

# Integrated Approach in Management and Design of Modern Web-Based Services

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**Abstract** The new kind of applications being currently developed deserves more attention in the user interface development area. This paper takes into account slightly different needs of new applications such as Web 2.0 and considers new approaches in their development cycle. Namely, the development is more based on user comfortability needs and the paper stirs the processes needed to accomplish this successfully and early in the development phase. Thus, minimizing the bucket demands which is critical for project managers. The paper outlines also future steps to reach even better results.

## 1 Introduction

The importance of modern web-based services has arisen in the field of software development as well as in ICT industry in general. Since then, significant changes in approach to a software product can be seen. It does not matter whether we consider classical desktop application or web application. But thanks to web applications, the process of changes has been catalysed and user is becoming the primary factor determining the product's resulting form – both from the point of functionality and user interface.

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Web technology advancements caused transition of companies from desktop applications to the Internet services. During this period, processes of the web transformation have been replaced in favour of the higher level of Internet development. The Internet from the Web 2.0 point of view is not a provider of exclusively static, passive information anymore. The Internet became a standalone platform offering *Rich Internet Applications* (RIA) – modern web-based services [13]. Increasing complexity and usability of RIA have changed people's understanding not only of the Internet but the whole development process of such application, communication interface of that application and the approach to people who create the application in the end. These significant questions regarding the software development [15] are now broadly discussed and the process itself has been redefined. The most important change is diverting from purely technological perception of a final software product to the consideration of product's user acceptance. Not the functionality is standing on the first place but usability. This change has second major influence on developers. Companies gradually turn their task orientation to developers where they are carriers of the tasks and potentially of a product success. The more a developer is satisfied the more the task will be fulfilled in a satisfactory manner.

## **2 Combining Disparate Technical and Humanistic Aspects in IT Project Management**

Development of modern web-based services is very appropriate for an application in new humanistic management approaches with outlook emphasizing common human needs. It is because they are strongly oriented to the fundamental social principles of their users. A social aspect for the modern web is essential. Whereas the content of Web 2.0 is mainly user-generated, communities and collaboration are highlighted. After a very short period, new Web 2.0 phenomena capture the heart of millions Internet users. They are blogging, using wikies (which become modern encyclopedias), various community networks such as MySpace (approximately 200 million users and slightly decreasing), Facebook (about 400 million users and growing), LinkedIn, XING, etc. One of the core concepts of Web 2.0 became so called *Folksonomy* – attaching unstructured – a combination of "folk" and "taxonomy". This concept was defined thanks to long interest of Thomas Vander Wal (he observes a phenomenon of tagging since the pre-web era in 1980s). Folksonomy represents a process of tagging with social titling (social indexing, social classification, collaborative tagging) of resources. Tagging is very similar to the way how our brain works. It creates transcendent manifold associations rather than inflexible categories. More plainly – folksonomies are sets of names tagged to the content by users without any fixed predetermination. It is usually an informal free form.

In these days, human management is characterised by acceptance of business enterprise as anthropomorphized, being where persons in the enterprise define the culture and quality of the organization and its products as well.

## ***2.1 Management***

Organizations should build up a unity to achieve the community of persons being stronger as a community [9].

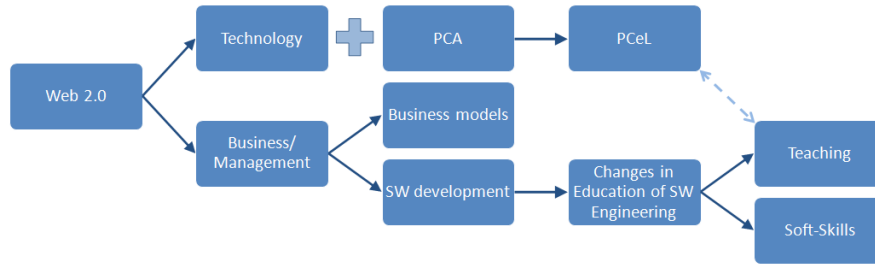
The business cannot be considered only as a "society of capital goods" because it is also a "society of persons" [14]. Managers have to motivate people around them to acquire virtues and try to discover and promote beliefs and values within the organizational culture that foster human virtue, in all its forms, to its fullest extent. Humanity management is neither a naive approach nor a lack of realism. It fulfills aim of the third approach to humanistic management, which is still emerging. It considers a team as a real community of persons. The connection to virtual community of Web 2.0 is obvious [10]. This humanistic project management approach is a real challenge in order to achieve higher moral quality in management, more efficient development and in the end more efficient organizations. Only by this the full potential of the organization, mainly formed by people, will be exposed. Possible aspects of person (developer) psychology development can be conceived as a continuum encompassing training, conditioning, introjection and receptive learning of foreign experiences. Personal values and project goal are on the same level of importance and they get in the relationship between project manager and developer. In that manner the growth process is created and sense of personal and project development is higher.

