

POSSIBLE BENEFITS OF WEB 2.0 TO CONSTRUCTION INDUSTRY

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ABSTRACT

Despite the fact that it has taken a long time for construction industry to enter the information era, information technologies (IT) significantly changed and still changes the way professionals in building and construction (BC) industry work. Consequently, construction industry is in relatively early phase of adopting web-based technology, even though the web has already moved deep into its second phase.

During the recent years, a phenomenon of Web 2.0 attracted a lot of attention not only in the Internet, but also in business community. It is considered as a next step and a major evolution of the traditional web from both a technological and social perspective. New on-line applications not only make tasks as individual and group on-line learning, communication, collaboration and creation easier, they also have the capability of upgrading the experience by using the vast amount of information from the Internet, previous sessions and so called collective intelligence of its users.

The possible benefits of adapting Web 2.0 technologies, principles and strategies into construction industry are numerous. Using new approaches can affect marketing strategies, data and information exchange, customer contacts, life cycle management, knowledge management and can result in substantial savings in time and money, customers' satisfaction, improved internal and external communication and collaboration, etc. What is more, shift towards modern web can also have a positive impact on the name and brand of the company.

This paper presents the concepts which can affect the way how construction industry currently works and the key reasons why the AEC community should seriously consider the shift towards the next generation of the web.

KEYWORDS

Web 2.0, Enterprise 2.0

1. INTRODUCTION

Information and communication technologies (ICT) nowadays have a great impact on building and construction (BC) industry and the way it works despite the fact that it has taken a long time for them to enter the information era. ICT Technologies in BC industry are now mainly used to support traditional tasks, to ease communication barriers, find relevant information and to speed up processes. Majority of work supported by ICT is done inside relatively closed networks and Intranet. In-house developed software solutions installed either on servers or working machines are used in spite of all the benefits current web-based tools are offering. Consequently, construction industry is in relatively early phase of adopting modern web-based technology, even though the web itself has already moved deep into its second phase.

While AEC sector was struggling to adopt and take advantage of the use of IT and ICT tools supporting everyday tasks in the industry, powerful new ways of using the Web and the internet for various reasons

(including solving problems and supporting every day business processes) have emerged. This new wave of web applications and services is known as the Web 2.0.

The possible benefits of adapting Web 2.0 technologies, principles and strategies into construction industry are numerous. Using new approaches can affect marketing strategies, data and information exchange, customer contacts, life cycle management, knowledge management and can result in substantial savings in time and money, customers' satisfaction, improved internal and external communication and collaboration, etc. What is more, shift towards modern web can also have a positive impact on the name and the brand of the company.

After a brief review of the development of the web and the introduction of the key reasons why to move towards the next generation of the web, the authors of this paper will present the concepts which can affect the way how construction industry currently works.

2. FROM WEB TO ENTERPRISE 2.0

The web today is not only the source of information, but also the way people do business. World Wide Web has revolutionized the economy and impacted the majority of the world's population within in the last decade or two. In the meantime, the use of the Internet evolved from static web pages to interactive, user-driven Web experiences. (Kabir 2006).

2.1 WEB 1.0 VS. WEB 2.0

During the recent years, a phenomenon of the Web 2.0 attracted a lot of attention not only on the Internet, but also in business community. New on-line applications not only make tasks as individual and group on-line learning, communication, collaboration and creation easier, they also have the capability of upgrading the experience by using the vast amount of information from the Internet, previous sessions and the so called collective intelligence of its users. It is considered as a next step and a major evolution of the traditional web from both a technological and social perspectives.

Although it is the single most used buzzword in the internet community in the past several years there is still no official definition of what the Web 2.0 actually is. The term has numerous definitions and more or less all of the authors agree that it is a trend, a perception of the direction the Web is heading, and not an object that can be created (Jewell 2007). It is an attitude towards radically open communities and communication (Nivi 2005).

It is not possible to define classic and next generation web by describing the technology. Instead, the focus has to be on the changes in human behaviour that the technology enables, and those changes are hard to describe or define (Nivi 2005). Therefore it is not surprising that it is hard to define Web 2.0 since there is no good definition of Web 1.0 either. Both principles are more or less always presented as a comparison between them (see Table 1).

