A METHOD OF MEASURING INFORMATION OVERLOAD IN CONSTRUCTION PROJECT MANAGEMENT

A. Mehmet Haksever and Norman Fisher

The University of Reading, Reading, Berkshire, U.K.

SUMMARY

This paper proposes a method to measure information overload in construction project management. The method uses time as a measurement unit and describes five information load situations that may be encountered by project managers. These situations are identified in an information load matrix (ILM) representing key project team members and distinct stages of a construction project. Data for the ILM was gathered using a questionnaire, which was sent to 140 project managers in the UK. A weight scale is introduced for each situation in order to calculate information load points (ILP). A graphical representation of the ILP suggests that there are three distinct information load zones in construction project management. Zone 1 is an information overload free area. In zone 2, information overload is normally at an acceptable level, but sometimes the circumstances in this zone can easily rise to zone 3, where information overload is at its highest. The method sets a numeric norm on identifying the degree of information overload. Some implications of the results and potential applications of the method are discussed, and suggestions, based on time management principles, for managing information overload are made.

KEYWORDS: Information overload; Construction project management; Time; Information load matrix; Measurement of information; Information load point

INTRODUCTION

Project organisations and their members are affected by the ever increasing quantities and varieties of information they are required to process. However, even the most able project managers are limited in their capacity to process information. This mass of information is mainly due to the advancing level of technology which has resulted in fragmented expertise, thus increasing the need for co-ordination, integration, control and in particular, communication. The combination of surplus information and finite information processing capacities has led to the phenomenon called information overload.

Although information overload has interested researchers in management [1], accounting [2], marketing [3, 4] and information science fields [5], relatively little attention has been given to it in construction management literature. Some recent studies in construction [6, 7] have shown that, unless it is understood and managed well, information overload can be a critical information problem which prevents project managers from performing their tasks effectively. Although the problem has been acknowledged, effective solutions have yet to be found.

It is generally accepted that project managers are overloaded with information from time to time, and on numerous occasions are very busy with information processing. However, there is conflicting opinion regarding the extent of the problem of information overload. Some argue that the real problem concerning information management is issues such as missing, late or unclear information. The ensuing impact on information processing can be more damaging than most other information related problems. Others argue that dealing with paper work and attending meetings prevents project managers from finding sufficient time to deal with other management responsibilities. It is also claimed that to rectify any information problem, indirectly contributes to the need to process more information. The same diverse opinion is also present in attempts to deal with information overload. The lack of knowledge about the circumstances in which project managers are prone to excessive amounts of information, and how the degree of that information overload fluctuates from situation to situation, hinders attempts to manage information overload efficiently. One reason for this is that no technique or method is available on defining information overload and measuring it in a numerical fashion. Following the principle that 'if you cannot measure it, you cannot manage it'; subsequent attempts to prevent the occurrence of information overload are ill-defined and ineffective, both in literature and practice. Therefore, there is an urgent need to develop a technique to illustrate the extent of information overload in construction project management.
The paper is based on an ongoing research project at The University of Reading on managing information overload in construction project management. In the paper, the definition of information overload is made and a measurement unit is defined. The methodology used to measure information load is then described. Following this, the data collection method in the form a questionnaire survey is explained. Finally, the results and their implications are discussed.

**Definition of information overload**

In order to measure information overload, a precise definition of the term needs to be made and a practical measurement unit identified. The definition of information overload is based on the notion that time for processing information is used on the interactions project managers have with other project team members and relevant outside authorities, and on internal information processing. The meaning of the term 'information processing time' is taken as time spent interacting with project team members and outside legal and local authorities, and time to perform internal information processing, such as thinking, reading, planning, problem finding, problem solving, implementation and review. Time is used to measure project managers’ information load so that the information processing demands placed upon their time is seen as equivalent to their information load. The number and nature of the demands are measured by the actual time for information processing. Thus, information overload occurs for a project manager when the information processing demands on time (information load) to perform information processing exceed the supply of time available (information processing capacity) for such processing [2].

Although the use of time makes it possible to determine whether or not information overload has occurred, it is not the only criteria. The volume of information can also be used as a measurement unit, but has many shortfalls from the researchers’ point of view. Having received a high volume of documentation does not necessarily mean that the project manager is overloaded with information. Without considering the amount of time spent on a particular document, the thickness of it fails to provide a meaningful indication of the level of information overload.

