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INFORMATION OVERLOAD IN USING CONTENT MANAGEMENT SYSTEMS: CAUSES AND CONSEQUENCES

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Abstract

In order to effectively manage organizational information assets, more and more organizations are beginning to implement content management systems (CMS) to consolidate multiple information sources into a single, centralized repository. While organizations implement CMS in attempts to help employees easily identify information sources and quickly locate relevant organizational documents, prior findings have suggested that many CMS projects fail to reach the expected adoption rates. The present paper proposes that advanced information technologies such as CMS may pose a problem of information overload. Drawing upon the information processing theory, this paper develops a research model examining users’ experiences and interactions with CMS in relation to information seeking and retrieval in organizations. In particular, the model centres on exploring some potential causes of individuals’ perceived information overload when using a CMS, and clarifying the effects of information overload on actual performance outcomes and on users’ system evaluations. The present paper responds to calls for more empirical research aimed at understanding the challenges and issues surrounding user adoption of CMS. Further, the proposed research model provides a conceptual basis to inform future research initiatives for advancing CMS designs and improving the implementation processes of CMS in organizations.

Keywords: content management systems, information overload, IS adoption
1 INTRODUCTION

In order to effectively manage organizational information assets, more and more organizations are beginning to implement content management systems (CMS) to consolidate multiple information sources into a single, centralized repository (Tyrväinen et al., 2006). In general, a content management system (CMS) refers to a specific software application that provides functionality to support the creation, collection, storage and reuse of digital content in any medium. Many organizations implement CMS with promising goals of improving staff productivity, controlling document distribution, saving operation costs, and so forth. However, the results in business practices do not always match expectations. Recent research shows that up to 85% of CMS implementations do not meet organizations’ expectations (AIIM, 2011). In particular, the implementations of such systems tend to have substantially lower adoption rates than what was initially anticipated (Doculabs, 2010).

While IS scholars have highlighted the importance of research in relation to the implementation and use of CMS in organizations (Munkvold et al., 2003; Smith & McKeen, 2003), there is scarcity of research on users’ experiences and interactions when searching for relevant organizational information (Tyrväinen et al., 2006). In particular, little research has addressed a potential paradox of CMS use. That is, although the deployment of advanced information technologies such as CMS offer rapid access to large amounts of information, it poses a serious problem of information overload (Eppler & Mengis, 2004). More specifically, organizations implement CMS in attempts to help employees more easily identify internal information sources and more quickly locate relevant organizational documents and other historical materials by integrating all information assets into one centralized digital repository. (Smith & McKeen, 2003). However, in the event of searching for unfamiliar content, employees may need to invest additional time and effort to identify and sort out the relevant files from the large-scale content database (Stenmark, 2005). Thus, there is a need to examine how users apply specific content management tools to different work tasks in organizational contexts, and how CMS features may increase or reduce information overload.

This paper centres on exploring some potential causes of individuals’ perceived information overload in using a CMS, and explaining the effects of information overload on actual performance outcomes and on users’ system evaluations. Drawing on the human information processing theory, and a research model is proposed to explain users’ perceptions of CMS and the potential impacts on work practices. The model can potentially inform future research initiatives to help advance CMS designs and improve the implementation processes of CMS in organizations.

2 LITERATURE REVIEW

In this section, the concept of information overload is firstly reviewed with respects of the theoretical background and basic elements in the definition. Prior findings in relation to the effects of information overload are then presented. Next, existing research on the impacts of using information technology on cognitive demands in an information seeking and retrieval process is reviewed.

