2023 European Conference on Computing in Construction
40th International CIB W78 Conference
Heraklion, Crete, Greece
July 10-12, 2023

THE ROLE OF SOCIAL MEDIA IN BIM-BASED PROJECTS

Dilan Durmus[1,2], Robert Klinc[2], and Žiga Turk[2]
[1]Università Politecnica delle Marche, Ancona, Italy
[2]University of Ljubljana, Ljubljana, Slovenia

Abstract

Project teams are composed of diverse professionals who need to collaborate and communicate, but often lack the will, skills, or tools to do so. Through a literature review, this paper identifies topics and activities where social media supports the BIM-based projects. In addition to smoother collaboration, the informal knowledge and information exchange enabled by social media technology provides a better understanding of project requirements and helps project managers better analyze and deploy team members' skills and needs. Future work should explore how BIM tools can be made more social or how generic social tools can work better with BIM data.

Introduction

In today's world, the Internet has become a necessary and critical tool for both individuals and organizations. Media firms have progressed from offline materials to online resources on behalf of the Internet, and online resources are now more accessible than offline materials. The increase in content creation, participation, and communication among individual users, companies, and researchers is a result of technological advancements and improved Internet accessibility (Kaplan & Haenlein, 2010).

Social media, according to Kaplan and Haenlein (2010), is a category of Internet-based services that expand on the conceptual and technological roots of Web 2.0. People may collect, publish, and disseminate public messages freely and worldwide through social media, which opens new communication possibilities (Stieglitz & Dang-Xuan, 2013). Kietzmann et al. (2012) introduced a social media functionality model to assist managers and academics in understanding various social media capabilities, including seven constructs which are (1) identity, (2) presence, (3) relationships, (4) conversations, (5) groups, (6) reputations and (7) sharing.

In their work, Kietzmann et al. (2012) underscore that the elements constituting the model are not mutually exclusive, and their incorporation in a given social media context is not mandatory. Regarding the domain of project management, Troukens, (2012) proposed a categorization scheme that is augmented by appropriate social media tools. Kanagarajoo, (2021) subsequently introduced slight modifications to this scheme and presented an adapted version in Table 1.

Table 1: Social media categories and related tools

Number	Social media category	Social media tool
1	Microblogging	Twitter, Tumblr, Plazes, Twitpic…
2	Publishing	SharePoint, WordPress, Basecamp…
3	Sharing	YouTube, Dropbox, Slideshare, Flickr…
4	Social Networks	Facebook, LinkedIn, Ning, MySpace…
5	Discuss	Skype, Google Talk, Yahoo Messenger…
6	Event Organiser	EventBrite, Eventful, Doodle, Meetup…
7	Advice	Epinions, yelp!, Customer Lobby…
8	Career	Monster, BCentral, Career Builder…

People can use social media to express their feelings, opinions, knowledge, and personalities for socializing, and informing themselves in a more ubiquitous, effective, and rapid way. Businesses can reach and attract more customers for improving their managerial procedures and customer satisfaction, or they can obtain useful and remarkable insights from user posts, comments, and customer reviews. As a result, social media platforms evolved to web-based community platforms that allow users to create and discuss material to share their common interests and knowledge (Lee, 2018).

Background

In the 21st century, the Architecture, Engineering and Construction (AEC) industry has been one of the last industries experiencing the Digital Revolution, or Industry 4.0, in today's technological parlance (Agarwal et al., 2016). In the AEC industry one of the most transforming digital technologies is Building Information Modelling (BIM) (Azhar, 2011). It is a combination of technologies and processes to deliver design and support construction, operation, and maintenance of the building in a collaborative way. The use of BIM requires sound

understanding of these processes, but also necessary skills in the related use of technology (Turk & Klinc, 2020).

Because of the construction industry's unique project-based character, various participants with different skills and knowledge are required to jointly achieve project goals. However, the project teams face the difficulty of inefficient communication due to the diversity of team members and increasing complexity of the drawings (Turk & Klinc, 2020). In the temporary teams with strong time limitations, team members frequently lack face-to-face communication. Considering this, the project managers are beginning to utilize mobile Information and Communication Technology (ICT) within the project activities and tasks (Hasan et al., 2019).

