

Communication of Construction Health and Safety Information in Design

Norhidayah Md Ulang*

Civil and Building Engineering Department, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK

* E-mail of the corresponding author: cvnbm@lboro.ac.uk

Abstract

Although all parties involved in the construction industry may address their respective responsibilities, the lack of integration between each organization often results in communication problems which jeopardize health and safety (H&S). Of particular note is the communication during the design phase. All information pertaining to the project must be readily accessible for all parties, to ensure smooth and hitch-free project execution. This paper presents the challenges in the communication of H&S information in the design phase of construction projects derived from semi structured and focus group interviews with 53 construction practitioners in the UK. It characterizes the various aspects of collaborative communications at this stage and highlights the problem area.

Keywords: Construction H&S, Communication in Construction, Communication of H&S, Design Phase and Construction Management

1. Introduction

The effectiveness of communication relies on many factors. Dainty et al. (2006) summarize four factors that enable communication: the effectiveness of encoding and transmitting information through communication systems; channel and network; the suitability of communication medium and channels; reactions of the receiver and the abilities to control noise. Titus and Brochner (2004) suggest that sharing information is a key component of effective communication. On the other hand, according to Cheng et al. (2001), the significant reasons for ineffective communication are closed lines of communication due to protocols, unsuitable communication channels and unexpected communication breakdown. They add that information overload, lack of openness and filtering of information may increase the lack of communication efficiency.

Another main focus of this research is construction H&S information in design. Construction has a reputation for poor H&S performance and consistently exhibiting poor accident records (Edwards and Nicholas, 2002). As in other countries worldwide, the construction industry in the UK has a poor record of H&S performance, with roughly three times more workers expected to suffer from injury than workers in other sectors (Marsh et al., 1995). Traditionally, the main contractor is the person who bears the responsibility for H&S risks (Hare et al., 2006). The introduction of the Construction (Design and Management) Regulations (CDM) in 1994 addressed the roles and responsibilities of each of the construction team members for H&S in construction projects. The CDM Regulations emphasize the importance of safety management and require the development of a safety culture (Langford et al., 2000).

The UK is subjected to legal directives which must be interpreted and implemented as part of European Union membership (Griffiths and Griffiths, 2011). The CDM Regulations were revised in 2007 with new obligations specifically for clients, designers and contractors, and generally further engaged the project team members (Griffiths and Griffiths, 2011). CDM 2007 introduced the CDM Coordinator or CDMC as the replacement for the Planning Supervisor, introduced when CDM was launched in 1994. The CDMC, according to Barrett (2008), is the 'person' who 'is bound to coordinate with the other persons upon whom duties are imposed by the regulations to ensure the H&S of persons carrying out and affected by the construction work'.

In order to identify the real issues that affect H&S communication in construction, feedback from the industry is urgently needed. The interviews were intended to address the problem and to identify the flow of H&S communication at the design stage. Barriers and challenges as well as suggestions for improvement were also determined. The findings were very useful in determining that there are critical communication issues in conveying H&S information to practitioners involved in the design stage of a project.

2. Methodology

There are two major divisions of research methodology – qualitative and quantitative. Quantitative research is often employed for studies related to natural phenomena (Faisal, 2010) and when there are clear conventions that a researcher can use (Miles, 1979). On the other hand, qualitative research requires data collection instruments that are sensitive to underlying meanings, such as observation, interviews and analyses (Merriam, 2009).

Based on the research questions of this study, qualitative research methods were chosen. This is due to the need to understand the nature of the issues being investigated. The literature reviews revealed that there are communication issues in construction, particularly in the design stage. However, there were only limited sources that could aid the author's understanding of the issues of communication of construction H&S information in design. To investigate these issues, face-to-face and open-ended interviews were conducted with a number of construction professionals to produce a rich description of the issues under investigation (Merriam, 2009).

The scope and the nature of the industry had to be understood to ensure an appropriate mix of participants. Interview questions were structured and divided into three categories:

2.1 Background and responsibilities

These questions determined the background of the interviewee, such as education, roles in construction, involvement in H&S matters, duration of service in construction and level of awareness of H&S issues.