2.1 The Concept of Information Overload

The concept of information overload is rooted in theories of human information processing. Miller (1956) proposed the idea of “chunking” to describe how people retain a small amount of new information in their minds for a short period of time. A chunk of information refers to a unit of the material being presented, which can vary from digits, words, and text to chess positions and people’s faces (Miller, 1956). When individuals receive a piece of new information from the external environment, they will divide the information into meaningful units according to its characteristics, hold it in short-term memory, and then organize and manipulate it to generate a response or make a decision (Bettman, 1979; Miller, 1956). Past research has shown that short-term memory has limited storage capacity: it can hold only five to nine distinct chunks of information (seven plus or minus two) for no more than 30 seconds at a time (Brown, 1958; Miller, 1956; Peterson & Peterson, 1959). Thus, people’s ability to perceive and respond to new information is also bounded (Hiltz & Turoff, 1985).
Information overload has been studied in various disciplines, including accounting (e.g. Schick et al., 1990), marketing (e.g. Meyer, 1998) and management information systems (e.g. Schultze & Vandenbosch, 1998). As different disciplines approach information overload from different perspectives, there is no single generally accepted definition (Rochat, 2002). Nevertheless, the concept of information overload encompasses three fundamental elements: the quantity of information that needs to be integrated to complete a task, the individual’s information-processing capacity and the amount of time allocated to the task (Eppler & Mengis, 2004). According to Meyer (1998), information overload refers to situations where the volume of information presented exceeds an individual’s cognitive capacity for information processing. Wilson (1996) defined the phenomenon as an overabundance of relevant information, or being burdened with excessive amounts of unsolicited information that cannot be assimilated due to a lack of time. In other words, overload occurs when individuals do not have enough time to digest relevant information even if they are aware of its presence (Schick et al., 1990).

In addition to the volume of information supply, several scholars suggest that the overall information quality can be seen as a major overload element. Lossee (1989, p179) defines information overload as the “economic loss associated with the examination of a number of non- or less-relevant messages, as in related to information retrieval models.” In this sense, information overload is considered a consequence of information degradation (Klapp, 1986). When an individual works with materials that contain large quantities of noise-like or redundant information, he or she needs to make an additional effort to sort out the most appropriate and useful information from everything else. As such, identifying and selecting relevant information takes up substantial cognitive resources. The resulting heavy cognitive load will affect an individual’s ability to recall prior information and consequently interfere with information analysis and decision-making (Keller & Staelin, 1987).

2.2 The Effects of Information Overload

While some scholars define information overload by addressing its objective causes, others conceptualize the phenomenon from a subjective view, stressing the psychological consequences of overload (Eppler & Mengis, 2004). According to Wurman’s definition (2001), perceived overload refers to an unhealthy mental state that stems from surplus of information. The mental and emotional fatigue, the feelings of stress, anxiety and helplessness are seen as typical signs that indicate the occurrence of information overload (Haksever & Fisher, 1996; O’Reilly, 1980; Wurman, 2001).

Studies have shown that information overload leads to changes in one’s information seeking and use behaviours, which in turn result in decreased efficiency of information processing (Miller, 1978). Cook’s study (1993) on design support systems showed that people tend to shift from compensatory to noncompensatory search patterns, as information load increases. Although the latter pattern tends to simplify information seeking and evaluation processes, it leads to inconsistent search outcomes (Cook, 1993; Pennington & Tuttle, 2007). In addition, under conditions of high information load, individuals tend to either intentionally ignore particular information to control the volume of information received (Hiltz & Turoff, 1985; Miller, 1978) or selectively extract only a few information cues from a piece of information to comprehend its original meaning (Miller, 1978; Sparrow, 1999). While such information processing mechanisms help individuals cope with limited cognitive capacities (Pennington & Tuttle, 2007), they may potentially introduce serious biases in information selection and consequently lead to misinterpretation of information relevance and/or misjudgement of information accuracy (Edmunds & Morris, 2000; Pennington & Tuttle, 2007).

In addition to the impacts on individuals’ information behaviours, information overload has direct negative effects on ones’ task performance. This phenomenon has been observed in a broad range of business and management activities, including business consulting (e.g. Hansen & Haas, 2001), decision making (Meyer, 1998), electronic meeting management (Grise & Gallupe, 1999, 2000) and project risk assessment (Pennington & Tuttle, 2007). Studies across various disciplines have found an inverted U-curve relationship between information load and decision accuracy (Eppler & Mengis, 2004). Specifically, decision quality or task performance is positively associated with the volume of information being received by an individual -- up to a certain point. When the information supply
exceeds this point (i.e. surpasses information processing capacity), the individual’s performance is found to be negatively related to information load (Chewning & Harrell, 1990).