## ***2.2 Person-Centered Approach***

Thanks to close connection of Web 2.0 to the *Person-Centered Approach* (PCA) via Web 2.0 definition basis (e.g. collaborations, user-generated content, and collective intelligence), it is an application of Web 2.0 technologies that supplements original intention of PCA properly [5]. PCA was introduced by an American psychologist Carl Rogers. According to Rogers, the essentials are three attitudinal conditions [18]. They are a motive power in personal development of each person. These conditions are:

- acceptance (unconditional positive regard),
- emphatic understanding and
- congruence.

Congruence expresses personal integrity composing from experiences and feelings in mutual complementation. Integrity comprises acceptance and emphatic understanding as well. Those attitudes are beneficial for all relationships characterized by psychical development – relationship between child and parents, partners, or relationship between manager and developer too. We called this *Developer-Centered Approach* (DCA). With the help of changes that Web 2.0 introduces to the software development, the classical software development and project management method-



**Fig. 1** Influence of Web 2.0 in Technology Advancement, Project and Business Management resulting in Education

ology adapts especially in methodology exactly for the Internet environment. In a certain point of view, the PCA alters the management methodology as well.

### 2.3 Methodology

In order to choose proper Web 2.0 tools, special visual patterns and specifications of PCA (or its specialization DCA) should be implemented during the development of software products. But generally it does not matter whether it is a desktop application, web-based services or modern mobile application in the end. The fundamental approach shall be the same.

Technically, the differences that Web 2.0 brings to ICT have important impact on project management of these services [19, 21]. Special features of modern-web based services such as development stage of "perpetual beta", absence of software release cycle, dynamic scalability, lightweight programming models, sampling and testing, etc. requires special approaches being distinguished from the classical ones [13]. Many books were written about project management and surely many will appear in the future. A basis of planning a software project, estimating its workload, building a schedule, gathering software requirements and creating use cases, improving programming with refactoring, unit testing, version control and testing software is well known. So far we dealt with approaches and software development processes which have been established and introduced into the practice (cf. [20]). These include the simple Waterfall model, Critical Chain Project Management, Extreme Project Management including Scrum and Agile Software Development to the sophisticated methodologies like PRINCE2 or Rational Unified Process by IBM. But those approaches mainly result from an earlier degree of software development appropriate for desktop programs. Web 2.0 projects have significant differences such as a rapid deployment or sharing the web-based services with many users with the ability of collaborative work accessing the data wherever the users are, while desktop programs are primarily used by one user, on one computer (or small local network) using local computer (local network) resources.

From practical experience, *Agile Project Management* is the closest approach to satisfy Web 2.0 needs so far. It is a quite new approach and therefore agile methodology reflects the current development of ICT industry tightly. Agile project management stands on simple idea of incremental or iterative (depends on what you prefer) proceedings. Thanks to this, developers are able to react on changes in time, or eventually stop the whole project, redefine it, etc.

With agile development the Scrum method is connected very closely. The basis of Scrum is so called *Product Backlog* or in other words a wish list of all things that the product shall contain. In this phase, often unrealistic requirements are included in the Product Backlog. However, immediately after the work on *Release Backlog* starts, it represents the implementation plan of particular functionalities. This may be considered as the first deviation of Web 2.0 definition from Scrum.

