,
– adjusting the costs to purchase receivables and the cost of factoring fees to the level of risk exposure,
– offering different lines of factoring products, e.g. recourse factoring, non-recourse factoring, maturity factoring, etc.,
– providing additional protection for factoring transactions (e.g. a bill of exchange),
– establishing the right combination of different types of factoring limits,
– ensuring diversification of the clients and debtors portfolio,
– 24/7/365 monitoring of the parameters of factoring transactions.

IT vendors must confront the challenge of creating a tool that would be capable of performing such a broad range of functionalities and, at the same time, flexible enough to be able to interact with all major transactional solutions available in the trade finance market.

Comarch Factoring Fraud Prevention – system architecture

The preceding chapter has led to the question of what kind of information system could help simplify and automate these processes. Recently COMARCH S.A. undertook a project called *Implementing innovation in IT systems for factoring process management* [WWW1]. A considerable portion of the project was concerned with the design and development of Comarch Factoring Fraud Pre-

vention (CFFP) – a system which provides factors with assistance in analyzing large amounts of transactional data and satisfy the requirement of delivering *the right information to the right person in the right format, at the right time and the right place* [IaHe07]. This innovative solution has close affinities with two classes of information systems: decision support systems and Business Intelligence systems. Considering its key characteristics, it can be said to belong to both these classes [Stan99]:

1. It employs data mart technology, where the data mart is a standalone, independent system rather than part of another data warehouse.
2. It has a rich set of atomic indicators which can be easily aggregated to any level of detail.
3. The system is equipped with presentation tools to visualize indicators the same way that Management Information Systems typically do.

For the sake of clarity of presentation, the CFFP architecture and functionalities will be discussed in reference to the extended Sprague-Carlson paradigm which has been introduced in first part of this paper. This methodology permitted the developers to create a tool that would be flexible enough to support such complicated processes as risk management and fraud prevention in factoring.

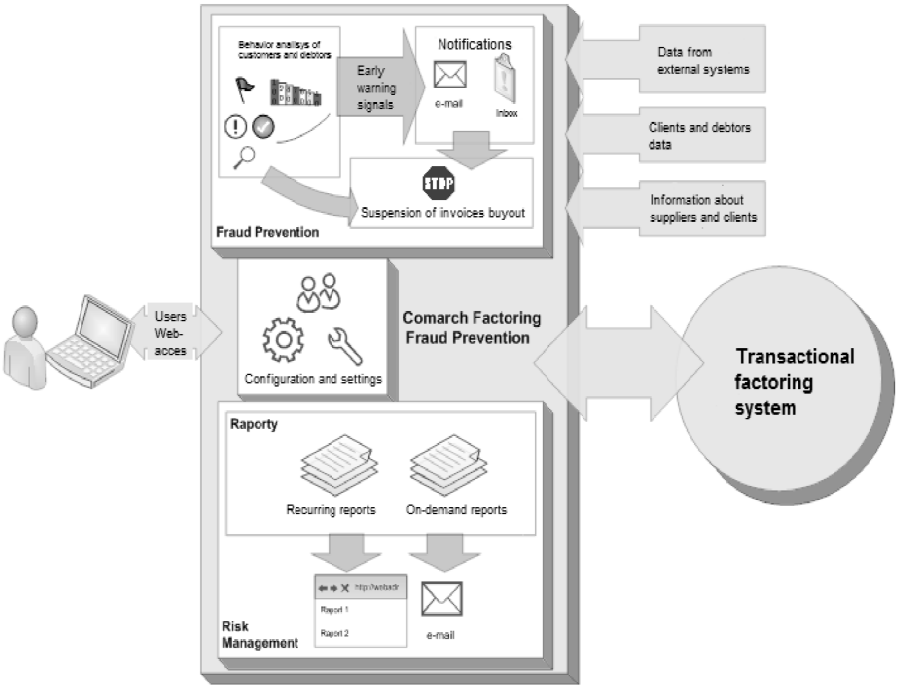


Fig. 3. The Comarch Factoring Fraud Prevention architecture

Source: COMARCH S.A.

Figure 3 provides a high-level overview of the CFFP system architecture. The following system components can be distinguished, corresponding to the elements of the data-dialog-modeling-communication-creativity paradigm [Stan06].

The Data component. Unlike more traditional information and decision systems, the CFFP is built around a data mart that stores data from the transactional factoring system. It is not necessary to utilize a classical data warehouse, since all of the data are completely homogeneous (transaction parameters are loaded only). Moreover, it is possible to eliminate extraction, transformation and load (ETL) tools [Dudy03]. Within the CFFP, this role of an ETL tool is actually performed by the interface between the transactional data base and the data mart.

The Dialog and Communication component. Within this specific implementation of the proposed architecture, the Dialog component takes form of an executive dashboard or control panel. The system's main page presents all the essential information, divided into groups by priority:

1. Informative – reminding of routine tasks, notification of indicators returning to acceptable values.
2. Warning – informing of any parameter exceeding the first validation level (specified in the underlying risk model).
3. Alarm – which occurs when a ratio exceeds the threshold set by the factor as an alert area.

All of this information is role-sensitive, i.e. to targeted at specific roles defined in the CFFP's Creativity component. Another important element of the system architecture is the expert system, which performs three fundamental functions [KoST05]:

1. Diagnosis – using a set of observable symptoms to determine the current state of the clients and debtors portfolio (as well as identifying weak signals e.g. from the relations between clients and debtors).
2. Construction – creating detailed user reports based on the diagnoses performed. Importantly, the system allows the user to instantly export data from any table in the system. Owing to this functionality, users may choose to perform further operations on data in a more familiar environment, e.g. using a spreadsheet application.
3. Control – controlling the application by monitoring the user's activities and triggering appropriate actions depending on the current date or behavior of enterprises taking part in the factoring transactions.

The classical ad hoc drill-down search is supported by the system and allows the user to move toward required tables faster and more effectively. This means that the formulation of a drill-down query depends on the conclusion

produced by the system. The query result then fires another sequence of rules, which in turn triggers a further drill-down query. The process terminates in case the system is unable to generate a conclusion and, consequently, activate another query. The objective finding should take place through the discovery of the underlying cause-and-effect chains among the increasingly more detailed information sets delivered in the query reports.

The Modeling component. The modeling process aims to support the user (risk analytics) in detecting symptoms of potential frauds – like non-standard behaviors of clients and debtors during factoring transactions. The variables which the system tracks fall within the following main areas:

- monitoring of payments (looking out for direct payments, i.e. payments from unrecognized accounts; the average payment time),
- analysis of the claims indicator (e.g. the average worth of credit notes, the number of overdue invoices),
- monitoring of invoices in operational factoring data (e.g. the average amount of receivables purchases, the number of recourses),
- monitoring of credit exposure (e.g. the average worth of invoices purchased),
- overdue monitoring (i.e. the number of outstanding invoices and the number of days overdue),
- monitoring of capital-associated companies (i.e. the number and worth of transactions between certain companies),
- monitoring of clients' and debtors' behavior (i.e. the number of recourses over a period, the average [length of] trade credit period).

This approach substantially extends the area in which to search for component combinations most suited to addressing a specific problem, and brings one closer to the selection of the best solution. The author's experience has enabled him to tentatively validate the effectiveness of behavioral analysis in the process of fraud detection and risk management.

The Creativity component. Within the proposed approach, this component is closely linked to visualization and comparison between different values and measures produced by the system. It is creativity that accounts for the possibility to apply user-defined parameters in performing a particular instance of behavioral analysis. Rules can be enforced in two basic ways:

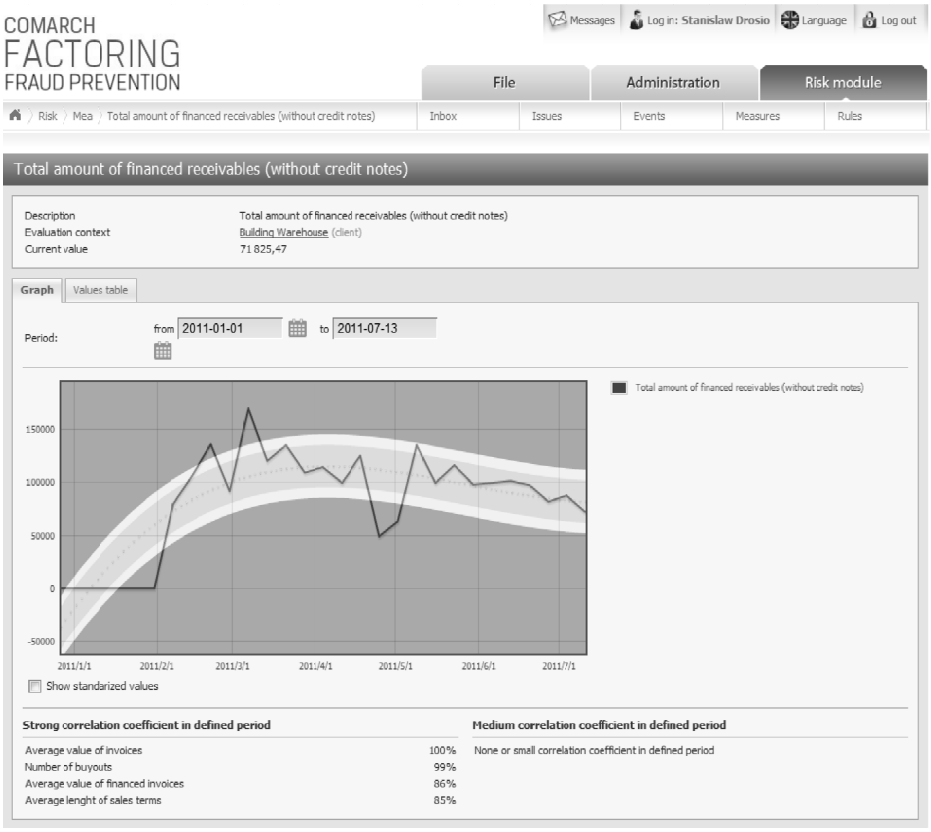


Fig. 4. Visualization of total receivables

Source: COMARCH S.A.

1. By comparison to the fixed thresholds used in analyzing debtor concentration. This is done by computing a value for the relationship between the client and the debtor.
2. Using a percent deviation from the trend line, which makes it possible to take advantage of the self-learning elements within the system (cf. Figure 4). By linking the trend line based on data mart data to the parameters of the risk module, the system will be able to advise the user of sudden changes in values.

Support tools have been implemented, too, such as simulation models, sensitivity analysis and business simulators, and/or strategic decision making games [StDr12], constituting a complementary knowledge resource for use in creative solution finding for future diagnostic problems.

Within the system being discussed, the software architecture also includes creativity elements. The three-layer architecture is made up of the following:

– the data base layer (a data mart), which can be implemented using any viable data base technology, although Comarch does recommend Oracle products,
– the application layer based on Java technology,
– the presentation layer developed using Apache Wicket.

This approach made it possible to apply service-oriented software development elements. As a result, users can customize the tool's basic features to adapt it to their specific needs. In the context of support for the risk management process, a degree of flexibility is crucial, making the tool capable of e.g. functioning under different measurement systems (setting decimal or thousands separators, date formats, etc.).

A business solution and use case

To achieve the system's primary goal and enable it to provide support to end-users, as described below, the operators have to determine the basic configuration of risk models. The process of model definition is based on the parameterization of percentage or linear thresholds. If the parameters of a transaction are outside the allowed range, the system will generate a warning message for the user.

The real goal is then to not only support data analysis by risk management teams, but also to propagate the findings to everyone involved in the process of making decisions as to whether to accept or decline a factoring contract, alter the contract terms, or withdraw from an agreement due to excessive risk of financial loss as a result of fraudulent behavior [Bakk04]. The CFFP addresses these concerns as follows:
– a three-layer system architecture was applied where the presentation layer is placed in the most intuitive environment that today's users can think of – an Internet browser,
– a data mart was employed instead of a full-fledged, complex data warehouse, which was possible owing to the easy-to-establish focus of the data being processed [Dudy03].

However, from a factoring company's perspective, it is the CFFP's inherent mobility that makes the real difference [Sosn05]. In business practice, the tool is deployed in the following four steps:
– launching a server computer to host the application,
– synchronizing data derived from the factor's transaction system,
– configuring the indicators and threshold values for the automated behavioral analysis of debtors in the factoring agent's portfolio,

– the system's automatic operation, resulting in warning signals to get users' attention, triggered on detection of specific behaviors inferable from factoring transaction data.

As a practical outcome, through implementing the tool a factoring broker will be, in the first place, able to diversify sources of data on a factoring transaction and on parties involved. Diversification can be also perceived in the context of the work of specialized risk assessment staff as the mobile application enables them to delegate powers and exploit other personnel's knowledge – for an even smoother factoring process – by involving them in direct interaction with customers.

On an everyday basis, factoring risk managers have to follow and analyze enormous amounts of data on factoring transactions from all parties involved in the factoring business. Comarch Factoring Fraud Prevention addresses their needs by deploying a considerable degree of automation to these processes. Owing to the tool, basic data analysis proceeds automatically, and the system can detect a number of major threats, e.g.:

– split (splitting high value invoices into smaller ones to avoid inspection from the factor),
– detection of incoming transfers from unidentified outside accounts (factors might make out fictitious invoices and pay those themselves in order to boost their financial liquidity),
– unexpected extensions of trade credit periods granted to debtors (it is known to often precede a company's ultimate collapse),
– growing concentration on a single debtor (this may be indicative of collusion between the customer and the debtor).

An automated tool facilitates the observation of such behaviors without engaging the attention of the factoring company's staff. Alongside process automation, staff concerned with risk identification and management is offered neatly organized data on factoring transactions. This obviously accounts for early and more effective fraud detection.

Conclusion

The technologies described above make Comarch's Factoring Fraud Prevention capable of serving all of the factor's personnel who might need data on risk assessments elaborated by specialized departments of banks or financial institutions. Comarch S.A. has designed the tool to deploy mobile support primarily in two areas:

- continuous analysis and delivery of data alongside their visualization in the form of graphs and tables,
- involving more of the factoring agent's staff via the issue processing facility; by delegating the requisite rights and powers to those users who interact with customers, data mentioned at the outset of this section can be instantly verified and updated.

On the other hand, the system has been furnished with high-level overview templates that come in handy in performing such simple procedures as routine customer relations while, owing to its mobility, all that one requires to launch the tool is a login, a password, and a device capable of running an Internet browser (e.g. a smartphone, a tablet, or a conventional laptop computer) [StND13].

In undertaking the research on the data-dialog-modeling-communication--creativity architecture the author and his teammates hoped to devise a useful framework within which to develop decision support systems that could truly rise to today's challenges, needs and expectations in such a difficult business as factoring is. This paper delivers an outline of the author's implementation work done within COMARCH's recent project [WWW1] in an effort to verify the applicability of the proposed architecture, seeking to contribute to the progress of decision support theory and methodology.

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ZASTOSOWANIE ROZSZERZONEGO PARADYGMATU DANE-DIALOG-MODELOWANIE W PROCESIE BUDOWY SYSTEMU WSPOMAGANIA DECYZJI UŻYTKOWNIKA – PRZYKŁAD SYSTEMU COMARCH FACTORING FRAUD PREVENTION

Streszczenie

Niniejszy artykuł prezentuje praktyczne zastosowanie innowacyjnego podejścia do procesu budowy komputerowych systemów wspomagania decyzji (SWD). Podejście to opiera się na przedstawionym w 1999 roku rozszerzeniu klasycznego paradygmatu Spraqea-Carlsona dane-dialog-modelowanie służącego do budowy systemów wspomagania organizacji. Stanisław Stanek w swojej książce zaproponował dodanie do powyższego narzędzia elementów komunikacji, wiedzy oraz kreatywności. W niniejszym artykule zaprezentowano praktyczne wykorzystanie rozszerzonego paradygmatu w procesie budowy narzędzia Comarch Factoring Fraud Prevention, które wspiera podejmowanie decyzji przez użytkowników końcowych w zarządzaniu ryzykiem na potrzeby realizacji transakcji faktoringowych.

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THE HEURISTIC EVALUATION OF VISUALIZATION IN SEARCHING ECONOMIC INFORMATION IN THE TOPIC MAP. THE PROPOSAL OF A RESEARCH METHOD

Introduction

Nowadays there is a need for solutions which allow obtaining information from different, scattered sources in order to integrate, analyze and present them in various layouts, as well as discover new knowledge. More and more attention is paid to the use of semantic technologies such as a topic map (TM) as a solution that can be used to search and acquire unique information (see e.g. [WuSm08]). Usually TM is a semantic graph which contains definitions of a set of topics and a set of associations between topics called ontology of a domain. Used visualization of the semantic network in TM can provide valuable assistance for the economic data analysis and decision making tasks.

Issues of searching information basing on semantic network technologies is a subject of many studies and concerns various fields (see inter alia [AAOL04]; [WuSm08]; [WIEN10]; [Yi08]). It is caused by the users' need to search information also on account of contextual connections. In this approach the special attention is paid on the role of the visualization of a semantic network which is not only a tool for presenting data, but also provides an interface allowing interactive visual searching information (see inter alia [GrSo10]; [WIEN10]). Interactive visualization of data supports innovative looking on information, allowing user to formulate new hypotheses and their validation. Graphical methods and techniques can increase effectiveness of used automated exploration data methods by using perception and user's general knowledge [KeSc05, p. 1767].

Visualization in TM allows navigation from a topic to a topic in a highly interactive manner: interesting nodes can be put in the foreground with zooms, translations and rotations. Fundamental factors for a good visualization of the application of TM are:

1) the overview of the structure for the global understanding of the structure and of the relationships within the hierarchy,
2) the ability to zoom and to select some nodes,
3) dynamic requests in order to filter data in real time.

One of the most pressing questions about visualization-based information retrieval systems is: "Can people use them?" (see [Kosh05, p. 824]). This question can also be raised for the semantic searching in TM for the analysis of economic indicators, where the visualization plays important role. Systems that enable information retrieval should be intuitive to use and easy to interpret by the users.

The aim of the present article is to present the proposal of the research method of the heuristic evaluation of visualization in searching economic information through a topic map. The article is structured as follows. The first section presents shortly the evaluation of the usability of IT system. In section 2, there is a brief description of the planning the research. In section 3, the proposal of a research method on the usability of the visualization of semantic network in searching economic information is discussed. Finally, in the last section there is a summary of the work.

1. The evaluation of usability of IT system

The standard ISO 9241-11 defines the usability of IT systems as the three components: effectiveness, efficiency and satisfaction. A well-designed user interface facilitates inter alia the performance of user's task (effectiveness) and provides the pleasure of its use (satisfaction). J. Nielsen defines the usability of an IT product by such component characteristics as: ease of learning, effectiveness in achieving task objectives, ease in remembering gained skills, tolerance for human errors, as well as creating user satisfaction, understood as subjectively perceived enjoyment from using the system [Niel93]. B. Shneiderman defined five measures essential in studying the system usability: system familiarity time, task performance speed, errors in task assignments, system feature retention, and subjective satisfaction [Shne98]. However, in the research on evaluation of visualization in searching economic information the following parameters are important: information retrieval speed, errors in interpretation of data (errors in task assignments), and subjective satisfaction.

One of the most important areas of IT system is the user-system interaction design, because [Siko12, p. 12]:

- usability requirements are usually not given in a quantitative manner (as measurable parameters), and the evaluation of their fulfillment is often subjective,
- the impact of psychological and social factors requires performing experiments, tests and studies involving users.

In literature many methods of the research and evaluation of the system usability and human-computer interaction are described (see inter alia [LaFH10]; [Siko12]; [Siko10]; [TuAl08]). The study of a prototype is conducted with the participation of experts (e.g. heuristic evaluation, inspections, reviews, checklists) and/or users (e.g. usability tests, eye tracking, evaluation by observation). There are many questionnaires of heuristic evaluation and checklists for evaluating user interface, available both in the literature (see e.g. [RaJo89]; [Siko10]) and on the Internet (see e.g. [Pier12]). We suggest two research methods on the usability of the visualization of semantic network in searching economic information. These are usability tests and heuristic evaluation.

2. The design of research

TM application may be a useful tool in the visual searching of information for decision-makers. However, firstly the method requires a study of the solution. Our study has been carried out in the two main phases and five stages (Figure 1).

Phase 1 is a conceptualization of the ontology of economic indicators and creating TM application. The goal of this study is to verify the concept of using TM standard for the model of knowledge about analysis of economic indicators. This phase consists of three stages.

The first stage consists of the creation of the ontology for the selected analysis of economic indicators. This stage can be realized either by a team consisting only of economic experts or by a team in which they participate. Additionally this ontology should be reviewed by other economic experts. Experts in economic indicators should be involved in the process of creating ontology in order to use an appropriate vocabulary and consider semantic connections that can be tacit knowledge (see inter alia [SaST07]). However, if the ontology is built by the team consisting only of economic experts it should be reviewed by the experts of the ontology design. Created ontology is independent of any IT solution.

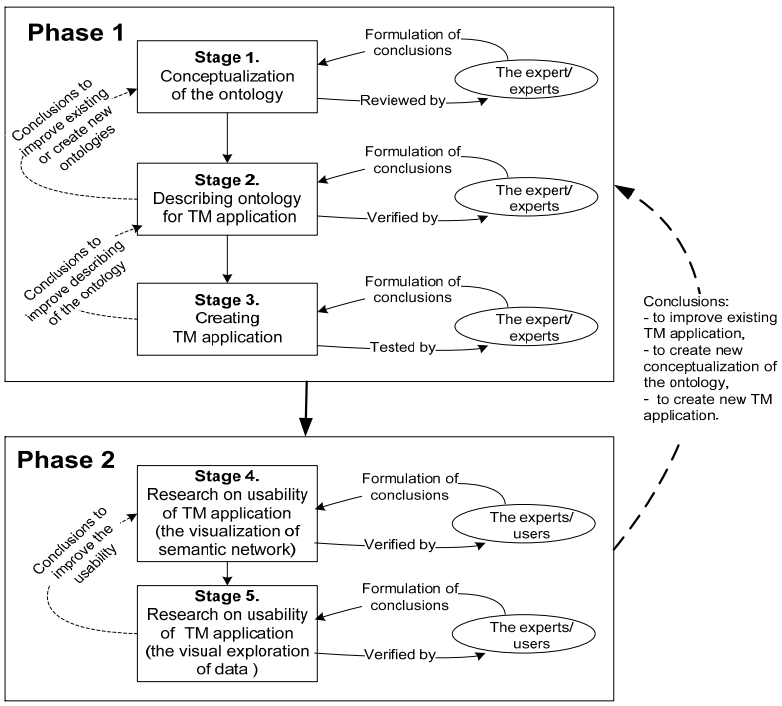


Fig. 1. Scheme of the design of the research on the visual exploration of information using the semantic searching based on the applications of TM

Source: [Dudy12, p. 132].

In the second stage the ontology is described in the topic map standard. This stage is realized by people knowing TM standard. Furthermore this description of the ontology is verified by economic experts. Created ontology is described in the topic map standard, and therefore dependent on a specific IT solution. In case of building ontology in order to create TM application, stages I and II can be merged, that is at once describing created ontology in TM standard. If the ontology for the selected analysis economic indicators already exists for other IT systems, stage I can be omitted, that is we can begin from describing the existing ontology in the topic map standard.

In the third stage a topic map application is built, which is then tested by the experts. Results of this work are inter alia the following: the creation of TM application for a specific field of analysis of economic indicators, the creation of the procedure of building TM applications for the ontology of the analysis of economic indicators (based on the analysis of existing methods and methodologies), and the verification of the visualization semantic network in TM for searching and acquiring unique information on economic indicators.

Phase 2 is a study on the usability of the visualization in economic information retrieval in TM application. The goal of this study is to verify the usability of applying the visualization of semantic network in TM in searching and acquiring unique information in the analysis of economic indicators. This phase consists of two stages (numbers 4 and 5).

The fourth stage is the heuristic evaluation of the visualization in searching economic information in a topic map. The research is carried out with the participation of experts and potential users.

In the fifth stage the visual exploration of data from all relevant subsystems existing in an enterprise is verified by decision-makers using TM as a model of economic knowledge representation. Results of this stage are inter alia the following: the evaluation of the usability of visualizing a semantic network based on TM, the solution of the problem of large number of topics in using TM as a tool enabling a visual exploration of a huge, complex and multidimensional data set.

Research in the phase 2 is carried out on the basis of the model proposed by E. Brangier (the usage – adaptation – re-engineering cycle), "(…) which highlights how human adaptations (of the users) are a source of innovation to design new uses" [EASB09]. These studies enable to identify users' needs precisely and may contribute to the development of innovations (see [Dudy12, p. 134]).

Between phases of proposed research method there is a feedback, i.e. conclusions from the second phase influence both the improvement of the created a topic map application and procedure of creating the ontology and TM for the analysis of economic indicators.

The characteristic feature of proposed approach is the process' interactivity at the level of both phases and stages. This procedure assumes cooperation of creators of the ontology and a topic map application with economic and financial experts and potential users.

3. The proposal of a research method

The topic map can be one of various tools for the information visualization, which – as a visual interactive interface – allows decision-makers to search information. However, it requires carrying out a research on the usability of visualization in searching information. Before starting the research on the system utility we have created an ontology for economic indicators and built TM.

In the heuristic evaluation of visualization in searching economic information in a topic map the applied method is a combination of two methods of evaluating interface enabling human-computer interaction that is heuristic evaluation and usability tests. In literature there are described many procedures

using these methods. Basing on the research procedure proposed by M. Sikorski (see e.g. [Siko12]; [SiGa10]), research with the use of these two methods is realized according to the following plan:

1. Creating test task for the usability testing and questionnaire of heuristic evaluation of TM application for ontology economic indicators.
2. Study with participation of users and experts:
   2.1. Selection of research participants.
   2.2. Introduction to the study (short training: 20-30 minutes).
   2.3. Performing usability tests.
   2.4. Heuristic evaluation of usability of using the visualization of semantic network in searching information.
3. Data analysis on account of the following criterions:
   − correctness of performing tasks,
   − evaluation of easiness of finding information,
   − evaluation of interface usability,
   − identification of potential difficulties connected with used human-computer interaction.
4. Discussion of results and conclusions.

Presented procedure contains both tasks to be performed by research participants and heuristic evaluation of visual searching information.

In the first stage of this procedure questionnaires are prepared. They consist of three parts. The first part contains tasks to be performed by a user, which consist in searching needed information basing on visualization of semantic network. Research participant writes answers (that is found information). Orders are placed from potentially easiest to hardest to accomplish. In this part of the questionnaire heuristic evaluation is also used. For every task there is a table in which, after performing the task, a research participant assesses the difficulty in finding information. In the questionnaire five-grade scale was used: *very easily (quickly)*, *easily (quickly)*, *average, hard (long)*, *very hard (long*).

The second part of the questionnaire contains some criterions of an interface evaluation. The evaluation of visualization in searching economic information can be conducted in terms of the following four criterions:

1. How would you rate the system in terms of visual clarity?
2. How would you rate the system in terms of its functionality (in the context of searching information)?
3. How would you rate the system in terms of flexibility of its structure and the presentation of information?
4. How would you rate the way of searching information which is based on the visualization of semantic network?

Each of listed criterions is assessed by a user according to five-grade scale, i.e.: *highly satisfactory*, *satisfactory*, *average*, *unsatisfactory*, *and very unsatisfactory*.

The third part of the questionnaire concerns identification and evaluation of potential difficulties in using the system. It is very important part of the research. In case of evaluation of the visualization in searching economic information these difficulties can be as follows:

1. Understanding how to navigate the *OntoGraf*.
2. Understanding how to perform tasks.
3. Understanding the relation between the information on the screen and the performed operation.
4. Finding necessary information.
5. The difficulty in reading the information on the screen.
6. Too many colors on the screen.
7. The necessity to memorize too much information during the execution of the task.
8. Understanding names of relations between topics.