2.3 The Role of Information Technology

Information and communication technologies have been suggested not only as a major factor contributing to higher information load, but also as a key solution that improves the efficiency of individual information processing (Schultze & Vandenbosch, 1998). On the one hand, technological features, such as rapid and convenient access to data, vast storage capacity and unrestricted routing of messages, have made the retrieval, production and distribution of information much easier than in earlier periods (Heylighen, 1999). As a result, the exponential growth of information availability increases the difficulty of finding relevant information and makes individuals more vulnerable to the burden of heavy information load (Schultze & Vandenbosch, 1998). Bawden (1999) suggests that the use and misuse of advanced information technologies, including the internet, intranets and particularly e-mail, are commonly seen as major reasons for information overload.

On the other hand, others argue that certain functionalities of IT have the potential to reduce information load and improve an individual’s information processing capacity. In this sense, information technologies are regarded as a countermeasure against information overload (Eppler & Mengis, 2004). Prior studies have revealed that while increasing the supply of information, certain technologies help to structure and organize information flows. For example, collaborative groupware applications provide efficient cognitive support by facilitating and controlling distributed work and communication processes (Grise & Gallupe, 1999/2000). With advanced information retrieval and filtering tools, decision support systems (DSS) can contribute to an effective reduction of high volumes of information to a manageable size and consequently improve decision quality (Cook, 1993).

In the context of using a CMS, the occurrence of overload is not only associated with the amount of information supplied by the system, but also related to the users’ search tasks at hand (Eppler & Mengis, 2004). Research in web search has demonstrated that different types of search tasks impose different levels of cognitive demands and result in different levels of difficulty experienced by web users (e.g. Gwizdka, 2009). According to Bates (1986), online information retrieval can be distinguished based on users’ passive or active information seeking modes. In a passive seeking mode, users are simply aware of the existence of information and merely absorb what is presented to them. They may have a question in mind and maintain alertness to information that may be relevant to the question. Nevertheless, users in a passive seeking mode do not engage in an active effort to find out the answer (Bates, 1986). In this sense, information-processing requirements in this seeking mode are relatively low. In organizations, employees are less likely to adopt such a passive seeking mode, because most of their search tasks are performed for specific purposes and expected to be completed in certain time frames. Instead, they tend to actively and intentionally gather information, by directed searching or undirected browsing through the system (Bates, 1986). Search tasks with an active information-seeking mode require users to repetitively form specific queries, continuously examine search results and make judgements of the topicality and relevance of retrieved individual records or documents. Hence, the search process involves high cognitive demands (Gwizdka, 2009) and tends to lead to the occurrence of information overload.

3 RESEARCH MODEL AND HYPOTHESES

The present proposal investigates the causes and effects of individuals’ perceived information overload in using a CMS. Based on the information processing theory (Miller, 1956), it is proposed that in using a CMS, three main factors, which are time pressures, search task complexity and the number of information cues presented, potentially lead to users experiencing information overload. This theory also helps to justify the proposed causal link between information overload and task performance.
In addition, the model examines the effects of information overload on user evaluations of CMS. Past research suggests that people have a tendency to hold their beliefs, attitudes and actions in harmony. When there are discrepancies between incompatible ideas or experiences, they may change their beliefs or behaviours to reduce the psychological discomfort (Festinger, 1957). In terms of the use of a CMS, users may initially hold a favourable evaluation of the system features. The occurrence of information overload will result in users’ psychological strain and mental fatigue and consequently negatively affect their satisfaction, and perceived system usability.

Figure 1: Research Model

3.1 Causes of Perceived Information Overload

From the perspective of human information processing, any information-searching task can be conceptualized in terms of information processing requirements and information processing capacities (Eppler & Mengis, 2004). An individual’s information processing capacity refers to the amount of information that he or she can process in the available times slot (Schick et al., 1990). Because an individual’s ability to process information is time-contingent, time constraints are a major factor triggering the occurrence of information overload (Eppler & Mengis, 2004). For a pre-defined search task, the total amount of information that needs to be processed is fixed. Under conditions of high time pressure, individuals are required to process more information per unit of time to complete the same task than under low time constraints, and thereby are more likely to reach their information processing capacities. Hahn et al. (1992) stress that only under high time constraints, a certain amount of information has the effect of being too much. Empirical findings have also revealed that an individual’s ability to collect, analyze and organize information in a web-based system alters when time pressure is present (Pennington & Tuttle, 2007). Therefore, it is expected that:

Hypothesis 1: When users perform information-seeking tasks in a CMS, higher time constraints lead to higher degrees of perceived information overload.