Social media has penetrated people's everyday lives as well as workplaces as a representation of mobile ICT (Song et al., 2019). Scholarly attention has been paid to profound changes in companies because of social media use in several sectors, such as knowledge management (Jia et al., 2020), communication (Leonardi, 2014), and virtual collaboration (Zhang et al., 2018). Construction firms have started to see the benefits of social media applications in different areas of project management, including improved project communication, information integration and digital business (Azhar & Abeln, 2014). However, the social media usage in the construction teams, particularly the preadoption variables and post adoption consequences remains underexplored. It is resulting in unwillingness to implement social media in construction organizations. As a result, construction industry is among the least digitized industries (Agarwal et al., 2016). This situation is leading to a gap in communication and information.

The vast majority of scientists and practitioners agree that BIM is the most suitable methodology for the AEC sector. Even though BIM is about communicating, and sharing structured information along different project teams, communication gap remains a challenge in the teams of construction-based practice. However, integration of social media tools with BIM can enhance the efficiency of BIM project collaboration through information flow and knowledge sharing in construction projects and it will increase the team performance in the project management.

In the following section, the paper presents the literature review methodology that was used for examining the current state of social media adaptation in the construction industry. Then, the possible ways to share BIM knowledge on today’s popular social media platforms such as Twitter and Youtube will be investigated and presented. The next sections will discuss the collaborative working for BIM workflows through social media tools and enhancing social dimensions in Building Information Modelling by engaging project stakeholders such as end users. Finally, the paper will conclude with discussion of the synthesis and future work suggestions.

Methodology

This research has undertaken as a systematic literature review based on the Kitchenham review methodology (Kitchenham et al., 2010). The purpose of the review in this case is to evaluate systematic literature reviews called secondary studies, so this study is categorized as a tertiary literature review. By following this formal methodology with clear inclusion and exclusion criteria, it was intended to ensure a reproducible research review with minimal bias arising from the review process itself. The procedure applied was as follows:

1. Defining the scope and research question
2. Defining search terms according to 1
3. Choosing resources (digital libraries)
4. Application of the search term in selected sources
5. Selection of primary studies by applying inclusion and exclusion criteria to search results.

Social Media Acceptance in AEC

The construction industry has a unique project-based nature, different participants with diverse skills and knowledge are required to achieve the project objectives for a collective approach. Construction project teams including various professions are assembled to perform planned, specific tasks in a limited time and they disintegrate after the project execution (Buvik & Tvedt, 2017).

Other industries have used social collaboration tools like SharePoint, IBM Connections, and Confluence extensively for information sharing, including the automobile, industrial, information technology, and oil and gas industries. However, the cyclical nature of building projects, people's aversion to change, and the industry's significant fragmentation make it challenging to adopt such platforms (Perera et al., 2015). Industry has built tools to capture explicit information produced on projects. Although most construction information is known to be tacit, tools have not been built to capture this information (Fikri & Anumba, 2006; Grover & Froese, 2016).

Management (Jia et al., 2020; Nisar et al., 2019), communication (Leonardi, 2014), and virtual collaboration have all attracted scholarly attention because of significant changes in companies related to social media use (Zhang et al., 2018). Despite some studies focusing on social media adoption from an organizational perspective, few is known about the factors that influence social media adoption through the context of construction projects (Hasan et al., 2019).

The construction sector has been dealing with the ever-sophisticated demands that require the most effective use of resources. As a result, the construction sector operates as a reference network (Cheng et al., 2001). People tend to collaborate with people they know and trust, who know the answer when they ask a question. In contrast to the limited weekly interactions in traditional work settings, social media allows individuals to connect with professionals globally, enabling virtual interactions and access to specialized knowledge 24/7 (Zhang et al., 2018). As a result of this communication shift, project life cycles are slowly decreasing. Accordingly, the construction industry has evolved, with the segmentation of production duties into various sub processes divided among many

stakeholders who belong to different organizations with diverse knowledge, objectives, and practices. For this reason, social media usage has become a very efficient way to collaborate, conduct research, and it can be used to learn or teach without even moving from the exact physical space.