Participants of the research choose one of the following answers: *no problem*, *a small problem*, *an important problem.*

The preparation of questionnaires is followed by the process of carrying out the research. The important issue is the selection of research participants, because they cannot be random people. They need to fulfil a double role. The first one is to be a typical user, performing specific tasks in a topic map application for ontology indicators (research using the usability testing technique). The second role is to be an expert evaluating the usability of the applied interface (research using the heuristic evaluation of a user's interface). The selection of the research participants allowed obtaining a group of people, who had various experience and knowledge concerning economy and analysis of economic indicators as well as systems and information technology, e.g.: with only computer education, computer science and econometrics education, economic education, non-computer education. None of them searched information basing on the visualization of ontology before or was familiar with the topic map program.

Before performing usability tests by a user there is an introduction, in which it is shown how to open the application with an ontology and what is the idea of semantic search and the topic map standard. The introduction should not be longer than 30 minutes.

After executing usability tests, the same people perform the heuristic evaluation of the visualization in searching economic information in a topic map.

Obtaining data from the research is followed by its analysis according to different criterions (i.e. according to presented four basic ones listed in presented procedure of research).

The analysis of responses in the questionnaire is to help verifying the correctness of the realization of tasks by research participants. This research can also tell how easy and clear is searching information with the use of the visualization of the semantic network, for a user who is not familiar with the topic map application.

The important part of the research is data obtained from the third part of the questionnaire (i.e. the identification and evaluation of potential difficulties of using the system). Its analysis allows both improving the interface and better preparing training for potential users of the topic map application.

The research following the presented research method was carried out twice: firstly for the ontology for return on investment (ROI) indicator, then for the ontology for early warning system. The conclusions from the verification of the first application were used in the creation of the application for an early warning system, whereas the conclusions from the heuristic evaluation of the second? application allowed us to better prepare a user-based study with the use of the application for the early warning system.

4. Discussion, implication, and conclusion

There is still problem of defining good solution that will allow representing economic knowledge in information systems. There are three reasons of that. Firstly, there is not still good representation of economic knowledge in information system. This is because economic phenomena usually have weakly structuralized form, and characterized with changeability. Secondly, knowledge on this subject is usually expert knowledge (so called hidden). Thirdly, there is lack of tools that would be appropriate to illustrate ontology covering economic reality, and at the same time would be effective and friendly solutions for users, and especially for decision makers.

Listed reasons caused developing the conception of using TM: as a model of economic knowledge, which put emphasis on data semantics and ease of finding desired information, as the useful visualization in searching and acquiring unique information, as a visual interactive interface, which allows decision-makers to search information. The present concept constitutes the new, original research subject. In the literature there is no the holistic approach to the research problem concerning the application of the topic maps to represent economic

knowledge in the information system. In the present article the emphasis was put on presenting the concept of the original method including the interdisciplinary way for conducting research related to the use of the topic maps to representation of economic knowledge in the information system. The essential element of this article is the description of the research method of the heuristic evaluation of the visualization in searching economic information. Presented procedure was verified twice by carrying out the research on applications built for the ontologies for ROI indicator and early warning system. This research is the first formal user evaluation of an application for the ontology for the selected analysis economic indicators.

The essential element of this study, unprecedented in the field of works related to usage of topic map, is research on evaluation of usability of topic map application. This issue is especially important in case of developing information systems for decision makers. In the literature there is lack of complex presentation of problems related to research on using topic map standard to represent economic knowledge in information system and evaluation of its usability in interactive and visual searching needed information.

The methods and the results presented in this article can be useful tips and recommendations of the usage of TM as a model of economic knowledge for other researchers, systems designers and managers.

The research, based on the presented methods, will be conducted in two ways: testing created topic maps applications for selected areas of the economic analysis and studying the usability of visualizing semantic network to search information. The presented methods in this article will be used during the InKoM project, which is conducted by a consortium led by the University of Economics in Wroclaw, and the other principal member is the company UNIT4 TETA BI Center. The work is supported by the National Research and Development Centre within the Innotech program (track In-Tech), grant agreement no. 153437.

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HEURYSTYCZNA OCENA WIZUALIZACJI W WYSZUKIWANIU INFORMACJI EKONOMICZNEJ W MAPIE POJĘĆ. PROPOZYCJA METODY PROWADZENIA BADAŃ

Streszczenie

Obecnie istnieje potrzeba rozwiązań, które pozwolą na uzyskanie informacji z różnych rozproszonych źródeł w celu pozyskania nowej wiedzy. Coraz więcej uwagi poświęca się wykorzystaniu technologii semantycznych, w tym bazujących na standardzie mapy pojęć, który może stanowić strukturę do zapisania opracowanej ontologii dla określonego obszaru wiedzy. Wizualizacja sieci semantycznej w mapie pojęć umożliwia interaktywną nawigację umożliwiającą zarówno przeglądanie struktury, jak i analizę szczegółów w celu filtrowania danych w czasie rzeczywistym. Tworzone systemy z mapą pojęć mogą potencjalnie stanowić użyteczne rozwiązanie wspomagające kadrę kierowniczą w pozyskiwaniu potrzebnych i unikatowych informacji ekonomicznych. Wymaga to jednak przeprowadzenia badań. Weryfikacja zastosowania standardu mapy pojęć zarówno jako struktury reprezentacji wiedzy, jak i wizualnego interfejsu jest realizowana według metody badawczej, która składa się z dwóch faz. Celem niniejszego artykułu jest omówienie zaproponowanej procedury badawczej i koncentracja na fazie drugiej, której celem jest weryfikacja zastosowania wizualizacji sieci semantycznej w mapie pojęć jako wizualnego interfejsu w pozyskiwaniu informacji.

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MODELLING OF COMMERCIAL WEBSITES. A NEW PERSPECTIVE ON USABILITY AND CUSTOMER RELATION

Introduction

Internet development and its market expansion result in the necessity to expand the research on the factors that impact customers behaviour to incorporate shopping for products and services online. From the economic point of view, the skills of winning customers and, first of all, keeping them is a critical aspect of the activity of modern websites offering online services. The process of loyalty building is the creation and cultivation of positive relationships with service consumers. Such relations should be based on client perceived high quality of services and on trust to the service provider [SrAP02; WLJB10].

Previous studies [e.g. DrJe05; HJJM09] have shown that factors affecting users' trust in web services may be assigned to two fundamental groups: construction features of service websites and users' characteristics. The first group includes technical quality, ergonomics and the information content of the website. The second one comprises social factors such as trust, a tendency to take risks, approach to the safety issue and user experience associated with previously visited websites.

However, in view of dynamic development of online services and the employment of modern technologies, the existing approach so far, appealing to quality and information attributes of service websites and generalized characteristics of users turns out to be insufficient [Siko08]. Therefore, the authors of the present study made an attempt to apply a Visual – Interaction – Process – Relation (VIPR) layer model (described in further sections) for commercial websites.

Models of building relationships in web services

According to literature data, there are many models trying to reflect the impact of various characteristics, concerning both web services and users, on building relationships between service providers and customers. These models are focused on certain aspects of relationship building, such as:

- building loyalty [HwKi07; GaBa08; Palv09],
- usability and technical quality of the website [SrAP02],
- perception of transaction risk [DrJe05; KuKn05; LNMC08],
- the impact of customer experience on the evolution of the retailer-customer relations [HJJM10; ZFWR11],
- satisfaction as a source of customer loyalty [LiWa06; PhVo10].

Visual – Interaction – Process – Relation layer model

As already mentioned, dynamic development of online services has caused that the existing approach to the attributes of web services and characteristics of customers turned out to be insufficient to describe the complexity of building relationships between service providers and customers. Hence, a necessity emerged to seek new methodologies in this field. A VIPR layer model of the quality of online services [SiWa09] is a proposal extending the perspective of building relationships between service providers and customers beyond the groups of factors named above.

The VIPR model describes technical attributes of online services supporting the completion of a service and affecting consumer behaviour. The attributes have been assigned to four layers:

- "V – **V**isual user interface layer, facilitating perceptual/manual operations,
- I – **I**nteraction layer, facilitating user-system dialogue progress,
- P – business **P**rocess layer, facilitating subsequent steps in selecting, purchase and payment,
- R – economic value/**R**elation layer, affecting willingness of the consumer to come back, buy again and to recommend this service/website to others" [SiWa09].

The latest studies carried out by a service decomposition method [Siko12] have demonstrated that elements of online services should be examined in eight categories: *Visual clarity*, *Interactivity*, *Ease of use*, *User guidance*, *Information content*, *Personalization*, *Recommendations* and *Customer care*. It is worthy of notice that these categories resemble those proposed in [SrAP02], although their

connection to the VIPR layers is a novel approach. The VIPR model extends the perspective beyond constructions and technological features of service websites to include also process and relational factors.

The aim of the present study was to apply the VIPR model to commercial web services and examine relationships between individual layers of the model and categories relative to building long-term relations with customers.

Methods

Opinions of customers of commercial websites was measured by means of the authors' 27-item Web Services Credibility Scale (in the appendix in the Polish language version). Eight factors were distinguished according to the VIPR model: *Visual clarity*, *Ease of use*, *Interactivity*, *User guidance*, *Recommendations*, *Customer care*, *Information content*, *Personalization*. The respondents were asked to express their opinion on the relevance of individual criteria as regards the credibility of the online provider. The perceived credibility was assumed to be an indicator of trust level and of building long-term relationships. A 5-point answer scale was used, where 1 denoted "definitely reduces the credibility" and 5 "definitely improves the credibility".

207 students of the Faculty of Management or Computer Science, 106 men and 101 women, took part in an anonymous, volunteer questionnaire survey. All respondents were experienced users of commercial web services. Students below 25 years of age were the most numerous group (87%). The selection of the group was intentional since, according to current surveys (e.g. NetT12), persons in this age group account for more than a half the population of Polish Internet users.

The results were analyzed using a STATISTICA 10.0 computer program. Descriptive statistics of individual factors and *r*-Pearson's correlation coefficients were calculated. The Bonferroni correction applied to control type 1 error was calculated by dividing the expected alpha significance level ($p = 0.05$) by the number of tests conducted. The reliability of factors having at least 2 items was evaluated using Cronbach's alpha coefficients. For exploratory analysis, data clustering was employed to show their structure. Euclidean distance was chosen to calculate the distance between the objects and the single linkage rule was applied for agglomeration of clusters [KiMi09].

Results

Descriptive statistics are given in Table 1.

Table 1

Web Services Credibility Scale – descriptive statistics of the factors

Factors	M	SD	Range	Skewness	Kurtosis
F1: Visual clarity	3.85	0.59	1–5	-0.2	-0.07
F2: Ease of use	3.87	0.56	1–5	-0.3	0.33
F3: Interactivity	4.11	0.53	1–5	-0.1	-0.35
F4: User guidance	4.07	0.63	1–5	-1	2.59
F5: Recommendations	4.25	0.64	1–5	-0.9	0.89
F6: Customer care	3.79	0.82	1–5	-0.3	0.11
F7: Information content	4.14	0.45	1–5	-1.2	4.05
F8: Personalization	4.2	0.79	1–5	-1.3	2.23

Mean values reflect the force of influence of individual factors on customer perceived credibility of web services. High values of skewness and kurtosis for *Information content* and *Personalization* may be a sign of their great significance for credibility. Standard deviations of *Recommendations* and *Personalization* are higher than those of the remaining factors. Such a spread of results may indicate that not all users expected this type of elements in the web service.

Next, *r*-Pearson's correlation coefficients were obtained with the Bonferroni correction (Table 2). The values of Cronbach's alpha reliability coefficients of individual factors are placed on the diagonal of the table.

Table 2

Correlations between the study factors

Factors	F1	F2	F3	F4	F5	F6	F7	F8
F1: Visual clarity	0.76							
F2: Ease of use	0.8	0.72						
F3: Interactivity	0.41	0.43	0.03					
F4: User guidance	0.43	0.49	0.24	0.62				
F5: Recommendations	0.23	0.37	0.18*	0.44	0.8			
F6: Customer care	0.57	0.56	0.23	0.41	0.29	-		
F7: Information content	0.49	0.41	0.33	0.33	0.3	0.32	0.62	
F8: Personalization	0.34	0.44	0.34	0.42	0.44	0.35	0.31	0.76
Note: * $p < .01$, the remaining correlations: $p < .001$ (the Bonferroni correction 0.05/28 = 0.0018). Cronbach's alpha reliability coefficients are placed on the diagonal								

The values of correlation coefficients indicate strong interactions between individual factors. Moreover, positive values of the coefficients are the evidence that the factors considered strengthen one another. Cronbach's alpha coefficients suggest good reliability of the factors, except *Interactivity* (consisting of two items).

Cluster analysis was used for a better specification of the structure of relationships between individual factors (Figure 1).

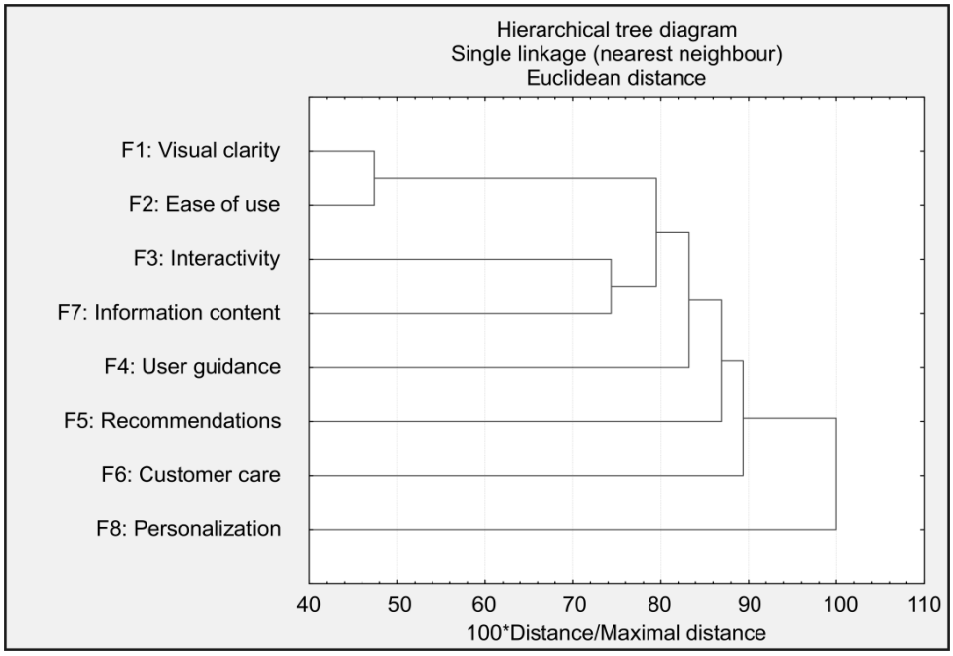


Fig. 1. Cluster analysis: Hierarchical tree diagram

Visual clarity, *Ease of use*, *Interactivity* and *Information content* made up one group, whereas each next factor formed a separate element.

Discussion

The results obtained indicate that customers of commercial websites notice the differences in the significance of individual attributes for building strong relationships with service providers. Factors which build up the usability, i.e. both *Visual clarity* and *Ease of use*, were the least important. This group included also *Customer care* (represented by one item) connected with general impressions evoking positive emotions in customers. It may be presumed that this is not a perfect example for the care about the client, reflecting perceived website aesthetics rather.

Considering the importance for customers, *User guidance* and *Interactivity* were ranked higher than the factors named above. *Information content* was even more important for consumer trust in web services. Although *Personalization* and *Recommendations* were ranked the highest by respondents, these factors were not so important for all users (a wide range of answers). These are probably quite new needs of users which have emerged along with the growth of competition on the online services market. A great developmental potential should therefore be seen for companies in these aspects.

The analysis of the mean values of individual factors has shown that the elements distinguished are arranged in 4 levels which may be presented in the form of a pyramid (Figure 2). These levels are equivalent to layers in the VIPR model.

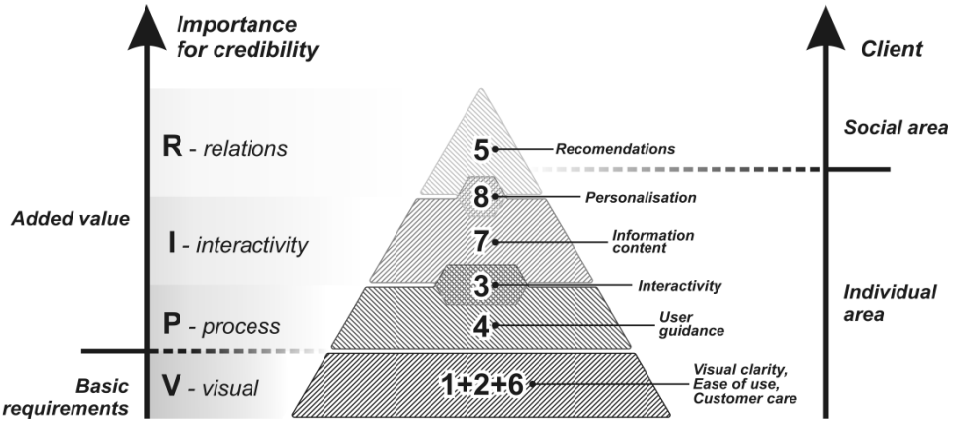


Fig. 2. Model of factors' importance for perceived e-retailer credibility

The base of the pyramid is formed by factors building the functional quality (*Visual clarity* and *Ease of use*), and by *Customer care*. These elements primarily affect general impressions of the user on the first visit to the website. If these impressions are not positive enough, the user may give up further exploration of the site. Therefore, the creation of a high-quality website within constituent categories of the layer is a fundamental requirement the website should meet to encourage the customer to use the service.

The second level of requirements is occupied by elements affecting the fluidity of the process: *User guidance* and *Interactivity*, that latter being assigned also to the third level. The website should guide the user to finalize the transaction easily and as quickly as possible. In addition, this process should be accelerated by interactive elements.

The third level comprises *Interactivity*, *Information content* and *Personalization*. *Information content* is a key element of this level, enabling comparison of the offer of a given website with offers of competing web services. Therefore, the diversity of information may be a strong point in gaining advantage in the competition. The connection of this level with layer I (*Interactivity*) of the VIPR model is not accidental. *Interactivity* and *Personalization* are by nature related with the interactivity of the website. However, the bulk of information available requires not to stun the user with its mass but to provide only such part of it which refers to the service demanded. Interactive solutions, adjusted to the current task, should therefore be applied.

The highest level is intended to build relationships with the customer by adjusting the offer and the website to personal needs of the client (the so-called "tailoring") and by providing opinions and recommendations concerning the service website.

While the base of the pyramid is formed by fundamental constructional requirements for the website, the higher levels constitute an added value intended to build advantage in the competition by strengthening trust and deepening the relationships.

It is worth noting that almost all categories refer to the interaction between individual users and the service website. Only *Recommendations* situated at the top of the pyramid are related with the social area. Humans, being social animals, seek opinions and information on objects and phenomena they are not sufficiently experienced with [Aron72]. Social networking websites are the most common source of such information. Being aware of this fact, service providers, apart from own commercial website, create and keep profiles on such social websites, thus additionally strengthening the relationships with customers.

It is recommended to service providers to make their best to mould positive opinions about themselves and the services offered. This concerns both opinions and recommendations directly reaching the customer and those expressed by other users or institutions.

Conclusion

The significance of commercial websites attributes for building customer trust was diversified. The attributes were arranged in layers, beginning from the basic usability of the service website to the highest layer involving relationships with customers. Here, similarity to Maslow's hierarchy of needs [Masl54] comes to mind. It can be presumed by analogy that the usability satisfies basic needs of

customers, related with perceived website quality, whereas the higher levels constitute the added value, being the answer to higher order needs.

It has been demonstrated that when entering the interaction with the service website, the user acts as an individual being, expecting satisfaction of own needs. Such behaviour is observed in the lower layers of the pyramid. When the user wants to make sure of taking the right choice, he acts as a social being, asking other users or institutions about their opinion. This behaviour is connected with the relationship layer which is the most important for the perceived provider credibility and for building relationships with the customer.

In summary, on the one hand the study presented has confirmed suitability of the VIPR model in modelling of commercial websites. On the other, it has revealed the sequence of layers of this model. Moreover, the layers turned out not to be mutually independent. They overlap and smoothly penetrate each other.

The indication of two dimensions: basic – added values and individual – social area has shed a new light on human-computer interaction. This is the strong point of the present survey. The first dimension shows the significance of the VIPR model for building the credibility of the service provider, from the basic to added values. The second one places the significance of these layers in the area ranging from individual relationships with the customer to the social aspect, when the customer adds opinions of other users to his/her relationships with the service provider. This sheds a new light on the human-computer interaction, particularly from the economic point of view.

It is worth emphasizing that the results were based on the measurements of individual opinions of users who were engaged in the relationships building process. It would have been difficult to obtain such results by using an expert approach only. The research, however, has two major limitations. First of all, it has been conducted on a random sample consisting of students only. Secondly, the research has focused on online shopping in general without considering specific character of certain goods.

Further studies focused on building customer – service provider relationships should be carried out. The attempt to apply the VIPR model to commercial web services turned out to be satisfying and delineating new research trends.

Appendix

Web Services Credibility Scale

Item No	Item
F1: Visual clarity	
17	The sites do not open properly in some Internet browsers (e.g. Opera)
22	The sites are legible and clear
23	The web site structure is clear
30	Graphic design is polished and easy on the eyes
F2: Ease of use	
18	The store site has a local search engine
21	The site menu is clear and allows access to basic functions of the site
25	It is easy to find the required information and goods on the site
28	The web site is user friendly and useful
F3: Interactivity	
9	The web store provides information on the goods shipping options
11	The wait time for the ordered products is long
F4: User guidance	
19	The web store protects the transmitted data against capture
20	The web store provides information on how the customers' personal data are stored and used
26	The website provides a help system explaining the ordering process
F5: Recommendations	
13	The website provides a user forum enabling the exchange of opinions between the store customers
14	The information about a product includes customers' opinions about such a product
15	The web store has recommendations from known institutions and the media
16	The web store presents the opinions of experts and test results
F6: Customer care	
29	Homepage encourages to enter the website
F7: Informational content	
2	No web store registration data
3	The price information is unclear or placed in an inconspicuous place
4	The offer is wide and up to date
5	Product information is extensive and complete
6	Product information includes high quality images
7	The information on the website contains errors
8	The information on the website is incomplete
F8: Customisation	
10	The web store accepts numerous forms of payment (credit card, cash, bank transfer, etc.)
12	The customer can choose the shipping method (e.g. mail, courier, etc.)

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MODELOWANIE KOMERCYJNYCH SERWISÓW INTERNETOWYCH – NOWE PERSPEKTYWY W ZAKRESIE UŻYTECZNOŚCI I RELACJI Z KLIENTAMI

Streszczenie

Z ekonomicznego punktu widzenia krytycznym aspektem działalności serwisów usług online jest umiejętność utrzymania klientów. Celem artykułu było zastosowanie modelu warstwowego VIPR (Visual – Interaction – Process – Relation) w odniesieniu do usług handlowych online.

Wskaźnikiem zaufania i nawiązywania trwałych relacji były oceny doświadczonych użytkowników serwisów handlowych online (n = 207) uzyskane za pomocą Skali Wiarygodności Internetowych Serwisów Handlowych, która mierzy 8 czynników, takich jak klarowność wizualna, łatwość użycia, interaktywność, prowadzenie użytkownika, rekomendacje, dbałość o klienta, zawartość informacyjna i personalizacja.

Czynniki: klarowność wizualna, łatwość użycia, interaktywność oraz zawartość informacyjna tworzyły jedną grupę. Każdy następny czynnik stanowił odrębny element. Dla klientów najmniej ważne dla wzbudzania zaufania były klarowność wizualna i łatwość użycia (wartości podstawowe, obszar indywidualny). Najwyżej oceniano personalizację oraz rekomendacje (wartości dodane, obszar społeczny). Zwłaszcza rekomendacje reprezentują nowe potrzeby użytkowników, które pojawiły się wraz z rozwojem konkurencji na rynku usług online.

Pozytywnie zweryfikowano model VIPR. Wskazanie dwóch wymiarów: wartości podstawowych – dodanych oraz obszaru indywidualnego – społecznego daje nowe spojrzenie na interakcję człowiek – komputer.

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TOWARDS HUMAN-INFORMATION SYSTEM INTERACTION MODELS DERIVED FROM EYE-TRACKING DATA

Introduction

Eye-tracking has been employed in usability testing of interactive information systems for more than a decade. The main use of eye-tracking has been limited typically to examining temporal patterns of eye-gaze locations. This kind of data and its visual representation can reveal interesting aspects of user interaction with information systems and help to identify usability problems. There is, however, much more can be learned from eye-tracking, including specific mental states of users during interaction. To learn user mental states, we propose creating intermediate constructs from eye movement data and then correlating them with higher-level constructs such as the user's task type and task difficulty, cognitive load, and level of the user's knowledge. This approach to processing eye movement data from user interactions with information systems provides a high-resolution user-centric view of the process. It is also a novel methodology to investigate task, individual differences (e.g. knowledge and cognitive abilities), and interactions with information systems.

Motivation and Our Approach

Our research in human-computer information retrieval (HCIR) aims to improve *understanding* of human information search mediated by information systems. The goal is to *enhance* search user interfaces and learn how best to adapt information systems to support the user in achieving their goal.

Information retrieval (IR) systems that do not take account of the user or their task provide less than optimal support. If users would indicate which documents

they found useful during a search, then a representation of that document, that is some selected words from the document, could be added to the user query in order to allow the search system to find documents that are more likely to be useful to the user in their task. This procedure of selecting words from documents likely to be useful to the user has become one of the most important elements in improving information retrieval systems and is now a core part of all of the search engines. These systems take a user's query and run the search. From the results of that search a number of terms are selected from the highest ranked documents and added to the query. Then the expanded query is run again and those results are returned to the user. This procedure is called pseudo-relevance feedback (PRF) and is used by all of the major search engines. The "pseudo" in PRF comes from the recognition that the highest ranked documents that supplied the terms may not in fact be relevant to the user. If a system could have some other mechanism that better identified documents useful to the user, then the performance of the IR system could be further improved. Since users will not typically supply explicit indications of document usefulness, the idea of learning implicitly the documents that are useful has been a significant research thread for IR. One approach that has received a lot of attention is to discover which documents are useful from observations of user behaviors during information search. A behavior could be clicking on a link to reach a document, a revisit to a document, the time of viewing the document, mouse movements, and so on. The general idea in this research is to make a model from these behaviors that makes predictions of document usefulness for a new behavior observation [Kell05].

Another source for implicit information about user interactions with information systems is eye tracking. Data collected by eye trackers has been used in IR as an additional evidence for information relevance. The focus has been on eye fixations, for example to indicate which items are considered in ranked search results pages [BrHo08; PaHe07], or in identifying words useful for relevance feedback [BuDe08; LoBr11]. In contrast, we use eye-tracking data to calculate objective measures of a user's cognitive processing related to reading and interacting with text.

Two important discoveries from reading research explain why eye movement-based approaches can reveal user mental states during interaction with an information system. First, eye movements are cognitively controlled [FiGi03] and directed by the processing needs of a task [TrBa03]. Second, the duration of observed fixations indicate current mental state of acquiring information because the eyes remain fixated during the lexical processing period independently of the stimuli, for example even if the word is removed [FiGi03]. The next saccade takes place only after lexical processing is completed. It is possible that the user

could be looking but not really seeing the word and so engaging the machinery that does the lexical processing. Recent research has established that such 'mindless reading' can be detected (e.g. [ReRe10; ShNu12]).

These two facts mean that observations of fixation properties are also direct observations of at least the user's immediate state of processing the information. One can infer other mental states from these direct measurements of processing states. For example, familiar word meaning is acquired faster than unfamiliar meanings. This is an implicit indication of the user's level of domain knowledge. So, it is possible to infer something about user knowledge levels from observations of reading eye movements under assumptions about language features involved in the mind's representation of concepts.