A difficult and intriguing aspect of information overload is its measurement. In reviewing the literature, it appears that the measurement of information has always been very context-specific. Cravis [8] uses the number of telephone calls as a measure of the interactions between countries based on communication. Other measurement units for the volume or amount of information are; bits in an electronic mail setting, words for an article, pages of a book, time for a TV commercial, and so on [9]. The common element in these examples is a type of unit that is appropriate for the purpose of measuring information. Therefore, the unit to be used to measure project management information must provide a meaningful explanation of how, where and how much information overload has occurred. Using the time element is ideal to serve this purpose as time links information load with information processing capacity.

**THE METHOD**

It is inappropriate to say that project managers’ information load is very high (information overload) or low without investigating the level of information processing at different project stages and with different project team members. In another way, project managers cannot be labelled as overloaded with information for the whole project duration, although this may sometimes be the case. As a project progresses from inception to completion, the level of information load for the project manager will change. The blend of project team members who interact with the project manager also will change. Therefore, any system designed to identify the level of information load should first consider that information load changes with time, and second, the mixture of people who contribute to that information load also change. The information load of the project managers is identified in the form of a matrix. Using a matrix format enables one to identify the level of information load that project managers have and to see how the pattern of the information load changes with project stages and project team members. The information load matrix (ILM) designed for construction project managers represents project stages on the x axis and project team members on the y axis, or vice versa.

Construction projects are divided into four stages. These are: feasibility/briefing, design, procurement and construction/completion. The way a construction project is divided into stages can vary from as low as two, design and construction, up to ten stages [10]. The way these different stages are established in literature depends on the purpose of the individual studies. The reason four stages are considered in this study is that these are the key stages where the tasks of project managers and as a consequence the level of information load changes. Another important factor that limited the researchers to keep the stages to a minimum, but still observe the change in information load pattern, is that the ILM is put to use in the form of a questionnaire. If it had been chosen to divide the project into more detailed stages, to complete it would have been much more difficult and time consuming. Therefore, four stages are seen as ideal for simplicity to complete, but still sufficient to study the changing pattern of information load.

The project team members who interact with a project manager are classified into six different groups. These are: client, architect, consultant(s), main contractor, subcontractors and outside local and legal authorities. These groups cover all the key expertise that
Another characteristic of the ILM, as explained earlier, is using time as a measurement unit in order to determine the level of information load. If the time available to project managers is less than the time needed to process information, this scenario is defined as the project manager is overloaded with information. Ideally, based on this definition and conceptualisation of information overload, the amount of time project managers have and the amount of time they need to spend on processing information, should literally be measured. This concept of measuring the amount of time available and needed to process project information is considered, but because of the following reasons it is not seen as feasible for this study. These reasons are:

i. It is not practical to measure it for the duration of the whole project as it requires the researchers to spend the whole project duration with a number of project managers. This can be done only on a case study basis, with investigations that look at a particular project stage, function or interaction with one project member, although it would be a tedious job. This method is used by some researchers, for example, the York study which examines information in architectural design [11].

ii. The second option is to ask project managers to keep a record of how they spent their information processing time by providing specially designed diaries. This option is not practical either, due to the difficulty of keeping a diary regularly for the duration of the whole project. Other drawbacks are the difficulty of finding willing participants and the time limitations of the research waiting for the construction project to reach its completion. Applications of this approach can be seen in Mintzberg's work [12]. In summary, the nature of the problem with measuring information overload is to operationalise the concept definition of information overload. The following method has been developed to overcome these difficulties of measuring information overload.

It is accepted that those who should know best whether or not they are overloaded with information are the project managers themselves, even though they may not be aware of this situation, or know how to determine it. Based on the definition of the information overload used in this research, five real life information load situations that may be encountered by the project managers are defined. These situations describe the information overload in terms of information processing time and are described in Table 1.

Table 1 Description of possible information load situations of project managers.

<table>
<thead>
<tr>
<th>Situation 1: No Communication</th>
<th>Situation 2: Very Little</th>
<th>Situation 3: Some</th>
<th>Situation 4: High</th>
<th>Situation 5: Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>No communication or information processing time spent.</td>
<td>very little interaction or communication occurred. It did not affect project managers' information processing.</td>
<td>project managers had reasonable information processing or interactions. They could deal with information processing most of the time without affecting their performance or working schedule. However, there were times when they had to process more information than was possible in the time available. This ranking shows that they were sometimes overloaded with information.</td>
<td>often, the amount of time needed to process information and interactions was much higher than the time available. This ranking indicates that most of the time they were overloaded with information.</td>
<td>very often, the amount of time available to process information was less than the required time. This ranking shows that information overload was very high, and present almost all the time.</td>
</tr>
</tbody>
</table>

The data for the ILM is gathered by using a questionnaire survey with 140 project managers in the UK. Project managers are asked to mark the situations best suited to them in the ILM provided in the questionnaire. They are given a scale of 1 to 5, each number representing the same real life situation, for example the score of 4 indicates situation 4. Project managers who are targeted work full-time and are asked to consider their information load situations in their current project if it is coming towards completion, otherwise to consider the last project completed.