On the other hand, there is a misconception in the construction sector that social media is a waste of time. So, it is a question of what is done with the tool rather than the tool itself. Grover & Froese (2016) discuss that the main barriers preventing knowledge sharing via social media platforms are dread of the extra time and effort needed, worries that it could just be another underutilized information system, and the concerns of not receiving useful knowledge in return.

Even if the impacts of social media on team or organizational performance have already been studied (Ma et al., 2021), it is more important to look at how project team communication has changed since poor team member communication has become a threat for the success of the projects (Zhang et al., 2018). With this approach, if project teams consider social media as highly suited for dealing with project challenges such as information and knowledge transmission, they may adopt it since they perceive project complexity in terms of project scale, objective or team necessitates such affordances (Perera et al., 2015). Furthermore, social media offers team members creating social bonds and exchanging information among project participants with channels (Ling & Lai, 2016), which supports the project coordination.

Social Media and BIM Knowledge Sharing

Nowadays BIM is an enormous topic; it is going to be an already huge disruptor in the AEC industry and lots of people have misunderstandings about it and need to learn about it (Eastman et al., 2011). Whilst there are individuals who possess considerable expertise, a considerable proportion of professionals within the AEC sector lack sufficient knowledge and experience regarding BIM. The complexity of BIM poses a challenge, as although a wealth of information is available, it may not be immediately apparent how to access it or ascertain its relevance to the user at hand. The issue of discerning its applicability to individual circumstances is particularly pertinent to discussions involving social media.

Utilizing the internet, particularly the Web 2.0 platform, has proven to be a proficient approach in facilitating knowledge and experience dissemination. This is attributable to its high level of efficiency, which enables users to readily access information, as well as its interactive features that allow for the exchange of ideas and discussions (Ziegler, 2022).

Panahi et al. (2013) studied the usage of social web technologies might be viewed as supplementary to enhance knowledge capturing and sharing. Such social platforms could capture both tacit and explicit information created every day in projects and share it with other stakeholders, resulting in cross-project learning.

It is especially important to create content to be able to share information (Kaplan & Haenlein, 2010). There are many key elements that influence professionals' knowledge sharing behavior on social media platforms, including personal (benefits, social media expertise), organizational (managers' and colleagues' engagement, guidelines, collaborative features), and technological aspects (user-friendliness and skills required) (Grover & Froese, 2016). Therefore, writing about one's expertise and sharing content not only helps to demonstrate credibility, but also allows the information to be shared with a wider audience, people interested in this specific topic can find this content through search. The key motivators for professionals are the desire to achieve collaborative goals, support colleagues, and acquire knowledge in return, all of which are intrinsic advantages (Vuori & Okkonen, 2012).

The contemporary era has witnessed a burgeoning trend among social media users, characterized by the emergence of a practice where hashtags are generated to facilitate the dissemination or referencing of a specific topic. A hashtag is a metadata tag that is prefaced by the pound sign or hash symbol (#). Hashtags are used as a form of user-generated tagging on sharing and microblogging platforms like Instagram, Twitter, Facebook, and YouTube to facilitate cross-referencing of information for sharing a subject (Chang & Iyer, 2012). In simple words, hashtags make a word, a piece of content clickable. That is, when a hash sign (#) is placed in front of a word or phrase, it allows access to all shares and content related to that phrase anywhere on Twitter or even on Facebook or somewhere else on the internet.