In Web 2.0 we often do not have very detailed implementation plans. Surely even in the Internet environment there has to be a control. But in pure understanding of Web 2.0, a new functionality is added according to the need of user, not the plan. Iteration cycle with reference to Agile methodology and Scrum is Sprint. It builds on relatively short period of time (usually 7-30 days) which satisfies Web 2.0 very short deploying cycle. Although RIA can be deployed very quickly, for instance every hour, Flickr (a famous photosharing site) has an iteration cycle a half an hour sometimes.

Therefore there is a need for project management approach combining such classical methodologies with more complex approaches reflecting the necessity of proper business models closely connected to the development, efficiency and performance of RIA also considering security issues and so on. According to contemporary trends of humanistic approaches described above, this modern approach shall not only focus on the development itself, but to developers who back up every single project as well as to users who judge the project's success. Development orientation should be also dependent on users opinion, habits and customs. Not only of control interface, but the whole software product functionality should fulfill their needs. From the very beginning, the modern IT project management shall consider this necessity.

### **3 User-Centered Approach in System Development**

Since the information technologies have become significant part of people's everyday lives, the need to consider human perspective and various aspects of usability seems to increase.

People use technologies at work, at schools and also in their free time. Activities which depend on technologies have become more responsible (health care, process control, financial services). Moreover, not only technical-oriented people have to deal with different systems, services and devices. Current users of technologies are people with various backgrounds, motivations and skills. All these aspects indicate that orientation on usability and user needs is important.

For designing web applications, user-centered approach is particularly crucial. An application, which takes human perspective into account profits from competitive edge. If customers are satisfied, they are more likely to use new services and recommend the application to other potential users. The high number of users indicates high popularity of the product. Furthermore, if people use the product, they provide a feedback – especially, they report errors and require new features. This feedback can lead to significant improvements of services and as a result, it can enhance system as a whole. G. Donahue identified broader benefits of usability in [6]. Benefits concerning web applications are mainly reduced development, maintenance and support cost, advertising advantages and better notices in media.

### 3.1 Designing usability

Designing usability introduces several requests. First of all, usability must be related to a concrete project or product. According to international standard ISO 9241 (see [7]), usability is defined as: "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." This means, there is no guaranteed method, which can be applied to reach satisfying results. The selection of suitable method or combination of methods depends strongly on the particular project. However, there are several recommendations which can help to develop a usable system:

- *Future users' involvement*: Future users should be involved in the process of development from the very beginning. In the stage of requirement analysis, they should be in the center of interest rather than technologies. Requirements should take into account human perspective, needs, wishes and limitations. To understand these aspects, it is important to engage users into the process. In case of designing a system that should support people while performing certain kind of activities, it is appropriate to examine the activities, ask people to explain what they like and do not like about the current way of performing activities, observe them while working, look for problems they have, and so on. Future users should also participate in later development stages – especially in system evaluation and usability testing.

The situation is more complicated, when future users are not known explicitly. This is often the case of designing web applications – development process is not initiated by the needs of future users, it is rather started by the idea of the product owner and their business plan. In this situation, it is quite difficult to predict future users' requirements. Therefore it is suitable to ask marketing department to develop profile of target audience for the product. Characteristics of future users can be built upon the market research and design process should be oriented on representative sample of future customers.

- *Usability experts' involvement*: Usability experts should be involved in the process from the very beginning. To achieve best possible results, a usability specialist or a group of them should be devoted to deal with usability issues as a part

of the project development team. They can help with specifying requirements, because they are experienced in using various techniques to identify and understand users' needs. They can suggest suitable design approach – select effective methods and techniques of usability engineering for particular product. They can also identify usability errors and find solutions to fix them. However, their work should not be focused primarily on error detection and elimination. The main reason of their participation in the project should be matching design with users needs [8].

- *Iterative process*: Development process should be iterative. Process of specifying requirements should evolve during the time – initial requirements are usually brief, they must be refined gradually and adjusted according to the situation. Iterations should be frequently discussed with future users, evaluated and redesigned. In order to make this process easier and faster, prototyping can be used. The main reason is to identify and eliminate errors in requirement analysis, specification and design as soon as possible. Removing an error which is detected after the implementation is much more expensive and time-consuming in comparison with an early detected error.

