The Problem of Information Overload on Executives: Information Systems Perspective

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ABSTRACT: *The late 20th and early 21st centuries brought some dramatic changes in terms of volumes of information executives in enterprises have to grapple with for decision making. This paper reviews the literature on the problem of information overload with particular reference to information systems executives use in their enterprises. The literature reveals that although the problem of information overload has existed for many years, in recent centuries the problem has become more widely recognised and experienced by many executives. The perceptions and the actual effects of information overload have been given rise because of the rapid advances made in information and communication technology in many enterprises. Although there is an abundance of information available in information systems, it is often difficult to obtain good information when it is needed for decision making by executives. There are various solutions put forward to mitigate information overload in personal, information, tasks and processes, orgnisational and information technology perspectives. This article reviews literature on information overload in information systems perspective since many executives in one way or the order depend on information systems to obtain good information for decision making. The final section proposes some strategies to mitigate the problem of information overload when executives have no other choice but to use information systems to obtain good information for decision making.*

Keywords: Information Overload, Information systems, Enterprise Resource Planning Systems (ERPs), Executive Information Systems (EISs), Industry Executive Information Systems (IEISs), Significant Standard Specific Information, Statistical Analytical Process (SAP)

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1. Introduction

The increasing mass information from information systems is one of uppermost puzzles for executives who force to confront them. On one hand, there is also deficiency of good information from the systems executives use. The problem may be partly related to the design and performance of management information systems.

Most executives spend most of their useful time trying to get the information they need through organizational computer-based

information systems. During this process, they have to sift through a great deal of irrelevant information, a situation commonly referred to as "*information overload*". With the proliferating capabilities and drastic fall in cost of computers, it seems relief should be in sight for stressful demotivated executives. Unfortunately, most information systems do not meet executive needs. Indeed, most new information systems require extensive revision to even partially fulfill the needs of executives. Most information systems in use in enterprises by executives are expensive to develop and implement. They are even more expensive to revise if executives are not satisfied with the information they require from them for decision making. As the pace of business accelerates, decisions need to be made timely to compete in an industry. Failure to get executives the information they need in a timely manner can result in lost opportunities or in a problem not being solved in time. Increasingly, executives have little reaction time to make decisions on various business issues in their respective organisations. They need access to information without waiting for too long. Why can executives and system designers not work together to arrive at the significant information executives require for decision making before information systems are designed and implemented for executives? This article tries to make suggestions to accomplish that feat.

Majority of executives are faced with the problem of information overload on regular basis and complain that information overload has negative effects on their work [45]. An international study reveals that information overload is prevalent amongst managers [115]. The majority of managers surveyed (66%) in an international study did not deny they needed '*very high levels of information to perform effectively*' [115] or that information is needed for decision making, but 49 per cent felt unable to handle the large volume of information they were receiving.

Executives experience information overload because when individuals receive an external information stimulus, they perceive the information, divide it into meaningful units according its characteristics, and generate a response using working memory [18]. Research has shown that the span of information processing for human beings is between 5 and 9 chunks; in other words, human beings processing capacity is quite limited [103]. Thus when the information is complex, overload occurs [78].

2. Definition of Information Overload

At the most basic state, information overload refers to the simple notion of receiving or having to go through too much information [42] [127]. In order to go to a deeper definition of information overload, researchers have taken two major paths: **objective sense** and **subjective sense**.

Objectively, information overload can be defined based on the information processing view that information overload occurs when the information processing requirements (IPR) exceed the information processing capacities (IPC) of an individual (IPR>IPC) [142].

Subjectively, information overload has been investigated by researchers who believe that information overload cannot be investigated under experimental conditions as time constraints and forced absorption set in; experimental conditions do not apply in most real life situations [111]. These researchers define information overload as being burdened by a large supply of information that cannot be assimilated, leading to breakdown: feelings of stress, confusion, pressure and anxiety when in an information overload state [40, 45, 46, 67, 110, 116].

The **objective** definition is adopted in this paper. The terms '*requirements*' and '*capacities*' in the above definition can be measured in terms of the available time. The requirements refer to a given amount of information that has to be processed within a certain time period (Information needed to complete a task). The capacities refer to a given amount of information that has to be used within a certain time period (The quantity of information one can integrate into the decision making process).

3. Recent Research on Information Overload

3.1 Causes of Information Overload

As far as the corporate context is concerned, the main reasons for information overload can be related to five constructs. These inductively generated categories of major overload causes are the **person** receiving, processing or communicating information; the **information** itself (its quantity, frequency or intensity, and quality or general characteristics); the **tasks or processes** which need to be completed by a person, team or organization; the **organizational design** (i.e., the formal and informal work structures), and the **information technology** that is used (and how it is used) in a company. The acronym **PITODIT** can be used to refer to these five constructs. Usually, information overload emerges not because of one of these factors, but because of a mix of all five

constructs (Figure 1).

Literature has indicated that to mitigate or to cope with information overload, all the other factors which interrelate with each other to cause the overload should also be considered in mitigating or coping with it [42]. From the literature analysis on information overload, future research directions have emerged. Literature has shown that the analysis of information overload should no longer be studied using models of linear cause and effect, but should rather be represented with cyclical structures and a focus on interdependencies. This is important since the complexity of the phenomenon is mainly given by the interconnectedness of its various variables. [42] (Figure 1).