As an example, UK BIM group hashtag which was created originally for a group of people who are going to a conference in USA to keep in touch with the UK people at that conference for a specific purpose, but it has turned into a place where people can find other useful, helpful people who are interested in the UK in talking about BIM (*How Can Social Media Support BIM Knowledge Sharing?*, 2015). The use of the specific hashtag, it is possible to get information about a specific topic, for example, "common data environment" or a specific knowledge about a specific software (Figure 1). This hashtag makes the information reachable from all around the world and it provides interactions with people to get answers for the questions or it helps to get suggestions about the topics they have been talking about.

It is also claimed that, for those who are not willing to participate that public realm and do not want to participate in such conversations might just check the relevant people's name on Google or in another database and they can find a useful phone number, or an e-mail address and they can reach those people as offline, or they can make more private connections (*How Can Social Media Support BIM Knowledge Sharing?*, 2015). So, it also proves that there are different methods to use social media to enable knowledge sharing.

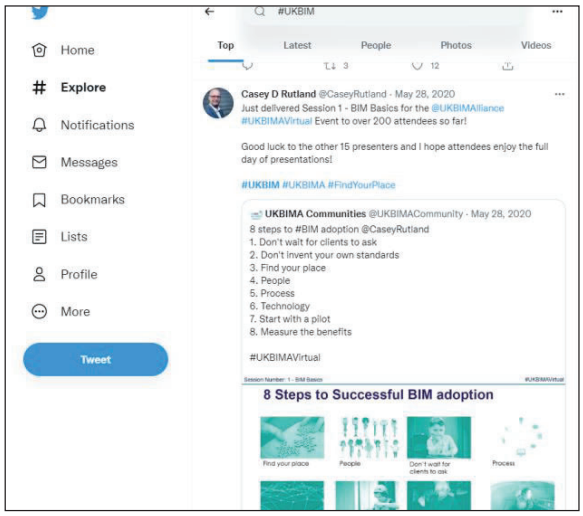

Figure 1: Discussions and information exchange on a BIM topic (source: twitter.com)

As another example YouTube is a social media platform to share knowledge even for free. It has become popular to have conversations on the comments section under YouTube videos. So, it is also a blogging platform where people can join a community and participate in discussions such as the level of their BIM expertise or the knowledge they have (Figure 2).

Collaborative Working for BIM Workflows through Social Media

BIM is not just about 3D models; it is about shared data and information (Azhar, 2011). Therefore, it involves people and cultural relationships. So, BIM is about a cultural exchange within the construction industry; it is about encouraging more effective, efficient working through collaboration and that is why social media, and the concepts of social media should be applied within BIM to enable an ideal connection between two.

The construction sector has been discussing collaborative working for many years. In 1994, the Latham Report revealed strategic issues with the construction industry and began to discuss collaboration and teamwork (Latham, 1994). Constructing Excellence which is the cornerstone of collaborative working in the construction industry defines collaborative working as "Working together in a seamless team to common objectives that deliver benefit for all through mutually beneficial (i.e., including commercial) alignment."

Constructing Excellence outlines six crucial characteristics for implementing successful collaborative work in order to achieve collaborative nirvana:

1. Early Involvement
2. Selection by value
3. Aligned commercial arrangements
4. Common Processes and Tools
5. Measurement of Performance
6. Long Term relationships

All six of these characteristics are essential for BIM to function successfully, and BIM provides the type of joined-up thinking that allows collaborative working to occur. So, it could be said that collaborative working is a prerequisite for BIM, and vice versa.

Social media tools and platforms can be leveraged to support these collaborative work pillars by providing a means of communication, information sharing, and coordination (Razmerita et al., 2014). Microblogging tools like Twitter and Tumblr can be useful for quick updates and interactions, while publishing tools like SharePoint and WordPress can enable more in-depth information sharing (Lee, 2018). Sharing platforms like Dropbox can facilitate the exchange of large files and media, and YouTube can support knowledge share and exchange visually. Social networks like Facebook and LinkedIn can be used to build and maintain professional long-term relationships (Lee, 2018). Discussion tools like Skype and Google Talk can support real-time communication, while event organizers like EventBrite and Meetup can help coordinate meetings and projects. Finally, advice platforms like Epinions and Yelp can provide valuable feedback and insights (Lee, 2018), while career-oriented platforms like Monster and Career Builder can help connect professionals during the project collaborations and provides potential job opportunities.