The nature of the data gathered to identify the level of information load is nominal [13]. Therefore, analysis of the data requires the application of nominal data analysis techniques. One of these techniques is to allocate weights to each information load situation. Through this, relative comparisons of the information load between different project managers, and between project stages can be made. A weight scale of 0–4 is allocated to information load situations of 1 to 5 respectively. The score of zero indicates no information processing and eliminates the relevant circumstances. In this way, it is possible to calculate a total information load point for each circumstance in the ILM. This is done by multiplying the number of project managers who identified each situation by the weight of that situation. The scores of each situation are added to calculate the grand total of that circumstance. The total is then divided by the total number of project managers to calculate the information load point (ILP) of that circumstance. These calculated points are a representation of the information (over)load situations and used for relative
comparison purposes only. Table 2 illustrates an example of how ILP are calculated.

<table>
<thead>
<tr>
<th>IL Situations</th>
<th>IL Weights</th>
<th>No. of PMs</th>
<th>Total points</th>
<th>ILP</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>0</td>
<td>31</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>1</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>2</td>
<td>47</td>
<td>94</td>
<td>256/140</td>
</tr>
<tr>
<td>S4</td>
<td>3</td>
<td>26</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>4</td>
<td>16</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>[Circumstance 8] Total</td>
<td>140</td>
<td>256</td>
<td>1.706</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: An example of information load point calculations.

**RESULTS**

The results are presented in an ILM in Table 3. The mean values of information load situations (ILP) vary between 0.564 and 2.135, on a possible scale of 0 to 4. The higher the value of the ILP, the higher the level of information load of the project managers in that circumstance. Scores of less than 1, or around 1, indicate that information overload has not occurred. If the ILP is between 1 and 1.5, the information load is at an acceptable level and is easily manageable. Scores higher than 1.5 indicate information overload is at a high level and needs to be managed carefully if the effectiveness of information processing is not to be lost.

<table>
<thead>
<tr>
<th></th>
<th>Feas./Brief</th>
<th>Design</th>
<th>Procurement</th>
<th>Construction</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>1.835</td>
<td>1.800</td>
<td>1.450</td>
<td>1.871</td>
<td>1.739</td>
</tr>
<tr>
<td>Architect</td>
<td>1.578</td>
<td>2.064</td>
<td>1.357</td>
<td>1.828</td>
<td>1.706</td>
</tr>
<tr>
<td>Consultant(s)</td>
<td>1.521</td>
<td>2.135</td>
<td>1.514</td>
<td>1.900</td>
<td>1.767</td>
</tr>
<tr>
<td>Contractor(s)</td>
<td>0.564</td>
<td>0.964</td>
<td>1.621</td>
<td>2.057</td>
<td>1.301</td>
</tr>
<tr>
<td>Sub-contractors</td>
<td>0.585</td>
<td>1.014</td>
<td>1.385</td>
<td>1.921</td>
<td>1.226</td>
</tr>
<tr>
<td>Outside authorities</td>
<td>0.928</td>
<td>0.971</td>
<td>0.585</td>
<td>1.021</td>
<td>0.876</td>
</tr>
<tr>
<td>Overall</td>
<td>1.168</td>
<td>1.491</td>
<td>1.318</td>
<td>1.766</td>
<td>1.435</td>
</tr>
</tbody>
</table>

Table 3: ILP for each stage-member circumstance in the ILM.

A graphical representation of the ILP has also been developed, which enables the results to be displayed in a more explicit way, see Figure 1. This illustrates that there are three distinct information load zones in construction project management which are in a continuation norm. Zone 3 is where information overload is at its highest. In zone 2, information load is normally at an acceptable level, but sometimes the situations can easily rise to zone 3. Zone 1 is an information overload free zone.
The circumstances which fall into each information load zone are given below in Table 4. Examination of the common points of the circumstances in each category provides some insight into understanding in which situations project managers are more likely to be overloaded. The level of information overload is at its highest in situations where project managers interact with the consultants and architect in the design stage, and with contractors and subcontractors in the construction/completion stage. This is followed by interaction with the client in construction/completion, feasibility and design stages.