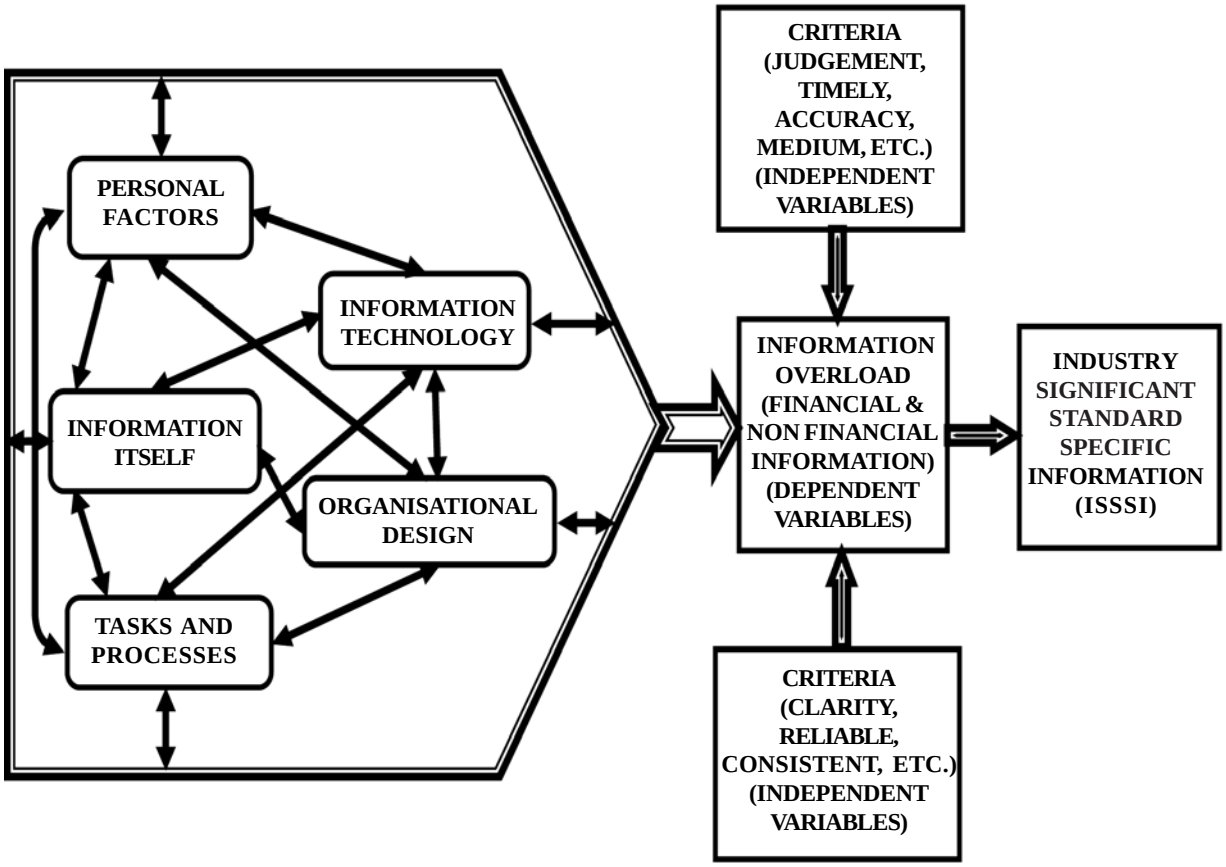

Figure 1. Information overload issues. Source: Author

In figure 1above, the causal relations between the five building blocks are neither linear nor singular. That is why the five competing explanations of information overload, the personal factors, information itself, tasks and processes, organisational design and information technology, are not taken in isolation but rather used as the building blocks for interactionism. The same logic is applied to mitigating, assuming that the five types of mitigating can be studied through the prism of ongoing interaction.

3.2 Symptoms of Information

In **personal** situations, the symptoms exhibited are demotivation [12], satisfaction negatively affected [77, 82], stress, confusion and cognitive strain [82, 94, 120]. The executive lacks learning anything since too little time is at his disposition [132]. There is a greater tolerance of error in jobs performed [132] and lack of perspective [120]. The executive exhibits sense of loss of control which leads to a breakdown in communication [121].

With regards to **information**, sub-optimal decisions are made when information overload manifests itself. When information overload manifests itself, decision accuracy, quality [92, 77, 73], decision effectiveness are lowered [122]. Inefficient work [14], potential paralysis and delay of decisions [14, 120] are some of the inevitable symptoms.

The complexity of **the task** is often discussed as a contributing factor when studying information overload. The work of [60]

has taken the research a step further by analyzing the effects of distractions on the level of information anxiety. Their research shows that, in relation to task complexity, the level of information overload in complex tasks increases as the quantity and force of distractions increases.

In the **organizational context**, the presence of information overload is felt when there is overlapping and inconsistent information categories [43]. Executives ignore information and become highly selective thereby omitting significant information for organizational management [14, 40, 66, 67, 132]. Executives loss control over information in the organisation [14, 146]. Mangers lack critical evaluation of issues and become too credulous and analyses are very superficial [127, 120, 123].

In relation to **information technology**, limited information search and retrieval strategies are present. Search strategies through information sets become less systematic (this is less true for more experienced searchers) [137]. There are limited search directions for information in the information systems provided by the enterprise and move from compensatory search patterns to non-compensatory search patterns exist [28].

3.3 Solutions to Information Overload

Literature on information overload does not only discuss major causes and effects, but also proposes possible effective countermeasures to address the issues related to information overload. These countermeasures range from general suggestions concerning attitude to very specific software tools (such as filtering agents, automatic summarizers, or visualization algorithms) that help to process large amounts of information [42].

Several authors advocate the use of intelligent information management systems to foster an easier prioritization of information [14, 101, 120] or to provide quality filters [3, 40, 59]. Examples of such intelligent systems are Decision Support Systems (DSS) that reduce a large set of options to a manageable size [28]. Installation of voting structures to make users evaluate and select the information they require was advocated by some authors [34, 67]. Some prefer push- to pull-technologies [14, 34, 48, 66]. Facilitator support through (e-) tools were also suggested by other authors [59]. Cook suggested Decision Support Systems could reduce a large set of alternatives to a manageable size [28]. The use of natural language processing systems i.e. searching with artificial intelligence (AI) was also advocated [107]. Information overload can also be mitigated by the usage of intelligent data selectors (intelligent agents) [17, 40, 93]. Some authors recommend the use of systems that offer various information organization options (e.g. filing systems) [67, 131].

Intelligent agents are applications that scan, comprehend, summarize and automatically route the information for users. An intelligent agent acts with autonomy by making decisions on the basis of the data it acquires about the environment, and it has the facility to learn about individual personal preferences [67]. Intelligent agents that scan and comprehend text and summarise and automatically route the information for users have been proposed as a tool to help reduce information overload as, to be really useful, information needs to have value added to it by way of summary or analysis. [15] suggest that as a radical solution to the problem of information overload, intelligent agents are smarter than average search tools for two reasons:

- An intelligent agent acts with autonomy by making decisions on the basis of data it acquires about the environment, rather than as a result of direct instruction from the user;
- An intelligent agent has the facility to learn about individual personal preferences so that gradually it is able to predict the likelihood of items that will be of interest to the user [15].

A useful explanation and evaluation of an intelligent search agent is provided by [138]. They conclude that the search agent evaluated could not (at that time) compete with the power of a solid search engine. The use of concepts to build a search strategy did not produce satisfying search results in comparison with tools that use search terms in Boolean combinations. The benefits of saving time can therefore be outweighed by the lack of control and unreliability in using intelligent search agents [67].

The continuing growth in the amount of information available and the recognised need for specific information for good business practice indicates the need for methods of filtering of information to support the organisation's aims. Information filters have the potential to reduce information overload. A good information filter should 'deliver all information relevant to specific users and should exclude all irrelevant information' [133].

The goal of an information filtering system is to assist users in dealing with large amounts of information. This is done by

screening out irrelevant incoming information or by ranking incoming information based on their relevancy. For the filtering mechanism, these systems make use of a user's long term interests and information needs described by means of a user profile. One distinguishes two main filtering approaches; cognitive filtering and sociological filtering. In the cognitive filtering system, the user profile is based on the content of the information and in the sociological filtering system; the personal and organizational interrelationships of individuals within an organization are also considered [126].

Push Technology can be seen as an extension of both search agents and the information filtering systems as the incoming selected and/or filtered information is pushed to the user. Thus, a user does not have to retrieve the information. He or she will automatically be noticed of the availability of the information by the push system, while he or she is working on other applications [67, 26].

The role of information specialists in helping businesses to reduce information overload is, not surprisingly, discussed at length in the information science literature [67]. There are fears expressed that their role is not at the forefront of solutions, implying that the profession may be left behind in strategies employed by business organisations to reduce information overload. This has already been seen in the elevation of IT specialists in organisations whose emphasis may lie more on providing fast access to volumes of information rather than providing access to quality, useful information [67]. It would seem an obvious solution to the problem of information overload in businesses to employ specialists in information handling to carry out the acquisition of relevant information-processing and packaging the information needed as appropriate. Oppenheim draws attention to the total lack of any mention of information professionals in the responses made in the Reuters research and highlights the enormous market niche for the information management profession here [110]. Butcher makes the interesting suggestion that the answer could be to have an information worker as part of each team in an organisation rather than working in a separate information unit [24].

In some quarters it may be thought that technology is the answer, all the necessary information can be delivered to the desktop computer without the need for any mediation on the part of information professionals [67]. This brings us back to the general need for greater information literacy among those employed by business organisations and the importance of information content. As Martin states, the very availability and bewildering array of information and communication technologies, if not controlled, is a receipe for ad hoc development, system incompatibilities and the worst excesses of information overload [98]. Hyams, however, believes that the role of the information professional will be paramount in determining content of information [74]. The role, it is suggested, will also become much more global and involve more in terms of whole organisation strategy, while becoming more political.