2.2 Systems and content in communicating H&S information in construction

The second set of questions investigated the systems that the interviewee uses for H&S communication as well as the effectiveness of the system. The interviewees were also asked about the content of the H&S information, to whom they communicated the information and whether the information was imparted to all of the parties involved in the project or to specific team members.

2.3 Towards improving the communication of H&S information in construction

Here, the interviewees were asked their opinions regarding the current practices that impact upon the communication of H&S information positively and negatively. They were invited to explain what practices they thought would help overcome the issues in communicating construction H&S information. They were also prompted to give suggestions for improving the communication of H&S information in construction.

3. Phases of communication of construction h&s information in construction

The findings from the interviews are categorized into three phases of H&S communication at the design stage, as illustrated in Figure 1. The phases are developed from the research done by Kashyap (2007), which identified that H&S communication must be organised at different levels. These levels or phases are matched with the RIBA Plan of Work, which consists of three main stages – the pre-design stage, the design stage and the construction stage – and is subdivided into eleven activities. However, this research focuses on the design phases; therefore, the three phases of communication in this chapter are derived from the appraisal stage to the tender stages according to the RIBA Plan of Work stages.

Phase 1: Client's team and designers and CDMC (Appraisal & Strategic Brief)

Phase 2: Designers' team (Proposal Stages & Product Information)

Phase 3: Designers' team and other team members (Tender Stages)

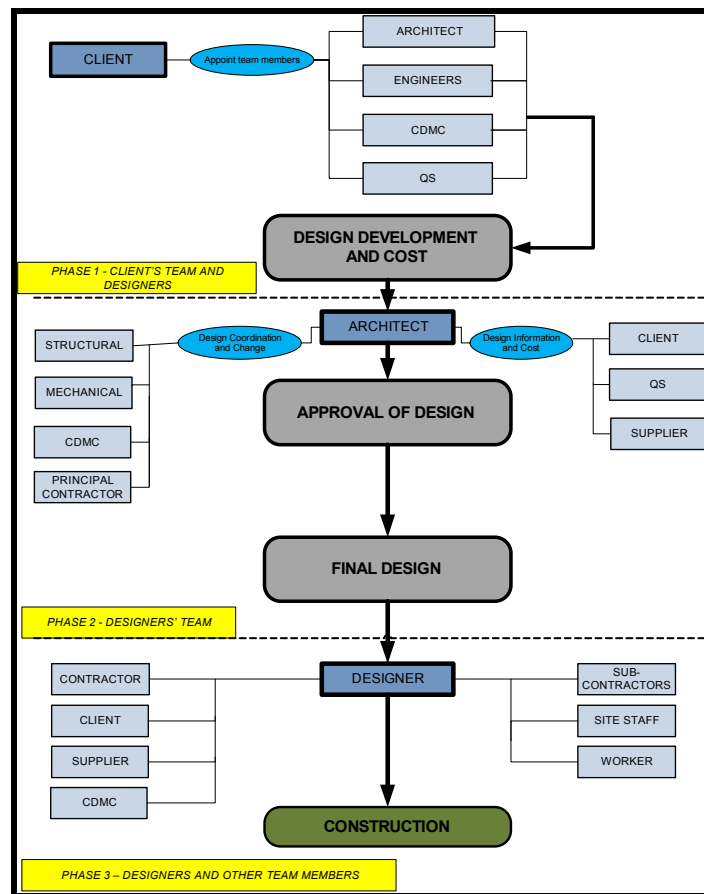


Figure 1 Communication phases in the design stage.

Communication of H&S information Phase 1 focuses on the pre-design stage, which determines the communication process of H&S information between the client's team and the newly appointed designers as well as the CDMC and the quantity surveyor. Communication of H&S information Phase 2 addresses the design stage, which determines the communication process of H&S information among the designers involved in design development until the final design has been produced. Communication Phase 3 covers the H&S communication process between the designers and the other parties as well as the contractor's team involved in the construction process. All these phases are illustrated in Figure 1. Although the design process is not straightforward due to changes and alterations of the design, the phases of H&S communication in the design stage are intended to identify the H&S issues. The communication process will be repeated several times until a design is finally approved.