Methodology

We model aspects of a user's interactive (text-based) information search using a reading model inspired on the E-Z Reader model [RePo06]. We implemented a simple, line-oriented reading model influenced by the E-Z Reader. The E-Z Reader model is a cognitively-controlled, serial-attention model of reading eye movements. It takes word identification (i.e. it is not a sentence processing model), visual processing, attention, and control of the oculomotor system as joint determinants of eye movement in the reading process. Our algorithm (Figure 1) considers eye-fixations long enough (>=113ms) for users to identify words (semantically) to select those fixations that likely to result in word meaning acquisition. We use temporal as well as spatial features of lexical fixations and classify them into two reading sequence states: reading text in a line (called a reading state), and reading isolated words (called a scanning state) and calculate state transition probabilities between the two states. [CoGw11-1] provides implementation details.

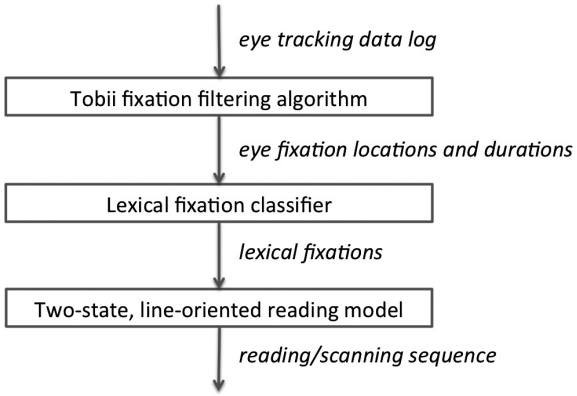


Fig. 1. The main components and the flow of processing in our reading model algorithm

Cognitive effort measures

Several measures based on reading fixation sequences have been developed. Studies of reading employ these measures but they have not been construed by others as cognitive effort, per se. The measures are:

1. *Lexical access duration excess (LADE)*: fixation duration in excess of the minimum required for lexical processing. Fixation duration is an indicator of the cognitive processing required to establish the meaning of the word, and the meaning of the word in context. The mean minimum time to acquire the meaning of a word is 151ms [RePo06]. We use a conservative figure of 113ms as an absolute minimum time for processing a word based on the mean minimum time for the familiarity check [PoRe06]. We define the lexical access duration excess (LADE) as the additional observed fixation duration beyond this familiarity check minimum.
2. *Regressions: the existence and number of regression fixations in the reading sequence*. A regression fixation is a fixation that, in left to right reading, returns to a portion of the text already processed. We operationalize a regression measurement as a count of the regression fixations in a single reading sequence consisting of at least four fixations.
3. *Perceptual span*: the spacing of fixations in the reading sequence. Perceptual span reflects the spacing of the fixations in the horizontal dimension while reading and describes the amount of text one takes in as a unit. We measure the mean perceptual span in a reading sequence as a cognitive effort feature. Since regression fixations may occur, a reading sequence can have several left to right subsequences. The reading/skimming distinction made by Buscher and colleagues [BuDe08] is similar to our definition of mean perceptual span, although we classify reading sequences in a different way.
4. *Reading speed*: defined as the length of text acquired per unit time. Reading speed is the ratio of the amount of text processed (the reading length) to the processing time. Reading speed is a function of the duration of the individual fixations in the reading sequence, the spacing of the fixations (perceptual span), and the regressions in the reading sequence.

We use transition probabilities between reading and scanning states and the above measures that reflect some aspects of cognitive effort in reading to characterize differences in reading between tasks, interfaces, and users with diverse levels of cognitive abilities.

Validation of the methodology: Evidence from three user studies

In two controlled Web search user studies, the eye-tracking cognitive effort measures have been shown to correlate with designed and perceived task difficulty. Some characteristics of information search tasks are correlated with differences in reading-state transition probabilities. This confirms the intuition that different tasks induce different reading strategies. Finally, using the results from the third study, we demonstrate a correlation between the eye-tracking derived cognitive effort measures and users' self-assessed domain knowledge.

Study 1: Cognitive effort and task difficulty

A user study (n = 32) was conduced to investigate the effects of task characteristics on information search behaviors used journalism students performing realistic journalism information search tasks. The journalism domain was selected because the same task can be associated with any topic and this supports generalization of the study results. Four tasks were identified by interviewing journalism faculty and practicing journalists. The tasks were designed to vary by characteristics that were expected to affect search behavior [Li09]. These characteristics included: complexity, defined as the number of necessary steps needed to achieve the task goal (e.g. identifying an expert and then finding contact information), the task product (factual vs. intellectual, e.g., fact checking vs. production of a document), the information object (was processing a complete document or only a document segment required), whether the search target is specifically identified (named), and the nature of the task goal (specific vs. amorphous). The tasks and their categorization are described in [CoGw11-2].

Our reading model was used to identify sequences of eye fixations as 'reading' or 'scanning'. A scanning instance is an isolated lexical fixation. We used this classification of eye fixation sequences to fashion a state model (an example for one task is Figure 2) of the user's engagement. The state model transition probabilities may be understood as reflecting a personal or task-induced bias on the strategy to process the page. Figure 3 shows there were significant task effects on the scan to start reading and the end reading to scan transition probabilities. This suggests users adapted their information acquisition and processing strategy for different types of tasks.

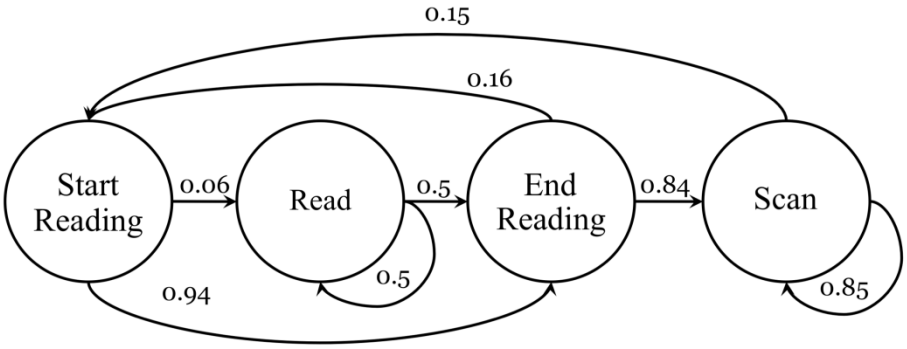


Fig. 2. An example of a reading state model for a task in the user study

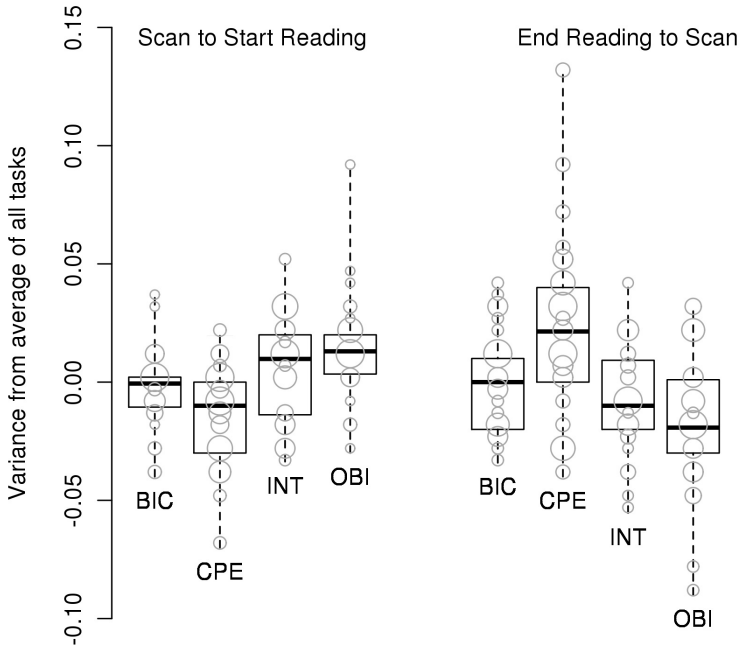


Fig. 3. Journalism search tasks: Task effects on reading state transition probabilities. The size of circles represents the distribution of the number of participants for each task

Turning to the analysis using the cognitive effort measures of the reading sequences shows there are correlations with the user subjective task difficulty assessments and with other objective measurement of task effort, such as time on task, etc. Figure 4 provides a model of the analysis framework.

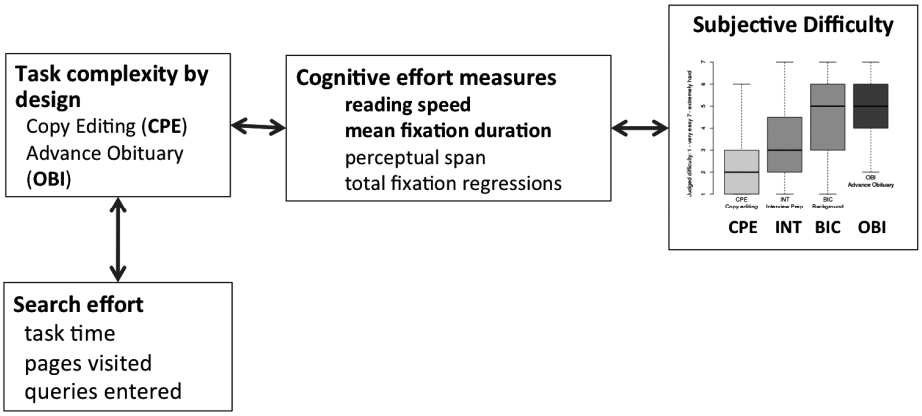


Fig. 4. Analysis framework showing the designed task complexity in the user study and the relationships between the cognitive effort measurements, subjective task difficulty, and the other objective task effort measurements

The cognitive effort measures correlate well with user subjective task difficulty assessments and other measures of effort in a task (Tables 1 through 3). For example, the CPE task was subjectively the easiest, took less time to complete, etc. and had the greatest perceptual span, fewest regressions, highest reading speed and lowest LADE. The correspondence between these high level task measures and the cognitive effort measures is not perfect but a consistent story overall emerges.

Table 1

Behavioral measures for tasks

Task	Mean subjective task difficulty (sd)	Mean task time [minutes] (sd)
BIC	4.53 (1.76)	17.95 (6.16)
CPE	2.31 (1.28)	9.42(6.63)
INT	3.31 (1.57)	11.63(5.94)
OBI	5.25 (1.37)	12.52 (5.45)

Table 2

User search effort measures for tasks

Task	Number of content pages		Mean number of queries (sd)	Mean number of unique pages visited (sd)
	Total	Saved		
BIC	1161	271	24.62 (12.39)	25.72 (8.57)
CPE	513	212	7.81 (5.35)	10.41 (7.09)
INT	1101	262	11.28 (6.4)	21 (11.46)
OBI	950	288	20.78 (11.87)	19.59 (10.89)

Table 3

Cognitive effort measures for tasks

Task	Mean regressions per page	Mean perceptual span [px]	Mean total reading length [px]	Mean reading speed [px/ms]	Median LADE (ms)
BIC	3.89	81.40	2566.96	0.4437	198.68
CPE	4.77	81.59	2780.39	0.4957	184.15
INT	3.40	79.12	2239.43	0.4578	203.00
OBI	3.02	77.86	1981.75	0.4239	199.20

For task difficulty, there was a clear distinction between CPE (copy editing) and the other tasks. By both the subjective assessment and objective task effort measures (time on task, pages visited, etc.) CPE was the task that required the least effort. This is unambiguously reflected in the eye movement pattern cognitive effort measurements. The tasks were designed to vary in several dimensions that impact task completion requirements. OBI and CPE were the least similar tasks overall. One can see that OBI was unambiguously judged the most difficult task and most of the cognitive effort measures distinguish it from the other tasks, especially CPE.

In summary, the cognitive effort measurements derived from the eye movement data appear to correlate well with both the subjective task difficulty and task session effort. Further, the cognitive effort measurements distinguish between the individual tasks.

Study 2: Understanding search user interfaces

Another user study employed the cognitive effort measures to gain a detailed understanding of how users worked on the same tasks in different user interfaces. We wanted to know how the addition of an overview tag cloud affected user actions during search. It seems reasonable to think a tag cloud can help people navigate to document(s) that are more likely to be relevant. To investigate this we observed eye movement behaviors in two interfaces, one with and one without a tag cloud derived from the search results (Figure 5).

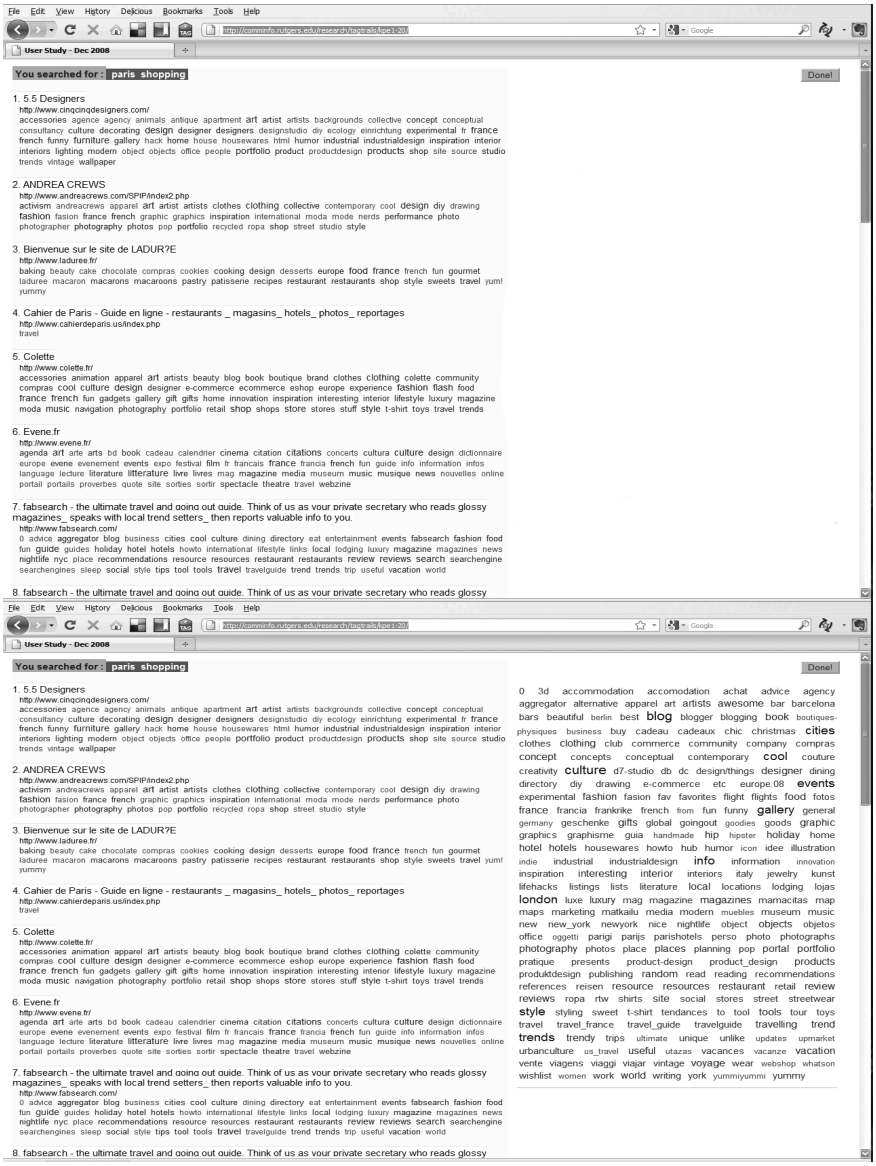


Fig. 5. Two user interfaces from study 2. Top: List (L) interface and bottom Overview+List (O+L) interface

The documents used in study two were related to topics on travel, sightseeing and shopping in London and Paris selected from the Delicious social bookmarking site. The tags were the ones assigned by the Delicious users to these documents.

Travel, sightseeing and shopping were selected as everyday search topics familiar to the general public. Task scenarios were constructed to present realistic situations where the participant was searching for information to help a friend who

is traveling. All participants started each task from the same search results list. Users looked for information within these results. They could narrow or expand results by clicking on tags or by removing tags from the list of words that acted as a query. The selected tags were used to retrieve the documents. After finding the information they would compose a short message advising their friend of the results of their search, for example the name of an inexpensive hotel near to Heathrow airport. The tasks were designed to have different levels of complexity.

The eye fixation cognitive effort measures were calculated for each sequence of reading and the results compared within users for the two interfaces. We found the UI with the tag cloud allowed users to work faster. The eye tracking data provided a detailed comparison of how much effort was expended in each of the two interfaces. Table 4 provides the results.

Table 4

Significant effects of UI on eye movement measures

Eye movement measures	L vs. O+L UI
Number of fixations	524 vs. 167***
Reading length [000' pixels]	40 vs. 12.4***
Total fixation duration [seconds]	174 vs. 60.3***
Reading vs. scanning [in proportion of all sequences] (for list part of UI only)	0.42 vs. 0.36***

Non-parametric tests Wilcoxon: *** p <.001.

The cognitive effort measures also permitted a detailed understanding of how effort is allocated within the UI. For example, we found that in the UI with the tag cloud most reading effort was devoted to processing the search results. The ratio of number of fixations in the search results list to the overview tag cloud was 2.89 ($W(35)$, $p<0.001$). The total reading length (scan path length in pixels for each reading sequence) ratio was 2.95 ($W(35)$, $p<<0.001$).

These cognitive effort measures not only provide evidence that the tag cloud helped, but also provide rich insight into the amount of cognitive effort and its characteristics – for example whether the average time to acquire word meanings while processing the search results is reduced after processing the tag cloud. It happens that the effect of the overview tag cloud seemed to be quite powerful, as 41 eye fixations on the tag cloud reduced the number of fixations on the search result list from 451 to only 104. Apparently, the presence of the clickable overview tag cloud helped participants to find the right terms for queries faster and to find the needed information faster.

This study demonstrated the use of eye tracking data to generate a model of reading and objective user performance measures (cognitive effort) that were then used to obtain explain differences in interaction with two interfaces.

Study 3: Detecting user domain knowledge

Another user study (n = 40) examined domain knowledge effects on search behaviors. Participants with differing levels of knowledge of genomics self-rated their knowledge of 409 concepts from NIH MeSH, a comprehensive biomedical controlled vocabulary. These self-ratings were normalized and used as a representation of their level of genomics knowledge. Participants were then asked to search and collect documents relevant to each of four research tasks. These tasks varied in difficulty, but were all difficult search tasks when compared to more typical search tasks. The details of the study design and calculation of domain knowledge are given in [CoGw12].

The cognitive effort measures were calculated from the logged eye-fixations. Two regression models learned to see if using the cognitive effort measurements as independent variables could classify participants by knowledge level. One model was a simple linear regression. The other model was a decision-tree ensemble model, random forests [Brei01]. Figure 6 shows the overall flow of the analysis in this experiment.

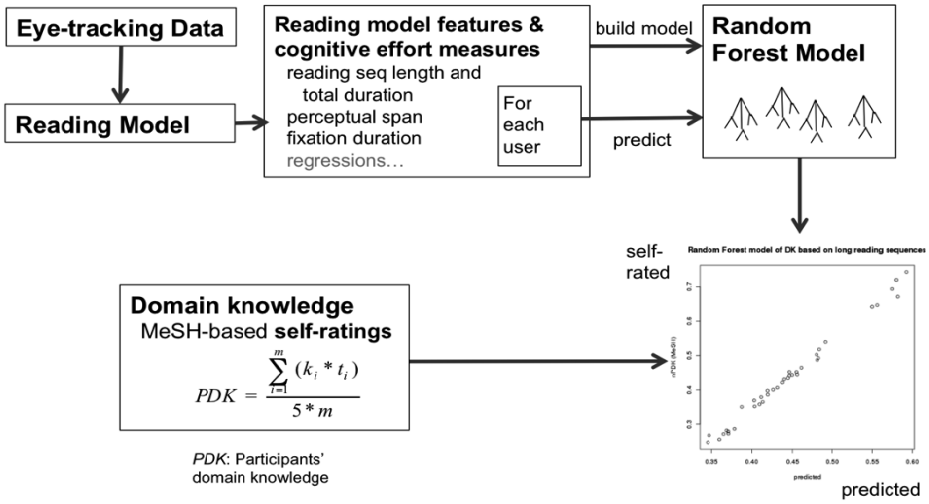


Fig. 6. Modeling domain knowledge using random forests

The results [CoGw12] show that the linear model gave reasonable discrimination between the high and low domain knowledge groups. After removing non-native English speakers (n = 14), the model results were better for the high knowledge group, but deteriorated somewhat for the low knowledge group. The random forest model performed much better and when the non-native English speakers were removed the model was able to classify all of the participants cor-

rectly into high- and low-knowledge groups. These results provide evidence for the ability of the cognitive effort measures to capture salient aspects of differences in the reading-based information acquisition process due to a user's knowledge of their task and domain.

One complexity in modeling interactions with an interface and an information system is the conditionalization of interaction due to varying levels of user knowledge. This may affect the use of resources in the interface, selection of items, search strategies, and strategies to process the information presented by the system. All of these factors are associated with interface design choices and lay at the heart of questions about how best to adapt the system to the user and their immediate need. Eye tracking-based cognitive effort measurement can allow inference of the user's state of knowledge and trigger modification of the system or its interaction with the user to improve the overall performance of the UI and the system during the task session.

Discussion

We motivated our work by describing importance of obtaining implicit feedback from users engaged in interactive information retrieval. Traditionally, the emphasis of information retrieval research was on using user behavior as an indicator of document relevance [Kell05] that could be incorporated as pseudo-relevance feedback and used in query expansion or in document re-ranking. More recently, eye fixations were used to indicate which items are considered by users in ranked search results pages or to identify words useful for relevance feedback [BrHo08; PaHe07; BuDe08; LoBr11].

In contrast, our work uses eye-tracking data to calculate objective measures of a user's cognitive processing related to reading and interacting with text and shows that these measure are good implicit indicators of several aspects of human-information interactions. Specifically, we used results from three controlled Web search user studies to demonstrate that reading model parameters (such as, reading-state transition probabilities and the frequency of reading-states) correlate with differences between search user interfaces and with some information search task characteristics, and that eye-tracking derived cognitive effort measures correlate well with: designed and subjective task difficulty, users' self-assessed domain knowledge, and differences in interaction with search interfaces (search result list and overview tag cloud + search result list).

Conclusion

The objectives of this work are to inform theories and models of human-computer information retrieval and to develop information systems that better support users in their tasks. Our approach is to learn more about users using information systems without asking them and while they are still engaged in their tasks. What we learn will be eventually included in algorithms embedded in information systems that will adapt to user. Eye tracking provides a rich dataset for this effort. Representation of the eye movement behaviors as measurements of cognitive effort associated with the information acquisition process have been shown to allow for deeper understanding of how users work within information system interfaces and to predict mental states germane to the information task, such as perceived difficulty and the user's level of domain knowledge.

At the fundamental level, eye tracking is appropriate because it is a direct observation of the user's interaction with information. The reading model methodology and cognitive effort measures are based on many years of empirical research in cognitive psychology. They are domain independent because the content of the text document is not used, and are largely culturally independent. The algorithm we use for processing the eye-movements can be adjusted to different languages, orthographic systems, and reading patterns (i.e. left to right, top down, etc.) by changing model parameters. Calculating the cognitive effort measures is easily accomplished in real time because simple calculations are applied to the eye tracking data stream, which consists of three numbers: the fixation duration and its location coordinates. A couple of the cognitive effort measures that require identification of the entire reading sequence, such as perceptual span and reading length, can be accomplished as soon as the reading sequence is completed. The result is that eye movement analysis can be conducted in real time using the immediate eye position and caching just a few seconds of fixation data to ensure capture of extended reading sequences. The analysis can be continuously updated and the resulting stream of reading sequence representations filtered for important cognitive effort events.

Implications

Appling and extending our eye-tracking based method has a potential for refining and extending theories and models in human-computer information retrieval. For example, it can be used to validate significance of search task characteristics (such as those proposed in [Li09]).

A prediction about the state of the user takes less than 40 ms using a standard computer where the stream of eye fixations is input to an existing model, e.g. a random forests model. This enables real-time assessment of cognitive effort and system detection of user characteristics in just a few seconds, including level of domain knowledge and task characteristics. That is fast enough to permit a system to seamlessly adapt support to information searchers in their immediate state.

Application of our work is today only possible in research settings because eye trackers are expensive and used mainly ass research tools. However, there are reasons to think that devices with eye tracking capabilities may come into widespread use. A consumer laptop prototype with camera-based eye-tracking technology and a gaze interaction interface was demonstrated at the recent Consumer Electronics Show (CES 2012) by Lenovo and Tobii, a Swedish producer of eye-tracking solutions. Google will soon market Web-connected glasses expected to incorporate electrooculography eye position sensors. Olympus and Oakley are also ready to introduce such smart glasses to the consumer. If the eye position sensors have sufficient resolution, such augmented reality glasses would be a suitable real time input for our system.

As noted above, calculations of cognitive effort measures from eye fixation data streams is easy to accomplish and models can be used to make real time predictions of the user's current mental state. These predictions can be a basis for a system to adapt to the user in several ways. For example, if the cognitive effort measurements predict the user will assess the task as difficult, the system might intervene to provide memory aids in the interface, for example automated note taking. When the user issues a query to a search engine the system can use the cognitive effort measurements on each of the documents processed by the user to predict which of them were useful, extract the most informative terms, and add those terms to the query that is sent to the search engine.

Limitations and recommendations for future work

The studies presented in this chapter were conducted with a limited set of search tasks. Future work should extend the types of examined user tasks. Reading states identified by our reading model take into account reading each line of text separately. While this approach is appropriate for the analyses presented here (we used aggregated measures of reading and scanning states), in the future, we will extend our model to identify reading sequences that span multiple lines of texts and to parameterize the model with the number of text lines read. Our reading model and the cognitive effort measures were created based on the knowledge of human text reading, and thus they do not cover looking at and

processing of images. The use of an eye-tracker carries with it limitations inherent in this technology (the accuracy and precision of the hardware [Tobii11-1]) and the associated algorithms (eye-tracker fixation detection algorithm). In the work presented in this chapter, we used Tobii T-60 eye tracker [Tobii11-2] manufactured by Tobii Technology AB.

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MODELE INTERAKCJI CZŁOWIEKA Z SYSTEMAMI INFORMATYCZNYMI BAZUJĄCE NA OKULOGRAFII

Streszczenie

Okulografię (eye-tracking) stosowano do badania użyteczności interakcyjnych systemów komputerowych od ponad dekady. Główne zastosowanie eye-tracking ograniczało się do badania temporalnych zmian kierunku patrzenia. Ten rodzaj danych i ich wizualna reprezentacja pozwalały odkryć interesujące aspekty interakcji użytkownika z systemem informatycznym i pomagały w zidentyfikowaniu problemów z użytecznością. Jednakże eye-tracking może dostarczyć dużo więcej informacji. Na przykład dzięki tej technice można identyfikować stan umysłu użytkownika w czasie interakcji z komputerem. W artykule zaproponowano stworzenie i użycie pośrednich zmiennych uzyskanych na podstawie ruchu oka i skorelowanie ich z bardziej ogólnymi aspektami, takimi jak: typ zadania użytkownika, cognitive load (wysiłek umysłowy) oraz poziom wiedzy użytkownika. Takie podejście do przetwarzania pomiarów ruchu oka z interakcjami z systemem informatycznym daje dokładniejszy obraz interakcji. Proponowana metoda jest nowym podejściem do badania zadań użytkownika, różnic między użytkownikami (np. w poziomie wiedzy czy też różnic kognitywnych) i interakcji z systemem informatycznym.

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INFORMATION ARCHITECTURE ASPECTS IN VOICE PORTAL DESIGN

Introduction

Voice User Interfaces (VUIs) have been in common use for many decades [DeMo98], but never gained the wide mainstream attention as other forms of Human-Computer Interaction (HCI). The many reasons for this include the complexity and limited practicality in most scenarios. On the other hand, the systems that absolutely relied on such technology, e.g. telephony call centers, were not accessible by most engineers studying HCI. Given the few companies worldwide developing the VUI technology, much of its HCI concepts were discovered independently from the rest of the industry.

On the other side, we see enormous efforts in developing new concepts and approaches to HCI design. The popularization of the computer as a common household appliance allowed it to flourish not only as a consumer product but also as a cheap and easy platform for engineers. The discovery of the Internet significantly increased the usefulness and the popularity of computers, but also created new challenges and opportunities in the study of HCI. Thanks to millions of engineers working on the development of various components of the computer technology, we have witnessed a very rapid advancement in all its aspects, including HCI.