As findings regarding information overload became increasingly available, some methods for dealing with it were also proposed. Moutinho suggests that information overload can be successfully managed by organizing complex problems into meaningful structures; in this case, by structuring problems using the Analytic Hierarchy Process (AHP) methodology [105]. It is generally accepted that some formal problem structuring does facilitate quality decision making [65] since the relevant information is used and mitigates against the use of informal decision heuristics – such as satisficing.

Executive information systems provide a means of eliminating informational overload, and thus improving the decision-making capabilities of the user [113]. As its name implies, EIS systems were originally designed for the top-level executives in a company. The basic concept is to provide executives with a set of tools specifically designed to assist them with their primary roles [143]. Back in 1973, Mintzberg stated that one of the main roles executives have is monitoring information from a myriad of sources about their organizations and environments [104]. Echoing Mintzberg's thoughts, Leidner and Elam define an Executive Information System's purpose as the monitoring and scanning of the environment to give executives rapid exposure to changes in the environment [90]. The three key terms in this definition are monitoring, scanning, and environment. Specific items are continuously monitored; a wide range of information is periodically scanned; both scanning and monitoring are functions that assess the nature of the organization's internal and external environment [52].

A more detailed definition reflects the ability of EIS to make the information contained in the lower-level systems in the organization available in a form that is easy to access, easy to use, and germane to decision making [136]. In addition, EIS provides executives with access to external information such as news, regulations, and competitive analysis [147]. Because EIS are executive focused, semi-structured reporting system that filters, extracts, and compressed a broad range of current and historical data, both internal and external to the organization [68], much consideration must be used during its construction and implementation. Executive involvement is required for such an information system that addresses these higher-level, less-

structured problems [41].

At its root, EIS is most concerned with data and ways of interacting with the data [68]. In order for EIS to provide this data, assumptions regarding executive skill level are critical. Since most EIS systems assume a non-technical user, the human-computer interface is critically important. This is echoed in the fact that ease-of-use is consistently rated as among the most important determinants for EIS acceptance [84, 147].

In order for EIS to help executive make better decisions, executives must make use of the systems and digest the available information. For an EIS to be successful, it must provide the executive with either better (higher quality, more complete) information or easier access to information than he or she had from using traditional information sources [85]. Isenberg observed that executives tend to rely on data that is easily available [75]. Executive involvement in the design and implementation phases will help to ensure that the data is easily available and thus, the adoption of EIS is successful.

Some of the actual functions that an EIS application typically provides include graphical presentation of information. Drill-down capabilities are very common [148]. Either touch screens or mouse driven menus allow executive to "*drill-down*" from top-level summaries to transaction specific entries.

The literature also enumerates some possible strategies to mitigate information overload. These include: Focused search [143], executives being highly selective in the information they require [77, 123, 80] executives using intelligent search agents or interfaces [14]. Selection of specific information [35] for executives, filtering information so managers receive only that information they need to do their job well [115] were also recommended by some authors.

4. Information Overload and Information Systems

All the studies considered in various literature approached the problem of information overload within a context of the single technology: electronic mail, groupware application, or web application. However, in contemporary organizations the problem of information overload is not only application-contingent, but it is rooted in and is linked to the entire technological platform: in compatibility of application, the sufficiency of applications, the quality of each application, etc. [75].

Computers have been used to implement information systems to support the management function. Approaches to satisfy the information needs of executives have led to the development of computerised systems in the form of Management Information Systems (MIS) and later, Decision Support Systems (DSS). However, despite their relative superiority over non-computerised systems, and the relative success with middle-management, these systems failed to satisfy the needs of senior executives because they lacked significant standard specific information (SSSI). One of the main causes of this failure is best summed up by the term '*information overload*'.

Computerised systems operated by other people did not provide the necessary support to executive managers. An alternative to the traditional reliance on subordinates for the supply of information was the development of information systems used directly by executives. The result was the emergence of Executive Information Systems (EISs). Since the term was first introduced in 1982, the trend of senior managers having direct access to computers has grown. With the increasing need for information at a strategic level, the importance of EISs is increasing. EISs should provide significant standard information to avoid information overload. This paper suggests ways in which executives can obtain these significant financial and non-financial information as contents of EISs to enable executives make effective decisions for their enterprises to develop and remain competitive in their industries.

Enterprise Resource Planning Systems (ERPs) are part and parcel of modern information technology applications which are prevalent in organisations. While the focus of ERP systems is on the operational and tactical level, [44] argues that they lack comprehensive reporting and analysis functionalities at the strategic level. The aim of this paper is to suggest means to determine significant standard specific information (SSSI) from ERPs for executives to use to make decisions. A scientifically designed EIS whose contents are the significant standard specific information (SSSI) should reduce IPC considerable in relation to IPR. An EIS designed with inputs from executives and their managers should enable them to have confidence in the information they require for decision making.

Enterprise Resource Planning systems, evolved from advanced manufacturing technologies (AMT), aimed at increasing quality,

lowering inventory levels, improving customer service and manufacturing flexibility [36, 69, 112, 129, 130]. In particular, MRPII (Material Requirements Planning II) appears as a critical component of a "*complete*" ERP system [61]. Further, the year 2000 problem, currency consolidation, integration of all business functions and processes, and Internet interface constitute additional motives for companies adopting ERP systems [61, 124].

Transactions under ERP systems are treated as part of the inter-linked processes that constitute the business in its entirety [61]. Such systems allow companies which adopt them to automate and integrate business processes, share data across departments and produce and access information in real-time environment [106, 140]. For example, entering a client order to the system would be sufficient to update all its relevant parts, such as stock levels, general ledger and logistics. In essence, a "*complete*" ERP system would incorporate a number of modules relating to not only the traditional accounting information system, but also stock control, MRP (Material Requirements Planning) and logistics.

Additional dimensions of an ERP system might involve EDI (Electronic Data Interchange) systems, and e-commerce [37, 62]. This all-inclusive Information System is capable of generating tremendous benefits to organizations via increased effectiveness and efficiency in operations, business processes and strategic decision making [37, 64, 125]. Specifically [125]classify those as operational, managerial, strategic, IT infrastructure and organizational; therefore, permeating all aspects of business enterprises at all levels. Executives do not need information from all these modules to make decisions. All these should be put in one basket as total information pool for the significant standard specific information (SSSI) to be selected by Statistical Analytical Process (SAP) for executives to make decisions.

Researchers have examined the prerequisites for successful ERP systems characterised as:

- National/environmental; and
- Organizational/internal [69].

Others classify ERP prerequisites as "*critical success factors*" [4, 21, 86, 134]. Specifically, [86] report that organizational culture is associated with ERP implementation problems, but national culture is not. They conclude that to improve ERP implementation methods one might have to be aware of the stakeholders involved and their respective norms. Violating the latter appears to cause implementation problems. Further, [134] argues that the trust within the organization and between the organization and associated companies is important in this context. In essence, overcoming behavioural problems and particularly employee resistance to change would require a careful planning of an ERP implementation strategy [5, 6].

The Accounting Information System (AIS) development/acquisition approaches by Greek SME are examined by [135]. He found that there are some problematic areas in AIS development. The lack of a development/acquisition methodology in the majority of cases might result in misspecification of requirements and ineffective, inefficient and inflexible AIS. This is further supported by the findings regarding inadequate accountants' participation in the development/implementation process. These accountants should be able to supply significant standard specific information to the executives to make decisions. More often than not, these accountants, because they want to show the executives that they are working assiduously, end up causing information overload by putting all the information on the table for executives to select from.

There should be a framework for the determination of significant standard specific information obtained from financial and non financial pool in an industry to be the content of an Industry Executive Information Systems (IEISs) for these executives to use in decision making.