3.1 H&S Communication Phase 1: Client's Team and Designers

The first phase of H&S communication, as illustrated in Figure 2, is initiated at the start of a new construction project. The project starts with the client issuing a proposal. From the interviews findings, it was discovered that some clients might be equipped with construction knowledge while others barely understand construction or buildability. This has created challenges for H&S communication from the earliest point of a project.

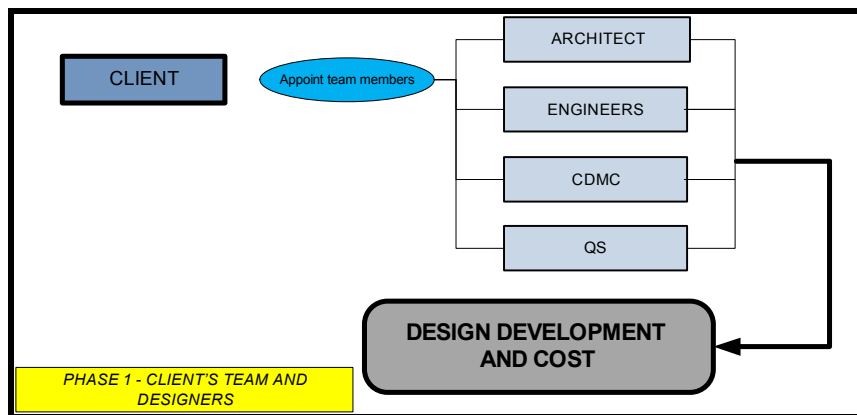


Figure 2 H&S Construction Communication Phase 1: client's team and designers

It also appears that the communication challenges start when a client lacks construction H&S knowledge or is not interested to know about H&S aspects in further detail. In a worse case scenario, some clients depend too much on designers or the CDMC to solve H&S issues. These attitudes affect H&S information output from the clients. Rather than communicating the H&S issues with the project team members, the client will appoint an agent to deal with these matters.

At this phase, in order to initiate effective H&S communication from the beginning of a project, the client must be clear about his/her role and responsibilities with respect to construction H&S. Only then can the H&S culture be embedded in the working environment and H&S information cascaded down the line. With regards to the communication issue with the clients, some of the interviewees in the focus groups suggested that the client should be actively involved in the project and equip themselves with the necessary knowledge.

As the owner of the particular project, the client could encourage H&S to be considered right from the start if they understood the requirements. Budget allocation for H&S implementation must be included when the client proposes a project. Although the budget for H&S implementation used to be an issue for most clients, the industry is seeing improvements due to the growing awareness of the need for safety in construction projects. The H&S budget should include the hiring of the CDMC and contractor at an early point of the design. Their knowledge and experience will assist the designer to design for H&S. According to one of the participants in the focus groups, prevention through design results in less work that has to be done on site.

"...if you put more into the prevention through design at the beginning, you do less on site."

The findings from the focus groups show that there are improvements from some clients who make H&S a top priority. At the first phase of H&S communication in construction, the client appoints designers, a CDM coordinator and a quantity surveyor to the team to finalise the primary design. At this stage, the client has frequent contact with the team members, especially the architect, to develop the preliminary design either verbally or in writing. The main method of H&S communication at this stage is via meetings. Telephone calls, emails and faxes are also used. At this stage, risks and hazards are identified. Therefore, it is crucial that the client encourages the project team members to eliminate these risks and hazards and communicate with each other to solve the issues.

At this stage, communication between the client and the engineers is rare. Design engineers are likely to be contacted (via informal meetings or telephone calls as well as via email) only if there seems to be an issue in their work scope. The frequency of H&S communication between the client and the CDMC is the same as with the architect. The feedback from the industry clearly shows that the team members and the CDMCs would like to see the CDMC being appointed at an early stage of the construction. Communication of H&S with the quantity surveyor at this point is very limited apart from making budget calculations for H&S implementation in the project. Figure 2 shows the communication flow in H&S communication Phase 1: Clients' Team and Designers, which has been described in this section.

3.2 H&S Communication Phase 2: Designer' Team

After the design has been finalized, in the second phase of construction H&S communication, designers mainly communicate H&S information. The development process of the final design of a project enables the designers to see each other more often and to get involved in frequent discussions regarding the project and, in particular, issues regarding risks and hazards. It is crucial that the risks and hazards detected are eliminated at this point of design.