Ultimately, when it comes to the HCI studies, certain technologies, like VUIs have been lagging behind more popular ones, like the web. That is why in certain situations, it became a common practice to transfer the knowledge gained from one domain of HCI to another. This isn't always possible and there are some obvious limitations, as discussed in this paper.

The authors of this work have been given a task to create a simple automated voice activated telephony service to aid the already existing call center used for providing information about the public city transport system of the city of Warsaw,

Poland. Having little previous experience in designing such systems, the authors used the common principles used in the rest of HCI. This included concepts of User-Centered Design [MaBKSG09] and Information Architecture (IA) [RoMo98].

This paper describes the process and tires to rationalize its usefulness in VUI design. The following chapter describes some basic concepts behind VUI design. After that, the notion of IA and its application to VUI is shown in more detail.

VUI Design Concepts

VUI is a term used for software components that allow the user to interact with the computer using voice. It relies on the technologies of Automatic Speech Recognition (ASR) which is the ability to translate the user's voice into text or commands understandable by the computer and Speech Synthesis, also known as Text-To-Speech (TTS), which allows the text presented by software to be read out loud as synthesized speech.

A VUI is also the core component of a Dialog System. Dialog Systems are one of the most sought after pieces of technology that would allow people to communicate with computers in the same way as with other human beings. While it still ultimately belongs to the realm of science fiction, dialog systems have been implemented with reasonable success in various limited domains, such as call centers. One more component, that is probably the main cause behind the Dialog System's letdown is known as the Dialog Manager, which is a component that should understand the meaning of the users' speech as processed by ASR and provide answers that can later be synthesized using TTS. This is a problem, which has a lot in common with pure AI, although it is not impossible to solve for very limited domains, such as certain call center tasks, e.g. ticket reservation, travel information, simple troubleshooting, etc.

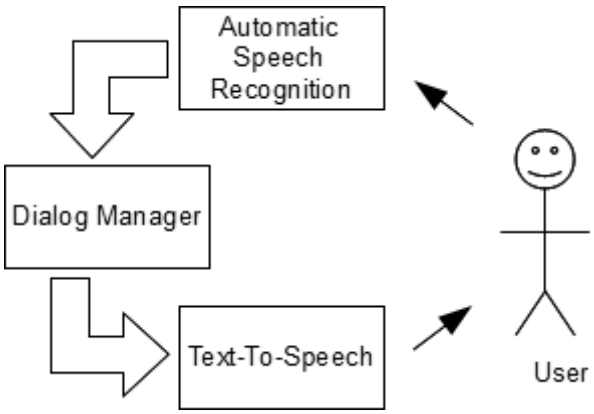


Fig. 1. A diagram of a typical Dialog System and its components

This work is based on the example of an automated call center that provides information on the public transport system in the city of Warsaw. This includes timetable, routing and ticket information for the city's bus, tram, subway and city rail lines. The reason such a system was developed was to reduce the workload of human operators that normally service the call center. Because increasing the number of human operator posts is usually quite expensive (it entails not only labor costs, but also the cost of property), such technology is a popular alternative, even if it doesn't solve the problem completely. A reduction of as little as a few dozens of percent of calls that can be automated is enough for justifying the automated system costs. Apart from lowering costs, such systems are known to help user satisfaction by reducing waiting times, therefore increasing the speed and availability of information. Finally, there are several methods of automating a call center, but none of them is as intuitive as a VUI. This means that a user can speak to a computer just as with another human being and not have to learn the structure and idiosyncrasies of a new system [CoGB04].

All these advantages don't come for free however. There are many limitations of VUI systems compared to other well-known interfaces (Table 1).

Table 1

Comparison of interfaces

	VUI	WWW
Time	Constantly changing – requires memorization. Limited context	Static – always present. Wider presentation of context
Presentation	Sequential	Lots of information in parallel
Tempo	Flow of information controlled independently from the user – computer controls the tempo	Processing of information at user's own pace
Mental model	Cannot predict the next step of the dialog	Clear model
Error correction	Difficult, errors are likely to happen and hard to fix	Easy – errors are easily fixed an system is not error prone
Latency	Slow access to information	Almost immediate

The main characteristics of UIs include:

- modality – text, GUI, voice, touch, etc.,
- style – command driven, menu driven, natural,
- initiative – system, user, mixed,
- domain.

The analyzed public transport call center system was designed as a part of a EU FP6 funded project, LUNA which had a goal of creating a framework for a natural, mixed-initiative dialog systems in any limited domain and while this was also our own research goal, the practical solution was to rely on a well-known menu-driven style and reduce the influence of user initiative in most situations throughout the dialog.

User-Centered Design (UCD) is a common method of designing systems with unknown specification. Unfortunately, in many situations we do not have the luxury of possessing a system to run usability tests on users. This is where a Wizard-of-Oz (WoZ) comes heavily into play and helps resolve major questions, at least until we manage to construct the first prototype for further tests. This was also important in our project [KoBGM08], because it allowed us to collect and test a lot of details about the Information Architecture of the system even before dealing with complex issues such as speech recognition and dialog management. The results of this UCD backed WoZ study are presented in the following sections.

Information Architecture Features

Information Architecture (IA) is a study that tries to emphasize the role of information and its flow within the system [IAIN07]. While other studies deal with similar issues from different points of view, IA becomes very relevant when the system becomes large and too complicated to be understood by the user at a single glance. A common mistake is to give the user too much information at once, making it difficult to find what is relevant. Likewise, providing too little information makes it inconvenient and tiresome to reach the same. Proper categorization and organization of information is one of the main goals of IA.

Ontology

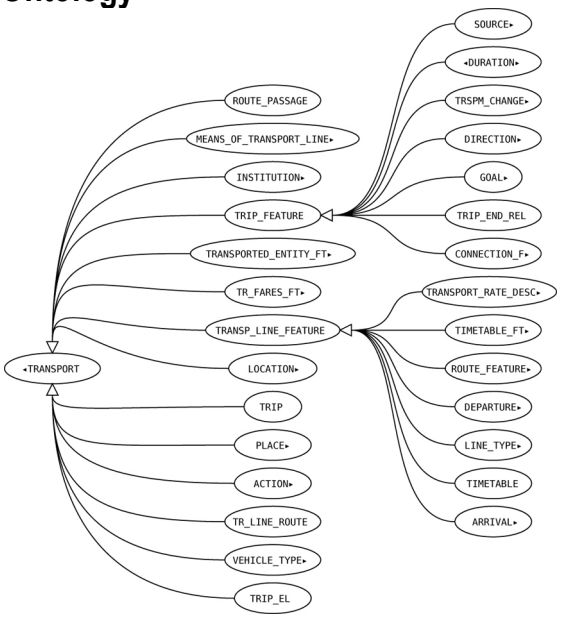


Fig. 2. Breakdown of the "Transport" class in the system ontology

A helpful tool for creating a proper IA analysis of a system is the creation of an ontology. On the example of the call center project, the ontologies were created by a group of linguists that analyzed the recordings of human-human and later also human-computer recordings made during the WoZ phase. They describe the linguistic content of the dialog between the user and the system, interfaced by the call center operator. The preparation of the ontology is even more straightforward and useful in the speech modality as the method of communication is actually the natural language and the concepts described are based on dialog turns, sentences and phrases. Not all the human-human dialogs were described in detail, as people tend to lose focus and chat about various unrelated topics (e.g. weather) when talking to human operators, so only sentences related specifically to the public transport domain were chosen. All the details about this procedure can be found in the book describing the project [Marc11].

Categories

After analyzing the recorded dialogs and studying their ontology, a set of categories was constructed. This was done not only based on user needs but also the functional requirement of the system. It is important however, that both of these are seriously taken into account, otherwise the system might suffer either from being difficult to use or lacking necessary features. The categories chosen for the system were the following:

– timetables – times that buses/trams depart specific stops,
– route lookup – how to reach a destination from a certain location in the city,
– ticket prices and fare reductions – cost of tickets and reduction of these for certain customers (e.g. seniors, students, disabled, etc.),
– lost and found – information about finding lost items in public transport vehicles,
– complaints – general complaints about various issues, e.g.: public transport not on time, driver misconduct, malfunctions, etc.,
– other – anything that doesn't fit in the above categories.

From studying the dialogs, it was apparent that most calls were regarding the first two topics, with route lookup being slightly more favored (timetables were available using other means as well, while route lookup required some prior knowledge of the system). Nevertheless, other categories were also very popular, especially at certain times, e.g.: ticket prices and fare reductions were popular at the start of school year, when students buy their tickets, and complaints were more popular during traffic jams induced by bad weather or traffic accidents.

For practical reasons, not all categories ended up in the final product. When it was infeasible to fulfill a category, it was simply redirected to the human operators, which were still hired to deal with the last category. The "route lookup" for example, was later deemed unrealizable due to the lack of proper language-to-geolocation mapping. It was still useful to leave the proper categorization both to make the user aware of the information they could acquire and to leave the possibility of creating such a solution later.

Attributes

The next step after determining the categories is looking up the attributes for each category. The attributes determine all the information we need to acquire from the user before being able to provide the answer. This is the list of attributes for the individual categories mentioned above:

- timetable: date, line, place (street, stop), direction, time,
- route lookup: start, destination, (time),
- fare reductions: passenger category,
- ticket prices: ticket category,
- lost and found: line/location, time,
- complaints: nothing,
- other: nothing.

An important concept that comes in play here is the ergonomics of the dialog. When we have to ask the user a lot of questions, we have to do this as simply as possible. In case of the first two categories, all the attributes need to be acquired to able to determine the answer, but sometimes certain questions can be skipped or made simpler.

In the timetables category for example, it is essential to know which date the query is about since the schedules are different for work days and holidays. On the other hand, 90% of users are interested in the today's schedule and that is why the first question is "Are you interested in the schedule for today?" and the date question is reserved only for those that answer "No". This is because the procedure for recognizing the dates can become quite time consuming, especially when it comes to misrecognition and error correction.

The "ticket prices" and "fare reductions" categories, on the other hand, have only one attribute with many possible values. To make things more complicated, these values tend to change over time with the city coming up with new rules every couple of months. The ideal ergonomic solution to this problem is a tree structure. In order to reduce the amount of questions we try to group similar val-

ues into subcategories and first ask about those, e.g.: are you a student, a pupil or a senior citizen? Then if the answer is "student", we ask about: are you a student of a domestic or a foreign school? A good guideline is to keep the number of options to no more than 5-6 at each step of the dialog, but to reduce it to even less if possible. Using heuristics based on the analysis of calls is also possible here. In our case, for example, it was determined that most calls about this category were made by seniors above the age of 70 which are eligible to totally free fares. This was in fact a tip that was given to us by experienced call center operators. By asking about the age of the customer as the first question in the dialog (i.e. "Are you older than 70?"), it was possible to rule out about half of the calls without having to make them listen through a long list of categories.

The last two categories are marked to have no attributes. This is because they were designed as such that the system doesn't require any interaction from the user and can immediately initiate an action. In case of complaints, the content of a complaint is simply recorded and stored as an MP3 file that can be later listened to by a member of the staff responsible for filing complaint reports and distributing them to proper units within the organization. The "other" category is simply redirected to the human operator, as mentioned before.

Labels

One final, and often looked over, concept is the idea of proper labeling. When creating a familiar system, especially if it is to replace an older one, it is important to use such labels that users are going to be familiar with. For us, this meant that we had to use names of categories that are as close to the human-human dialogs as possible. These are things that are often based on information far from the system developers reach (e.g. terminology present in information banners and manuals predating the system even by decades) and it would be foolish to try to change them. Such decisions are also sometimes consulted with linguists that posses a greater familiarity of local language use.

Ultimately, the only way to see how this works is to test the system with users, see their reaction and not be afraid of making drastic changes if necessary. Running several stages of WoZ tests can help greatly with reducing costs, but issues may sometimes arise months after the system is fully developed. An interesting example in our project was related to a simple instruction that explains how to connect to the human operator in case the system doesn't behave as expected – a very important feature of the system. In one specific call that lasted for several minutes it was made apparent that the users didn't understand what to

do when instructed “please press any key on your phone to connect to the operator”. Even though from the technical point of view, it made no difference which key the user has to press, changing the prompt to say “press zero to connect to the operator” made the system much easier to use, from the users’ point of view.

Conclusion

In the past, many new directions in the study of HCI were discovered and rediscovered by different people in different domains [Guen12]. This has led to repeated calls to merge knowledge from various similar domains rather than partitioning them even further [Boga12]. It was our goal here to demonstrate that just such an opportunity exists with applying known HCI concepts to the VUI technology. Other work found similar lack of study in VUI design [Skór11]. This is related not only to the IA, as mentioned in the title but also other domains that or out of scope of this work.

In our example project, we managed to apply the concepts of IA to design a system that is still in successful use long after the research project it was designed for. The scope of our work is obviously limited to a specific problem domain and more research should be performed for other tasks. With VUI becoming more viable and popular every day, it is our hope that the wider HCI community will see it as a possible avenue of research to apply their experience.

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ASPEKTY ZARZĄDZANIA INFORMACJĄ W PROJEKTOWANIU PORTALU GŁOSOWEGO

Streszczenie

Niniejszy artykuł opisuje zasady projektowania Portalu Głosowego wykorzystywanego w informacji telefonicznej komunikacji miejskiej oraz wpływ Zarządzania Informacją (ang. Information Architecture, IA) podczas jego budowy. IA jest najczęściej omawiane w kontekście projektowania stron internetowych i aplikacji graficznych, ale wiele z jego aspektów można zastosować do innych zadań projektowych. W artykule tym zanalizowano, jak można wykorzystać IA w procesie tworzenia systemu, w którym jedynym sposobem interakcji z użytkownikiem jest mowa. Głównym zadaniem tego systemu jest przekazywanie użytkownikom informacji o komunikacji miejskiej przez telefon. Cel ten osiągnięto poprzez użycie systemu dialogowego wykorzystującego technologię rozpoznawania i syntezy mowy. Procedurę IA zastosowano w kilku fazach projektowania dialogu, zwracając szczególną uwagę na różne ograniczenia tego nietypowego podejścia do interakcji z użytkownikiem. Głównym celem jest zaprojektowanie systemu dostarczającego żądanych informacji w szybki i wygodny sposób. Jest to trudne z kilku powodów: kosztu i ograniczeń czasowych, braku doświadczenia użytkowników w interakcji z podobnymi systemami, braku wglądu w ogólną strukturę systemu, co wymusza na użytkowniku wizualizację struktury we własnym umyśle, treściwej prezentacji znaczącej ilości informacji. Typowych rozwiązań takich problemów, obejmujących nawigację, przeglądanie i wyszukiwanie, nie można bezpośrednio zastosować w takim medium, ale wszystkie mają własne, interesujące odpowiedniki.

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University of Economics in Katowice

ENHANCING USER EXPERIENCE THROUGH PROSUMPTION IN THE ERP SYSTEM

Introduction

Looking through computer science literature, prosumption is always described in the context of Web 2.0. Web 2.0 philosophy fits perfectly into the idea of self-production of new products (content, media, etc.) by consumers. Surprisingly, only a small fracture of computer science publications are related to prosumption. Not to mention its business supporting application/role.

And yet, as R. Kitchin i M. Dodge say: "Software has deepened and diversified participation by enabling people to interact with, customize, and accessorize a wider range of services, media, and products; to move from being a consumer to a prosumer in more realms of everyday activity" [KiDo11].

Unlike the Internet, where together with the phenomenon of mass communication comes mass production, traditional user produces almost exclusively for himself − satisfying his own needs.

In case of this publication we concentrate on supporting users of the ERP system in executing tasks, which comprises preparing analysis, based on the data taken from SAP Business One (further referred to as 'SAP B1'), an OLTP class information system. Simplification of the process of preparing and executing analysis of the transactional data helps with fulfilling users' needs. According to Hassenzahl et al. needs fulfillment is one of the main assumptions of many user experience (UX) models in context of Human-Computer Interaction (HCI) [HaDG09].

This publication aims to present the ways in which an individual can improve his/her performance at work. We want to present how prosumption affects a process of decision making through increasing user's commitment to process of data analyzing. We postulate that prosumption leads to enhancing user experience related to using analytical tools.

User experience

The concept of user experience (UX) is part of the research field, that covers the interaction that occurs between the computer and the user (e.g. human computer interaction – HCI).

It can apply to both, in a narrower sense, the experience of a person using a specific artifact (e.g. system), as well as cover all feelings that result from contacts with the company, including its products and services [NoNG].

The term 'user experience' is ambiguous. It can be interpreted in different ways, such as: usability, aesthetics, pleasure, feelings related to technology used [HaTr06]. In 2008 Law et al. conducted a study to determine how the term UX is understood by people who are professionally connected with this subject. Among the respondents there were both practitioners, using knowledge about UX in their work, as well as people doing research in that area. The researches selected five definition of the term UX. The choice was made based on differences in perspectives on UX presented in the definitions and different attitude to the five elements, encompassing the meaning of UX [LaRHVK09]:

- focus: the main concern to be addressed,
- who: the experiencing agent/subject of interest,
- what: what is the something/object that is experienced,
- how: how is the experience brought about,
- when: three possible states: before, during and after interacting with the object being experienced.

According to the results of the above mentioned study the definition that was chosen most often as best reflecting the sense of the term was one provided by Hassenzahl and Tractinsky:

"A consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.) the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organizational/social setting, meaningfulness of the activity, voluntariness of use, etc.)" [HaTr06].

User experience in data analysis in the ERP system

Working with data analysis technology is always a challenge for the user. On one hand, it's related with the need to learn complex and sophisticated tools, on the other a large amount of information needs must be satisfied. User hardly has the ability to produce new content with a classic ERP system (we're not talk-

ing about the data entry). His work boils down to generating predefined statements or reports and drawing conclusions. Thorough analysis of the problem requires not only the access to large amount of data but also creativity and often outside the box approach.

ERP predefined reports often present data in a standard way making a deeper analysis almost impossible. Designing custom statements or reports is often impossible due to the need of expanding the system with optional reporting tools. Those tools are ignored in the standard implementation of the ERP system for multiple reasons.

In Poland, the lack of user involvement in data analysis process can also be explained by a relatively low awareness of senior management, regarding the existence of appropriate tools/technologies and their usefulness (read: influence on company's financial results).

However, the most serious obstacle is the cost associated with staff training on new tools and technologies. Currently, due to changes in the knowledge and skills of executives an increased interest in the analytical tools is seen in the segment of small and medium-sized enterprises.

In the case of an ERP system it is very important for users who use it, that they can do it quickly and at the lowest possible effort associated with the exercise of the functions. In order to achieve these objectives an ERP system must provide the user interface of an appropriate quality, which will positively affect the UX. Among the elements that affect the UX we recognize:

1. Logical layout of functions – similar functionalities should be available close to each other – grouped in sets.
2. Lucidity of the interface – can be reached through applying appropriate color and fonts.
3. Ease of obtaining information on how specific business process is being implemented – determined by the existence and ease of use of system manual.
4. Ease of obtaining information on what are the consequences of executing specific functions – every user should be able to easily get information on what's going to happen when he uses the specific function.

In the long run the course of changes applied to the user interface should be taken into consideration as well. Sustainable development of the interface is needed instead of revolutionary changes, so the users of an ERP system were not overwhelmed with the changes being applied.

Analysis of transactional data

One of the most popular data analysis tool is Microsoft Excel. Due to its popularity, most of the other analytical software is based on its interface and functionality (using the idea of a spreadsheet as an interface). It is dictated by the fact that MS Excel users largely act as prosumers: creating templates, checklists, analysis, etc. which they later use as a template for future tasks. The level of experience of such users is so high that manufacturers want to provide them with a familiar interface, rather than convincing to something new. In addition to standard applications, MS Excel is often used as a last resort in situations where a lack of basic software functionality (ERP system) makes a specific task impossible to complete.

It should be noted that performing analysis based on a larger amount of data requires great knowledge from the user (the ability to connect to relational databases) or a lot of patience (exporting data through reports and statements). In both cases, the risk of failure is so high that analysts generally avoid performing such analyzes without adequate support. Products which extend MS Excel capabilities with a data access layer to ERP systems are becoming a real alternative.

XL Reporter is a reporting tool directly connected with a relational datasource. Fully integrated with SAP B1 interface, XL Reporter allows user to run a report directly from the SAP B1 menu. Based on user parameters, it displays the data directly into MS Excel spreadsheet. In case of such software one of the most important success factors (ease of use by users who are not developers) is a data access interface.

XL Reporter works in three different modes of operations: report organizer (RO), report composer (RC) and report designer (RD). RO is designed to enable user to manage reports' definitions − give them names, plugging them into SAP Business One menu, schedule running the reports – all of it without any IT knowledge. Similar situation takes place when it comes to work with Report Composer. Report Composer offers the possibility to use a menu, which helps users in making a choice of which business area the report will take data from and what dimensions and measures to include in the preparing report. In addition the user can use a 'drag-and-drop' option to select appropriate dimensions in a way similar to working with pivot tables.

Figure 1 presents a screenshot of Report Composer window. In this case we assumed that SAP B1's user wanted to know what are sales numbers for the specific sales person with regard to a warehouse and displayed by customers, items and financial period. Dimensions, such as salesperson, customer and item and measure: amount of items sold were dragged from upper part of menu and dragged to the report data area on the bottom of screen. The selectors – warehouse and period were dragged to the selection area.

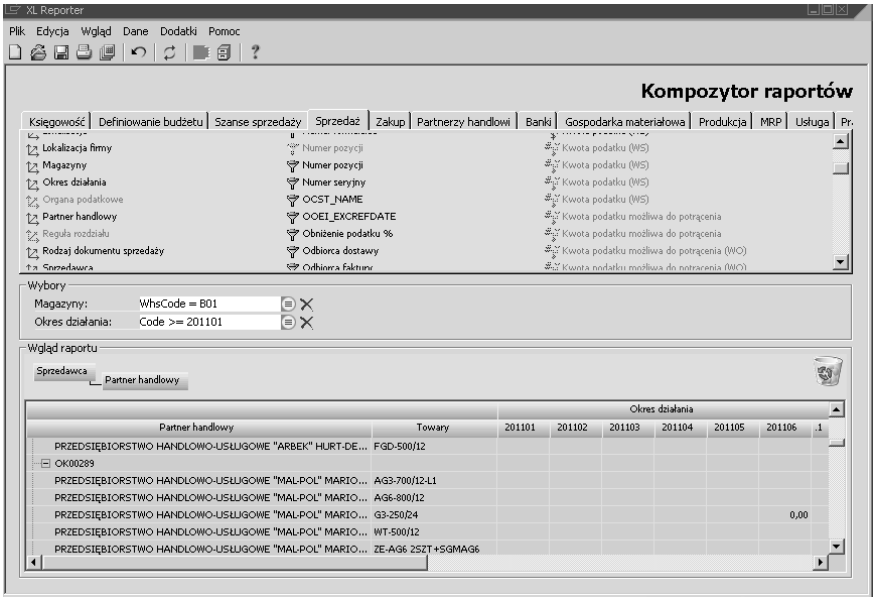


Fig. 1. Report Composer in XL Reporter

After creating the report definition user has the opportunity to continue its processing in the spreadsheet – MS Excel. User can use all of MS Excel functions in doing so, as well as use the XL Reporter menu, running directly in the spreadsheet. The XL Reporter add-in enables user to include parameters in the report and enhances the selection of data being analyzed – Figure 2.

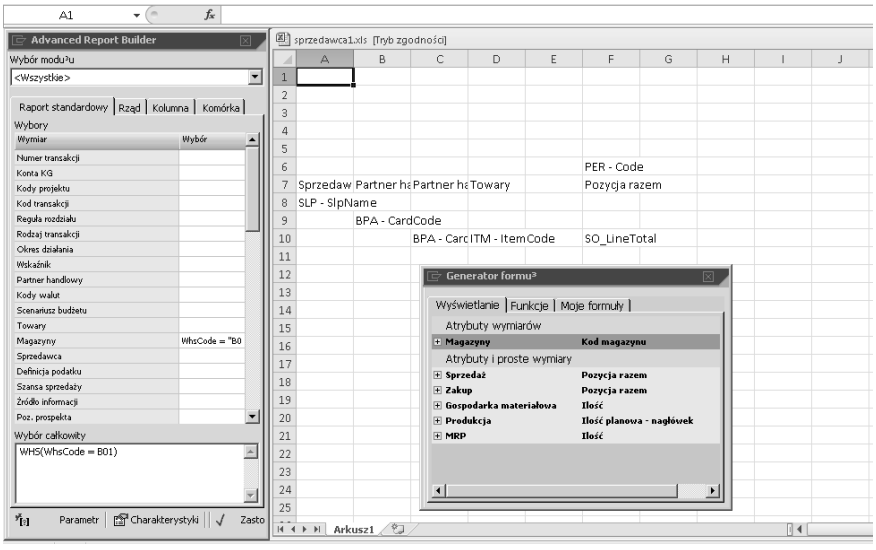


Fig. 2. Advanced Report Builder

The knowledge that is needed to effectively use this tools doesn't exceed the business knowledge. Thus users of Report Composer become the active prosuments – producers of statements and reports, which are further used by themselves, helping them in accomplishing common tasks related to data analysis.

Multidimensional data analysis

A much easier data access is provided to the user by Business Intelligence tools which are based on multidimensional structures. In accordance with best practices for implementing business intelligence systems (BI), one of the key element is to gain user's trust. The trust concerns accepting the sense of changes and purposes which BI serves. It then translates into user engagement and the quality of decisions. The trust itself is gained by offering the opportunity to create personal analysis and sharing them with others. The recipient of content becomes the supplier. Unfortunately, BI modules supplied by the ERP manufacturers are often too expensive for small and medium-sized companies. Third-party tools might be a good alternative in this situation.

The "BI Studio" platform from Consorg SA is an example of this kind of software. It uses "develop a system in place" methodology and has a proven track of successful implementation in Poland, both in small and medium-sized enterprises as well as those listed on the stock market.

Most of the tools included in the BI Studio package are focused on prosumption − the user can (without much IT support) develop business applications that have been already implemented. XlStudio (Figure 3) offers this kind of functionality. It acts like the XL Reporter − that is being a Microsoft Excel add-in. It uses both relational and OLAP data technology, enabling the usage of multiple datasources (not limited to the selected ERP database).

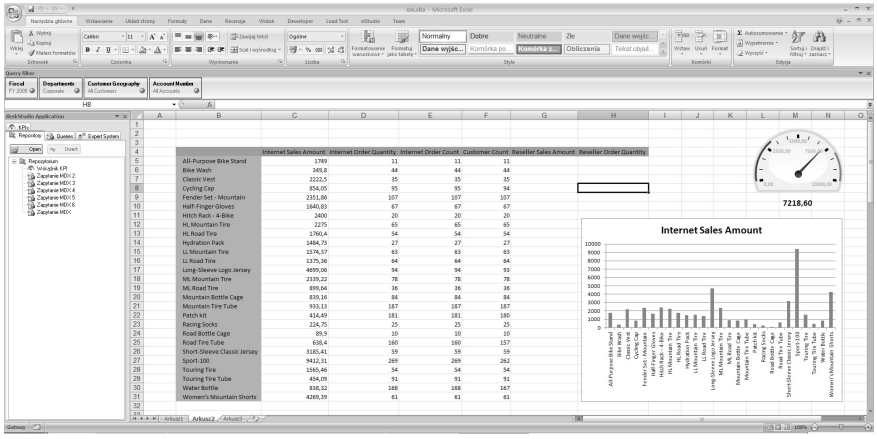


Fig. 3. XlStudio in MS Excel

XlStudio allows its users not only to build and view interactive reports (using drill down, up and drillthru operations) directly in MS Excel, but also binding additional descriptive information and provides an alternative way to enter data through multi-dimensional structures. It extends the range of potential applications with the usage of simulations. The user fetches the data from the ERP system, completes additional information and then using the simulation model created with standard MS Excel functionality saves the results back to the transaction system. In addition, XlStudio is integrated with an expert system enabling the use of the results as another data source.