More than a decade ago, a technique was utilized by Dave & Koskela (2009) to assess a social media platform for a construction company; the platform permitted interactive

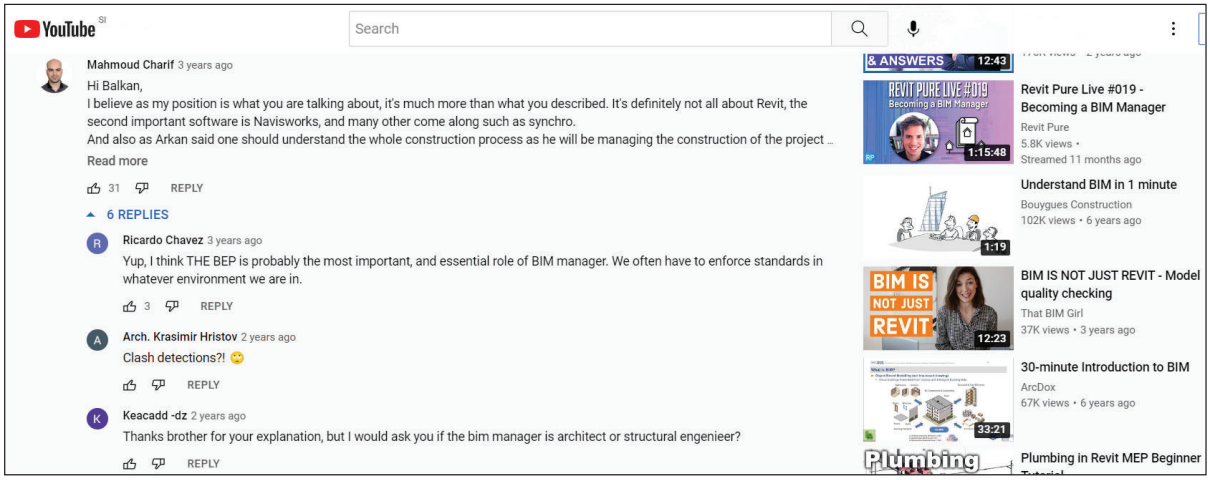

Figure 2: BIM discussions on YouTube channels (YouTube, 2023)

knowledge sharing, offered substantial user interaction, and the supplied information was immediately put to use in the workplace. This research also pointed out some of the issues connected with deploying a platform for latent knowledge capture, such as simplicity of use, team cohesion, the relevance of knowledge sharing in organizations, and managerial engagement. Tan et al. note that the following needs must be fulfilled for the live capture and reuse of project knowledge in their research: accuracy of information obtained, simplicity of knowledge capture and reuse, and avoidance of legal issues, additional expenses, or worker workload. A web-based knowledge repository, an integrated work-flow system, and a project knowledge manager are the key components of their recommended live knowledge capture and reuse approach (Grover & Froese, 2016).

Even though all the platforms are available for professionals, there are still not many people in the AEC industry to start integrating social media tools with BIM to enable social collaboration to happen within that environment (Perera et al., 2015). Furthermore, using social media platforms effectively is going to make a significant commercial benefit for professionals and it will make collaboration work effectively in the construction industry (*Why Social Media for AEC?*, 2015).

Enhancing Social Dimensions in Building Information Modelling

Communication problems in the AEC sector are usually caused by not involving the correct individuals at the right time, or by concealing information for personal or organizational advantage (Brown, 2012). BIM has gained significant attention in the construction industry due to its potential to revolutionize the traditional project delivery process by promoting the notion of integrated project delivery. The integration of various project stakeholders, including architects, engineers, contractors, and end-users, into a collaborative and coordinated workflow is a key feature of BIM (Azhar, 2011). By utilizing BIM from the very inception of a construction project, stakeholders can benefit from a multitude of advantages, including improved design quality, reduced errors and omissions, increased efficiency, enhanced communication, and better decision-making (Azhar, 2011; Eastman et al., 2011).