Issues relating to the functionality ([124] of ERP systems and their flexibility [92] have also been discussed. Specifically, the "*best of breed* " (BoB) approach accommodating both inflexibility and functionality problems encountered by single vendor ERP solutions has also been advanced (Lang *et al.*, 2001) [128]. An additional important problem is the integration of ERP systems with the existing (legacy) systems [140]. Overall, their core advantage, i.e. the interdependencies involved, may also constitute an important limitation resulting in data errors and business interruptions [61, 71, 140]. Substantial cost and time overruns, organization problems such as employee resistance also appear to be important barriers for their success [106, 140] [140]. Furthermore, ERP systems are not a panacea for "*false*" underlying business structures and processes. Issues such as change of management programs (business process re-engineering – BPR) and culture, top management support, communication and the appropriateness of business and IT legacy systems are often critical success factors in implementing ERP systems [7, 61,106].

The core of Information System is traditionally thought of as an accounting information system (AIS) integrating transaction processing, reporting and decision support. The primary aim of any AIS is to provide accounting information to a variety of users (internal and external). In order to achieve that, the following objectives are pursued, namely:

- To support the day-to-day operations (transaction processing);
- To support decision making by internal decision makers (information processing); and
- To fulfil obligations relating to stewardship (legal obligations).

The accounting module is the heart of an ERP system, typically incorporating applications such as general ledger, accounts receivable and payable, fixed assets, cash management, cost control and budgeting. However, ERP systems offer companies the ability to improve business processes by integrating all the functional areas within an organization. Both financial and non-financial data can be integrated.

Evidence suggests that ERP systems have proved to be effective in transaction processing and less effective in reporting and decision support. Further, it is suggested that ERP systems provide both the incentives and means for adopting newer accounting practices such as activity based budgeting (ABB), product lifecycle costing (PLC), and balanced scorecards. Although ERP systems are appealing in this highly competitive business environment, they have a number of limitations. These limitations include information overload. Executives do not gain anything from ERPs because the information they provide are too much. It is suggested the determination significant standard specific information from ERPs should be its core function.

4.1 Financial Measures, Erp Systems and Information Overload

The evidence presented earlier regarding the operation of accounting modules and the underlying reasons for adopting ERP systems leads us to expect notable changes in the accounting practice in the post ERP period. Rather surprisingly though, the only notable changes in accounting methods and practices resulting from adoption of the ERP systems relate to the increased use of "*internal audit function*", "*non-financial performance indicators*" and "*profitability analyses by business segment and by product*". Clearly, these changes evolve from the integration of applications, the production of real-time information and particularly information for decision making. Therefore, considering the motives for adopting ERP systems, the outcome of their application appears to be successful in achieving its purpose. But they do not satisfy executives for decision making since they produce a lot of information which make executives more confused, stressful and demotivated.

The adoption of ERP systems has enabled a number of companies to introduce financial ratio analysis, the production of budgets (including cash budgets), profit centres, absorption costing and profitability analysis per customer. These changes also stem from the availability of real-time data and the integration of applications, further reinforcing the argument posed earlier. A small, but an important proportion of ERP adopters have introduced a number of more "*sophisticated* " accounting techniques in their accounting processes including activity based costing (ABC) and "*target costing*". On the other hand, [19] report less changes in management practices introduced by ERP systems, including the use of financial/non-financial performance indicators, customer profitability analysis and Activity Based Budgeting (ABB).

Perhaps this is due to the fact that ERP users have been using these practices before, and the introduction of ERP systems has not been seen as a means for introducing new practices. In conclusion, the adoption of ERP systems appear to have fulfilled its purpose as demonstrated in the changes in the accounting practices brought in. However, more changes are expected to follow as the introduction of ERP systems for many enterprises is still in its infancy and do not supply significant standard specific information executives require to make effective decisions for their enterprises to develop.

The most highly rated perceived benefits achieved via ERP systems relate to "*increased flexibility in information generation*", "*increased integration of accounts applications*" and "*improved quality of reports-financial statements*". These further reinforce the argument posed earlier regarding ERP systems' success in achieving their purpose. That is, the integration of applications, the production of real-time information and particularly information for decision making clearly affect business processes and particularly the financial practices of ERP adopters. Additional benefits achieved though to a lesser extent involve time reductions for accounts closure and preparation of financial statements. Further, "*improved decision-making process*", "*increased use of financial ratio analysis*" and "*improved internal audit function*".

Overall, the benefits achieved by ERP adopters strongly influence financial information and practices and also organizational

planning at a strategic level. Nonetheless, there is still room for improvement as individuals' perceptions are not that strong on the above benefits. Further, [19] report ERP users' perceptions of the quality of accounting Information Systems in financial and management accounting as "*adequate*" in terms of reporting and decision support and "*good* " in terms of transaction reporting. It is noteworthy that [135] also reports the integration of accounting applications, information exchange and reporting capabilities as notable advantages/strengths of ERP systems. It is clear that the strengths of ERP systems are the massive financial and nonfinancial information they produce. The disadvantages are that they do not provide any significant standard specific information for executives to use resulting in information overload.

Evidences suggest that enterprises adopting ERP systems are driven by the needs of this increasing competitive environment in order to survive and succeed. That is, integration of applications, real-time information, and particularly information for decision making are the underlying motives for ERP adopters. This further confirms that ERP systems are currently becoming a necessary tool for enterprises to remain competitive in this new business environment rather than constituting a new strategic move. Nonetheless, ERP systems also offer the opportunity for enterprises to re-engineer their activities and revamp both their Information Systems and practices. Empirical evidence confirms a number of changes in the financial processes introduced with the adoption of ERP systems. The most frequently quoted ones involve the introduction of an internal audit function, the use of non-financial performance indicators, and profitability analysis at segmental/product level. It is noteworthy though that these changes stem from the main advantages of ERP systems, which have also been the driving force for managers adopting them. That is, the integration of financial applications, increased flexibility in information generation, and improved quality of financial reports and decisions based on timely and reliable financial information.

Further, the fact that some changes in the financial processes have not been so widely applied and the potential benefits from adopting ERP systems have not been highly rated has been attributed to the infancy of these systems. Specifically, as these enterprises have only introduced ERP systems relatively recently, their impact on financial practices cannot be fully appreciated at this stage. Moreover, the complexity of ERP systems requires some time to elapse before users can reap all the benefits. In essence, the benefits from the ERP implementation are accrued in the longer-term [114].

However, these changes and the benefits associated with them do not constitute innovation per se, but rather keeping up with the changes in the business environment. The increased demands in this highly competitive, highly automated, IT-driven business environment forced enterprises to resort to ERP systems to remain competitive. But executives are not taken care of in these ERPs. Despite the massive information provided by these ERPs, executives still cannot get the significant standard specific information they require to make effective decisions so as to remain competitive.

It is inevitable that ERP implementations require a reorganization of business processes and organizational structure but, most importantly, a change of management style and culture [145]. Therefore, top management support, collaboration within the enterprise and between the organization and the ERP provider and employee training/participation appear to be successful ingredients in ERP applications. Therefore, accountants need to have good IT skills to apply their knowledge in this new IT-led work environment. Accountants also have to know what their executives require.

Therefore, it is suggested that significant financial and non financial information should be supplied to the executives. This should also be inputs of an IEIS.

4.2 The Impact of Erps on Non-Financial Measures and Information Overload

Since ERPs are actually a new or changed form of Financial Information Systems (FIS), they could be interpreted as a major technological change in response to a "*new*" environmental challenge - the need to reduce uncertainty. Therefore, they influence almost all aspects of the enterprise (both financial and non-financial). Hereby, we define the organization as the organization itself, the different departments, as well as the various individual employees, such as financial managers, IT-professionals etc.