Manager cockpits

Further ERP data processing gives multiple possibilities and variety of applications to the user. However, the biggest prosumption activity can be observed in a situation when a user builds his own user interface. A popular scenario would be designing a management dashboard where a certain analytical problem can be visualized instead of just generating single reports. Although creating dashboards can be very intuitive and straightforward it requires more experience and analytical knowledge from the user. It involves mixing different types of content and present them in a user friendly manner. Depending on the recipient a text description would be an appropriate presentation, others (accountants) prefer tabular data or even charts or graphics (managers).

One of the key innovations delivered in the new version of SAP B1, version 8.8 was the change of the user interface. There is still a possibility to use the old layout, well-known from the previous versions of SAP B1. In the old, so-called ‘classic’ menu style user worked with menu, grouping similar functionalities in modules – Figure 1. In the new style of menu user can display functions in cockpits which are the containers for widgets. In other words cockpit is a single workspace which can be populated with different widgets according to one’s needs. Widget, in turn, took the form of windows placed within the cockpits. There are several kinds of widgets, each one serving different purposes: list of frequently used functions, alerts, internet browser.

Prosumption appears here when user of the ERP system starts to freely compose the workspace within the system. User can observe his own actions in the system and gains experience. According to the learning theory people gather knowledge when they are able to make critical reflection on their experiences. We assume that user is able to and based on that knowledge he can make decisions about the composition and look of his workspace.

Especially interesting is the usage of common functions – users can build their own menus (within widgets) and decide which menu would suite them best for realizing specific tasks – using cockpit's functionality.

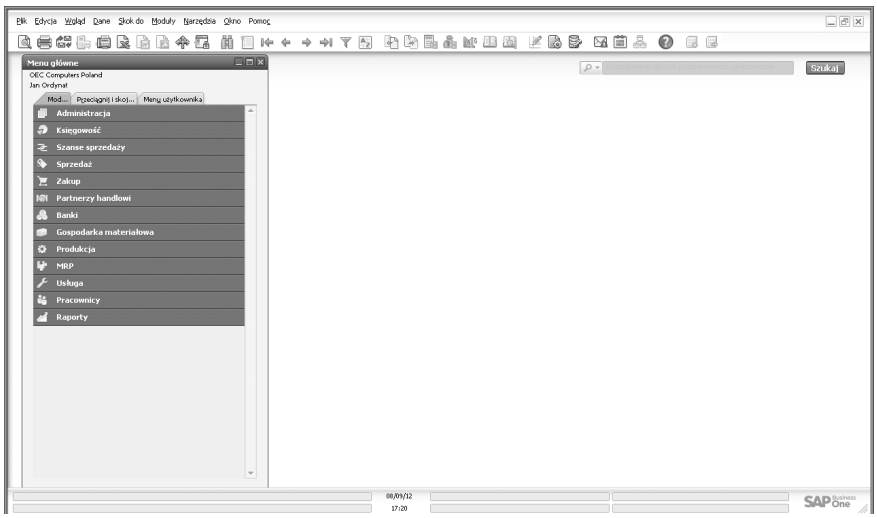


Fig. 4. 'Classic' style of menu in SAP Business One

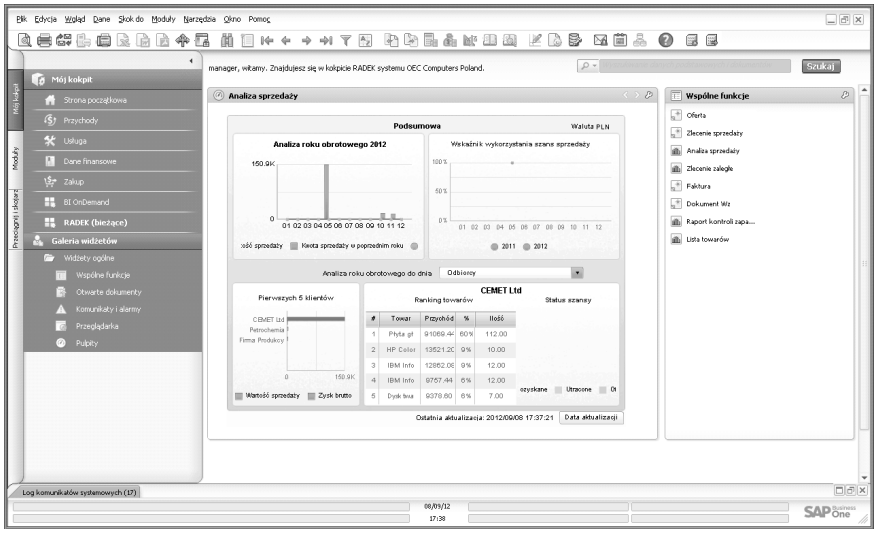


Fig. 5. User's cockpit and widgets in SAP Business One

As a result working with the system resembles a work with Web sites, which offer the ability to create user's own widgets composition – (cf. http:// iGoogle.com).

There is a web browser available among other widgets, what increase the range of possibilities for SAP Business One users in the area of customization the interface to better suit their needs. The browser can be used to integrate SAP B1 interface with other solutions, for instance one of the online analytical tools.

The novelty in the ecosystem of SAP solutions is a service called BI OnDemand. This service helps users with minimum or none knowledge on information technology to prepare data analysis on their own. All that has to be done is to prepare a dataset with data taken from SAP Business One database and upload it to the server. Because this service is provided using SaaS model (Software as a Service) users access the prepared analysis using internet browser, such as IE or Mozilla Firefox. Thanks to that this offer is especially important for mobile users – a group of users which is growing very fast lately. When dataset is ready at the BI OnDemand platform user has a number of tools which enables him to prepare more advanced analysis or apply an previously arranged visualization. What is also very important the platform offers the ability to share analysis with other users.

More advanced users have to use independent software vendors solutions. Designing an interface using external data creates data access problems. Companies that have chosen to implement BI tools often receive tools for creating dashboards. Referring to the previously mentioned platforms, WebStudio from Consorg is this kind of a tool – Figure 6.

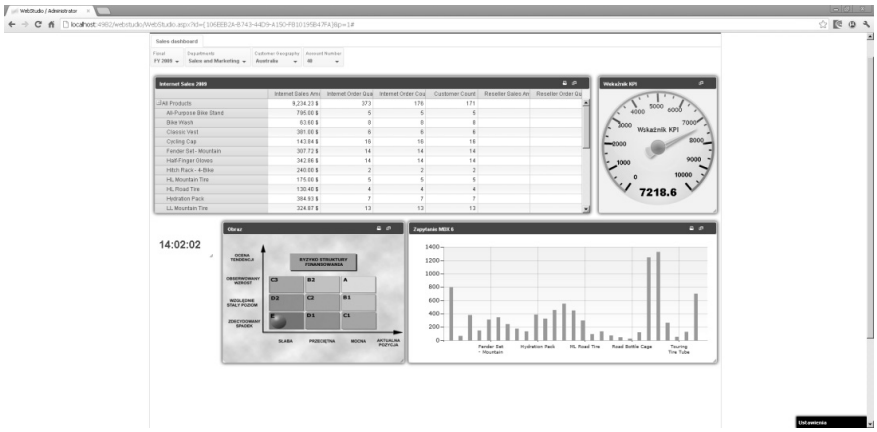


Fig. 6. Dashboards in WebStudio

It provides a user friendly interface for creating and publishing dashboards both for group and individual users. It also gives the ability to create custom multidimensional queries, which can be later converted into charts or KPIs. The

biggest advantage of the solution is the ability to design interactions between objects. The prosumer is responsible for the content, appearance, and behavior of the dashboard. As a web-based solution it also allows for integration within a single dashboard of content from various datasources (including external − web sites).

Summary

This paper concentrates on supporting an ERP system user in executing tasks related to data analyzing. Because making the analysis in the ERP system affects the overall experience about this system we draw a conclusion saying that when user can engage himself in the process of preparing data analysis such fact can positively influence his user experience. More and more critical publications concerning prosumption can be found over the Internet, where it is often just an excuse to make money of others' people work. This raises the question whether the idea can be used in traditional prosumption business so that it is done for the benefit of both the employee and the company. The answer is yes and a confirmation of this thesis can be found in EMC Corp. report, where prosumption is shown as on option for the user to create his own analysis. It also affects the quality of work with an analytical tool and its effectiveness.

"The end-user perspective must be an integral part of the effort from the very beginning. By allowing the end users to shape the solution, the true business requirements are met more effectively. This results in a higher adoption rate and subsequent broader use of the tools" [EMC10].

When it comes to enhance UX it seems, that facilitating user creation independent analysis allows on the one hand to increase his satisfaction with using the ERP system, and on the other hand it increases the effectiveness of his work. Such effectiveness is here understood as matching the results of work to the expectations that were formulated about these results before the work began. User changes the way he participates in the process of data analysis – from passive receiver to active producer. That's how prosumption takes place and how it increases user experience. An ERP user who acts as a prosumer acquires experience that pays off later on. Initially he is able to generate standard reports, than he learns how to create custom reports, and eventually is able to build a complete analytical platform based on dashboards. Activities that were initially supposed to help him work expand among a group of colleagues for whom he provides content. Expanding his experience as a user, increasing its effectiveness as an employee at the same time benefiting the company he works for.

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WZBOGACENIE DOŚWIADCZEŃ UŻYTKOWNIKA DZIĘKI PROSUMPCJI SYSTEMÓW ERP

Streszczenie

W artykule opisano możliwości wspomagania pracy użytkownika systemu klasy ERP w wykonywaniu zadań, które obejmują przygotowanie analizy danych pobranych z systemu SAP Business One. Przedstawiono sposoby określające, jak użytkownicy systemów informatycznych mogą doskonalić wykonywanie codziennych zadań. Wykazano prawdziwość tezy, że prosumpcja oddziałuje na proces podejmowania decyzji i zwiększa zaangażowanie użytkownika w analizę danych biznesowych.

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USING PROSUMPTION PARADIGM ASSUMPTIONS FOR BUSINESS MODEL DEVELOPMENT OF CONSORG S.A.

Introduction

„[...] Reduction of the costs of technology has enabled people the access to the tools which had been out of their range before; at present, millions of amateur fans may record music, produce short movies or design simple software with the similar effect to that reached by professionals" [OsPi10, p. 72].

Prosumption in IT-sector became most remarkable when the WEB 2.0 age came which is totally based on the creativity of Internet users. In the case of business oriented IT solutions (especially DSS) prosumption is seldom mentioned. However, it does not mean that the phenomenon of prosumption is marginal or useless in this area. On the contrary, when observing the changes in the approach to software development and implementation, it can be said that, presently, nearly all the enterprises have the necessary tools at their disposal which enable the potential of their employees for creating the own IT solutions aimed at supporting their work, to be used.

In this paper the problem of prosumption is considered from the point of view of an IT solution provider. These deliberations focus on the factors which shape the provider's business model allowing the value to be offered to clients through IT solutions based on the prosumption concept. Such an approach has allowed to formulate the main thesis of the paper, according to which the solution based on prosumption concept will be necessary in order to keep the future competitive position on the market of IT systems aimed at supporting the user's information and decision related processes. It will enforce the reengineering of

key business processes of IT solution providers which will result in deep innovations covering the business models exploited presently. Business model of CONSORG S.A. company which began its activity with business consulting and then supported it with its own IT and the own tools, has been used as an example of business model evolution towards the solution based on the prosumption concept. After several years DSS development and implementation became the company's main business. Nowadays products as well as the company's business model are using the assumptions of prosumpton paradigm more and more courageously and thereby the idea of shaping its clients (prosumers) becomes closer and closer to CONSORG S.A. company. Its activities (oriented towards clients' training) are helpful in raising their certainty and self-confidence and in winning their confidence to the system. The implementation is not completed at the moment of giving the product to the client but at the moment the client gains the skills required for using the system by himself in the creative work.

1. Foundations of business model

Different theories which can be encountered in the literature of the subject regarding the client's participation in the process of creating products or services indicate some significant relationships occurring between the enterprise and the clients who co-create the added value. In the consequence of the evolving approach to the client, the manufacturers/service providers have transferred a part of functions upon the consumers according to the prosumption rule, i.e. "do it yourself" [LaMa09, p. 164-166]. As early as in the eighties of last millennium Alvin Toffler announced the inevitable social integration (proposed by the theory of "prosumerism") aimed at combining the sphere of production with that of consumption and, simultaneously, he foresaw the dissemination of tele-work [UjNa09, p. 297-302];[LaMa09, p. 164-165].

Prosumption has been used by CONSORG S.A., one of the first Polish companies offering IT services including the specialized business consulting and the improvement of management processes through introducing the specialized organizational solutions based on controlling philosophy and supporting the client's business key processes by means of a modern IT technology, from the very beginning of its activity.

Business model constitutes the foundation on which business key processes are built and the unit goals are defined and translated into operational activities. Perception of an enterprise's business model logic allows to identify its key factors determining the added value [Wart12]. CONSORG's business model is strongly accentuating the value proposal for the client based on knowledge and

experience of the consultants who design business processes along with the future client treating the IT technology as a significant added value for the proposed solutions. Such an approach was of a great influence on the directions of CONSORG's business model evolution. Initially, consulting was the exclusive activity of the company. However, the optimizing of business processes in a way bringing significant advantages relating to the proposed solutions, has nearly always required the use of IT technology. CONSORG included IT solutions in its offer aimed at supporting the designed business tools. It was decided to develop the tools and applications (in-house) by extending strongly the team of programmers and IT consultants for this purpose. The approach to implementation was not changed. The offer is still based on the activities aimed at optimizing the client's key processes and the developed tools „support" the consultants in the implementation of the designed business applications. IT in the CONSORG's business model is oriented towards providing internal services for the consultants who design business solutions for the client. Implementation of the systems aimed at supporting the decision-making (operational or strategic ones) requires a high flexibility of IT technology expressed by the possibilities to quickly match the application functionality to the changing needs of users. Thus, it was the task of IT technology to provide CONSORG's consultants implementing the designed business solutions with a tool platform enabling a quick creation of an application prototype and then to optimize the solution through co-operation with a very exacting client (most frequently with Management Board of large corporations). Implementation was closed as soon as the basic functional requirements being the agreement subject had been met and the training had been given to the system users (in this case they were business analysts, financial supervisors, IT services) which ensured the independent modification of the application. At the first stage of the CONSORG's IT platform development the above mentioned modification of the application by the client lied above all in the independent preparation of reports. For this purpose a great importance was attached to the transparent for the future user designing of multidimensional OLAP cubes at the time of implementation. With time the possibilities of user's intervention in the delivered IT environment increased to such an extent that it is presently possible not only to develop the implemented applications but also the independent creation of applications in the areas that were not foreseen in the implementation agreement. De facto, a well-trained user provided with technical documentation and exploring the environment intensively, is able to reach the level of competence in the area of creating the application which is comparable to that of CONSORG's business consultants.

In view of the prosumption CONSORG has passed several stages. At the two first stages, i.e. software creation:

- on „turn key" basis according to the design worked out by consultants,
- dedicated to the consultants enabling business solutions to be accomplished by them,

client's prosumption is limited to the joint work with consultants and to the use of remarks and ideas collected when creating the software. The effect of such a cooperation is a tool matched to client's needs with a high-level support from substantial consultants. Moreover, the software is developed each time "from the ground up" which means increased costs and implementation time and affects its flexibility. Flexibility is increased after the accomplishment of a later client's new order when the consultants are able to individually develop the solutions. However, there still remain restrictions related to the cost and accomplishment time from the moment of reporting the idea by the client up to its completion.

Further stages approaching CONSORG to the prosumption idea constitute a significant change for the client. Initially, the client receives the tools allowing the independent build-up of reports and compilations which shorten his working time and diminish expenses on further solutions within the system. At the next stage he receives a full package of software, the same as that being at consultants' disposal, so he can develop the application in any direction. However, the increased system flexibility requires its stability to be ensured. When the tool is transmitted too quickly to the client it is impossible to eliminate the errors generated by the system which significantly brakes the client's prosumption-oriented behaviours related to the lack of confidence. Such an approach closes CONSORG by high outlays on R+D department aimed at stabilizing the tools. In spite of a high system flexibility the clients prosumption-oriented activity has its limits determined by the multidimensional model worked out by CONSORG's consultants at the beginning of the implementation.

2. Corporation business model of Consorg S.A.

The basic business model of CONSORG S.A. company was based on maintaining three main areas of business activities, i.e. the widely understood creating and keeping relations with clients, creating product innovations and development of tool platforms and implementing the business solutions and servicing the implemented applications at the client's, within one single organizational structure (see Figure 1). The key clients of CONSORG were large industrial corporations acting most frequently within a holding or concern structures*. Val-

* See e.g. [GrMT05] or [StST07].

ue of the implemented solutions resulted from the knowledge and experience of consultants who designed business solutions and their flexibility in responding to client's needs. Functionality of the tool platform on which the applications designed by consultants were built, was optimized along with business project. Such an approach enabled a flexible co-operation between the consultant and the client. The consultant created a prototype and then, after client's remarks (i.e. without the aid of IT), he developed the applications. The number of iterations could be very large with such an approach as the time of response to user's needs was the key parameter of the assessment of co-operation quality. Up to now the fastness of responding to client's needs has been shaping the competitive position of CONSORG on the market of IT services. The most valuable functionalities resulting from identification of client's new needs have been included in the tool platform developed by IT department. Thus, on one hand the platform became more and more versatile but on the other hand, which is obvious, the cost of its maintenance and development were growing, mainly due to labour input devoted to ensuring the integrity of its particular components.

<table>
<tr>
<td rowspan="2">Key partners
Suppliers of system and tool software (e.g. Microsoft)</td>
<td>Key activities
1. Solving the client's business problems</td>
<td rowspan="2">Value proposal for the client
Knowledge and experience of the consultants designing business solutions and their flexibility in responding to the changing needs of the client</td>
<td>Relations with clients
1. Personal support
2. Client's dedicated customer service</td>
<td rowspan="2">Clients' segments
1. Large economic organizations, capital groups
2. Capital groups quoted on Stock Exchange</td>
</tr>
<tr>
<td>Key resources
1. Trade relations
2. Business consultants
3. R+D team
4. The own technological platform</td>
<td>Distribution channels
Own, direct, based on tradesmen employed within a permanent employment agreement</td>
</tr>
<tr>
<td colspan="3">Cost structure
1. Costs of business consultants (provision and keeping)
2. Cost of implementation related services
3. Costs of research and development
4. Costs of client support and post-implementation services
5. Costs of client acquisition (commercial)</td>
<td colspan="2">Revenue streams
1. Revenues on consulting services
2. Revenues on the own license fees
3. Revenues on commissions from external licenses
4. Revenues on implementation services and trainings
5. Revenues on the maintenance of tool platform and applications</td>
</tr>
</table>

Fig. 1. CONSORG S.A. Corporation Business Model

Source: Own elaboration based on the template of business model as proposed by [OsPi10].

Business model management as presented in Figure 1 lies in mitigating the obvious conflicts between the required scale of sale of license which justifies the IT platform development and the development of business applications aimed at solving the client's individual problems. Inclusion of further components (functions) in the tool environment and their further integration within one single "consultant friendly" platform are justified if there is a chance of their reuse.

The requirement regarding the scale of sale financing the platform development causes an automatic change in the orientation of commercial activities. Tradesmen must focus on looking for a client whose needs can be served by modifying the platform functionality to the smallest possible extent. In turn, such an approach is opposite to the requirements of business consultants who are interested in solving the client's non-standard problems [TwSt09]. Despite the fact that the client is able to individually build the whole solution, he does not make use of it as the implementation is based on the use of the business applications worked out before by CONSORG Company's consultants which are matched to client's business model. The scope of system functionality which has been extended for this purpose causes that, at first the consultants and then the clients, have the possibility to independently extend the multidimensional structures. On the other hand, the number of IT tools used by clients has forced the software manufacturers to search for some new solutions allowing their integration and ensuring the convenience of their use. By going this way CONSORG has provided the access for its clients to the possibility of publishing the analytical objects designed by them (used in client's business applications) on WEB platform and integrating them with other WEB resources used in the enterprise. From the point of view of prosumption the client has been given the possibility of a free build-up of dashboards integrating the information coming from different sources dedicated for his specific needs. Additionally, a solution running under Microsoft Excel system has been made available for a specific group of employees (accountants, financial analysts, etc.). The application of such an approach does not force the user to change systems or to learn a new interface as it works within one single environment which is matched best to its character. It results from the observation, that the integration of different functionalities has allowed to increase prosumption behaviors among this kind of employees.

3. Towards the build-up of a prosumption business model

Gradual separation of particular activities seems to be the best way of optimizing the business model of CONSORG S.A. Redefinition of business activity related to the maintenance and development of OT platform is of a special im-

portance in this respect. Revenues generated from the sale of license at the level of profitability threshold, at the least, may be achieved in three following ways: firstly, selling the license to other partners (competition); secondly, implementing the unique functionalities of the platform within the most famous competitive platforms (IBM/Cognos/TM1 or OBI). Thirdly, matching the platform to final user's needs who is able to quickly develop his own applications, not only without the support from CONSORG S.A. consultants but also with minimum participation of his own IT. The last approach which gives the fastest effects has become the subject of intensive activities aimed at re-engineering the business processes of CONSORG S.A. The basic assumption of the designed business model for the activities related to the maintenance and development of a tool platform was the change of the definition of the final client. The market for CONSORG platform has been created by both the existing internal client (CONSORG business consultant) and the clients of the leading ERP system suppliers, clients of CONSORG business partners and the clients acquired in an indirect way (see Figure 2).

<table>
<tr>
<td rowspan="2">Key partners
1. Suppliers of system and tool software
2. Suppliers of ERP systems
3. Business partners of Consorg S.A.</td>
<td>Key activities
Development of technological platform</td>
<td rowspan="2">Proposal of value for client
Efficient and easy to maintain tool platform enabling the creation of independent advanced business applications by the end user</td>
<td>Relations with clients
Automatic and semi-automatic support by CRM system</td>
<td rowspan="2">Client segments
Small and medium commercial service and production companies SMB-sector)</td>
</tr>
<tr>
<td>Key resources
1. Own technological platform
2. Pre-defined business models</td>
<td>Distribution channels
Indirect channel basic partnership; direct − the own one − complementary</td>
</tr>
<tr>
<td colspan="3">Cost structure
1. Cost of research and development of IT tool platform
2. Cost of client support and post-implementation services</td>
<td colspan="2">Revenue streams
1. Revenues on the own license fees</td>
</tr>
</table>

Fig. 2. Separated CONSORG S.A. business model for the area of maintenance and development of IT platform

Source: Own elaboration based on the template of business model as proposed by [OsPi10].

The target group of clients and the proposed value added are the first to change along with the modification of business model. The offer is directed to SMB sector by assuming a smaller revenue on a unit transaction, a larger num-

ber of them and decisively lower costs of client's acquisition and maintenance. The proposal regarding the value changes from solving business problems to the delivery of an efficient tool platform where the end user builds up business applications independently by solving his own specific problems. Relations with the client (acquisition and support) are created in a semi-automatic way by telemarketing team supported by CRM system which has been worked out especially for that purpose. Platform implementation is limited to software installation and a training for the staff. Apart from having a flexible tool platform, the key factor of success for such an approach is a system of trainings for users based on pre-defined business models received from the best implementation practices of CONSORG (worked out during the accomplishment of large business projects in different branches). Due to that the last barrier has been broken related to the multidimensional data model. The clients are able to independently build up a multidimensional model and to provide it with the data from their own IT systems. Like in the case of business applications, CONSORG company prepares the pre-defined models (based on the most popular ERP systems) which can be extended by the client individually, or the client may create his own models and their resources (supplies).

4. Possible scenarios of prosumption business model development

Development of network technologies, especially the one enabling the data to be processed within cloud computing, gives an opportunity to analyze the chances and threats for the designed prosumption business model of CONSORG. The first positive effects of installing the own technological platform in an environment which enables the data to be processed within cloud computing are provoking the business part of such an approach to be deeply reconsidered – Figure 3.

It is worthwhile to remember that the build-up of a complete IT solution requires a well selected and efficient equipment architecture, apart from the knowledge and tools. Then, the maintenance of equipment and IT tools forces the employment of further specialists. Transfer of the solution into cloud computing simplifies the business model (due to outsourcing of equipment and software or intuitive tools enabling the individual accomplishment of needs by the client). At the same time the client is transferred to a higher level of prosumption, i.e. he independently modifies and creates IT solutions for himself and matches the computational possibilities of cloud computing (which also means equipment resources) to his current needs.

<table>
<tr><td rowspan="2">Key partners
Suppliers of environment enabling the processing within cloud computing</td><td>Key activities
Development of technological platform for the needs of cloud computing</td><td rowspan="2">Value proposal for the client
Efficient and easy to maintain tool platform available from any location of the user and enabling the creation of independent business application by the end user</td><td>Relations with clients
Automatic and semi-automatic support by CRM</td><td rowspan="2">Client segments
Small and medium commercial service and production companies SMB-sector)</td></tr>
<tr><td>Key resources
1. Own technological platform enabling the work within cloud computing</td><td>Distribution channels
Indirect channel basic partner-ship; direct − the own one − complementary</td></tr>
<tr><td colspan="3">Cost structure
1. Cost of research and development of IT tool platform
2. Cost of the use of the environment for cloud computing</td><td colspan="2">Revenue streams
Revenues on the use of tool environment</td></tr>
</table>

Fig 3. Separated business model of CONSORG S.A. for the area of maintenance and development of IT platform taking the processing in cloud computing into account

Source: Own elaboration based on the template of business model as proposed by [OsPi10].

From technological point of view CONSORG company has extensive possibilities to use such an approach, due to, inter alia, WEB interface for the tools offered by it and to the components made available for data integration with the user's transaction systems.

Conclusion

IT companies can manipulate the determined factors by discouraging or by approaching their clients to the prosumption concept. Three factors proposed by R.H. Walker and L.W. Johnson seem to decide about the success of CONSORG, i.e.: personal capacity (ability and self-belief that they can use the prosumption technologies and interfaces successfully), perceived risk (extent to which a prosumer believes the software system is reliable and secure) and relative advantage (the extent to which prosumption is believed to be more convenient, faster, more efficient, and more productive than the traditional mode of consumption). The use of prosumption assumptions by clients does not need to mean their total separation from IT solution suppliers. Prosumption in enterprises may be at different levels of progress. R. Kitchin, M. Dodge have proposed the prosumption to be divided into 6 types depending on the possibilities offered by the software, i.e.: feedback, customization, content, architectural, market and self-service. With reference to the above mentioned prosumption levels and the presented business model of CONSORG S.A. company, the above specified types may be assigned to subsequent stages of software development, i.e.:

- clients' participation in designing the solution, reporting remarks and ideas to be taken into account in further versions of the system, i.e. feedback,
- independent extension of business applications within a narrow scope, i.e. customization,
- extension of business applications within any scope – the possibility of creating the whole solution independently, i.e. content,
- extension of multidimensional models, integrating different solutions operating within the enterprise and creating new solutions on their basis (e.g. dashboards), i.e. content and architectural,
- potential possibility of designing and creating the own business solution based on cloud computing which is independent of the company's equipment infrastructure, i.e. self-service.

The solutions based on prosumption concept aimed at supporting the management processes, especially within the area of decision-making require not only a flexible IT technology in order to constitute the added value, but also an effective business model of the supplier. In Table 1 the development stages have been presented in respect of both technology and organization of CONSORG.

Table 1

Development stages of IT technology and business model of CONSORG S.A.

Stages / MODEL	Feedback	Customization	Content	Architectural	Self-service
Prosumption business model	Trainings and experience exchange	Creation of business objects	Designing the interface for the whole solution	Independent build-up of multidimensional model matched ideally to the model of client's business	Independent designing and implementation of business solution within cloud computing
Separated business model	Collecting users' opinions and development of tools	Adaptation and extension of business models	Creating manager's portals and integration at the level of Excel	Change in a multi-dimensional model	
Basic business model	Joint project of a business solution	Parameterizing the existing lists and reports	Creating business objects		

Apart from technological platform, knowledge transformation procedures supporting the end user in matching the applications to the solving of decision-making problems, constitute the key resources of the described business model. It implies the development of technology and the operation mode of the enterprise.