Table 1: Web 1.0 vs. Web 2.0 (Drumgoole 2006, Barefoot 2006)

WEB 1.0	WEB 2.0
was about companies	is about communities
was about client-server	is about peer to peer
was about HTML	is about XML
was about portals	is about RSS
was about taxonomy	is about tags
was about owning	is about sharing
was about web forms	is about web applications
was about screen scraping	is about APIs
was about dial-up	is about broadband
was about hardware costs	is about bandwidth costs
was about lectures	is about conversation
was about services sold over the web	is about web services

Tim O'Reilly (2005) stated that the concept of "Web 2.0" began with a conference brainstorming session between O'Reilly and MediaLive International. O'Reilly stated that Web 2.0 doesn't have a hard boundary, but a gravitational core, and later enumerated the characteristics of successful Web 2.0 companies:

1. The Web is used as a platform.
2. Harnessing collective intelligence.
3. Data is the next Intel Inside
4. End of software release cycle
5. Lightweight programming models
6. Software above the level of a single device
7. Rich user experiences

Almost a year later Tim O'Reilly formed a Web 2.0 compact definition as follows: "*Web 2.0 is the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that new platform. Chief among those rules is this: Build applications that harness network effects to get better the more people use them.*" (O'Reilly 2006)

Authors' personal choice is the clarification of the distinction between both approaches, published by Kabir (2006): "*An analogy from the world of building construction perhaps clarifies the distinction. Web 1.0 was like building houses from cement, sand, crushed bricks and aluminium. You had to mix cement, bricks and sand together to make concrete, then use concrete to make the house. With newer Web 2.0 technologies you effectively have concrete, prefabricated walls, corrugated iron sheets, etc. to build houses. So you can make more interesting and elaborate houses than before.*"

2.2 SEMANTIC WEB

Despite the common misunderstanding the semantic web is not a separate web, but "*... an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation*" (Berners-Lee et al. 2001). It is not different from the World Wide Web (WWW), nevertheless has an enhancements that makes the Web even more useful (Feigenbaum et al. 2007).

The vision of the Semantic Web is to extend principles of the Web from documents to data, which would reveal more of the Web's potential. It allows data to be surfaced in the form of real data (so that a program doesn't have to strip the formatting and pictures and ads off a Web page and guess where the data on it is) and allows people to write (or generate) files which explain to a machine the relationship between different sets of data (W3C 2008).

Semantic Web technologies can be used in a variety of application areas such as data integration (integrating data in various locations and various formats in one, seamless application), resource discovery and classification (in order to provide better, domain specific search engine capabilities), cataloguing (for describing the content and content relationships available at a particular Web site, page, or digital library), by intelligent software agents to facilitate knowledge sharing and exchange, in content rating, intellectual property rights of Web pages etc. (W3C 2008).

Alex Iskold (2007a, 2007b) noted that the original vision of the semantic web as a layer on top of the current web, annotated in a way that computers can "understand", has been a kind of academic exercise rather than a practical technology for at least a decade. The main problem Iskold (2007b) found is the bottom-up nature of the classic semantic web approach (each web site needs to annotate information in RDF, OWL, etc. in order for computers to be able to "understand" it), therefore he proposed the top-down approach, which is focused on leveraging information in existing web pages, as-is, to derive meaning automatically (Iskold 2008).

Semantic Web is sometimes mentioned together with another buzzword Web 3.0, the term used to describe the future of the WWW, although the views on the next stage of the WWW's evolution vary greatly. Some authors believe that the semantic web will transform the way the Web is used; other visionaries on the opposite side suggest that increases in Internet connection speeds, modular web applications, or advances in computer graphics will play the key role in the evolution of the World Wide Web.