Traditionally, the architect is the main actor involved in developing a design. The architect defines the client's ideas and concept in drawings. The engineers will later complete the design with the necessary details such as the structure, services, materials and so on. In this process, many risks and hazards will be identified. According to the findings from the industry, communication in this phase becomes more condensed and is held in more formal ways. More meetings are held and the H&S information is recorded. To facilitate informal discussions with one another, the designers use telephone calls, emails and faxes to keep each other updated or to demand more information.

In order to develop a safe design, it is crucial for the designers to have the necessary knowledge, skills, experience and training to design for H&S. It is clear that one of the main barriers for designers to communicating effectively about H&S is a lack of construction and buildability knowledge. Some of the designers do not understand how a building is constructed. One of the architects involved in the focus groups admitted that although he had been in the industry for more than 20 years, his knowledge of construction is still limited:

"I mean I know how buildings are put together but I don't know how they're built. I don't know how somebody is going to build something and I've been building buildings for sort of 25 years now."
(Architect)

It is understood that the communication of H&S cannot be effective when the actors do not understand their

It is understood that the communication of H&S cannot be effective when the actors do not understand their roles in producing a safe design. The knowledge and skills to design for H&S can be obtained by attending the appropriate courses and training. Young designers can also be equipped with construction H&S knowledge if the subject is included in their courses. Education could help designers to understand their roles and responsibilities for H&S in construction.

The designers are not only expected to produce a safe design, but they are also expected to think beyond it. They must consider the safest ways for the constructor to carry out the tasks involved in constructing their design as well as maintaining the building later on. Another means by which a designer can identify risks and hazards and communicate H&S information effectively is to make frequent site visits. According to the participants, regular site visits can add to the team members' understanding of the project.

From both the preliminary and focus groups, the principal contractors' early involvement is highly appreciated by the other team members at the design stage. According to them, the principal contractors can aid the design in terms of recognizing the risks and hazards and offer solutions to the issues. Designers and the principal contractor exchange a lot of H&S information at this stage. They must agree on the finalised design, because the contractors, through their experience and skill, may add considerations for safe methods of carrying out the construction of the project.

However, in certain cases, the clients do not agree with this idea, because they have to spend more money to hire the principal contractor for a longer period. CDMCs face the same situation in certain cases. Their early involvement can be seen as a burden to the construction budget. However, the client should see the benefit of their early involvement such as avoiding accidents, which could save them money and preserve the image of the company. The designers could be the party who persuade the clients to appoint a principal contractor and CDMC from the very beginning of the project.

In H&S communication in Phase 2, the CDMC is the person assigned to coordinate H&S information, as stated in the revised version of CDM 2007. It is very important that the CDMCs are actively involved in the design development process. Although the CDMC's role and responsibilities are clearly outlined in CDM 2007, some of the participants in the focus groups mentioned that they have difficulty liaising with the CDMC, as they are invisible. Some CDMCs are involved in several projects at a time. The time that can be spent on each project is limited. However, some of the CDMCs who took part in the interviews said that they are not appointed at the early stage of design development. This limits their communication with other team members, even though their role as H&S coordinator is seen as beneficial. In order to overcome this issue, the client should ensure that a CDMC is appointed

from the beginning of the project. The communication in Phase 2 is illustrated in Figure 3.