It is clear that ERPs-in combination with the increased competition from the current globalization trend-changes the nature of the organization and influences its value [58, 25], but one could ask to which degree these changes are different from those brought about by previous systems (e.g. EIS) or innovations (e.g. ABC)? Moreover, "*we may ultimately question whether the nature of managerial work truly changes due to the adoption of the new technology*" [58]. Nevertheless, it is obvious these new systems provide new information to the organization, and we would like to assess to what extent this information can be considered "*new*", and whether or not this information improves the decision making and performance evaluation processes

[22]. Therefore, it is important not only to determine how optimal these processes were before the introduction of the new system, but also to isolate the effects of this new system from other innovations, such as for instance the adoption of an EIS system.

Furthermore, it is also important to assess the accurateness of this "*new*" information, since numerous important decisions will be based on this highly integrated information. Several literary sources stipulate that the adoption of ERPs will encounter resistance from various sources in the enterprise, unless the implementation of the ERPs is carefully prepared. This resistance from various organizational sources can be explained following [47] who point out that information that is best suited to superiors for decision control, might not be optimal to other managers for decision management [1], as it is seldom recognized that both functions can be served equally by the newly implemented system [149].

Since executives and managers should supply the inputs to the IEIS, there should be less resistance towards the system. [88] states that "*the real problem is not technical change but the human changes that often accompany technical innovation. People do not resist technical change, rather they resist social change - the change in their human relationships that generally accompanies technical change*".

In order to overcome this resistance, it is very important not to dismiss it as emotional or illogical [118], but to recognize it and address it. One way to achieve this is to make sure that the various benefits (economic, technical and even individual) of the new technology are being acknowledged by the different organizational participants [81], since they will naturally embrace a technology that is considered capable to contribute to their personal or unit's effectiveness [70].

Therefore, it is of utmost importance that all the participants really understand what is being advocated, without being discouraged by the technical language surrounding ERPs. In order to achieve less resistance, the actual users of the system not only have to be adequately trained and briefed about the new system, they (executives) also have to be actively involved in the design and the implementation of the actual new system [1], so as to ensure that they can identify and commit themselves to the new implementation [81, 99, 63], which on their turn facilitates the adoption of the proposed system [33], since people automatically neglect to look any further at the abandoned alternative [81].

Furthermore, user involvement may promote the development of realistic expectations [87]. [81] also provides us with "*a considerable number of studies that have convincingly shown that participation leads to both commitment and acceptance of new initiatives* [29, 50, 79, 117]". Executives should, therefore, be involved in the determination of the information they require for decision making.

Furthermore, this approach guarantees the best use of the system since it has been tailored to the specific needs of the people who have to use it on a daily basis, which decreases the required effort later on and thus reduces ex-ante uncertainty [1]. Therefore, Hunton and Flowers (1997, p. 4) also suggest to verify the levels of user satisfaction and job commitment associated with the new system.

Consequently, it can be stated that the impact of ERPs on financial and non-financial measures will be greater (so less resistance) when the user has been actively involved in the design and implementation process. Since it is obvious that the available information will increase enormously due to the implementation of the new ERPs, and suppose the quality of the information [39] is also rather good, one would expect that this would lead to better informed decisions. The quality of IS information refers to the reliability, relevance, accuracy, precision and completeness of IS information [11, 139, 144]. Nevertheless, one could ask whether this new information is also effectively acted upon in order to make decisions [9].

This enormous increase in information naturally entails that the complexity associated with the actual decisions that have to be taken, will increase significantly. The information can be reduced by determining the significant standard specific information ones so that executives have only the essential ones they require for decision making.

Nevertheless, it remains highly advisable to limit the complexity introduced by the new system, otherwise this complexity will destroy the advantages of the reduced uncertainty, as [141] stipulate that an uncertain and complex environment both lead to bounded rationality, since it may be impossible for individuals to process all the information available. Furthermore, the effective use of the information is of course dependent on the flexibility the manager has in changing his actions due to the new information, as has been illustrated by [1].

Therefore, it can be stated that although the decision-making process will certainly be affected by the introduction of the new technology, the new information, provided by the ERPs, will not be used effectively in the decision process, unless one can effectively act upon the new information if the quantity is reduced for executives to use. Resistance can also be explained from an agency perspective, as the agent will be reluctant to reveal more information about his performance, in case for instance slack [38] was introduced into the budgets. [95] already identifies the visibility of introduced slack as a cause for the limited use of ABC. On the other hand, if the agent is performing well, he will embrace the dispersion of additional information to the principal, so the relation is not entirely clear [1].

Nevertheless, it should be clear that once again the agent has to be able to control the factors he is being assessed on, and strongly dislikes subjective evaluations (Merchant and Manzoni, 1989, p. 554). Therefore, it seems also logical that managers in more decentralized enterprises will easier embrace the eventual changes that are brought about by the new system, since they-as opposed to their colleagues in more centralized management structures-can participate in the actual decisions concerning these factors. Therefore, we might presume that the agent will embrace information that reduces this subjectivity concerning his assessment, as this will enhance the fairness and equitability of the system (Foster & Ward, 1994, p. 408). The agent is not likely to include significant standard specific information financial and non-financial information which the executives are likely to use since it will affect them.

Furthermore, apart from individual attitudes, it may be necessary to maintain stability in the performance evaluation system in order not to loose perspective entirely during the various changes in the enterprise due to the implementation of the new system [23]. Nevertheless, [47] point out that the disadvantages of having inaccurate information, may very well outweigh the desired stability. This attitude can also be defended on a more general level: "*As* [109] *emphasizes, one of the great management paradoxes involves the fact that while managers should be able to allow flexibility and change, their fundamental interest or task is simultaneously to generate and maintain control, predictability, and economic results: a balance between change and stability has to be found* [96]" [53]. This is the more reason why executives should determine their own non-financial information to be included in IEIS.

Another possible explanation could be the complexity of present-day ERPs which causes the resources to be concentrated on effective implementation instead of on the development of new methods. [10] identified the complexity associated with MIS-implementations as one plausible explanation for the often unmet a-priori expectations. Consequently, we can expect a growing (as time goes by) direct impact of these new ERPs on management control (depending upon the degree of centralization). And since one of the main benefits of ERPs is the high degree of integration, the organization could benefit from the storage of such information, if we follow [20]: "*Integrated information reduces uncertainty relating to cause and effect relations within departments as it encourages learning and the generation of ideas*." This way intra-organizational conflicts can be, if not eliminated, at least suspended. But the systems produce so much information for executives to use. ERPs are certainly driving changes in the organizational structures and lines of responsibility (e.g. again more centralized), because often it is too difficult or not advisable to adapt the ERPs to the organization, which results in the need to adapt the organization to the new system [1].

This way, the introduction of the new ERPs and its (expected) resulting decrease in uncertainty, might very well allow for more centralization, since the need for decentralization is very often linked to the degree of uncertainty present in the organization [49]. On the other hand, it may be necessary to allow for more decentralization in the organization in order to provide managers with the required flexibility to be able to effectively act upon the "*new*" information. The "*new*" information should also be significant standard and specific for executives to make effective decisions.

Furthermore, as ERPs facilitate the vertical distribution of information, their adoption can also very well entail a reduction in organizational levels [70]. The loss or reduction of informal relations and face-to-face contacts - associated with the world-wide adoption of these ERPs - in the new (partly) virtual organization [25], are also a driver for inevitable changes to the organizational structures. The importance of these so-called "*social networks*" for the contemporary organization is also stressed in the strategic management literature.