2.3 ENTERPRISE 2.0

With the popularity rise of digital platforms for generating, sharing and refining information on the internet, McAfee (2006c) used the term Enterprise 2.0 to focus on Web 2.0 technologies and platforms that can be used (or sometimes even bought) in order to make practices and outputs of knowledge workers visible. McAfee identified six most important components of Enterprise 2.0 technologies:

- Search. It is important that users can find what they are looking for.
- Links. Many technologies work best if there is a structure of links that reflect the opinion of majority of people.
- Authoring. In order to obtain valuable income from the users, there has to be a simple way for publishing.
- Tags. Users prefer to tag instead of gather into predefined categories.
- Extensions. Smart add-ons are automating some of the work and creating added value.
- Signals. With all the tools and the simplicity of them there is too much content created every day. That is why signals in the form of email alerts, pings, trackbacks and also RSS feeds are almost mandatory.

McAfee (2006a) described Enterprise 2.0 as “*the use of freeform social software within companies*”, where freeform software is optional and free of up-front workflow, indifferent to formal organizational identities and is accepting many types of data. McAfee (2006b) later changed the definition since the first one was not clear enough: “*Enterprise 2.0 is the use of emergent social software platforms within companies, or between companies and their partners or customers.*”

Since then, many authors used the term for the technologies and business practices that make the workforce free from the constraints of traditional communication and productivity tools. Enterprise 2.0 provides business managers with access to the right information at the right time (through a web of interconnected applications, services and devices) a huge competitive advantage over competition, stuck in Enterprise 1.0 (see the difference in Table 2) in the form of increased innovation, productivity and agility.

Table 2: Difference between Enterprise 1.0 and Enterprise 2.0 (Stevens (2007), Enterprise 2.0 conference web site)

Enterprise 1.0	Enterprise 2.0
Hierarchy	Flat organization
Friction	Ease of organizational flow
Bureaucracy	Agility
Inflexibility	Flexibility
IT-driven technology / Lack of user control	User-driven technology
Top down	Bottom up
Centralized	Distributed
Teams are in one building / one time zone	Teams are global
Silos and boundaries	Fuzzy boundaries, open borders
Information systems are structured and dictated	Information systems are emergent
Taxonomies	Folksonomies
Overly complex	Simple
Closed/proprietary standards	Open
Scheduled	On demand
Users search and browse	Users publish and subscribe
Messages pushed to consumer	Messages pulled by consumer
Institutional control	Individual enabled

However, there are also sceptics who think that vision like that cannot be achieved through new technology alone and that the absence of participative technologies in the past was not the only reason

that organizations and expertise are hierarchical. Davenport (2007) believes that organizational hierarchy and politics will not go away on account of Enterprise 2.0 software and the Internet, because the barriers that prevent knowledge from flowing freely in organizations cannot be addressed or substantially changed by technology alone, although this can change when generation changes.

3. CONSTRUCTION INDUSTRY 2.0

One of the key challenges of AEC is to provide an efficient, effective and flexible access to information and to provide all possible channels of communication. Web 2.0 may have some solutions to such problems, since the collaboration over the internet has never been easier. Working with a group of people on the same spreadsheet, sharing calendars, reading emails with attachments on mobile phones, publishing video tutorials on internal or external company pages, sending pictures from distant construction site locations directly to the concerned co-workers using only mobile phone and web based services, etc. - all those tasks became more or less trivial with the expansion of modern web services.

Stewart (2008) just recently stressed that *“the continuous process improvement via the strategic implementation of innovative information and communication technologies is essential for the long-term survival of construction firms”*. Despite that observation, common practice in the AEC industry is still the same as it was in the 1990s - the IT department provides a new user all the equipment (laptop computer and/or stationary workstation, mobile phone device) needed when the user joins the company. In addition, all the necessary tools and software programs are also provided, including office program suites, email, access to email, secure access to internal network of some sort, anti-virus and anti-spyware tools etc. All the above mentioned equipment is usually maintained by the IT department with the security as a core requirement in mind.