Task complexity is another factor that contributes to information overload. Perceived task complexity relates not only to objective task features such as difficulty and clarity, but also to individual differences such as task-domain knowledge and cognitive capacity (Mangos & Steele-Johnson, 2001). Information processing theory suggests that task complexity is closely associated with the amount of information inherent in a task and specific task processing characteristics (Bonner, 1994). As perceived task complexity increases, short-term memory may fill when acquiring and analyzing large amounts of data, resulting in an “information-processing bottleneck” (Lohse, 1993; Wickens & Carswell, 1995). In other words, an increase in task demands (i.e., task complexity) directly influences mental workload and leads to information overload (Hart, 1986). In relation to the use of CMS, the complexity of information-seeking tasks can arise from three areas: 1) the initial pre-search understanding of the search topic; 2) how easily the conceptual understanding can be converted to a specific search statement; and 3) what criteria are used to assess the relevance of retrieved materials (Bell & Ruthven, 2004). When performing a complex search task, the individual is unclear what files may be required and how to find them in the system. In this situation, the information seeker may not be able to narrow down the search scope from the start and inevitably engages in more information-processing activities. Therefore, it is proposed that:
Hypothesis 2: When users perform information-seeking tasks in a CMS, higher levels of task complexity lead to higher degrees of perceived information overload.

The human information processing approach suggests that information utilization mainly constitutes the interpretation and judgment of information cues (Savolainen, 2008). As the number of information cues increases, information-processing requirements increase (Wood, 1986). When users perform information-seeking tasks in a CMS, they primarily rely on meta-data to search for a document or a record (vom Brocke et al., 2010). CMS Metadata contain basic information about each digital file stored in the system, such as the title, the file type, the creator, the file path, etc. An excessive number of metadata elements may confuse users and affect their abilities to differentiate the relevance of retrieved materials. A number of studies have also identified the number of information cues as a direct determinant that induces information overload (e.g. Bawden, 2001; Herbig & Kramer, 1994; Pennington & Tuttle, 2007). For example, Chewning and Harrel (1990) found that an increase in information cues would hinder decision makers from cognitively processing a significant proportion of the information provided to them. Thus, it is proposed that:

Hypothesis 3: The greater number of information cues presented in a CMS leads to higher degrees of perceived information overload.

3.2 Consequences of Perceived Information Overload

Information processing theory suggests that individuals tend to use simplifying heuristics to compensate for information overload. In other words, when individuals reach their maximum processing capacities, they may adopt various coping strategies, and consequently become highly selective and ignore a large amount of information provided to them (Bawden, 2001). The omission of information may result in individuals making suboptimal decisions (Jacoby, 1984). Prior research has revealed that the burden of heavy information loads negatively affects task performance and outcome quality. For example, Sparrow (1999) argues that information overload causes managers to reduce their productivity and to form greater tolerance of error. Hence, it is proposed that:

Hypothesis 4: When users perform information-seeking tasks in a CMS, higher degrees of perceived information overload result in lower search performance.

Prior research has suggested individuals tend to seek a consistency among their cognitions in relation to past behaviours, beliefs and attitudes (Festinger, 1957). The psychological dissonance may occur when one of the cognitive elements contradicts another. One way to reduce the dissonance is to reduce the importance of the conflicting beliefs, adding more consonant cognitive elements or altering the dissonant attitudes or behaviours (Festinger, 1957). If the use of CMS leads to high information-processing requirements, users may consider that using the system is cognitively demanding. Their attitudes towards the system may change due to the experience of information overload. In this sense, users may consider the system as a burden rather than a benefit. In support of this, Bock et al. (2010) study has shown that levels of information overload are negatively associated with users’ perceived usefulness of electronic knowledge repositories. Therefore, it is expected that:

Hypothesis 5: Higher degrees of perceived information overload result in users’ lower ratings on the usability of CMS.