The standardization and globalization, introduced by the new ERPs, largely enhance the possible contacts and relations one can address and this may bring about new organizational forms such as the network organization [25]. In this concept, the individual organization has to be viewed as a link in the entire value chain, whereby the learning and innovating skills of the organization will be very important [83]. Therefore, it is clear that the ERPS will bring about significant changes to the organizational structures (e.g. "*the network organization*"). So will also be "*new*" irrelevant information for executives to use. This "*new*"

network enterprise - where the emphasis will be on value creation, and even inter-organizational accounting may become necessary [83]- will require considerable analytical and interpretative skills from the executive, as the other more routine tasks will be carried out by the system and simple parameters can be easily adjusted by the managers themselves [25].

Significant standard specific information should put the new information in the right perspective for executives to use.

4.3 Motivation for Implementing ERPs and Information Overload

Although it is often stated that erps merely just speed up the delivery of information [70], it is of course obvious that ERPs do a lot more than that. In defining ERPs, [56] is followed and refers to ERPs as: "*integrated software packages that control all personnel, material, monetary and information flows of a company* [13, 31, 32]". It could be argued that ERPs are introduced to reduce uncertainty, which can be explained following [49] who describes the increase in the capability to handle information (as ERPs do) as one of the options to reduce this uncertainty. Also, "[51] hypothesized that accounting information systems could be designed to cope with environmental uncertainty by incorporating more non-financial data, increasing reporting frequency, and tailoring systems to local needs [8]" [30]. This eventually causes information overload for executives who use the system.

One of the main features of all the major ERP-packages is their relatively high degree of standardization [55, 54], which allows the integration of information [57], not only in the entire (global) organization, but also along the whole value chain [16, 25], which entails on his turn economies of speed, scope and size [25]. This trend is consistent with the proposition of [89] that the need for more integrative devices increases as the level of organizational differentiation enlarges, in order to assure a consistent and coordinated strategic effort and to avoid interdivisional conflict (vide infra). The characteristics mentioned above, are also indicated by the study of [20] about the "*decision-facilitating function*" of management accounting systems (MAS) [91]. Following [51] and others [27, 101], they examine four dimensions of MAS: scope, integration, aggregation and timeliness, whereby the subdimensions of each of these four are also illustrated. But it remains debatable if the high degree of standardization is actually an advantage or a disadvantage.

In general, the inflexibility and the rather limited adaptability of the system is seen as a major problem in the contemporary business environment. This standardization defeats the tailoring of the system to specific local needs, due to for instance cultural differences [119]. Others, on the contrary, welcome the - according to them - increased flexibility : "*… they open new opportunities to tailor accounting information to the information needs that emerge in local decision situations*". [55]. The standardization is done for individual organizations without considering the entire industry. Significant standard specific information required by executives should be provided to mitigate information overload on them.

In a more general perspective, "[10] *has argued that the characteristics of 'local' and 'distant' information systems reflect different conceptions of management. In particular, 'distant' systems induce rational, abstract thinking and managers who are concerned with general conditions and trends, whereas 'local' systems encourage managers to think concretely and intuitively in order to respond to specific conditions*". [118]. Nevertheless one cannot deny the major advantages of this high degree of standardization and integration, such as the enhanced decision support, the improved quality of information [25], the possibility to centralize the coordination of data processing, the possibility of real-time reporting [58] and continuous auditing in the current insecure and dynamic organization context [54], the - although debatable - flexibility of the system, the answer to the quest for more rapid information due to the increased globalization and competitiveness, etc.

Furthermore, in their study about management accounting practices (MAP), [55] argue that accounting information systems (AIS) in general are among the economic pressures that drive the convergence MAP around the world, which consequently provides us with another explanation for the adoption of ERPs. And if we assume that ERPs are, among others, introduced to change MAS - whereby we leave it to the discussion and empirical investigation in the second part to determine whether they actually do - the study of [91] provides us with an additional reason for implementing an ERPs, namely the intensity of competition, which necessitates cost reduction, quality improvement and waste reduction.

All these can be achieved to the detriment of executives who actually make decision. This is because implementations are carried out without keeping in mind the significant standard specific information required which can be obtained by the press of the button.

"[97] *identifies the following five primary functions of systems*:

- *To structure work* (*operational systems*);
- *To evaluate performance and motivate people* (*monitoring and control systems*);
- *To support intellectual processes* (*planning and decision systems*);
- *To augment human communication* (*communication systems*); *and*
- *To facilitate interorganizational transactions* (*interorganizational systems*)". [16].

All these are necessary for an IEIS. But the IEIS should contain significant standard specific information for executives to avoid information overload.

5. Suggested Strategies for Mitigation of Information Overload

The suggested strategies for mitigation of information overload syndrome in this paper is based on the objective definition, i.e. Information overload occurs when the information processing requirements (IPR) (information needed to complete a task) exceed the information processing capacity (IPC) (the quantity of information one can integrate into the decision making process) [42].

The five constructs of information overload – personal factors, information itself, organizational setting and information technology all influence the fundamental variables of information overload: information processing requirements (IPR) and the information processing capacity (IPC).

All five constructs should be considered together as a unit in any methodology to mitigate information overload.

The paper considered the inequality (IPR>IPC) of information and find strategies for augmenting (increasing) the IPC to an acceptable level for executives.

From the literature discussed, IPC can be increased by the application of various methods. These include the following:

- Executives involvement in the selection of the information they require for decision making [75],
- Executives coming together as a group to determine the required information due to the fact that groups have higher information processing capacity, they outperform individuals all levels of information overload [75].
- Thought mode theories – conscious and unconscious thought - are also considered as one of the methods to employ to mitigate information overload since conscious and unconscious thought increases the information processing capacity (IPC) [108]. The thought mode deals with weighting of criteria to be used for selection of information [2].

[2] method should be applied in the questionnaire design to select the significant standard specific information based on the criteria which should take the five constructs (personal factors, information characteristics, tasks & process parameters, organizational design and information technology) into consideration. The data collected should be analysed using a Statistical Analytical Process (SAP) (i.e. a multivariate analysis) to determine the significant standard specific information executives require for decision making.

The significant standard specific information is used as the content for the development and implementation of an Industry Executive Information System (IEIS). Due to the time constraints and the over-abundance of information, the reduction of information is critical in the design of the IEIS.

For the purpose of this paper, IEISs are defined as: "*computerised information systems designed to be operated directly by executive managers without the need of any intermediaries which aims to provide fast and easy access to significant standard specific information from a variety of sources – financial and non financial (both internal and external) to mitigate information overload "*.

Executives should be involved in the design and implementation of information systems such as ERPs and IEISs. This will involve executives working as a group in the industry to determine the significant standard specific information they require for decision making. This significant standard specific information should be used as the content to design IEISs that could extract

information from ERPs. It is also suggested that since information requirements are dynamic, industries should form research and development (R & D) units to carry out the statistical analytical process every three (3) years to maintain the currency of the information they require. This current information when used as content of IEISs should make information systems designers current in the design and implementation of information systems especially ERPs to mitigate information overload.

6. Conclusion

Isolated interventions that neglect crucial interdependencies among the involved factors (such as personal skills, information itself, tasks and processes, organisational design and information technology) should be avoided in an attempt to mitigate information overload. For this reason, the challenge of information overload cannot be addressed by simply implementing one distinctive countermeasure, but there must be a continuous cycle of improvement and refinement by Research & Developments departments in organizations to determine significant standard specific information as time changes. It should be noted that no set of solutions to the problems identified in this review can be regarded as finally satisfactory. This is because new 'sets of information' will emerge as the information environment changes, primarily under the influence of new technologies, demands and social issues.