The overall stage-member based results indicate that in construction and design stages, information overload is high, followed by procurement and feasibility/briefing stages. As far as project members are concerned, interactions with consultants, client and architect are the most overloaded. The lowest information load occurs with outside authorities, subcontractors and contractors. The vast majority of circumstances which fall into zone 2 are interactions with all the principle internal project team members in the procurement stage. All interactions with outside authorities are in the information overload free zone. This indicates that information is mainly generated within the project environment. It also illustrates that at different stages of a project the principle causes of information overload vary, as do the changing roles of project managers.

Figure 1: Graphical representation of project managers’ information load situations
Circumstance 19: with subcontractors in procurement stage (1.385)
Circumstance 7: with architect in procurement stage (1.357)
Circumstance 24: with outside authorities in construction/completion stage (1.021)
Circumstance 18: with subcontractors in design stage (1.014)
Circumstance 22: with outside authorities in design stage (0.971)
Circumstance 21: with outside authorities in feasibility/briefing stage (0.928)
Circumstance 14: with contractors in design stage (0.964)
Circumstance 17: with subcontractors in feasibility/briefing stage (0.585)
Circumstance 23: with outside authorities in procurement stage (0.585)
Circumstance 13: with contractors in feasibility/briefing stage (0.564)

Table 4 The circumstances which fall into each information load zone.

DISCUSSION

Since time links information load with information processing capacity, certain actions in project organisations in terms of their effects on information processing can be analysed. This allows the identification of two general strategies, and various actions within each strategy, that project organisations can use to manage information overload. The first strategy takes the total supply of time as fixed, and decreases the actual time project managers spend processing information. This can be achieved by using time more efficiently or reducing the number of tasks to be performed. The second expands the total supply of time or capacity, holding information load as fixed, therefore increasing the actual time available for information processing. The groups of actions to achieve this either attempt to increase the time available or expand the size of the work force. Various combinations of these strategies can be implemented simultaneously and a detailed discussion of them can be found in Haksever [6].

The model links the concept of time management and the management of information load. Time management allows project managers to organise and set priorities. This helps them to focus on information needed to accomplish a task and helps in providing the time for accomplishment of further goals. The ability to manage time is directly related to the ability of managing the constant flow of incoming information. Through time management project managers are able to sift through the information based on priorities, eliminating unimportant pieces of information and locating those that are key to accomplishing their goals. The way in which project managers determine how much time should be spent on processing information is directly related to knowing the criticality of the function, task or decision on which information is required. Therefore, the amount of information project managers must react to during the day is limited. Principles of time management can improve a manager's ability to manage information overload [14]. Some of these principles are briefly explained in the context of managing information overload.

Establishing goals and setting priorities can help project managers focus on important issues and will enhance productivity. Organising effective meetings will not only reduce time spent in meetings, it will also limit the amount of information that is unnecessary in obtaining goals. Learning to handle difficult issues will help in reducing the stress they are exposed to during the project. Stress is a factor that makes managing information overload more difficult. Setting up an effective filing system is an important step in organising the information flow that is constantly occurring and will allow time to locate the information when needed.

An important implication of the method is its potential for use in comparative studies. Through the method, it is possible to map and compare the existing information overload situations of project managers working in different disciplines. An application of this has already been carried out successfully, and showed that the information overload pattern of project managers working for different organisations, namely; clients, consultants and contractors, displays a very different picture. It is also possible to calculate an ILP for individual project managers for each project they worked on. This allows individuals who took part in the study to be ranked, from the most overloaded to the least. The correlation between information overload and certain characteristics of the project managers and the projects involved can then be studied. Moreover, the relationship between information overload and the performance of project managers can be analysed. This will enable the identification of the
CONCLUSION

In today's information age, information overload is becoming a serious problem which affects project managers' performance. The lack of research into the topic in construction management literature and the disinterested attitudes of UK practitioners, due to other more immediate and urgent information related problems, only accentuate the need to investigate information overload as a serious research problem. The paper defined the term information overload as occurring when the demands on a management task for information processing time exceed its supply of time, and the concept of time is used as a measurement unit. On the basis of these, a method of measuring information overload has been developed and tested with practising UK project managers.

The results indicate that by using this method it is possible to have a numeric and better understanding of the extent of information overload during the course of a construction project. The method shows the situations where information overload is high, moderate, low or non-existent. It is then possible to concentrate on those overloaded areas by using the appropriate means or strategies. The method sets a numeric norm on identifying the degree of information overload, but for more reliable results, more applications of the method are needed. It also offers potential for comparative studies on the degree of information overload between project managers working for different organisations, project team members, project stages and projects with different type, size, and complexity attributes. Only then will it be possible to go forwards towards achieving a better management of information overload in construction projects.

REFERENCES