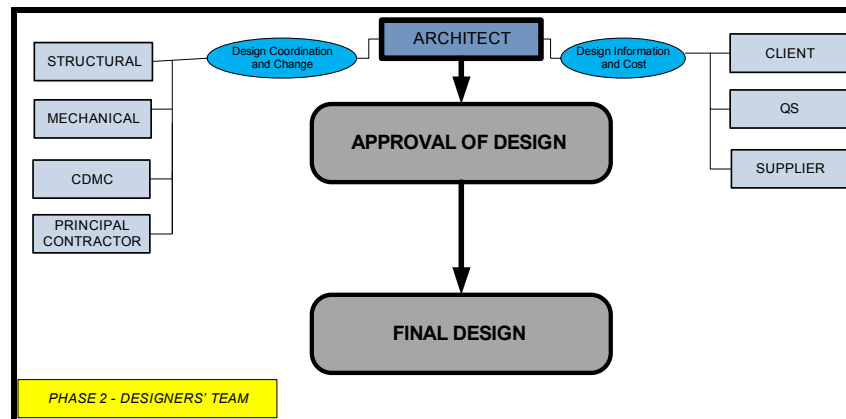


Figure 3 H&S Construction Communication Phase 2: Designers' team

In construction H&S communication in Phase 2, quantity surveyors and suppliers are involved in the design stage in terms of producing design information and design costing. The client is expected to be actively involved in this stage. According to the findings from the focus groups, in some cases the clients appoint representatives for them. Although they have to spend money to appoint consultants to deal with H&S, some critical decisions must be made by the clients, such as budget approval for H&S facilities, changes in design and so on.

3.3 H&S Communication Phase 3: Designers and the other team members

Communication of H&S information continues to Phase 3, which mainly focuses on designers and the other team members, including contractors, during the tender stages. A contractor is involved if they are appointed at this point. Apart from the CDMC, the designers also hold the responsibility of sharing H&S information with all parties involved in the project. This is due to H&S communication and practices expand as the project moves towards the construction phase.

The contractor's early involvement is very much demanded by the other team members, as discovered from the feedback from the industry, as they are perceived as having a great impact on construction H&S. Contractors are responsible for the other parties down the line such as subcontractors, site staff and labourers. It is critically important that contractors ensure that the people on site get the same H&S information and communicate with them effectively.

H&S communication in this phase is via meetings, drawings, telephone calls, emails and faxes. Some of the construction companies in the UK establish intra- and extra-networking systems to aid communication. Meetings are the most essential methods by which the project team members can address and solve risk and hazard issues. Other than meetings, the actors at this stage communicate H&S information via drawings. The focus groups confirmed that drawings are the best way to highlight risks and hazards rather than using documentation. According to the participants, tender documents and H&S files are very thick. It is human nature to avoid reading such documents. Notes, colours and symbols on drawings are the media used to communicate H&S information effectively to people involved in a project and is done from the design phases. The symbols and different colours used to highlight risks and hazards on the drawings are easily identified by any of the team members as well as the site staff and labourers as areas where they should take precautionary steps. The notes on the drawings help them to understand the risks and act accordingly. The communication in Phase 3 is illustrated in Figure 4.

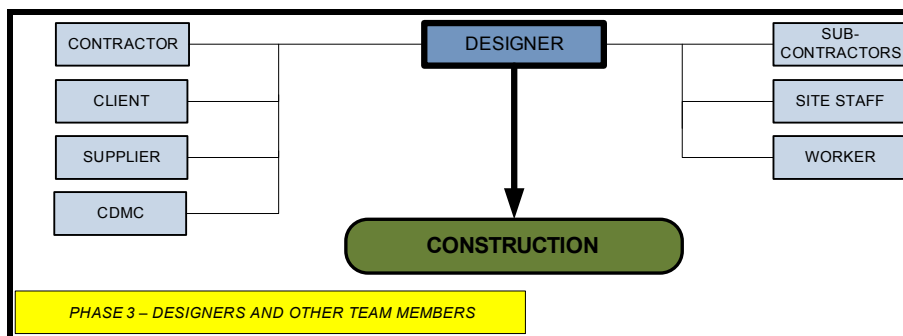


Figure 4 H&S Construction Communication Phase 3: Designers and the other team members

Although, traditionally, designers are not actively involved at the construction stage, according to the participants of the preliminary interviews, their role in terms of H&S should continue until construction completion. In the construction stage, the designers must communicate with the contractor's team if there are any changes or alterations to the design. According to one of the focus group participants, as the coordinator of H&S information, the CDMC should be available to the contractors at all times to ensure that the contractor obtains the relevant H&S information to be passed down to the people on site. It was highlighted in the focus groups that the clients are also responsible for monitoring the work on site and undertaking an active role in advising the contractor when they see any tasks that would endanger the labourers on site. One client who participated in the focus groups mentioned that he had started to have conversations with people on site. The fact that the contractors' attitude can sometimes be a big barrier to H&S communication between themselves and the designers was discussed. Some contractors have a 'can do' attitude. Some contractors refuse to take on board the designers' suggestions for carrying out a task in a safer way, resulting in less discussion in terms of finding ways to solve H&S issues.