3.1 SATISFYING EMPLOYEES = ADAPTING TO NICHE REQUIREMENTS

In contrast to the IT department's efforts, employees today are no longer satisfied with the predefined set of tools that have to be used since those solutions were tailored primarily for a time that already passed. This is especially true for the dynamic and mobile environments such as AEC industry, where time constraints often play important role and present the difference between success and failure. Employees today are used to live the life of “always on-line”, “present 24/7”, “access anywhere”, social networking, collaboration and feel more comfortable using tools that they are using in their personal life. Some research results (Forrester's NACTAS Q4 2006 Devices & Access Online Survey and Forrester's NACTAS Q4 2006 Youth Media & Marketing And Finance Online Survey, performed by Forrester Research) have shown that 80% of the workers born after 1980 (also called Gen Xers) are using social networking, collaboration and web tools daily (Perez 2008). The result is that the technology is also brought into workplaces and the use of traditional, conventional and awkward productivity tools are stepping aside in favour of text and instant messaging, mobile devices, web based emails, wikis, on-line document sharing etc. This new trend, emerged in the last years, is called technology populism.

Technology populism is a trend of adopting the new technologies, led by a technology-native workforce that self provisions collaborative tools, information sources and human networks with a minimal or even without support of an IT department (Forrester Research via Perez (2008)). The reason for this is that borders between personal and professional life today are more or less blurred and people are using the same tools and services at their workplaces as they are using at home. What is more, every person has its own preferences regarding what to use and it is safe to claim that using those tools and services results in more efficient and satisfying work. While some communities have already adapted to it, the AEC industry was left behind (see Fig.1). Gartner (2008) has predicted that by 2010, end-user preferences will decide as much as half of all software, hardware and services acquisitions made by IT departments.

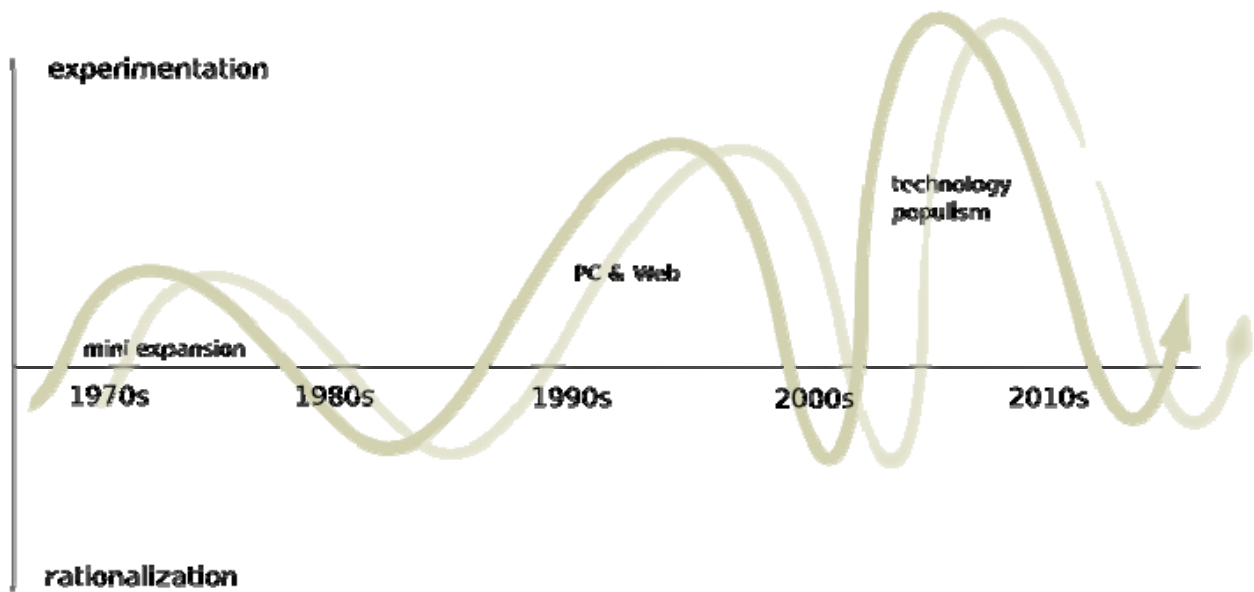


Figure 1: Technology populism as the latest adoption trend (the shadow presents the estimated lag of the adoption by the AEC industry) (based on Forrester Research via Perez (2008)).

3.2 MOVING ONLINE

Some of the authors speculate that in the few years' time the majority of business applications will reside on the web and that most of the business will be done on the devices smaller than laptop. Gartner (2008) is predicting that by 2012 more than 50% of the mobile workers will leave their laptops at home in favour of other devices and that by the same year more than one-third of business application software spending will present service subscriptions instead of product licenses. Ignoring those trends and predictions now can put companies into serious competitive disadvantage.