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WYKORZYSTANIE ZAŁOŻEŃ PARADYGMATU PROSUMPCJI DO ROZWOJU MODELU BIZNESOWEGO FIRMY CONSORG S.A.

Streszczenie

W artykule postawiono tezę, w myśl której utrzymanie w przyszłości pozycji konkurencyjnej na rynku systemów informatycznych wspierających procesy informacyjno-decyzyjne użytkownika będzie wymagać rozwiązań opartych na koncepcji prosumpcji. Nie ograniczy to działań dostawców rozwiązań IT jedynie do technologicznych zmian w obrębie swoich produktów, lecz przede wszystkim wymusi reinżynierię kluczowych procesów biznesowych. Podjęta problematyka została opisana z perspektywy ewolucji modelu biznesowego firmy CONSORG S.A.

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SOCIAL MEDIA FOR CORPORATE BRANDS

Try not to become a man of success
but rather try to become a man of value.

Albert Einstein

Introduction

Social media (SM) are communication channels enabling interaction between internauts by means of various communication technologies. Among basic platforms of interaction there are forums and discussion groups (e.g. GoldenLine), blogs, microblogs (e.g. Blip or Twitter), services for sharing the content (e.g. YouTube), creating groups, VOIP, P2P, virtual worlds (e.g. SecondLife) and social networking services (e.g. Facebook) [Pach09]; [Maje10]. Through them, users can share their knowledge and experiences. Social media introduced democracy into the way of sharing information. They changed readers into creators of content. They transformed the mechanism of broadcasting information into the model of "many-to-many", through enabling mutual interaction between authors, readers and reviewers.

Social media are based on relations between various objects. These can be relations B2C, B2B, C2C, B2A, etc. [PaSr10]. The presence of consumer brands (B2C) in social media is already common. Consumers value brands in social media, especially in Facebook and Twitter, companies gather loads of fans and try to earn their liking, by the use of games, applications, competitions. The interest in corporate brands' presence (corporate brand* – B2B) in social media

* The corporate brand defines the firm that will deliver and stand behind the offering that the customer will buy and use. The brand has access to organizational as well as product associations and the flexibility to play several roles within the brand portfolio. Of most significance is its potential in some context to be a master brand with a significant driver role. In fact, in the case of Dell, UPS, Sony, Samsung, IBM, and others, it can been seen as the ultimate branded house, where the product brands consist largely of the corporate brand plus a descriptor. In these cases, the use of a corporate brand as a master brand maximizes brand portfolio goals such as generating leverage, synergy, and clarity [Aake12].

still is not as common as in case of consumer brands, however, equally important. Behind business decisions concerning buying goods and services there are people who are present in social media, and there look for information about the goods and services. They can use this knowledge in their businesses [Tomk12]. Companies present in SM can have better financial results than the ones which do not use this medium. The aim of the article is to present the possibilities offered by social media to corporate brands. The hypothesis will be verified in the next research.

Popularity of social media

Social media are a new, direct (one-to-one), wide channel of contacting clients. The primary advantage of this channel is its size, range of activity, and the fact that its users are very active, they eagerly tell a lot about themselves, they comment on the reality, leave information about their preferences, gather into groups of certain interests and likes. Important merit of the channel is its reliability, as consumers trust informal information about products and brands much more than e.g. traditional forms of advertising. Table 1 shows comparison of traditional media with social media.

Table 1

Traditional media vs social media

Criterion	Traditional media	Social media
The direction of communicating information	oriented at broadcasting information (from up to down)	everybody can publish information or comments, the difference between a creator and a reader is blurred
Availability of information	creating and publishing the content is available for few − it requires capital, knowledge, special skills and access to right medium	easily (and usually for free) available for everyone, 24/7/365, the barriers of entry are low, i.e. everybody can create content
The speed of providing information	Depends on specific features of a communication medium and information distribution channel and the location of a recipient	faster than traditional media, everyone can be a journalist, it is enough to be in the right place in the right time, the variety of information sources and channels
Durability of message	content created by the radio, press or TV once published cannot be changed, its durability is often short (TV, radio)	ecosystem, where the content once created may be endlessly processed, edited, aggregated or cited
Control	usually belongs to a particular group	practically impossible to control, majority of the content is created by users who decide what will be published, read or modified

The interest in social media for the use of business has been continuously increasing since 2003. New social networking services began to appear very fast, trying to copy the ideas already implemented. Professional websites like LinkedIn, Visible Path or Xing concentrated on businesspeople, Dogster helped to meet people of the same interests, Care2 was targeted At activists, etc. [www1].

LinkedIn.com is the example of an Internet society used in business. It specialises in professional-business contacts. In recent years LinkedIn.com has become one of the biggest and commonly used portals, with over 135 mln registered users representing 150 different branches of industry [www2]. LinkedIn.com allows to find quickly previous and present co-workers, contacts useful when looking for work or new business opportunities, and business advice, thanks to availability of a lot of specialists of a given branch. Internet business societies function as on-line meetings for specialists of a branch of business and industry. Polish equivalent is GoldenLine and Profeo.pl.

GoldenLine is a social networking service that joins professionals of various interests, positions and professional aims. It is a society concentrated on developing career and professional life. It helps to meet people, come into being in an industry and monitor the job market. Members of this society can successfully manage contacts and maintain valuable relations. Thanks to innovative solutions implemented in the service, one can find here interesting job offers, and employers can quickly, easily and successfully gain good employees. Access to various resources of knowledge is possible, as users, discussing in forums, build up the base of experience and information. A special value of GoldenLine is the fact that its members are present with their actual name and surname and they care about maintaining high level of society.

Report "Social Media Benchmarking Study", prepared by Business.com portal, describes an influence of social networking services on building positive image and on making business decisions in B2B sector. The findings show that 62% of respondents*, when asked about the sources of information necessary at work, answered that they visit company profiles at social networking services, and 54,5% search for necessary information about certain companies, services or goods through social media [www3] (Figure 1).

* The study was conducted on the group of 2393 persons from B2B branch, making business decisions.

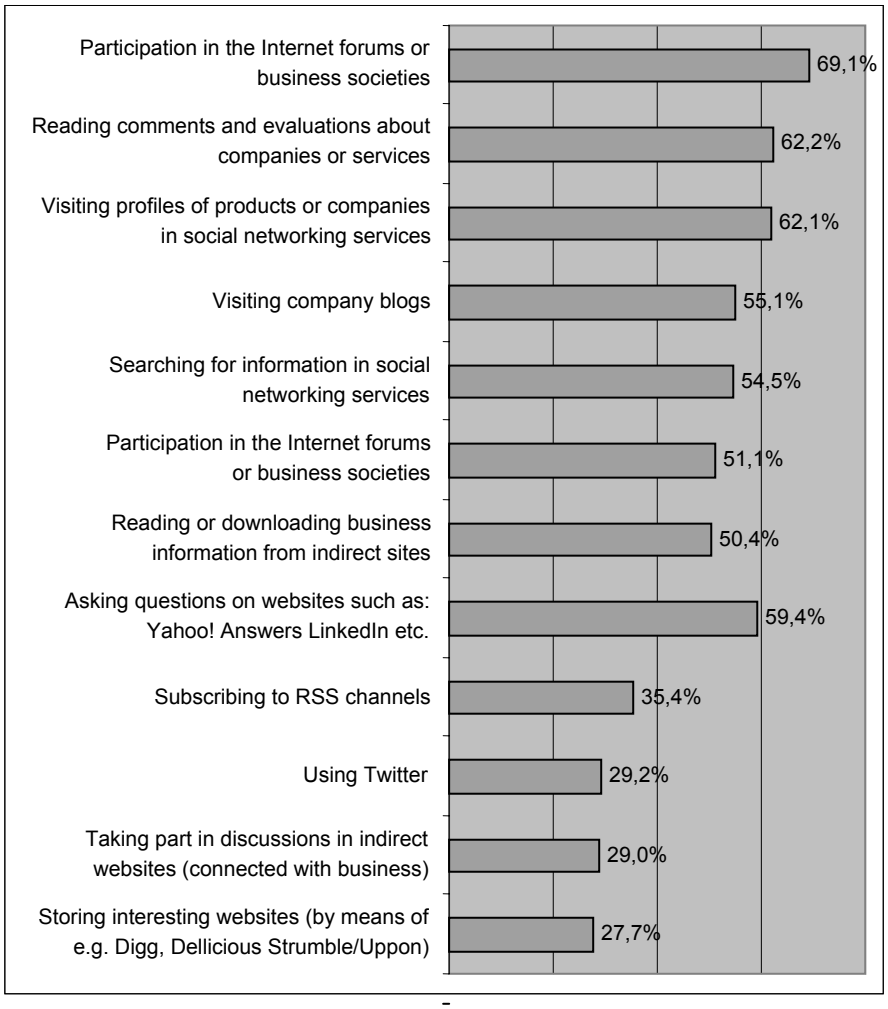


Fig. 1. Sources of obtaining business information

Source: Based on: [Dyre11].

Benefits coming from the use of social media in B2B sector

The information in social networking services spreads fast and can reach more a wider target audience. At the same time the media allow for reducing the costs connected with streaming information about a company's brand. A company's presence in social networking services can bring a lot of significant benefits. The key task of managers is, therefore, to understand the role of this communication channel in the whole process of integrated marketing communication of an organisation.

The benefits of social media potential in B2B sector are the following [Dyre11]:

1. Generating leads*. These can be, for example, inquires about products or services of a company, built on the basis of "Call to Action" (CTA). Facebook makes it possible to create applications encouraging potential clients/business partners to interact with a given company. It can be for example a window of a newsletter subscription, a form to contact a consultant or sending an inquiry.
2. Another place to find a company in the Internet. Thanks to running a website in e.g. Facebook, people who look for information about particular products, receive in the search results a place to acquire updated data about a company and its offer.
3. Gathering interested people in one place. A site in Facebook lets the users aggregate the content they are actually interested in. In B2B sector it is important to target the users, as the number of fans does not always equal the quality of measurable effects.
4. Building a company's image. What influence positively the image of a company is publishing information about its HR policy, social campaigns, won competitions, recent realisations, active participation in discussions between fans, encouraging them to speak, dealing with questions and doubts.
5. Press room. A company's fan page is a convenient place for publishing information about current events in the company. The company's photos or videos can be uploaded here, as well as links to the company's website. It allows for building networks and creates an easy access to information for journalists, the effects of which are publications in electronic press.
6. Focus group. Fan page in Facebook can be used in order to conduct some small research about a company's brand. Tools like opinion polls or discussions make it possible to easily obtain information from consumers.

Information about companies, present in social media, is increasingly used by providers of business information, because they check the companies that other companies could cooperate with. Societies are becoming places worth belonging to. It does not always mean active presence. It is also worth noticing the passive presence, visible in the results of social media monitoring. Tools like Brand24 or Sotrender Analytics let companies find out how they are perceived in social media.

* The term refers to creating future interactions from the part of clients.

Strategy for B2B in social media

Social networking services contribute to creating new quality of business. Nowadays, partners in business demand clearer, honest, direct and involved approach from companies they do business with. Social media best promote the companies which have some arranged strategy for the brand, and have given a lot of thought to why it is worth being in these media and who they want to encourage to cooperation [Dębs10].

In order to fully use the potential of social media in creating B2B relations, companies should concentrate their activities on the following directions [Dębs10]:

1. From the "wish to sell" to "creating friendship". In order to change the relation into "creating friendship" companies should use various ways to reach a customer, including the presence in Facebook sites, microblogs, e.g. Twitter or blip. There they should write less about offered products or services, but more about things that help to know the "personality" of the company. It will let the clients feel more comfortable while deciding to cooperate with such companies.
2. From "big campaigns" to "little actions". Instead of spending a lot of money on traditional big campaigns, it can turn out more profitable to act with "little steps". In social networking services, an opinion about a product spreads very fast, and Facebook or Twitter friends can share the information about what has just happened.
3. From "supervising a company image" to "being yourself". Companies that use social media increasingly give their employees the possibility to "be themselves". They try to provide them with means necessary to feel good, to speak positively about a company and thus show it in favourable light.
4. From a company that is "difficult to reach" to "available everywhere". In order to build relation with clients/business partners it is no longer enough to give an email address and a phone number on the website. What is important today is interaction through various channels of communication available through social media. Dell company, for example, makes use of a lot of such channels. In their website they inform how to contact the company – Twitter, Facebook, Flickr, YouTube, forums, blogs, mails, etc., giving consumers the choice to reach the company in the most convenient way (Figure 2).



Fig. 2. Methods of contacting Dell company

Source: [Dębs09].

While creating a communication strategy in social media, the kind of users should be taken into consideration. For an entertainment service the strategy will be slightly different than for a specialistic forum that usually gathers professionals of a given branch.

While planning activities for a corporate brand in the area of social media, the following key issues should be considered [Tomk10]:

1. Why – why to act? – what is the aim of activities in social media, is it more important for a company to develop brand recognisability or to support sales campaigns, etc.
2. Who – who to direct the actions to? – it is essential to determine preliminary profile of a user the company intends to have a relation with.
3. What – what could be achieved? – establishing what effects will be satisfactory, how a brand will benefit from being present in social media.
4. How – how to do it? – determining the method of achieving assumed goals, whether a company will focus on the brand profile or e.g. its CRS actions (Corporate Social Responsibility).
5. When – when to act? – every branch functions by its own rules. For a tourist sector brand, the pre-holiday season will be the most important, for a clothing brand – an autumn season. Involvement of different profiles of users will vary in different periods.

An important rule in creating strategies in social media is care about their coherence. While deciding to increase its transparency, a company must make sure that the information published in various services is not incoherent, let alone contradictory. While having an online dialogue, one cannot allow for negative emotions. Excessive emotional involvement can lead to decrease in a company records. Constant supervision of conducted activities is also important. There are tools available that allow for monitoring the effects of these activities. The best measuring instrument, however, are internauts themselves and their reaction to the company's activities.

The strategy of social media consists in [Kowa12]:

1. **Setting the goals in social media.** Selecting appropriate goals in social media is a strategic decision and depends on business goals of an organization/brand. Setting the goals of activities in social networking services should be done basing on SMART rule (Simple, Measurable, Achievable, Relevant, Timely). In case of social media, the SMART rule has one more meaning: Socialize, Monitor, Analyse, Report, Target, indicating a cycle that should be repeated. After defining strategical goals, operational goals should be determined, also according to SMART rule. KPI value (Key Performance Indicator) should be assigned to each operational goal. Some set key effectiveness indexes will allow for determining the direction and level of realising the strategy.
2. **Conducting analysis**. The analysis should allow for:
   - Determining the target group and the social media a company uses. Defining social media channels where the target group is present will enable to choose social networking services in which an organisation/brand will carry out the communication. For example, a lot of companies in the American market use at least four or five social networking services: Twitter, Facebook, YouTube, Google+ or LinkedIn. Polish companies are usually present in such social media as: Facebook (86%), YouTube (38%), LinkedIn (30%), GoldenLine (20%).
   - Recognizing how the competition acts, i.e. how the competitors use particular social networking services, what media they use and with what frequency, how they constructs announcements, what methods are used to support a brand's presence in social media. In order to study the opinion about a brand or a competitor, companies can use professional tools that allow for effective monitoring of the Internet and social media, e.g. Sentione, Brand24, Guarda, Mobuzzer, Centymetr, etc.

3. **Selecting the tools in social media.** After setting the goals of a company's /brand's existence in social media and after the analysis, suitable tools and other necessary resources (also human) should be chosen. Tools used in realizing strategies in social media can be divided into:
   - supporting the automation of log adding,
   - applications used with various activities within sales promotion, e.g. contests, etc.,
   - analytics in social media,
   - monitoring of a brand in social media.

   The key element of realising the strategy is appointing people responsible for realising the strategy of marketing communication in social networking services.
4. **Evaluation and optimization of a brand's existence in social media.** Each process connected with implementing and realizing a strategy ends with recurring summary, based on figures that are key performance indicators – KPI. Companies should apply both quality indicators of effects (e.g. clients' satisfaction, brand awareness) and quantity indicators (e.g. ROI, profits attributed to the existence in social media, data about activity of users). Strategy realization in SM should be optimized basing on experiences and research, and the best practices of the competition in national and foreign market.

Summary

Social media are an excellent tool to communicate with clients, gather information and opinion about a given brand, services or products, gaining new customers and business partners and conducting advertising campaigns. They are nowadays the source of massive, free knowledge, built on its own. The knowledge that after analyzing allows a company for development and optimisation of business. The potential lying in social networks can be skillfully used by companies in order to gain favour and involvement of clients. The companies, however, can also easily make their image worse, become exposed to anger and loss of clients/business partners. The dynamics, big interactivity and innovativeness of social media requires creativity – new ideas, not used so far. In order to achieve real business value , a strategy of activity in social media must be appropriately planned.

The strategy should involve three basic steps:

- listen to what internauts talk about in terms of a product or a brand, and what the activity of competitors is like, what will succeed and what will not (it is better and cheaper to learn from someone else's mistakes),

- it is good to have a plan for a longer period of time than for one campaign – a brand's existence in social media should be associated with the brand, not with the campaign,
- measures of effectiveness – to determine what will be measured in the campaign and how these measures will be evaluated (the number of fans is not always the most important), what is expected from the fans, followers or readers of a blog?

In social media there is a huge potential of building relation with a brand. However, in order to use it fully, companies have to:

- be honest in presenting their identity,
- communicate it clearly when they give their own opinions,
- be respectful and humble in the communication process,
- use common sense while selecting information for public presentation,
- remember that what is said/written in the net, will stay there forever,
- make use of the tools that are understandable for the organisation, which match the goals and which are used by potential business partners.

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MEDIA SPOŁECZNOŚCIOWE DLA ROZWOJU MAREK KORPORACYJNYCH

Streszczenie

Media społecznościowe (SM) to kanały komunikacyjne umożliwiające interakcję między internautami za pomocą różnych technologii komunikacyjnych. Media te opierają się na relacjach między różnymi podmiotami. Mogą to być relacje typu B2C, B2B, C2C, B2A itd. Obecność marek konsumenckich (B2C) w mediach społecznych jest już powszechna. Konsumenci cenią marki w SM, szczególnie na Facebooku i Twitterze, zaś firmy zbierają rzesze fanów i starają się pozyskać ich sympatię, wykorzystując gry, aplikacje czy konkursy. Zainteresowanie obecnością marek biznesowych (corporate Brand – B2B) w mediach społecznościowych nie jest jeszcze tak popularne, jak w przypadku marek konsumenckich, lecz równie ważne. Za decyzjami biznesowymi o zakupie produktów i usług stoją przecież ludzie, którzy są obecni w SM i poszukują tam informacji dotyczących produktów i usług. Wiedzę tę następnie mogą wykorzystywać jako przedsiębiorcy. Firmy obecne w SM mogą osiągać lepsze wyniki finansowe niż te, które nie korzystają z tego medium. Aby osiągnąć realną wartość biznesową, firmy muszą jednak zaplanować odpowiednią strategię działania w SM. W artykule przedstawiono możliwości, jakie oferują media społecznościowe markom biznesowym.

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CLOUD COMPUTING AS INFORMATION TECHNOLOGY PROSUMPTION ENVIRONMENT

Introduction

Innovation can be seen as a management activity, which involves focusing on the organization's mission, searching for unique opportunities, determining whether they fit the organization's strategic directions. Innovators are expected to deliver something new − new products, new processes and new designs, which create change in goods as in lifecycles. The creativity in innovations adds value to the individuals and the communities and is based upon perceiving and capturing an opportunity. Tidd and Bessant consider four types of innovations:

1. Product innovation − changes in the products or services that a business organization offers.
2. Process innovation − changes in the ways in which they are created and delivered.
3. Position innovation − changes in the context in which the products and services are introduced.
4. Paradigm innovation − changes in the underlying mental models which frame what the business organization does [TiBe11].

However, this paper focuses on information technology (IT) user as innovator. The paper consists of four subchapters. At first, the innovative role of IT users is discussed. Next, the cloud computing for end-users is presented in the aspects of benefits and limitations. The third subchapter covers the review of software application distributed in clouds for individuals and small business companies. The last part includes the cloud computing architecture model, where the role of end-user is emphasized.

IT user as innovator

IT innovation, as any innovation, demands the co-evolution and co-existence of the information technology invention and the socio-economic activity of any institution. The object of IT innovation does not stand alone, but is set in the cultural and business practices, social values and interests. Innovation research has emphasized the importance of understanding user needs in the process of new product development. However, it is not sufficient to understand or even satisfy existing users, but rather it is necessary to lead existing users and create new user segments. Therefore, companies could be interested in IT user involvement in production or service delivery process. IT users are able to support companies to change their image, reduce research and development costs, differentiate offers, reduce the time to market, facilitate user education, improve market acceptance or even to provide more original and valuable proposals than professional developers. General classification of IT users covers lead users, normal users and user communities [BHvH06]. Lead users are critical to the development and adoption of complex products. They demand innovation ahead of the general market of other users. They face needs that will be the future trends in the market place and they are actively engaged in the innovative process. Normal users could help to provide superior and differentiated services, reduce cycle time, increase acceptance of the new service. Communities are treated as a decentralized virtual design teams, as designers and as a source of innovations.

Users as innovators seek to develop new designs for their own personal usage or (in the case of user firms) internal corporate benefits. They do not anticipate selling goods or services based on their innovations, although they may later go into business as manufacturers. Designing for users and testing by users are the essential characteristics of users as innovators, they may subcontract production and parts supply, but they cannot outsource the innovation's conceptualization and design. Particularly in e-economy, it is visible that focus on users instead of customers is necessary. Users are customers, job candidates, business prospects and partners, brand fans, media agency members and other stakeholders, who interact with a company through digital media and technology. The interactivity is realized in Internet, through mobile applications, a Web site, customer relationship management software, the Facebook page or Twitter account. Usually, users want simplicity of IT solutions and intuitive software applications. When people find something difficult or confusing to use, they do not blame the software producer, but they blame themselves and reject that way of using and cancel the entire experience. Therefore, the companies must work on the im-

provement of usability to provide users an easy products, to satisfy the users with their experiences. User-centric management is a philosophy and approach to business management that puts users first in all decision making [Shap11]. Users benefit from their positive experience that fulfils personal needs and interests. However, there is a risk that the user involvement in the design process will never be properly rewarded and an organization will fail to provide a positive user experience, so the negative consequences can occur such as negative publicity and loss of user engagement. So, only through social interactions, perceived dialogue online and social accessibility and transparency the value can be co-created. Some initiatives have involved professional staff, others build on communities of practitioners and rely on their voluntary work. There are a couple of models of open collaboration.

- user-producer model: centralized model; although real costs can be met with resources other than money, most initiatives need to raise some capital,
- co-production model: equal participation of software application developer and users,
- replacement model: open (i.e. provided by user) content replaces other uses and benefits from cost savings,
- foundation, donation or endowment model, in which funding for the project is provided by external actors,
- segmentation model, in which provider offers value-added services to user segments and charges them for these services,
- conversion model, in which "you give something away for free and then convert the consumer to a paying client",
- membership model, based on fund-raising campaigns or paying members [GKfF11].

For many years, mass production and product customization were business strategies that aimed at fulfilling individual needs quickly and efficiently. However, concepts such as customer orientation, user-centered design, customer segmentation, customer relationship management, user-centric management reveal the importance of the user involvement. The separation of production and consumption cannot imply that consumer is a passive recipient, but they should be considered as creative actors. Consumers can act as resource integrators, when they use their competence, tools, raw materials and sometimes professional services to produce maintenance services, entertainment, meals for themselves. Prosumption implies that buyers manufacture products for their own consumption. Although most contributions in marketing to date have been consistent with the goods-dominant logic view of consumers as passive buyers of what others produce, there is a growing body of challenging this rather limited perspective.

Cloud computing opportunities

The prime revolutionary aspect of cloud computing (CC) is its ability to deploy location-independent services. The main challenge includes managing various infrastructures across multiple organizations consisting of frameworks that now include self-healing, self-monitoring and automatic reconfiguring of mission-critical applications [CAAS10]. CC services compris of three parts:

- basic infrastructure services that frequently provide remote storage, hosting, firewall services, identity services, backup services and so forth,
- platform software including various support functions such as standard libraries, storage, portal servers, development tools,
- service-oriented applications that exist primarily to provide services to users, but are also accessible by other applications or application platforms.

CC users include individuals or organizations who interact through cloud services and provide services on the cloud. They may supply information or non-technical services to their target customer communities for profit or non-profit activities (e.g. online legal consultants or blog authors). These users have an interest to monitor clouds for where their customers are connected. CC services offer the following opportunities:

- service-orientation: CC services are delivered over the Internet; the service components are modular, pluggable, composable, standardized, and loosely coupled,
- resource pooling: service virtualization facilitates shared resources and costs among a large pool of supply chains, it supports a multi-tenancy environment and allows for centralization of infrastructure for lower operational costs,
- centralization vs. federation: cloud configurations can be deployed to a centralized organization or be distributed among different locations that demand a certain degree of collaboration,
- security: CC technology provides infrastructure level oversight of security; although a cloud can enforce stronger endpoint security and better data protection, the sharing environment is vulnerable due to its open nature.

The other benefits of CC cover on-demand self-servicing without the need for interaction with cloud service provider personnel, broad network access to IT resources in the cloud, rapid elasticity and measurement of provided services, low costs of computing, high quality of service, simplified maintenance and upgrading, outsourced IT management, and low barriers to entry.

Cloud computing marketspace for individuals

Current trends in professional life, education and also in leisure time are characterized by increasing change and diversity. The diversity concerns people with different skills, knowledge, cultural background, and cognitive or psychological abilities, as well as diversity related to different tasks, contexts, and areas of work. End users are generally neither skilled nor interested in adopting their systems at the same level as software professionals. However, it is very desirable to empower users to adapt systems at a level of complexity that is appropriate to their individual skills and situations. Today, the focus is on the process of outsourcing to the customer with the help of the Web 2.0. Typical examples cover:

- product configuration, mass customization (e.g. Dell),
- product development, design, idea finding (e.g. Dell Idea Storm),
- innovation and design contests (e.g. Starbucks Idea),
- product rating (e.g. Amazon),
- internet-mediated self-service (e.g. buying rail or airline tickets),
- platforms for user-generated content or user activities (e.g. YouTube, eBay) [RiVo10].

The origins of Web-based consumer-generated content emerged out the rise of so-called Web 2.0. Participatory media formats like blogs, wikis, mashups, multiplayer video games, video hosting and social network sites are all developed out of the interactive and open architecture as well as of social software technologies that allow users to create, remix, and redistribute content traditionally owned and controlled by corporate organizations and the established culture industries. In the new model, prosumption includes iterative and non-linear practices of users and new media exploitation by them allowing them to be simultaneously producers and consumers in the act of creating, re-mixing and redistributing media texts, content, information and knowledge in participatory Web cultures. The new information technologies are expected to create the potential to overcome the traditional division between users and the individuals responsible for developing, operating and maintaining systems. Perhaps, a challenge for the next years will be the development of the computing environments that allow for the transposition from easy-to-use to easy-to-develop interactive software systems.

According to Lieberman et al. end-user development (EUD) can be defined as a set of methods, techniques and tools that allow users, who are acting as non-professional software developers, at some point to create, modify or extend any software artifacts [LPKW06]. Some forms of EUD are well known for years as

developed for commercial software companies e.g. recording macros in word processors, setting up spreadsheets for calculations and defining email filters. However, active users are highly differentiated, so the common categories of them are as follows:

- environment: personal (home) user or worker (corporate, organizational, enterprise) user,
- skill level: novice, semiskilled, expert using specialized software,
- frequency of use: occasional, frequent or extensive,
- software use: word processing, email, accounting, etc.,
- IT education level: basic, intermediate, advanced (i.e. having special software certificate e.g. SPSS),
- relationship: internal user (co-worker), external user (client).