New solutions will always be needed, although it will be vital to be selective in determining which new patterns and modes of information communication and use are truly problems in need of solutions. The solutions which emerge are not likely to be purely '*informational*', still less associated solely with formal information services and information management. Rather, information aspects will comprise part of solutions involving much wider issues of education, the nature of work, and individual responses to an increasingly complex, and largely digital, information environment.

Information managers will, no doubt, continue to devise and promote pragmatic solutions to these continuing and emerging issues. But satisfactory progress will depend on a better understanding of the fundamentals of human information behaviour, information systems and the ways in which information changes over time.

References

[1] Abernethy, M. A., Bouwens, J. (2001). The determinants of resistance to management accounting innovation. *Working paper, Management Accounting.* p. 30.

[2] Acker, F. (2008). New findings on unconscious versus conscious thought in decision making: Additional empirical data and meta-analysis. *Judgment and Decision Making*, 3, 292–303.

[3] Ackoff, R. L. (1967). Management Misinformation Systems. *Management Science*, 14, 147-156.

[4] Ahkiles, T. (1998). *Enterprise resource planning: what's there in it?* Retrieved February 1, 99 from www.geocities.com/CollegePark/Library/6045/erp.html.

[5] Aladwani, A. M. (2001). Change management strategies for successful ERP implementation. *Business Process Management Journal*, 7 (3) 266-75.

[6] Al-Mashari, M., Zairi, M. (1999). BPR implementation process: An analysis of key success and failure factors. *Business Process Management Journal*, 5 (1) 87-112.

[7] Al-Mashari, M., Zairi, M. (2000). Revisiting BPR: A holistic review of practice and development. *Business Process Management Journal*, 6 (1) 10-42.

[8] Ansari, S. (1977). An Integrated Approach to Control System Design. *Accounting Organization & Society*, 101–112.

[9] Argyris, C., Kaplan, R. S. (1994). Implementing new knowledge: The case of activity-based costing. *Accounting Horizon*, 8 (3) 83-105.

[10] Argyris, C. (1977). Organizational learning and management information systems. *Accounting, Organizations and Society*, 2 (2) 113-123.

[11] Bailey, J. E., Pearson, S.W. (1983). Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management Science*, 29 (5) 530-545.

[12] Baldacchino, C., Armistead, C., Parker, D. (2002). Information overload: It's time to face the problem. *Management Services*, 46, 18-19.

[13] Bancroft, N. H., Seip, H., Sprengel, A. (1998). *Implementing SAP R/3: How to Introduce a Large System into a Large Organisation* (2nd ed.). Greenwich, CT: Manning Publications.

[14] Bawden, D. (2001). Information overload: *Library & Information Briefings*, 92, Online. Retrieved September 14, 2004 from http://litc.sbu.ac.uk/publications/lframe.html.

[15] Belfourd, T., Furner, J. (1997). Fast learners or time wasters? Intelligent agents on the Web: A user study. *Managing Information*, 4 (9) 32-34.

[16] Benford, T. L., Hunton J. E. (2000). Incorporating Information Technology Considerations Into an Expanded Model of Judgment and Decision Making in Accounting. *International Journal of Accounting Information Systems*, 1, 54-65.

[17] Berghel, H. (1997). Email – The Good, The Bad, and The Ugly. *Communication of the ACM*, 40 (4) 11-15.

[18] Bettman, J. R. (1979). *An Information Processing Theory of Consumer Choice*. Reading, MA: Addison-Wesley.

[19] Booth, P., Matolcsy, Z., Wieder, B. (2000). *Integrated Information Systems (ERP-Systems) and Accounting Practise – the Australian Experience*. Paper presented at the 3rd European Conference on Accounting Information Systems, Munich, Germany.

[20] Bouwens, J., Abernethy, M. A. (2000). The consequences of customization on management accounting system design. *Accounting, Organizations and Society*, 25, 221-241.

[21] Bradford, M., Roberts, D. (2001). Does your ERP system measure up? *Strategic Finance*, 83 (3), 30-4.

[22] Bretz, R. D., Jr., Milkovich, G. T., Read, W. (1992). *The current state of performance appraisal research and practice: Concerns, directions, and implications* (CAHRS Working Paper #92-15). Ithaca, NY: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human

[23] Burns, J., Scapens, R. W. (2000). Conceptualising management accounting change: an institutional framework. *Management Accounting Research*. 11, 3-25.

[24] Butcher, H. (1998). *In Meeting managers+ information needs*. London: Aslib. (p. 53).

[25] Chapman, C., Chua, W. F. (2000). *Information Technology, Organizational Form, and Accounting.* Paper presented at the 2nd Conference on New Directions in Management Accounting: Innovations in Practice and Research, EIASM Brussels, 14-16 December.

[26] Cheng-Tung C., Wei-Shen, T., (2003). An information push delivery system design for personal information service on the internet. *Information processing and management*, p. 873 - 888

[27] Chenhall, R., Morris, D. (1986). The impact of structure, environment, and inter-dependence on the perceived usefulness of management accounting systems. *The Accounting Review*, 61 (1) 16-35.

[28] Cook, G. J. (1993). An empirical investigation of information search strategies with implications for decision support system design. *Decision Sciences*, 24 683-699.

[29] Cooper, R., Kaplan, R. S., Maisel, L. S., Morrissey, E., Ochm, R. M. (1992). Implementing Activity-Based Cost Management: Moving From Analysis to Action. Montvale, NJ: *Institute of Management Accountants.*

[30] Covaleski, M. A., Dirsmith, M. W., Samuel, S. (1996). Managerial Accounting Research: The Contributions of Organizational and Sociological Theories. *Journal of Management Accounting Research*, 8, 1-35.

[31] Curran, T., Keller, G., Ladd, A. (1998). *SAP R/3 Business Blueprint: Understanding the Business Process Reference Model.* New Jersey: Prentice Hall.

[32] Davenport, T. H. (July/August 1998). Putting the Enterprise into the Enterprise System. *Harvard Business Review*, 76 (4) 121-131.

[33] DeBrabander, B., Thiers, G. (1984). Successful Information Systems Development in Relation to Situational Factors which affect Effective Communication between MIS Users and EDP Specialists. *Management Science* 30 (2) 137-155.

[34] Denning, P. J. (1982). Electronic junk. *Communications of the ACM*, 25: 163-168.

[35] Drucker, Peter, F. (1995). The Information Executives Truly Need. *Harvard Business Review*, January-February, p. 54-62.

[36] Drury, C. (1996). *Management Accounting Handbook*. Oxford: Butterworth-Heinemann.

[37] Duff, R. J., Jain, M. (1998). CFO's guide to EDI: how can you control the new paperless environment? *The Journal of Corporate Accounting and Finance*. 10 (1) 107-27.

[38] Dunk, A. S. (1993). The Effect of Budget Emphasis and Information Asymmetry on the Relation between Budgetary Participation and Slack. *The Accounting Review*, 68 (2) 400-410.

[39] Dunk, A. S. (2000). Quality of IS Information, Innovation Budget Pressure, and Departmental Performance. *Working paper, Information System*, p. 320.

[40] Edmunds, A., Morris, A. (2000). The problem of information overload in business organizations: A review on the literature. *International Journal of Information Management*, 20, 17-28.

[41] Edstrom, A. (1977). User influence and the success of MIS projects: a contingency approach. *Human Relations*, 30 (1) 595-607.

[42] Eppler, M. J., Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines. *The Information Society*, 20, 325-344.

[43] Eppler, M. (1998). *Informative Action: An Analysis of Management and the Information Overload*, (PhD thesis, *HEC Management Studies*). Geneva: University of Geneva.