Because individuals tend to modify their attitudes or beliefs in accordance to their past behaviours and experiences (Festinger, 1957), perceived information overload may also have an effect on users’ satisfaction with the CMS. Past research has shown that information overload causes stress which, in turn, negatively affects satisfaction (Jacoby, 1984). In the case of using CMS, users may hold expectations that the advanced functionalities of the system can increase the efficiency of work-related information seeking. Because overload induces confusion, frustration and anxiety (Wurman, 2001), these negative experiences may conflict with users’ initial positive attitudes towards the use of a CMS. To alleviate cognitive dissonance, users are more likely to adjust their levels of satisfaction with the system (Bock et al., 2010). Therefore, it is expected that:

Hypothesis 6: Higher degrees of perceived information overload result in users’ lower satisfaction with the CMS.
Perceived system usability also has effects on user satisfaction. User satisfaction is an affective condition that results from an overall evaluation of all the aspects of task performance and outcomes (Anderson & Sullivan, 1993). Perceived system usability can be seen as part of the evaluation. According to Cognitive dissonance theory, people tend to use their own beliefs to as a guide in interpreting their experiences. In this sense, when users hold favourable perceptions of the usability of a system, they are more likely to express high satisfaction with the system. Empirical research on various IS applications has shown that user satisfaction is positively associated with perceived system usability (e.g. Tsakonas & Papatheodorou, 2006; Wixom & Todd, 2005). Thus, it is proposed that:

\[ \text{Hypothesis 7: Users' higher ratings on the usability of CMS lead to higher system satisfaction.} \]

4 IMPLICATIONS & CONCLUSION

The present model has some implications for IS researchers. The earlier literature on innovations holds an assumption that all innovations are always desirable and should be adopted by all members of a social system (Laukkanen & Kiviniemi, 2010; Rogers, 2003). Nevertheless, results across different studies have revealed that a variety of system and individual characteristics may potentially relate to employees’ reluctance to use new IS in organizations (e.g. Markus, 1983; Martinko et al., 1996). This paper extends this line of research by introducing the concept of overload in the CMS context. A recent study shows that perceived information overload has a direct negative impact on website usage intentions (Cenfetelli & Schwarz, 2010). Extending on this finding, the present paper provides a conceptual basis to further understand the antecedents of information overload, and identify the fundamental reasons that may contribute to low usage intentions.

From a practitioner’s perspective, the implementation of CMS may provide support for handling high volumes of documents in an organization. Nevertheless, it may potentially introduce the problem of information overload to employees who use CMS. The present research model proposes that when CMS users feel confused or anxious because of information overload, they may associate their experiences with ‘low’ system usability, which in turn undermines the full-utilization of the system. In addition, the model suggests that information-processing demands differ by the number of metadata elements presented in the system. To avoid overload, CMS developers may need to take into account users’ limited information-processing capacities in designing user interfaces and information architecture. Further, the proposed model indicates that time pressures and search task complexity are significantly related to the degree of perceived information overload as perceived by users. To ensure that employees can effectively use a CMS, the system developer may need to have a good understanding of employees’ current information behaviours, and then to determine system functionality. For example, if organizational members regularly perform information-gathering activities under high time pressures, they are more likely to need advanced search tools to help filter irrelevant documents or files. If organizational members are frequently involved in fact-finding tasks under low time pressures, they may prefer a navigation tool to locate specific materials.

In summary, this paper is proposed to investigate users’ experiences and interactions with CMS in relation to information seeking and retrieval in organizations. Specifically, the research model draws upon information processing theory to examine the causes and effects of information overload in using CMS to perform certain search tasks. Empirical research may examine CMS users’ information behaviours in different organizational settings. Longitudinal studies may be called for to investigate how information overload due to the use of CMS may affect organizational members’ work performance over time. In addition, future research may need to give attention to identifying other task and system characteristics as well as individual factors that can lead to perceived overload. More empirical studies are needed to validate findings of the present model and to better understand the key determinants of individual information-processing capacities. Lastly, future research may need to explore how CMS users make judgements on information relevance for different types of search tasks and how their information behaviours may vary by their motivations. Such research findings can potentially help advance CMS designs and improve the implementation processes of CMS in organizations.
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