Clouds satisfy different types of users:

- end users, who mainly use the services of the software as a service (SaaS) layer over a Web browser and basic offerings of the infrastructure as a service (IaaS) layer as for example storage of data resulting from the usage of the SaaS layer,
- business users, who might access all three layers: the IaaS in order to enhance their own infrastructure with additional resources on demand: the platform as a service (PaaS) layer in order to be able to run own applications in a cloud and eventually the SaaS layer in order to take advantage of available applications offered as a service,
- developers and independent software vendors, who develop applications that are supposed to be offered over the SaaS layer of a cloud,
- end-user as a hardware provider; the resources can be specialized hardware dedicated only to run the cloud applications or equipment that is used for other applications, such as desktop computers [SSWo10].

A private cloud is fully owned by a single company who has total control over the applications run on the infrastructure. A public cloud includes date centre hardware and software run by the third parties, e.g. Google and Amazon which expose their services to customers via the Internet. Through the cloud market, service providers have possibilities to define and customize the software service offers in a personalized way for each user by selecting the most appropriate services from the available repositories. Well known companies, i.e. Amazon, Google, IBM, Salesforce.com offer tools for cloud service developers. There are also a number of smaller companies working in this domain, e.g.:

- 10gen (www.10gen.com), which provides a platform for developers to build scalable web-based applications,

- Cohesive Flexible Technologies (www.cohesiveft.com), which offers the Elastic Server On-Demand virtual server platform,
- Joyent (www.joyent.com), which delivers the Accelerator scalable on-demand infrastructure for web application developers, as well as the Connector suite of easy-to-use web applications for small businesses.

CC applications for personal usage are to improve communications among family members, for example a web-based email service, such as Google's Gmail (mail.google.com), Microsoft Windows Live Hotmail (mail.live.com), and Yahoo!Mail (mail.yahoo.com). Collaborating on schedules is enabled through the use of a web-based calendar, such as Google Calendar (calendar.google.com) or Yahoo! Calendar (calendar.yahoo.com). All what users have to do is to create a public calendar and authorize access for all others within a group or a family. There are a lot of sites available to share family photos, from non-commercial sites like Flickr (www.flickr.com) to sites that sell the prints, such as Shutterfly (www.shutterfly.com). There are sites particularly offered for sport teams, e.g., web-based applications include eteemz (www.eteemz.com), League Athletics (www.leagueathletics.com), League Lineup (www.leaguelineup. com), and TeamSnap (www.teamsnap.com). Salespeople have to deal with lots and lots of contacts. Among the most popular of these applications are BigContacts (www.bigcontacts.com), Highrise (www. highrisehq. com), and the market-leading Salesforce.com. For managing projects, the most popular of these applications include AceProject (www.aceproject.com), Basecamp (www.basecamphq.com), onProject (www.onproject.com), and Project Insight (www.projectinsight.com). For enterprise management support, some of the most popular enterprise-level web-based expense reporting applications include Concur (www.concur.com), ExpensAble (www.expensable.com), ExpensePoint (www.expensepoint.com) and TimeConsultant (www.timeconsultant.com). Some of the popular event management applications include Cvent (www.cvent.com), RegOnline (www.regoline.com), and ViewCentral (www.rmkr.com/viewcentral). The CC software are small packages for communication. Web-based contact management applications enable access to contact information from any computer connected to the Internet. Instead of storing personal contacts on home PC, users can store all their contacts in the cloud, where they can be accessed from home and work. The most popular web-based contact management and CRM system available today is offered by Salesforce.com (www.salesforce.com). For Web-based word processing, Google Docs (docs.google.com) is the most popular web-based word processor available today. In the desktop computing world, the leading database program today is Microsoft Access. None of the major database software devel-

opers currently provide web-based database applications. However, Blist (www.blist.com) proposes easy-to-use database designed for non-technical business people. Dabble DB (www.dabbledb.com) makes it easy to create new databases and add new records. The application called myWebDB (hu.oneteamtech.com/mywebdb.html) is billed as a do-it-yourself Web 2.0 database application. Sometimes, users need support in the CC software utilization. The common ways to help users include:

- peer support: users frequently look to their colleagues, when they need computer assistance,
- part time user support: hardware and software vendors often provide informal client support during the early stages of product development,
- help desk support as a single point of contact for users in need of technical support, whether they are internal workers or external clients,
- user support centre, known as information centre, which provides a wider range of services than a help desk.

The cloud market analyses allow to aggregate information from various sources (operational, business, social, user feedback), in order to gain knowledge for improving the business terms and conditions for new CC products and business models. The general model of CC architecture is presented in Figure 1. The CC service provider office covers the following functionalities: service management, service cataloguing, service right management, pricing, user profiling, payments, product supporting, analytics and reporting. Product catalogue covers the product specification and is linked to the corresponding services and applications in the service repository. The second repository covers the contracts repository, where the agreements between providers and users for each marketplace transaction are placed. Presented in Figure 1 cloud computing architecture is an information processing model, in which centrally administered computing capabilities are delivered as services, according to the users' needs across the network to a variety of user-facing devices. The users should understand how the services are distributed, and how the service levels and performance indicators are monitored and measured by the providers. They can control access to cloud applications and services and can mediate between different internal and external protocols and standards.

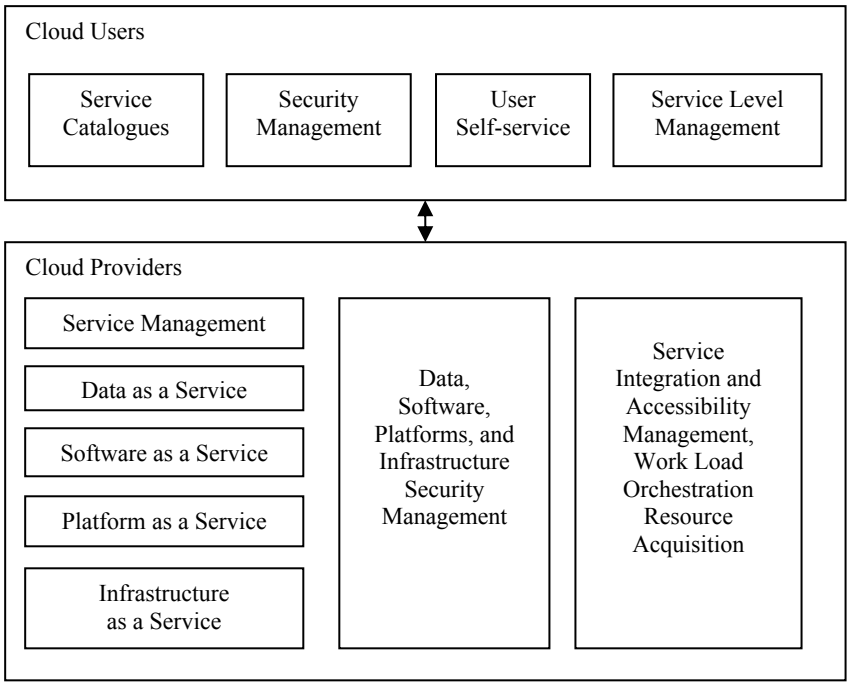


Fig. 1. User in cloud computing architecture

Source: Based on [RaPe11].

In clouds, information and services are programmatically aggregated, acting as building blocks of complex compositions, called service mashups [BBGo11]. That is a new kind of Web-based applications to foster EUD. To shorten the traditional and time-consuming development process, the applications are developed by non-professional programmers, often in a non-formal, iterative way by assembling existing building blocks.

The CC users expect on-demand nearly instant access to resources, therefore, cloud must allow self-service access and the users can request, customize, pay and use services without intervention of human operators (see Figure 1). Cloud services must be priced on a short-term basis allowing users to release resources as soon as they are not needed. In the cloud computing the high activism of users is not only visible in self-sourcing, because lately the term Dev 2.0 is used to describe platforms, that aim to bring user's participation into application development, much as Web 2.0 technologies, such as blogs and social networking [Shro10]. Non-programmers can use Dev 2.0 platforms to create a limited

class of business applications, in nearly the same manner as ordinary users of the Internet were empowered to publish content using Web 2.0 tools, such as blogs and wikis. Lately, many Dev 2.0 platforms have become available from startup companies i.e., Bungee Labs. TrackVia, Caspio, TeamDesk, ZohoCreator, QuickBase, Qrimp, Wold, OutSystems, PerfectForms, Cordys, Iceberg, WorkXpress and WorkLight. Each of these platforms is based on an interpretative and multi-tenant architecture, and allows creation of simple forms-based workflows. Dev 2.0 platforms represent a potential paradigm shift for development of small to medium enterprise applications, and can lead to significant improvements in development productivity for that class of applications.

Conclusion

The idea of Enterprise 2.0 and Dev 2.0 create opportunities for emergence of open innovation, which rely on the capabilities that modern telecommunication networks offer to collaborate at a distance. Open innovation realized by users could be greatly facilitated by providing some structured framework for the end user activities and by agreeing on common purposes and shared set of service expectations.

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PRZETWARZANIE W CHMURZE JAKO ŚRODOWISKO PROSUMPCJI TECHNOLOGII INFORMACJI

Streszczenie

Artykuł jest zorientowany na wyeksponowanie użytkownika systemów informatycznych jako innowatora. Składa się z czterech części. Najpierw wyjaśniono innowacyjną rolę użytkownika systemu informatycznego, następnie przedstawiono korzyści i zagrożenia przetwarzania w chmurze w aspekcie użytkownika systemu. Trzecia część zawiera przegląd oprogramowania użytkowego dystrybuowanego w chmurze, a ostatnia − model architektury przetwarzania w chmurze, gdzie rola użytkownika jest szczególnie wyeksponowana.

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THE EFFICIENT TAILORING OF IT PRODUCT, SPECIFIC TO THE STAKEHOLDERS' NEEDS THROUGH DIRECT, PERSONAL INVOLVEMENT AND UNDERSTANDING

Introduction

There are a few factors which may be the recipe for a successful IT project. First of all is an idea – the concept for a good product. It must be originated by finding the niche of the market. The niche market idea is the way to distinguish our product from others already existing in the market. If it is our intention that a target group will be youth, it is necessary to propose innovative and attractive solutions to encourage them to use the product. We – by giving a proposal to the Polish Ministry of National Education [Pols09a] to realise the "e-Experiments in physics" project – decided to "go even one better", to convince that our innovative product will have an educational use and value in completion of the curriculum in schools (in particular – upper secondary schools). However an idea, even the best one, is not enough. Therefore, we set the research question of how to achieve success, or how to carry out the project in order to create a product that will be well-received by the target group, i.e. students and teachers. The aim of this study is to identify and formulate methods and criteria for success. This is a very important issue in today's world based on IT technology, because there are still too many projects which end in failure [Standish09].

When we have a concept, we have to develop relevant software to satisfy the market and make it attractive for those who will be using it (in this case an educational market). It is also important to choose adequate technology. It

should be stressed that in today's IT world one of the most significant characteristics are portability and flexibility [ChunPL09]. Our product should be planned to be software and hardware independent, multi-platform, available for multiple, different operating systems and types of computer equipment (desktops, laptops, tablets, etc.), and multimedia boards. It is also important to ensure the possibility of running a program directly using a web browser (without the need of prior installation on the computer) or installed as a simple application when a computer is not connected to the Internet or access to the Internet is limited.

Therefore, in the first place we need to fully understand the requirements of both the end user and the recipient of our product [RozaW05]. In our case the recipient of the e-Experiments is the teacher and the end user is the student. To tailor the program specifically to their needs we invited them – our stakeholder to work with us. Their executive support in the project is exceptionally helpful in resolving any problems or issues such as adapting e-experiments to the conditions prevailing at school. Their expertise at teaching physics to upper secondary school student is invaluable in the first stage of development and we have utilised input from a methodologist from one of the best secondary schools in Poland.

Afterwards our e-experiments are presented to the teachers from selected schools taking part in the project and finally, during product testing we get feedback from the students. All these opinions will be considered to enable modification of the product to make it more attractive to the user, adding new features, functions, or suggestions for other exercises.

The paper describes the process of the e-experiments development paying special attention to stakeholders, user and recipient, participatory design and active participation in information system development. Authors present their own experience and methods for different group of stakeholders involvement and usage of their creativity support.

Structure of the paper is as follows: at the beginning we introduce into the subject by explaining the context of the project and its product, and how it fits into the niche of the market. Next, we describe the target groups and process of gathering requirements, due to designing and development of software. Then we describe methods of validation and verification of final product. Paper ends with conclusion remarks.

Niche of the market: about the project

Obviously, physics is an experimental science. Carrying out the experiments allows students to "touch" the problem, forcing the scientific activity. Let us stress, that only the self-experimentation by students leads to a correct and

deep understanding of the processes and physical laws, according to the famous maxim of Confucius: "Tell me and I forget, show me and I remember, let me do and I understand". On the other hand, there are many practical problems when carrying out experiments at schools. Laboratory equipment is very expensive. Usually, there is only a limited number of experimental sets, so only selected students are able to carry out the experiments, while the others are only watching [PłotSJ11; Pols09b; Pols10].

Moreover, there are only the basic instruments in schools. But the lack of proper equipment is not the only problem. Preparation and experimentation takes time, also some willingness and ability of the teacher is required to perform experimental lessons. Some teachers may restrict student's freedom in experimenting, being afraid of the experimental set-ups. This freedom is – of course – also limited by the physical conditions or for technical reasons – e.g. we cannot change the gravity or perform experiment in the accelerating train! It is also obvious, that there are some fields of physics (atomic and nuclear physics, astrophysics), in which carrying out experiments at school is not possible (e.g. for organizational, budgetary, safety reasons). Next, usually it is not possible to establish and carry out experiments by a student at home – this is a very strong limitation (it is very well known, that repeating things allows for better understanding and memorization) [PłotSJ11; RuttvJvdV12].

Our product, as opposed to existing ones [KąkoŻ10], is designed to resolve the above problems and limitations, but not in the real world, but in the "virtual" one. We live in a rapidly changing world, in which both the computers and the Internet are a natural environment for young people. Thanks to that, e-experiments, as the computer programs being equivalents to the real experiments, have a great chance to encourage this target group to use them, as a complement for the 'real' physics. Let us mention here, that e-experiments are just computer tools supporting traditional methods – we do not want to displace or replace the actual, real experiments. They are designed to show some physical issues in a broader perspective than is possible with real experiments, allowing for free experimenting – according to the rule: design, build, perform the experiment, then analyze and visualize results. This will allow students for a deeper understanding of the problem, for building better understood models, cause-effect sequences and sets of dependencies, which are necessary to describe the phenomena. e-Experiments are the very first such didactics tools, fulfilling the above criteria, thus filling the niche on the market.

Target group: stakeholders identification

At the beginning of the project careful stakeholder identification was carried out. The best efforts to complete a list of people, institutions, organisations and non-human (subject-matter) that could be affected in any way by the project considering any legal, economical-financial, organisational, technical and, above all, social environment affects [Gott02; GottR05; RozaW05]. Depending on the relationship between stakeholders and the project and actual involvement in the project there can be distinguished following groups of interests:

- customer – Polish Ministry of National Education, intermediary institutions for the EFS programmes implementation,
- project team – academic staff and students of the Gdansk University of Technology – subject matter experts group leaded by the assistant of the project manager supported by coordinator and methodologist that is responsible for the scenarios (requirement specification) of the e-experiments, numerical engine and the exercise books,
- developer – Young Digital Planet SA, responsible for technological tasks: coding, providing graphics and user interface to the application,
- consultant – L.C.G. Malmberg B.V. is to provide substantial support such reviewing and test ready-made e-experiments reports,
- administration – staff that care for the project's security in terms of legal, technical, financial as well as control progress and compliance with project documents project manager, monitoring and evaluation specialist, public procurement specialist and IT, financial, legal, office together with technical services,

and stakeholders that this paper gives more attention:

- end users – physics teachers,
- recipients – students, in particular (but not limited to) of the upper secondary schools,
- community – decision-making board, education and academic circles and net surfer,
- non-human – teaching programme.

Stakeholder engagement into project

End user and recipients

For the purpose of the project physics teachers who use e-experiments as educational tools during her/his lessons at upper secondaries schools and their students who were given classes using e-experiments tool as a recipients were used during development. Both groups are directly affected by the product so

their opinion is of the paramount importance for the project shape. Their participation in this development is described below in the section 'Validation with the use of Stakeholder's acceptance tests'.

Community

A community is not considered as a direct customer, user or recipient of the project but its opinion and/or decision can have a material impact on shape and future of the project as they have a direct influence in the successful mainstreaming of the product, after the testing stage. This group includes decision- and opinion-making bodies such as education, academic institutions/organisations related to education (e.g. National Thematic Network for Education and Higher Education – a forum of experience exchange and evaluation of innovative projects that may help in popularising and incorporating into the mainstream), education/academic institutions (also in higher education and especially in the field of technical and natural sciences). Full consideration will be given to opinions expressed by institutions/organisations and specialists (e.g. user interaction experts) and feedback has and will assist with further development.

Also net servers, potential users (maybe other physics teachers or students) can also provide relevant feedback assisting in an accurate assessment of the product and focus on their interface experience. Perhaps their independent opinion will help improve (e.g. add new functions/features) and make more attractive the proposed educational tool.

Decision- and opinion-making bodies: institutions/organisations, education and academic circles

During continuous development it is essential that we continue to strive to produce an effective tool that will perform and produce results that accurately compare to existing requirements and is able to adapt to future needs [PłotS12; RuttvJvdV12]. Therefore, the project can be of educational importance and can exercise significant influence not just on the testing group but for the whole future curriculum. Teachers using it and the students who according to this programme, modified/enriched teaching programme, will pursue education on physics and science and if the final product is admitted to dissemination and incorporation it into educational mainstream in Poland, it is essential that consideration and application of any valuable opinion from the educational, academic and subject-matter community is made.

In the end, if e-experiments do not raise any concern, National Thematic Network for Education and Higher Education that is made up of experts, innovation European projects beneficiaries and educational organisation representatives by validation of the product will recommend it's incorporation into mainstreaming.

Technology

To assure the attractiveness of the e-experiments, we decided to produce them with use of the rendered, often 3-dimensional graphics, very similar to the look and feel of the real equipment. Thanks to that, user has an impression of working in the same manner as he would do in the real laboratory. However, we try to keep a reasonable compromise between the attractiveness of graphics and the educational values, so that the user is not distracted at work.

e-Experiments are implemented in modern and convenient technology – Adobe Air. This technology allows users to run them as they wish – as a Web or standalone application, independent on hardware and software platforms. One can even run them on the tablets, with full use of touch interface. Thanks to that we do not limit in advance the circle of potential users.

Our solution is also very flexible: e-experiments can be presented to user in a several ways. The fundamental equipment is – obviously – a computer, but it can be accompanied by the multimedia projector or even an interactive board, allowing for better reception, adapted to the size and skills of the group.

Requirements

Our world is a rapidly changing world, in which computer and Internet are a natural environment for young people. This is where they are spending their free time or looking for educational aids [PłotSJ11]. However, is not the e-experiments goal to replace reality, experiments that should be conducted in physics laboratories at schools, but to support and complement traditional methods based mainly on theory that do not allow full understanding of the actual physics.

e-Experiments features such as:

- common set of tools (parts of experimental set-up, stopwatch, table, graph etc.) of a free choice,
- graphics derived from the real look of the experimental equipment,
- real-time, reliable calculations,
- the ability to change the frame of reference to enable specific experimental set-up and to repeat an experiment, using a different sets of parameters,
- allow the analysis of results by using the table and graph tool aimed at learning by mistakes by using alternative scenarios.

Verification

The verification, ensuring that product is developed in accordance with requirement specification (scenario) [Somm10]. This activity is concerned by the domain experts, project team members who check if there are no bugs that hinder the performance of the experiments. If there are any errors found they are reported to the developer team for correction. This phase is to prepare a preliminary version of the product that can be used during test lessons at upper secondary schools.

As soon as software delivered by the developer is approved by the project team a new experiment is placed on the testing platform and project website in order to perform acceptance tests/validation by the stakeholders. The testing platform has been introduced for monitoring the way the students and teachers are using the software (e.g. how often some features are used, how much time the students spend on the exercise etc.).

Validation with the use of Stakeholder's acceptance tests

When the product is verified by the project team, it is passed on to the teachers, and then, at a later phase, the students, who by testing provide validation and acceptance of the product [HsuCLC08].

The prime objective of the project is to prepare an aid that can be found valuable (by the teachers) and attractive enough to be willingly used by the young people, students. Stakeholders' (user, and recipient) acceptance tests serve to develop a product that will meet both educational and practical needs, together with being technically and technologically up-to-date [PłotS12; RuttvJvdV12].

Stakeholders' acceptance test course

e-Experiments will be tested during the two-year mandatory course – during physics lessons in the classroom, in selected upper secondary schools. During these lessons, teachers will introduce the e-experiments in a uniform manner.

1. The first year of testing (1st class):
   - the teacher demonstrates a physical phenomenon in the classroom by using appropriate e-experiment and computer and projector, and/or whiteboard,

or:

   - classes are held in the computer lab, all students perform the e-experiment by themselves or in groups, depending on the organizational features of school.

Notwithstanding the above selection, the teacher asks students to do homework using the e-experiment.

2. The second year of testing (2nd class):

The teacher informs students about the upcoming subject of the lesson. He assigns introductory tasks that students are expected to perform at home, using e-experiments. Next, an experiment is performed in the classroom:

- the teacher, using a computer and projector, and/or whiteboard,
- by selected student or group of students, using a computer and projector, and/or whiteboard,
- in the computer lab, all students individually or in groups, depending on the organizational capabilities school.

Notwithstanding the above selection, the teacher asks students to do homework using the e-experiment.

The general methodology of interaction between the teacher and students, through the testing platform, is as follows:

1. The teacher creates educational materials (he can add a description of the theoretical phenomenon, useful websites, additional literature, etc.) for a variety of physical problems that can be studied using an e-experiment.
2. The teacher creates various tasks (easy, difficult, very difficult – an individual approach to a student) in which he will need to use the e-experiment.
3. The student solves the tasks assigned to him, using the e-experiment – assembles experimental set, runs the experiment, creates and populates the tables, creates charts.
4. The student saves the status of the e-experiment, if it finds that he performed the task.
5. The student develops results in an external spreadsheet (if needed).
6. The student – on the basis of the results and his impression of the software – draws his conclusions and enters them into the interactive form.
7. The student sends to the teacher: a link to a saved state of e-experiment, the completed form with his conclusions, additional files (text, presentations, pictures, charts, spreadsheets, etc.).
8. The teacher receives a report form student; he can also view, test settings, perform an experiment (in the read-only mode).
9. The teacher – on the basis of a report – assesses the student; he can also view the statistics of student's activity on the platform. Then, the teacher's evaluation of student's issues, together with descriptive commentary, is sent back to the student.

The set of all the reports submitted by the student, along with a descriptive assessment of each report prepared by the teacher, together with various statistics collected by the platform, is then send to the project team, and used to evaluate the software.

Finally, the product is validated by the stakeholders (internal validation) and will be discussed by the members of the National Thematic Network for Education and Higher Education, and they will judge if e-experiments can be incorporated into mainstreaming.

Conclusion

As is clear from the literature cited in the previous sections, close cooperation with stakeholders enables resolution of many (technical, organisational or subject-matter) problems or issues that may arise. This helps to ensure that the software is not just in accordance with their requirement but enhances their interface and provides simplified user friendly interaction in the first place and gives its user expected support in their work and encourages their validation of the product. Any feedback from the users/recipients etc. during acceptance test/validation phase will allow for modifications and improvements before the final validation/approval of the product, in the described case by the National Thematic Network. All this serves a purpose of preparing a useful product that can be received by a well researched and targeted end user fulfilling their objectives and eventually is approved by the decision-making body of the organisation that are going to use it (Polish Ministry of National Education in the case of educational tools that are planned to be incorporated in the mainstream of education) and, finally, end-users/recipients (teachers, students etc.) that will be using it, directly working with the product.

The main limitation of this publication is the inability to fully evaluate the selected criteria. This is due to the fact that the project is still in progress. The future will show whether the application of the principles collected and described in this publication will prove to be sufficient for success.

Described case constitutes a subject of analysis (theory building element) in the positivist qualitative study into enhancement requirement engineering, Małgorzata's Ph.D thesis.

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EFEKTYWNE DOSTOSOWYWANIE PRODUKTU INFORMATYCZNEGO DO POTRZEB UDZIAŁOWCÓW POPRZEZ ICH BEZPOŚREDNIE, OSOBISTE WŁĄCZENIE, ZAANGAŻOWANIE I ZROZUMIENIE

Streszczenie

Istnieje kilka czynników, które mogą być receptą na sukces projektu IT. Przede wszystkim jest to pomysł − pomysł na dobry produkt. Należy zatem zawsze rozpocząć pracę od znalezienia niszy na rynku. Dobry pomysł jest sposobem na odróżnienie produktu od innych już istniejących na rynku. Jeśli grupą docelową jest młodzież, konieczne jest przedstawienie innowacyjnych i atrakcyjnych rozwiązań, aby zachęcić ich do korzystania z produktu. My − dając Ministerstwu Edukacji Narodowej propozycję realizacji projektu „e-Doświadczenia w fizyce" − postanowiliśmy „pójść jeszcze dalej", aby się upewnić, że nasz innowacyjny produkt będzie miał rzeczywiste zastosowanie i niósł dużą wartość edukacyjną. Jednak sam pomysł, nawet najlepszy, nie wystarczy. Należy oczywiście na jego podstawie stworzyć odpowiednie oprogramowanie, aby zaspokoić rynek (w tym przypadku rynek edukacyjny) i sprawić, że będzie ono atrakcyjne dla tych, którzy będą go używać. Ważne jest również, aby wybrać odpowiednią technologię. Należy podkreślić, że w dzisiejszym świecie jednymi z najbardziej istotnych cech oprogramowania są mobilność i elastyczność. Nasz produkt należało zatem zaplanować tak, aby był wieloplatformowy, dostępny dla wielu różnych systemów operacyjnych i rodzajów sprzętu komputerowego (komputery stacjonarne, laptopy, tablety itp.) i tablic multimedialnych. Ważne jest również, aby zapewnić możliwość uruchomienia programu bezpośrednio za pomocą przeglądarki internetowej (bez konieczności wcześniejszego instalowania na komputerze). Z kolei gdy komputer nie jest podłączony do Internetu lub dostęp do Internetu jest ograniczony, powinna być udostępniona wersja off-line. Musimy też w pełni zrozumieć wymagania zarówno użytkowników końcowych, jak i odbiorcy naszego produktu. W naszym przypadku odbiorca e-doświadczeń jest nauczycielem, a użytkownik jest uczniem. Aby dostosować program specjalnie do ich potrzeb, zaprosiliśmy ich do współpracy z nami. Ich wsparcie w projekcie jest wyjątkowo pomocne w rozwiązywaniu wszelkich problemów, takich jak np. dostosowanie e-doświadczeń do warunków i realiów panujących w szkole. Produkt (czyli e-doświadczenia) jest przedstawiany nauczycielom z wybranych szkół biorących udział w projekcie i wreszcie podczas testowania produktów otrzymujemy informacje zwrotne od uczniów − użytkowników e-doświadczeń. Wszystkie te opinie będą brane pod uwagę w celu umożliwienia zmiany produktu, aby uczynić go bardziej atrakcyjnym dla użytkownika (dodanie nowych funkcji, uwzględnienie sugestii dotyczące innych ćwiczeń itp.).

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PROSUMPTION – CONSUMER CREATIVITY IN E-BUSINESS

Introduction

Over the last few centuries the economy of the developed world has been dominated by capitalism. Its early years were dominated by production, especially in factories. Much more recently the focus shifted to consumption (with the shopping centre coming to rival, or even supplant, the factory as the centre of the economy). However, it is our premise that a capitalist economy (and even pre- and non-capitalist economies) has always been dominated by prosumption [Ritz09]. Prosumption involves both production and consumption rather than focusing on either one (production) or the other (consumption).

The aim of the article is focused on prosumption as a form of consumer creativity. In the present economic model creativity as a task lies on the side of the producers, as they have had to deliver innovative products to meet, or even create, consumer needs. In the era of prosumption, it is the consumers who can satisfy their needs for innovation and creativity by creating and modifying products not offered by the manufacturers.