Advantages of moving online are numerous and can be found on many sides. One of them is that with the central server solutions there is only one place that has to be maintained, and everything else is left to individuals' choice. Choices can start at preferred operating system (Windows XP, Windows Vista, GNU/Linux distributions such as Ubuntu and Suse, MacOS, ..., to name just few of them), and stop at browser level (Internet Explorer 6, Internet Explorer 7, Mozilla Firefox, Opera, Safari, ...). Web based software is usually platform (software and hardware) independent and can be used in combination with variety of devices (including desktops machines, laptops, phones, smart phones and other hand-held devices). This also coincides with the Web 2.0's freedom to choose what suites one's best.

Another benefit is accessibility. If mobile workers are to move to smaller devices than laptops, the infrastructure has to be adapted. Since it is still not clear what kind of devices (and platforms) will come to the market in the two or five years time, it is safe to predict that they will be connected to the internet and will have browser of some sort.

Last but not least, there is also an issue of fast growing price of the electricity that is necessary to run and cool servers. The rise is so rapid that a lot of big companies decided to outsource their services or at least backups that are now hosted by the clouds of computers (such as Amazon S3). Computer clouds offer scalability (really important these days), high availability and low latency at commodity cost.

What is in favour of the AEC industry is the trend of developing smaller devices which are very suitable for mobile work force and off-site work places. Additionally, the trend of web based software used as a

service can lower licence cost, overcome limitations, improve productivity and help in critical situations (it is not hard to imagine how full online CAD tool (such as eCAD – see Fig. 2) can improve on-site work of the engineers).