4. Conclusion

The client plays a very important role in creating an H&S culture in any project and initiating H&S communication from the primary design development stage (H&S communication Phase 1). The designers also contribute hugely to effective H&S communication by producing a safe design (H&S communication Phase 2). H&S information can be communicated during design development via meetings with project team members, as well as by including notes, symbols and highlighting to indicate risks and hazards on the drawings. The involvement of the CDMC and contractor from an early stage of the design would assist the designers to produce a safe design. Contractors, through their skill and experience, can add additional H&S considerations into the design. The CDMC, on the other hand, can help by coordinating H&S information and ensuring that all parties involved in the project get the same H&S information.

During the tender phase (H&S communication Phase 3), the designers should liaise with the other team members regarding H&S. Should there be any changes or alteration to the design, the designers must ensure that all of the team members including contractors (if appointed at this point) are aware of the changes and take appropriate steps to act accordingly. The contractors must have the initiative to discuss problems of construction with the designers. Despite the fact that the contractors are in control of the construction stage, they should not ignore other actors' opinions on resolving risks and hazards on site. Effective communication between team members from the start of the project until construction completion would ensure that all of the relevant H&S information is transferred to and referred to by all of the players in the construction project. Retaining the correct and appropriate H&S information would help the team members carry out their responsibilities in the correct manner. Accidents could be avoided by eliminating the risks and hazards earlier in the design stage. If there are any risks and hazards that cannot be avoided, then these should be reduced and must be communicated to the appropriate team members. Lastly, if risks and hazards still exist, the contractor should be able to control them with adequate preparation and the cooperation of the clients, designers, CDMC and people on site.

References

- Barrett, K. J. (2008) *Defective Construction Work*. West Sussex: Blackwell Publishing
- Cheng, E. W. L., Heng Li, Love, P. E. D. & Irani, Z. (2001) Network communication in the construction industry. *Corporate Communications: An International Journal*, 6(2), 61-70.
- Dainty, A., Moore, D & Murray, M (2006) *Communication in construction: Theory and Practice*. New York: Taylor and Francis
- Edwards, D. J. & Nicholas, J. (2002) The state of health and safety in the UK construction industry with a focus on plant operators. *Structural Survey*, 20(2), 78-87.
- Faisal, N. (2009) An Investigation of Relational Contracting Norms in Construction Projects in Malaysia. PhD Thesis. Loughborough University.
- Griffiths, O. V. & Griffiths, A. V. (2011) *Understanding the CDM 2007 Regulations*. 2nd ed. Oxon: Spon Press
- Hare, B., Cameron, I. & Duff, A. R (2006) Exploring the integration of health and safety with pre-construction planning. *Engineering, Construction and Architectural Management*, 13(5), 438-450.
- Kashyap, M. (2007) Intelligent Decision Support To Avoid Collapses in Structural Refurbishment Projects. PhD Thesis. Loughborough University.
- Langford, D., Rowlinson, S. & Sawacha, E. (2000) Safety Behaviour and Safety Management: Its Influence on the Attitudes of Workers in the UK Construction Industry. *Engineering Construction and Architectural Management*. 7(2), 133-140.
- Marsh, T. W, Robertson, I. T., Duff, A. R., Phillips, R. A., Cooper, M. D. & Weyman, A. (1995) Improving safety behaviour using goal setting and feedback: A description of the development and effects of behaviourally-based management techniques in improving construction site safety. *Leadership & Organization Development Journal*, 16(1), 5-12.
- Merriam, S. B. (2009) *Qualitative Research: a guide to design and implementation*. San Francisco: Wiley Publishers.
- Miles, M. B. (1979) Qualitative Data as an Attractive Nuisance: The Problem of Analysis. *Administrative Science Quarterly*. 24 (4).
- Titus, S & Bröchner, J. (2005) Managing information flow in construction supply chains. *Construction Innovation: Information, Process, Management*, 5(2), 71 – 82.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage:

<http://www.iiste.org>

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. **Prospective authors of IISTE journals can find the submission instruction on the following page:**

<http://www.iiste.org/Journals/>

The IISTE editorial team promises to review and publish all the qualified submissions in a fast manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