1. Production, consumption, prosumption

From the beginning of the Industrial Revolution, and for about two centuries thereafter, the economy of the West, if not Western society in its entirety, was said to be defined by production. When one thought about the economy of that period, the focus was almost always on production. Production was the focus, and even in fully understanding its relationship to consumption and vice versa, the role of production was a leading one.

Production predominated for almost two centuries. Starting from the 1960s, production, especially in the United States and later in Western Europe, moved from heavy industries towards the production of consumer goods. Production

was still seen as preeminent, but the pendulum was swinging in the direction of the centrality of consumption. At this time shopping centres, restaurants, fast food places and many more such places significantly developed. Since the crisis of the 1970s to the present day, this situation has only been intensified. An economy driven by the consumption of goods is increasingly produced abroad, mostly in China.

However, since the end of 2007 both production and consumption decreased as a result of the global recession. The development of prosumption can be noted along with the development of the Internet, social networking, Web 2.0, and the e-economy.

The term *prosumption* was first used in the book *The Third Wave* [Toff80] by an American sociologist and futurologist – Alvin Toffler. Toffler argued that prosumption was predominant in pre-industrial societies – what he called the "first wave". This was followed by a "second wave" of marketisation that drove "a wedge into society, that separated these two functions, thereby giving birth to what we now call producers and consumers" [Toff80]. Thus, the primordial economic form is neither production nor consumption, but rather prosumption. This Third Wave of society, a megatrend, would see more people spending their leisure time producing goods and services for their own use, and in effect marking a return to prosumption activities. Toffler understood prosumption as shifting some tasks from the producer to the consumer with the concept of *do-it-yourself*, also as the increasing involvement of the consumer to do tasks which had formerly been performed for that consumer by someone else. Many people appreciate the work of other people's own hands; it is a reason for them to be proud of.

Bill Quaine sees prosumption slightly differently [Quai02]. He understands it as some sort of loyalty programme. The producer provides loyal customers with a system of attractive discounts as well as participation in profits from the market for their help in promoting the producer's products. With this formula of business the money spent by the customers on the necessary products goes back and becomes a source of income.

On the other hand, D. Tapscott defines prosumption as the desire to have goods that are consistent with the client's imagination. The author believes that through the individual choices and actions of the buyers, they become the co-authors of the product [Gach08].

The main factors stimulating prosumption processes are primarily the following:

- increase of leisure time as a result of automation and robotic manufacturing processes and the need to spend this leisure time in an attractive way,
- the ability to perform work at home and to interlace it with consumer activities,

- the development and dissemination of education, and especially of continuing one's education,
- changes in the organisation of work and reevaluating its role in human life, the evolution towards creative work.

Classic examples of modern proactive consumers are the clients of Ikea shops. The consumer decides to purchase a product, such as cabinets, brings the furniture home and begins assembling it according to the instructions included in the package. The client's own share of the work in creating the furniture causes the client to believe that money has been saved – money which otherwise would have been spent if someone did the work. The great benefit of selling disassembled furniture for the company is the obvious lack of need for assembly, thus facilitating logistics processes by using smaller packaging of goods sold.

Education is a special form of prosumption. This is because of the characteristics of both consumption (meeting the needs of knowledge, experience, intellectual, aesthetic, etc.) and the characteristics of production (increasing one's qualifications, skills, expertise, etc.). Education is thus a kind of synthesis of consumption and production, and more specifically, of consumption and investment.

2. Prosumption in e-business

Almost ten years after the publication of Toffler, Tapscott and Williams, in their work [TaWi08] they popularised presumption by giving it the status of a core business in a new economy which is dominated by cooperation and peer-to-peer relationships between its participants. This form of activity is innovative and creative to the benefit of all participants.

The expansion of the Internet did not immediately contribute to the growth of prosumption. The first stage, called Web 1.0 (e.g. Yahoo, Amazon, etc.) was, and still is, created by the service provider, not by the user. However, here the first elements of prosumption can be found. A good example is electronic banking, where the client him or herself provides the data to the system, such as a credit transfer or by taking out cash at an ATM, and thus assumes the role of a bank clerk or cashier. But only at a later stage, called Web 2.0, was the content created together by the users. With Web 2.0 there was a big bang of prosumption. By analogy to the capitalist means of production, Web 2.0 portals have become the new economy means of prosumption.

Examples of this category include:

- Wikipedia, where users can create, edit and update articles and lead a discussion about them,

- Facebook, MySpace, nk.pl and other social networking sites where users can create profiles that include photos and videos, and users can communicate with one another in order to build a community,
- Second Life, where users create the characters, communities and the entire virtual environment,
- the blogosphere, blogs (Web logs), microblogging (Twitter) and the comments that are on them produced by those who consume them,
- eBay and Craigslist, where consumers (along with retailers) create the market,
- YouTube and Flickr, where mostly amateurs upload and download videos and photographs,
- Linux, a free, collaboratively-built, open-source operating system, and other open-source software applications, like Mozilla Firefox, that are created and maintained by those who use them,
- Amazon.com, where consumers do all the work involved in ordering products and write the reviews. Also, the users' buying habits and site navigation are documented to recommend products,
- iTunes and Google Play stores, which gather the content of all the software manufacturers and can sell them on a single platform.

Moreover, there is a large number of portals where users are given the tools to create their content. Web 2.0 services are enjoying a growing popularity. Users spend more and more time on all of these Internet portals, while at the same time more and more people are using these services to enable the creation of new content.

3. Consumer creativity

Prosumption is not only self-performing certain activities, such as those of a producer, seller or other support staff, it is also creating new products or innovations. The simplest example of this is directed to customers inventing new slogans. But not only. Creativity only through the internal research and development of a company is becoming less efficient. The whole process takes too long, and very often the results do not fully correspond to the needs of customers.

The new approach aims to incorporate the organisation's environment, with a particular emphasis on consumers. It is they who know what they need, and they are not only able to say what it is, also to construct it. A growing number of examples shows that the role of the company is beginning to become limited only to the manufacturing and distribution of the product, as the other functions are being taken over by the consumers.

Among the many specific activities related to the creative consumer–prosumer, D. Tapscott and A. Williams [TaWi08] include:

- adaptation to user needs: product-specific applications, but also deeper involvement in the design process,
- getting rid of control: their own products as a platform for innovation, regardless of consent or its lack,
- tools for consumers and arranging the context of use: the products are considered as a basis for experimentation,
- sharing the fruits: the prosumers' right to what they have created and to additional earnings, which increases the rate of consumer co-creation.

A great example of user's creativity is the development of free software, particularly of the Linux operating system. Free software under the GNU Manifesto [GNU12] is a matter of liberty, not price. Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software. More precisely, it refers to four kinds of freedom for the users of the software:

1. The freedom to run the program, for any purpose (freedom 0).
2. The freedom to study how the program works and adapt it to one's needs (freedom 1). Access to the source code is a precondition for this.
3. The freedom to redistribute copies so one can help his/her neighbor (freedom 2).
4. The freedom to improve the program and release one's improvements to the public so that the whole community benefits (freedom 3). Access to the source code is a precondition for this.

The software is free if its users can take advantage of all these freedoms. They have the freedom to distribute copies of the original or modified copies, either free-of-charge or by charging a fee for distribution. With the guarantee of such freedom, hundreds, thousands or even millions of people are currently working on improvements to the system and supporting applications, thus creating huge intellectual potential.

A similar situation occurs with the creation and development of other free software, such as content management systems (Drupal, PHP-Nuke, Plone), Wiki (MediaWiki), database management systems (Firebird, MySQL, PostgreSQL), graphics environments (GNOME, GNUstep), office productivity suites (OpenOffice, KOffice), typesetting (TeX, LyX, LaTeX), learning support systems (Moodle), Web browsers (Mozilla), and many others.

Social creativity takes place not only in open source software projects, as many companies making their products give users the opportunity to participate in the modification, improvement and gearing to their own needs. When thinking about creativity the LEGO company should be mentioned. LEGO has launched

a series of Mindstorms [LEGO12a] which allow consumers to create true robots from programmable parts. It turned out that the toy, originally aimed for children, was highly appreciated even by adults. Within a few weeks from the date of sale users developed and reprogrammed the sensors, motors and controls. The LEGO company decided to take advantage of the consumers' potential. From the company's website home users can download a free set of tools enabling the creation of robot control applications. Users can also publish a description of their projects, e.g. the code of the program and a list of parts needed to build the device.

The LEGO Mindstorms series has been so successful that the company has decided to use the potential of their consumers in the design of traditional bricks. In 2005 LEGO created the LEGO Factory [GAJE09], where customers have access to a virtual storage house of LEGO elements with which they can create their own sets of bricks. These consumers-prosumers can download free software from the network and design a virtual toy, then everyone can upload his/her project to LEGO and order it in the form of a set of real bricks with assembly instructions. Each project is available on the Internet as an example model. An extension of this idea is LEGO DesignByMe [LEGO12b], which allows one to design his/her own models, share them on the network and even create one's own set by giving it his/her own name.

Sometimes modification and extension by customers is contrary to the imperative of the business. Prosumers can use their products in entirely unexpected ways, as exemplified by the famous modifications of Apple's iPod, iPhone, iPad, or Sony Playstation.

"Customers get what they want, and companies do not have to pay for research and development. However, it's not so simple" [Knia12]. Users of Apple products improved the products to such an extent that it was out of control for the parent company. The users developed software that allowed to install applications without using the official iTunes store. A number of applications conflicting with the company's policy is available on an alternative distribution platform that is independent of Apple.

Similarly, consumers of Sony Playstation reworked the console to obtain a functionality that was not planned by the manufacturer. This allowed installing it on other operating systems, the use of an efficient Cell processor to perform any calculations, combining several consoles to create a multiprocessor machine, and copying content or SACD discs – which is impossible to achieve in any other way.

Focusing exclusively on the question of whether the phenomenon is something positive or negative for corporations should not be a priority. More important is the inclusion of the prosumption process in creative value creation. For

companies that are trying to force protection of their intellectual capital and wish to rely on just their own innovative ideas, this will constitute some risk, while for open organizations that treat consumers like partners and come out to meet them, it will be an opportunity not only to catch up with the market leaders, but also to outperform them.

Summary

There is a growing number of examples enabling consumers and innovative production processes. These show that consumer creativity can and is used to create new or to improve existing products and services. Prosumption is an opportunity to continuously create innovative ideas and to achieve higher profits by reducing the costs of research and development, and also for building a community. It is also a chance for success at innovation, because it is directly the customers, not the employees of R&D departments, that define the needs. Therefore, it is expected that organizations will see prosumption as an opportunity to achieve a competitive advantage.

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PROSUMPCJA – KONSUMENCKA KREATYWNOŚĆ W E-BIZNESIE

Streszczenie

Prosumpcja jest ideą ekonomiczną, zgodnie z którą konsument dobra jest jednocześnie jego producentem. Rozwinęła się ona wraz z serią zmian społecznych, w szczególności związanych z rozwojem Internetu, Web 2.0 i biznesu elektronicznego.

Artykuł skupia się na prosumpcji w aspekcie konsumenckiej kreatywności. Prosumpcja daje możliwość stałego wzrostu innowacyjnej kreatywności i osiągnięcia większych zysków poprzez redukcję kosztów działów badań i rozwoju. Daje również możliwość zbudowania społeczności użytkowników, zwiększa szanse sukcesu innowacji, gdyż to bezpośredni klienci, a nie działy badań i rozwoju w korporacjach definiują potrzeby. Dlatego umiejętne jej wykorzystanie może być źródłem przewagi konkurencyjnej.

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AGILE APPROACH TO USER-CENTRED SYSTEM DESIGN FOR IMPROVING SOFTWARE QUALITY

Introduction

Agile methods of software development have matured and now are capable to provide several benefits for the enterprises. That benefits comprises of reducing the cost within schedule and increasing responsiveness to the needs of the users. This could be a huge factor in today's world, where the companies need to get results faster. Given this backdrop, the research question is: can Agile methods produce a better software product in terms of reducing bugs and improving design? In this article the author argues that Agile approach and frequent feedback from the user are complementary for building high quality software. The relevance of the article is in conjunction of the Agile approach with UCSD. The aim of both methodologies is in fulfilling the users needs by engaging them in the development process.

Agile Strategies for Improving Quality

The vast majority of software projects suffer from a steady degradation of design quality and it becomes more and more difficult to maintain the software with the same level of quality. In some cases it becomes too expensive to maintain and in consequence it is put to rest and rewritten. In others, the software is released with a steadily increasing number of defects. Both of these common situations are deeply unsatisfying, but many of the practices from the Agile world stop the degradation of software quality and turn the trend around.

The rationale behind the Agile approach is to shift the overall focus of software development to a more "lightweight" perspective. This shift can be seen as a contrast to more formal commercial processes. Agile is not a single, well de-

fined process, instead, it is a generic name for several different processes or methods, sharing a set of core ideas, values and principles of software development. The principles are defined in the Agile Manifesto [AgAl01]. The values for the Agile developers are known as well [AgDe12].

The Agile community has been fertile ground for quality improvements in software development. There are four major strategies that can help you improve the quality of your software:

1. Reduction of Defects − it is the first thing that comes to mind when examining the quality of software. A low defect count is often synonymous with high quality software. Defects are also the most visible sign of quality problems.
2. Design Improvement − design is the model that a development team builds and maintains. High quality design makes for an application that is easy to understand and change as new requirements are discovered. Traditionally, the team has one attempt to get the design right and then it degrades over time as it is patched on and on. Agile practices, however, give an alternative; using practices like test driven development and refactoring teams are now able to continuously improve the design of their system.
3. Theory Building − one way to look at software development is "theory building". That is, programs are theories − models of the world mapped onto software − in the head of the individuals of the development team. Great teams have a shared understanding of how the software system represents the world. Therefore they know where to modify the code when a requirement change occurs, they know exactly where to go hunting for a bug that has been found, and they communicate well with each other about the world and the software. Conversely, a team that does not have a shared "theory" makes communication mistakes all the time. The customer may say something that the business analyst misunderstands because he has a different worldview. He may, in turn, have a different understanding than the developers, so the software ends up addressing a different problem or, after several trials, errors and frustrations, the right problem but very awkwardly. Software where the theory of the team does not match, or even worse, the theory is now lost because the original software team is long-gone, degrades in quality as design changes are made that don't fit with the theory, or even just as bad, cut-and-paste work is done because the theory is not understood. Building a shared theory of the world-to-software-mapping is a human process that is best done face-to-face by trial and error with ample time.
4. Build Less − it has been proved that people tend to build many more features than are actually used. In fact, most functionality built is never used. So, one

very effective way to improve the quality of our software is to build less of it. It makes it easier to understand, gives us more time to focus on the important parts that are actually used, and almost always has fewer defects.

Only about 20% of functionality we build is used often or always. More than 60% of all functionality built in software is rarely or never used. One way to improve the quality of software is to write less code which makes it easier to understand and maintain. There are several Agile practices that help you get to that point.

The four strategies above: maintain the theory of the code, build less, building less and improving the design are not independent. Maintaining the theory of the code makes it easier to modify the design because of a greater understanding of the existing design and also directly affects the number of defects and the difficulty in fixing those defects once found. Improving the design also makes it easier address defects by being inherently easier to change. And building less code makes it easier to understand and communicate the theory of the code and is directly related to the number of defects in the system.

Agile Practices

The most important of Agile practices are summarized below [Beck03; AgPr10]:

Test driven development is an effective cluster of practices that brings automated developer tests to the forefront of development and subordinates the design to testability. This form of development produces loosely-coupled designs which are easy to maintain, greatly reduce defect counts, and enable building and maintaining only what's needed. Finally, well-written tests act as a type of executable requirements that help keep the theory of the code from decaying. Practicing automated developer tests, refactoring, and simple design are applicable to all types of development projects.

Test driven requirements call for the customer (end user) to provide requirements in an unambiguous format − usually an acceptance test − at the beginning of the iteration. *Test driven requirements* drive the architecture of the system much like *test driven development* drives the design. They also help developers only build what is needed and maintain the theory of the code as up-to-date executable requirements.

Test driven requirements needs a customer who is willing and able to participate more fully as part of the development team. Your team will also be willing to make difficult changes to the code to accommodate for testing. Finally, you are willing to pay the steep price of the learning curve for this practice (which is well worth it).

The *done state* practice is a definition that a team agrees upon to precisely describe what must take place for a requirement to be considered complete. Defining and adhering to a *done state* directly affects the quality of the software by reducing defects. A properly defined *done state* is as close as possible to deployable software which means that defects are removed to achieve the *done state*. There is no partial credit with *done state*, either you are 100% done or you are not done at all; this mindset is crucial to successfully implementing this practice.

Development team performs iterations; this implies that it needs specific, measurable goals for requirements to be met at the end. Alternatively, the team may not be performing iterations and has a high rate of defects. The team can agree on a *done state* to be met for each and every requirement and still gain the benefits of improved quality.

Automated developer tests are a set of tests that are written and maintained by developers to reduce the cost of finding and fixing defects − thereby improving code quality − and to enable the change of the design as requirements are addressed incrementally. Automated developer create a safety-net of tests that catch bugs early and enable the incremental improvement of design. Beware, however, that *automated developer tests* take time to build and require discipline.

Development team in consolidated form has decided to adopt iterations and simple design and will need to evolve design as new requirements are taken into consideration. Development team in distributed form with the lack of both face-to-face communication and constant feedback should be ready to deal with increased bugs level and a slowdown in development time.

Automated acceptance tests are tests written at the beginning of the iteration that answer the question: "What will this requirement look like when it is done?" This means that developers start with failing tests at the beginning of each iteration and a requirement is only done when that test passes. This practice builds a regression suite of tests in an incremental manner and catches errors, miscommunications, and ambiguities very early on. This, in turn, reduces the amount of work that is thrown away and therefore enables building less. The tests also catch bugs and act as a safety-net during change. Finally, by making the codebase testable, developers are implicitly reducing the coupling which often result in improved design.

The development project group has an onsite customer who is willing and able to participate more fully as part of the development team. The team is also willing to make difficult changes to any existing code. Each member of the team is willing to pay the price of a steep learning curve.

The *refactoring of the code* is Agile practice which changes the structure (i.e. the design) of the code while maintaining its behavior.

Incremental improvement of design is the name of the game with refactoring; continuous refactoring keeps the design from degrading over time, ensuring that the code is easy to understand, maintain, and change.

The reasons of refactoring are: the development team is currently working on a requirement that is not well-supported by the current design or it may have just completed a task (with its automatic tests) and want to change the design for a cleaner solution before checking in the code to the source repository.

The *pair programming* is Agile practice when two developers work together at the same computer to build a feature. One developer is the driver, and the other is the navigator; the driver is at the keyboard building the task-at-hand, and the navigator is thinking forward to design implications and reviewing the work being done. *Pair programming* is sometimes described as a continuous form of peer review. This practice improves the design and reduces the defects because two people working together to solve the same problem almost always do a better job even if they are mismatched in experience and talent.

Continuous integration reduces the defects in a software system by catching errors early and often and enabling a stop-and-fix process. It leverages both automated acceptance tests and automated developer tests to give frequent feedback to the team and prompts removing these defects promptly.

Collective code ownership means that members of a development team have the right and responsibility to modify any part of the code. They get more exposure to the entire code base and are able to remove defects wherever they are found and incrementally modify the design of the system accordingly.

Evolutionary design is the simple design practice (below) done continuously. Teams start off with a simple design and change that design only when a new requirement cannot be met by the existing design.

An *iteration* is a time-box where the team builds what is on the backlog and is a potential release and therefore enables building less and forces regularly removing defects to reach the agreed upon done state.

Releasing your software to your end customers as *often* as you can without inconveniencing them forces you to constantly have your software in releasable quality and allows you to build in smaller increments and get feedback before too much of an investment is made.

Simple design − if a decision between coding a design for today's requirements and a general design to accommodate for tomorrow's requirements needs to be made, the former is a simple design. Simple design meets the requirements

for the current iteration and no more. In fact, Gartner [Gart12] now recommends an emergent approach to enterprise architecture.

Stand up meetings are daily meetings for the team to sync-up and share progress and impediments daily. This helps keep the entire team aware of what is being done and where in the system.

How to adopt Agile practices successfully?

To successfully adopt Agile practices let's start by answering the question "which ones first?" Once we have a general idea of how to choose the first practices there are other considerations. Then, once you've chosen the first practices that best fit your environment, you and your team(s) will need to be aware of the mindset you'll need to get the most out of the practices you choose.

Choosing a practice comes down to finding the highest value practice that will fit into your context. Figure 1 contains practices that help improve the quality that your software development team(s) builds. This figure will also guide you in determining which practices are most effective in increasing the quality of your software and will also give you an understanding of the dependencies.



Fig. 1. Steps for Choosing and Implementing Practices

The practices involved in improving the quality to market are some of the most difficult to do from the body of Agile practices. Things will get harder before they get easier. The first rule is to expect the difficulty, be patient, and don't stop the practices just because they uncover significant problems; be disciplined in your practice. Once you start a practice give it a chance because you will slow

down and confront frustrations before speeding up. For example, pair programming is frequently seen as a waste of resources and uncomfortable to many developers who are used to (and enjoy) working alone. Consider giving it a chance by agreeing as a team to practice pair programming for a couple of months before deciding whether it is worth adopting permanently.

Confront issues when they come up instead of stopping a practice because it is "too painful". Deal with pain differently than you are used to; instead of discontinuing something painful, examine it and find the source. Often Agile practices will uncover problems that have always been there but have not been felt. Feeling the pain is a chance to correct a problem and improve towards your goal of increased quality. A good example of this happens when teams start adopting done states for the first time. There is no partial credit, either you are 100% done or not done at all. A team that adopts this for the first time frequently works on multiple features at a time and at the end of the iteration they have not fully completed any of the features. Therefore they are 0% done with all of their tasks. This is discouraging and painful and a common response is to stop doing the practice instead of examining the pain and looking for alternatives to correct the problems in the next iteration.

Get Good at Small Steps − small steps are going to save your life with these practices because many are completely new ways of doing things that may slow you down and frustrate you as you are learning them. Take one practice, do it well, and do it regularly. You might consider pair programming along with any and all of the practices to make it easier and keep you on-track. How do you know you are doing a practice well? You get the value that you originally hoped to get – i.e. the quality of your software noticeably increases. You also have confronted pains and learned from them. If a practice is completely easy and comfortable from the get-go, or has not noticeably improved the quality of your work then you probably are not done yet.

Be Prepared to "Suspend Your Disbelief" − much of what you will be doing will not make immediate sense. It will feel that you are doing things that are more trouble than they are worth. For example − writing your tests first, before writing your code in the automated developer tests practice is non-intuitive. What can you possibly gain by doing things backward? Those who have successfully adopted this practice have "suspended their disbelief" and done it anyway. After experientially learning the practice they then made their judgments about its utility and usually kept doing it because they saw the value.

Be Proficient and Cooperate with the Users − members of the development team should realize that they are not competent in everything. Moreover, since

everything really does depend on context, and they are not qualified to deal with context as novices or advanced beginners, they had better get access to the people who are experts or at least proficient to help guide them in choosing the right way of progress. Cooperation and feedback between end users and development team are the main itineraries of the so called user-centered systems design (UCSD). One of the definitions of UCSD is as follows: "(…) it is an iterative process whose goal is the development of usable systems, achieved through involvement of potential users of a system in system design" [Kara96].

It may be seen that UCSD is a process which focus is set on usability throughout the entire development process and further throughout the system life cycle (Figure 2) [GGB03].

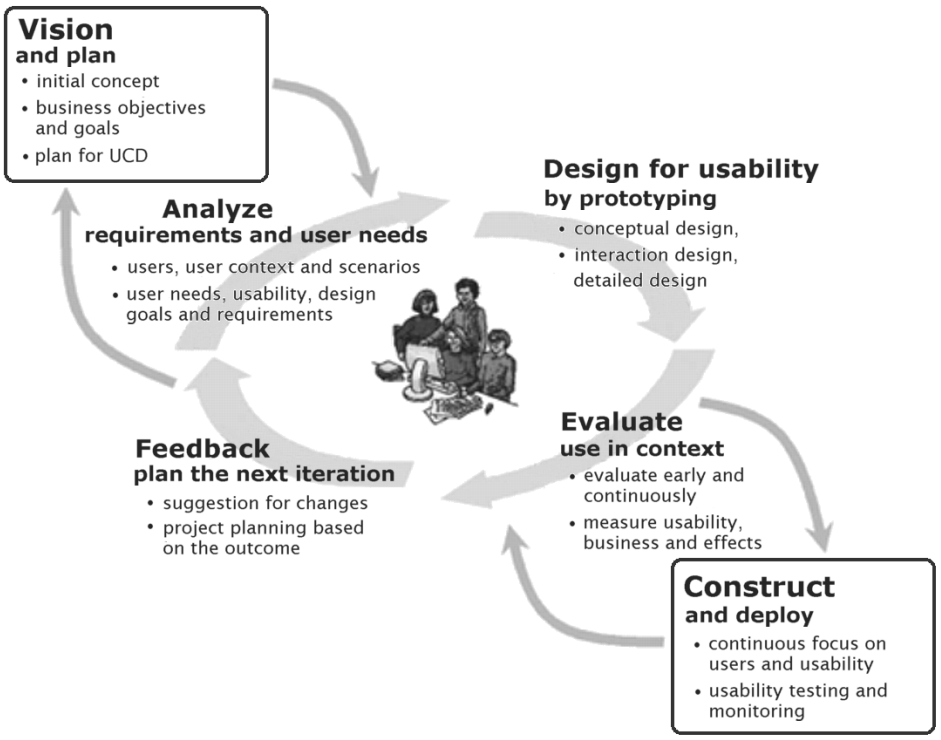


Fig. 2. UCSD is a process focusing on usability either during the development or throughout the system life cycle

What is interesting about Agile methods is that they are addressing some of the problems known to be part of traditional attitudes to the development process. With regard to the usability it may be pointed out that Agile methods are "closer" to the end user than older methods. In consequence, Agile methods

could create software which meets the users needs much better. Agile processes emphasize the pragmatic use of light, but sufficient rules of project behavior and the use of human and communication oriented principles. Hence, people are more important than processes and tools. Working software is more important than comprehensive documents and model building. Models and artifacts are only means of communication; consequently prototyping and simple design representations are preferred. Agile developers argue that projects should be communication centric, which implies that effective human communication with project members and users are important, e.g., face-to-face is the ideal way of communicating within a project and with users. Usually, there is a direct collaboration with users and customers – preferably, users and developers should sit in the same room during the development.

The problem with the Agile approach is that it does not guarantee by itself better usability of software produced. For example, the user interface of the system created using Agile "style" could be either carefully crafted about user expectations or just generated on used persistance layer. The main aspect of Agile methods is focused on delivering working software. This is of course excellent, as usable software also must be delivered and ready to work. But to get there, the development is focused on making coding effective and there is a risk that usability issues get lost as there could be no explicit user-centered focus. Agile projects include some roles that are supposed to work with user interface design and user requirements, but this is in most cases not enough. The whole project must be committed to the importance of usability. Another problem is that the users involved in the development are not always end users. Sometimes they are customers or domain experts. For the Agile approach it seldom makes a difference.

Summary

The consideration presented in this article support the evidence that practices of Agile development may be seen as a general set of advises for use in IT systems design and development. The effective delivery and implementation of high quality software require to conform to Agile practices and to cooperate with the end users as well. Especially that is true regarding active user participation and the necessity to use the simplest design representation possible.

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METODY LEKKIE W PROJEKTOWANIU ZORIENTOWANYM NA UŻYTKOWNIKA DLA DOSKONALENIA JAKOŚCI OPROGRAMOWANIA

Streszczenie

W artykule zaprezentowano połączenie dwóch metodologii, których celem jest poprawa jakości tworzonego oprogramowania. Przedstawiono właściwy sposób ich używania. Zdaniem Autora łączenie podejścia Agile z wytycznymi dla systemów tworzonych z udziałem odbiorcy końcowego (UCSD) prowadzi do tworzenia systemów informatycznych wysokiej jakości.