The projects are becoming increasingly user and customer oriented nowadays (Suwal et al., 2013). Therefore, there is a need to involve the end-users more closely in the decision-making process as well as in the implementation process (Hodorog et al., 2019). Novel technologies for active user engagement in projects are still in their early phases. However, involving users early in a multidisciplinary team allows the team to determine the actual objectives of the project and solutions on how to best achieve it (Baars, 2006).

In their systematic literature review, Prebanić & Vukomanović (2022) revealed that the most prominent feature of social media supported stakeholder management is the management of external stakeholders, primarily end users and the local community.

Suwal et al. (2013) define the term "Social BIM 2.0" as a collaborative approach to working in which end users of construction products or residents of the project location participate in generating socially accepted innovative construction solutions using tools developed by Web 2.0 technologies and having the potential for BIM integration. In this technique, users are able to engage in the project decision after agreeing to the user agreement terms and conditions specified by the implementing organization by creating a new user account or connecting to an existing social network account.

Users may discuss, post, comment on, and propose all sorts of ideas and solutions via various social media platforms, and they are rewarded for their active engagement. When user-generated solutions relate to BIM systems, they serve as a foundation for experts to instantly revise and build superior results. The basis to the notion of social BIM 2.0 is end user engagement in developing the optimized solutions (Suwal et al., 2013). Therefore, it is crucial for construction professionals to embrace these technological advancements and involve end-users in the project delivery process as much as the other stakeholders to achieve better project outcomes.

Discussion of the Synthesis

Teams working on construction projects are heterogeneous, fragmented, and diverse (Turk & Klinc, 2020). As a result, construction project management is challenging for construction professionals who oversee building projects. In this context, numerous information technologies, such as Building Information Modelling BIM) and social media platforms, have been used in recent years to help construction teams work more efficiently (Ma et al., 2021).

Despite initial skepticism about the use of social media in the construction industry, the conducted literature review shows that social media supports BIM collaboration by allowing easy communication and knowledge sharing between the project teams and the stakeholders. With this approach of allowing for easy sharing of images, ideas, updates, tips and tricks, social media helps to create a stronger connection between professionals and helps to ensure that all ideas are shared and considered. It provides instant feedback to team members, so it helps to promote BIM collaboration by instant information flow. Moreover, social media can be used to promote BIM events, and to connect with other BIM professionals and help to create a community of like-minded individuals. In light of these findings, the research identifies the role of social media for BIM projects in three topics:

1. Increasing communication and collaboration between team members: social media provides a platform for team members to communicate and collaborate with each other more quickly and easily. This leads to improved project coordination and a more useful information flow.

2. Better understanding of project requirements: social media can help team members to share and discuss project

requirements more effectively. Also, by allowing to interact other stakeholders such as end-users, it leads to a better understanding of the project scope and provides more efficient project engagement.

3. Improving project management: social media can help project managers to keep track of project progress and communicate with team members more effectively in terms of their skills and needs. This leads to improved project management and a more efficient workflow.

Conclusion and Future Work

Social media has the potential to enhance collaboration and communication within the project teams and stakeholders, particularly in the construction industry where diverse professionals need to work together towards common objectives. This paper has identified the areas where social media can support project teams in BIM-based projects, including smoother collaboration, informal knowledge and information exchange, and better analysis and deployment of team members' skills and needs. Additionally, this paper has explored possible ways to share BIM knowledge on different social media platforms like Twitter and Youtube, collaborative working for BIM workflows through social media, and the benefits that social media tools and platforms can provide for successful collaborative work.

Even if the existing studies show that social media acceptance is not on the convenient level in the construction industry, it is obvious that the AEC professionals will be engaging with social media platforms in the near future better. Depending on this, the future may make BIM tools more social or social tools may work better with BIM data. Practical studies should be conducted with surveys to prove how communication is happening before and after social media and how it is affecting the collaboration of the project teams and the construction networks.

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