### ***3.2 Usability Engineering Techniques***

There is a wide range of techniques that can be used to develop a usable and user-centered system [1, 4, 11]. A suitable combination for particular project can be, for instance, selected from the following activities:

- *Requirement analysis*: user and task analysis, interview, group interview, focus group, vision seminar process, survey, questionnaires, observation, study of end-users' work and context of their work, . . .
- *Prototyping*: low-fidelity, medium-fidelity, high-fidelity prototypes; simulations of activities, evaluation and redesign of prototype
- *Usability testing*: user testing, thinking aloud, cognitive walkthrough, heuristic evaluation, inspection.

### ***3.3 Integrating usability activities into development process***

Although the user-centered approach leads to many benefits (not only on the side of end-users; product owners and developers profit as well), it is usually quite difficult to enforce it in practice [12].

First of all, usability is often seen as something additional. Designing usability requires time and money. Discussion between users and developers is mediated by usability experts. It means, that communication is more time-consuming and involves more people. On the other hand, it is usually easier and more effective for usability practitioners to transform a users' expectation into requirements, because

they take human perspective into account rather than technical requirements and limitations.

Another problem is, that functionality is usually preferred over usability. Benefits of usability are not tangible. Therefore, when it comes to a decision, whether to invest money and time in usability or in development of new functions, functions are often prioritized. The problem is that specified functions might not meet users' needs. The features are present in the final product but since the end-users do not need them or do not know how to use them, they are worthless. In general, it is useful trying to identify and focus on small number of functions which are interesting for most users.

Even if requirements are specified properly, there are still many ways how to fulfill them. Developers often choose the way, which is technically easy to implement. This might lead to a formal accuracy but it does not satisfy users. Very common situation is that developers claim that better solution would take much more time to implement. Since they are responsible for technical part and other people involved in the process often do not have competence and knowledge to argue with this claim, it is usually taken as is. Therefore in this case, a project manager reduces usability requirements in order to meet the deadline and budget.

Usability testing and system evaluation is also quite expensive and time-consuming. Some companies might see this investment as additional, because users will test the product in use. This is not only inappropriate (because end-users have to cope with errors which lead to stress, inefficiency and anger) it also sheds a bad light on the reputation of product developers.

Other common problem with usability testing is that usability consultants are involved only into this late stage of development process. They are invited to perform user testing and evaluate final product. This is not convenient, because errors detected in this stage are very difficult to fix. These errors would be much easier and less expensive to eliminate in the early stages of development.

Developing a web applications introduces some additional challenges. The life-cycle of the web application is different from traditional software [2]. First of all, the process of development usually does not have clearly defined boundaries. It is rather an on-going activity of fixing errors and adding new features. Under these conditions it is difficult to determine individual stages of development process and plan usability activities suitable for particular stages.

In one sense, this might be an advantage. Iterative development process supports an opportunity to find and fix usability errors and gradually improve the application. Moreover, it also provides an opportunity to try innovative solutions for usability problems.

On the other hand, this approach can be dangerous. Usability activities are not usually part of the process. Usability is often evaluated afterwards – only after new features are implemented. It means software is not intentionally designed to be usable; it is rather created and later adjusted to be acceptable.

Potential threats of this approach are general usability reports, i.e. expert evaluations of applications provided by usability practitioners according to a set of general usability heuristics. These reports identify basic problems without taking a context

of the project into account. Therefore the evaluation is not always adequate and may lead to misinterpretation.

#### 4 Cost-Benefit Analysis of Usability

The main reason why it is difficult to enforce usability in the development process is that benefits of usable product are quite abstract. Moreover, these benefits are relative – various groups of people are involved in the process and each group has different perspective on evaluation of benefits and different priorities. Therefore it is difficult to measure and evaluate advantages and it is mostly impossible to transform all these advantages into financial gain, which is often most significant decisive factor for project managers. Main obstacle is the lack of metrics. Another problem is the need of appropriate model which allows decision-makers to evaluate investment systematically.

During the last decades, several models for justifying usability have emerged. These models use cost-benefit analysis – evaluation method for analyzing projects for investment purposes. In general, this method contains three stages: *identifying the value of expected cost and benefits, analyzing the relationship between these two values and making the investment decision* [3].

In terms of cost-benefits analysis of usability, a potential cost might be expressed as an amount of money spent on usability activities (salaries of employees and consultants, training costs) and benefits might be counted in connection with increased efficiency and productivity. The difference between these two values is used to demonstrate the profit which usability engineering brings to a project [8].