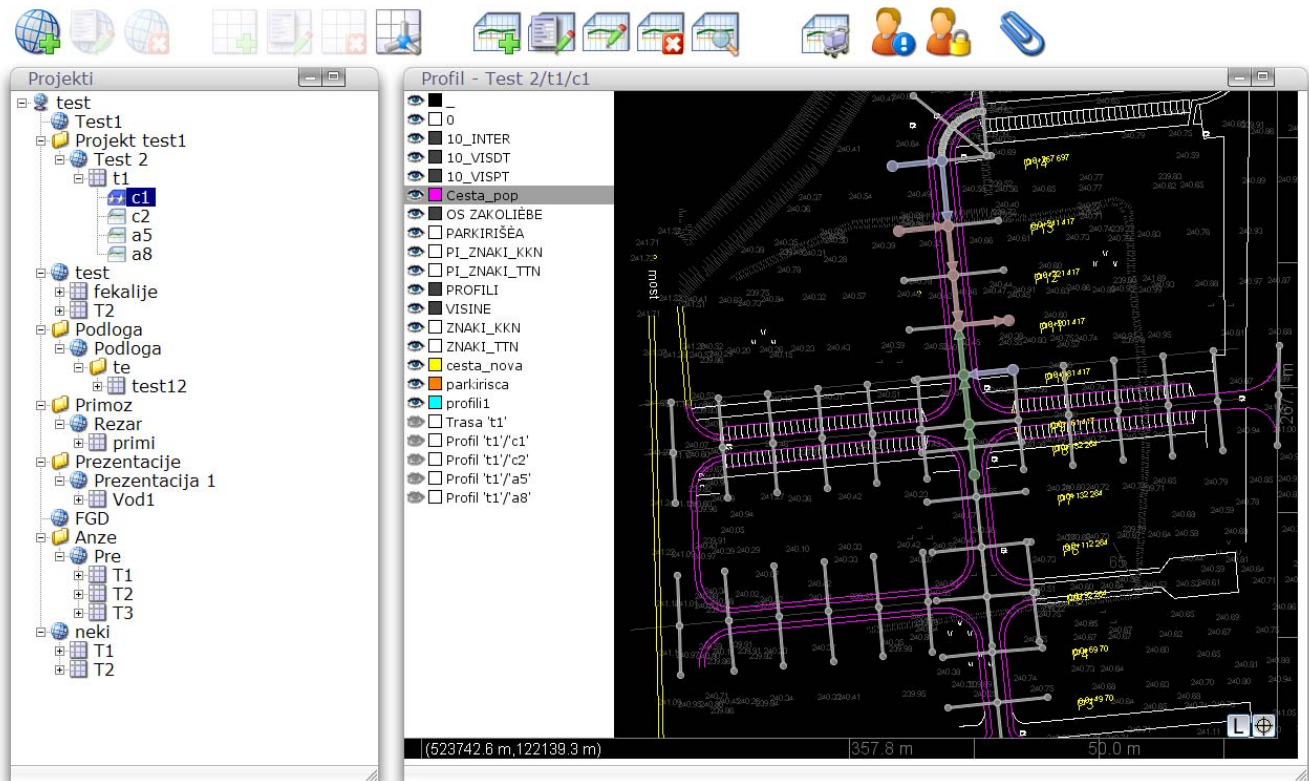


Figure 2: eCAD - CAD tool (similar to AutoCAD) as a Web 2.0 service, working through standard web browser (<http://www.ecad.si>)

3.3 EMPOWER SEMANTICS

Talking about semantics does not necessarily mean talking about ontologies, RDF, OWL, etc. and taking it from bottom-up, it is also possible to extract some meaning from the current set of data without too much effort (top-down approach). Web 2.0 provides some possibilities that would be interesting even to AEC industry.

Just recently some Web 2.0 start-up companies emerged that were promising to deliver semantics to the Internet. For example, Slovenian based start-up company Zemanta (<http://www.zemanta.com>) offered solution for bloggers all around the world that is giving them the opportunity to find links, pictures and text similar to theirs automatically using plug-in for either their blogging platform or their browser. They can do that by using sophisticated techniques such as natural language processing and machine learning. Their business model also predicts custom tailored solutions that would only work on custom set of data and would otherwise not be publically available, offering the chance to the industry to take advantage of it.

Another form of semantics is the usage of tags that are very popular among the Web 2.0 community. The most notable advantage of using tags is that the users are building a set of metadata about the documents, posts, texts and images without the awareness that they are doing that. It is not necessary to tag (people are not forced, for example), but they tag anyway.

Primitive forms of semantic applications are also vertical search engines. It is almost impossible to find specific information on the Internet these days, especially if the set of keywords used for search is quite common (we could try searching for “vibrating plate”, for example). That is why vertical search engines are proving to be very useful, searching only the pages and areas that we predict. Also, it is almost a trivial task building such a search engines with only few necessary information (such as which pages to include). For example, Google is offering APIs for building such engines.

4. CONCLUSION

During the recent years, the phenomenon of Web 2.0 attracted a lot of attention not only in the Internet, but also in business communities. Many traditional businesses stand to benefit from the new business processes, communities and business models enabled by the Web 2.0 movement, although it cannot be viewed purely as a technological phenomenon, it is also a sociological shift of the society as a whole.

The possible benefits of adapting Web 2.0 technologies, principles and strategies into construction industry are numerous: core enterprise applications are becoming more effective through the incorporation of Web 2.0 technologies, next-generation Web platforms are highly efficient, semantic tagging is closing the gap between working groups, for the first time community knowledge can really be used etc.

That is why it is necessary for enterprises in the AEC industry to closely monitor the advances in the information technology in order to be competitive in a few years time. This paper presented newly emerging trends (technologies, services, tools, solutions, etc.) that are already changing business processes as we know and even though one might think they will not play an important role in the future all the projections show that a lot can be expected from them in the following years.

There are also some concerns regarding the newly emerging web technologies in a work place. One of major issues is centralisation of the service and is closely related to the nature of web applications. The question is what happens when the server (or servers) goes down or when internet connection fails. Another concern is the disperse location of the information and documents, which can cause many practical issues (like searching for the information on different locations, security questions, etc.). Some of them can be solved using vertical search engines and search engine APIs, others remain unsolved for the time being. Last but not least, there is also an issue of IT departments which cannot master and support each and every Web 2.0 Ajax application that emerges.

Nevertheless, it is safe to say that most of the technical issues can be solved or at least controlled. However, the resistance to IT change which is so common in the AEC industry is a completely different story.

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