There are two typical examples of frameworks for cost-justifying usability [17]:

- Mayhew and Mantei's approach for cost-benefit analysis of usability activities consists of three steps: calculating costs of selected usability activities (broken down into techniques and steps); identifying and evaluating benefits relevant to a particular target audience of the analysis; estimating return on investment of incorporating selected activities into the process.
- Model designed by Clare-Marie Karat links cost-benefit analysis of usability into organizational business cases. The objective of this approach is to calculate costs and benefits of human factors work ([16]). Analysis consists of three stages: identifying all expected costs and benefits of usability activities; dividing costs and benefits into groups of tangible and intangible; calculating the value of tangible benefits.

### ***4.1 Use of Cost-Benefit Analysis of Usability***

Cost-benefit analysis might provide evidence for justifying usability activities in the development process. It tries to quantify possible benefits in terms of return-on-investment, which is often significant decisive factor for project managers.

However, there are still some problems left. Cost-benefit analysis is not always compelling. It is rather a retrospective approach. It can be used to count gains of finished project, but it is more difficult to quantify profits of oncoming project. In that case estimates are necessary and might be a source of inaccuracies. There are many variables, which are estimated, these variables are multiplied and this leads to a significant bias. Moreover, these variables are interdependent and there are too many side effects, which should be taken into account (for example, when we want to estimate increase in productivity of user of the new system, we have to measure the time for performing activity; the problem is that time for performing activity differs under normal circumstances and under stress circumstances and stress might be a result of being tested).

More accurate estimations can be gained by more precise research. It means more people involved, more time spent and as a result – higher price. Other source of data might be case studies of completed projects. This is also a problem – product owners usually do not accept data of other companies as a relevant source of information. Moreover, in practice there is a lack of this kind of materials – only few companies have published a complete empirical case study with original data.

Other problem of cost-benefit analysis is that various parties have different perspectives. Different people consider different aspects as benefits. Cost-benefit analysis can hardly cover and evaluate all possible gains. One problem is diversity of benefits, other problem is the lack of metrics and models to quantify them. Most profits are rather abstract and difficult to express in terms of return-on-investment (for example reputation of company, satisfaction of employees).

All these problems cause that cost-benefit analysis is not very common tool in practice. Evaluation of cost and benefits of usability activities is usually not conducted on its own, it is rather incorporated in cost-benefit analysis of whole incoming project. However, at that time, it is too early to estimate which activities might be necessary and what benefits might be gained.

In practice, it is usually conducted by usability consultants on customers demand. It is not very often used as a tool which should enforce project managers to invest money in usability activities. Main reasons are time and financial demands, the lack of data about finished projects and high possibility of inaccuracies.

On the other hand, cost-benefit analysis is the tool which is worth knowing. It can provide project managers with useful information, because models can be used to evaluate costs and benefits of usability activities incorporated into previous projects. Based on this evaluation, it is easier to predict what activity is suitable for particular situation and what activity should be avoided.

## 5 Conclusion

User-centered orientation is very important nowadays, the social and humanistic aspects arose in importance. It is not an added value, but in the case of close connection with Web 2.0 it becomes an essential part of the application development itself.

The proposed cost-benefit solution, which tries to express the user orientation in terms of Return of Investment, is technically of interest to be deployed in the development process, since the project managers can easily evaluate pros coming out of the considered approaches and can thus decide about them. However, practically, it is very hard to make a correct assumption of future user needs, it incorporates long term data collection and hence is not widely used in practice. In spite of that, CBA shall be reconsidered in defining the project cycle.

The latter approach where there are investigations of past project case studies is more promising since managers have the knowledge and experience of what way may lead to better results. These new challenges with a combination of derivatives of Agile Software Development force project managers to handle both requirements from users and developers. Especially evaluation of user-centered orientation importance, proper activity planning, determining process of development, defense of this process, introducing members of development team capable to understand user needs (many programmers are not capable of doing so) and so on.

In the end, the usability of discussed principles is profitable for all parties. The users are likely to use systems which were developed on a basis of their requirements, the developers create an application which will likely be used thanks to friendly interface and managers due to higher income to their bucket.

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