[44] Fahy, M. J. (2000). *Strategic Enterprise Management: The Implications for Management Accounting and Control*. Paper presented at the 23rd annual congress of the European Accounting Association, Munich.

[45] Farhoomand, A. F., Drury, D. H. (2002). Managerial information overload. *Communications of the ACM*, 45, 27-131.

[46] Feather, J. (1998). *The information society: A study of continuity and change*. London: Library Association.

[47] Foster, G., Ward, T. J. (1994). Theory of perpetual management accounting innovation lag in hierarchical organizations. *Accounting, Organizations and Society*, 19 (4/5) 401-411.

[48] Friedmann, M. (1977). Consumer use of informational aids in supermarkets. *Journal of Consumer Affairs*, p. 78-155.

[49] Galbraith, J. R. (1973). *Designing Complex Organizations*. Reading, MA: Addison-Wesley.

[50] Gilmore, T., Barnett, C. (1992). Designing the Social Architecture of Participation in Large Groups. *Journal of Applied Behavioural Science*, 28 (4) 534 – 548.

[51] Gordon, L. A., Miller, D. A. (1976). Contingency framework for the design of accounting information systems: Conceptual linkages. *Accounting, Organizations and Society*, 1 (1) 59-69.

[52] Gordon, L. A., Narayanan, V. K. (1983). Management accounting systems, perceived environmental uncertainty and organization structure: An empirical investigation. *Accounting, Organizations and Society*, 9, 33-47.

[53] Granlund, M. (2001). Towards explaining stability in and around management accounting systems. *Management Accounting Research*, 12 (2) 141-66.

[54] Granlund, M., Lukka, K. (1998a). Towards increasing business orientation: Finnish management accountants in a changing cultural context. *Management Accounting Research*, 9, 185-211.

[55] Granlund, M., Lukka, K. (1998b). It's a Small World of Management Accounting Practices. *Journal of Management Accounting Research*, 10, 153-179.

[56] Granlund, M., Malmi, T. (2000a). *The Liberations and Limitations of ERP-systems for Management Accounting, Preliminary Draft*. Paper presented at the 23rd EAA Conference, Munich Germany.

[57] Granlund, M., Malmi, T. (2000b). *Some Empirical Evidence of the Effects of ERP-systems on Management Accounting*. Paper presented at the 2nd Conference on New Directions in Management Accounting: Innovations in Practice and Research, EIASM Brussels.

[58] Granlund, M., Malmi, T. (2000). *Some Empirical Evidence of the Effects of ERP Systems On Management Accounting*. Conference on New Directions in Management Accounting, Bruxelles.

[59] Grise, M., Gallupe, R. B. (1999/2000). Information overload: Addressing the productivity paradox in face-to-face electronic meetings. *Journal of Management Information Systems*, 16 (3) 157-185.

[61] Gupta, A. (2000). Enterprise resource planning: the emerging organizational value systems. *Industrial Management & Data Systems*. 100 (3) 114-18.

[62] Hardy, C., Reeve, R. (1999). Wu and Hahn's control-complexity/control-point orientation for computer information system (CIS) audits: An empirical test in an electronic data interchange (EDI) environment. *Managerial Auditing Journal*, 14 (7) 339-50.

[63] Hartwick, J., Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science*, 40 (4) 440-465.

[64] Hayes, D. C., Hunton, J. E., Reck, J. L. (2001). Market reactions to ERP implementation announcements. *Journal of Information Systems*, 15 (1) 8-17.

[65] Henig, M. I., Buchanan, J. T. (1996). Solving MCDM problems: Process concepts. *Journal of Multi-Criteria Decision Analysis*, 5, 3-12.

[66] Herbig, P. A., Kramer, H. (1994). The effect of information overload on the innovation choice process. *Journal of Consumer Marketing*, 11, 45-54.

[67] Hiltz, S. R., Turrof, M. (1985). Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM* 28(7), 680-689.

[68] Hoven, J. V. D. (1996). Executive support systems & decision making. *Journal of Systems Management*, 47 (2) 48-55.

[69] Huang, Z., Palvia, P. (2001). ERP implementation issues in advanced and developing countries. *Business Process Management Journal*, 7 (3) 276-284.

[70] Huber, G. P. (1990). A Theory of the Effects of Advanced Information Technologies on Organizational Design, Intelligence and Decision Making, *Academy of Management Review*. 5 (1) 47-71.

[71] Hunton, J., Wright, A., Wright, S. (2001). *Business and audit risks associated with ERP systems: knowledge differences between information systems audit specialists and financial auditors.* 4th European Conference on Accounting Information Systems (ECAIS), Athens.

[72] Hunton, J. E., McEwen, R. A., Wier, B. (2002). The Reaction of Financial Analysts to Enterprise Resource Planning (ERP) Implementation Plans. *Journal of Information Systems*, 16 (1) 1-10

[73] Hwang, M. I., Lin, J. W. (1999). Information Dimension, Information Overload and Decision Quality. *Journal of Information Science*, 25 (3) 213-218.

[74] Hyams, E. (1997). New technological horizons and opportunities for LIS. *The Electronic Library*, 15 (6) 455-461.

[75] Iastrebova, K. (2006). *Managers' information overload: The impact of coping strategies on decision making performance.* ERIM Ph.D. Series Research in Management 77, Erasmus University Rotterdam.

[76] Isenberg, D. J. (1984). How Senior Mangers Think. *Harvard Business Review*, p. 81-90.

[77] Jacoby, J. (1984). Perspectives on information overload. *Journal of consumer Research*, 10, 432-436.

[78] Jacoby, J., Speller, D. E., Berning, C. K. (1974). Brand choice behavior as a function of information load: Replication and extension. *The Journal of Consumer Research*, 1, 33-43.

[79] Janis, I. L. Mann, L. (1977). *Decision making, a psychological analysis of conflict, choice and commitmen*t. New York: The Free Press.

[80] Janssen, R., Poot, H. de. (2006). *Information overload: Why some people seem to suffer more than others*. Proceedings of the NordiCHI, 397-400.

[81] Jermias, J. (2001). Cognitive dissonance and resistance to change: The influence of commitment confirmation and feedback on judgement usefulness of accounting systems. *Accounting, Organizations and Society*, 26, 141-160

[82] Jones, Q. (1997). Virtual-communities, virtual-settlements & cyber-archaeology: A theoretical outline. *Journal of Computer Mediated Communication*, 3, 3. Retrieved August 2010 from http://www.ascusc.org/jcmc/vol3/issue3/jones.html

[83] Jorissen, A. (2001). Van fabrieksboekhouden tot organizational accounting: verleden, heden en toekomst van management accounting. *In*: W. Aerts and E. Deweirdt (Eds.), Accountancy in Beweging, Garant, Leuven-Apeldoorn, 368 blz.

[84] Kelly R. R. J., Watson, H. J. (1995b). What Does it Take for Successful Executive Information System? *Decision Support Systems,* 14 (2) 147-156.

[85] Kelly R. R. J., Watson, H. J. (1995a). The keys to executive information system success. *Journal of Management Information Systems*, 12 (2) 83-98.

[86] Krumbholz, M., Maiden, N. (2001). The implementation of enterprise resource-planning packages in different organizational and national cultures. *Information Systems*, 26, 185-204.

[87] Krumwiede, K. R. (1997). ABC adoption hits new high, but is ABC worth implementation costs? *Cost Manage. Update*, p. 1–3.

[88] Lawrence, P. R. (1954). How to deal with resistance to change. *Harvard Business Review*, 32, 49-66.

[89] Lawrence, P. R., Lorsch, J. (1967). *Organisation and Environment*. Boston MA: Harvard Business School, Division of Research.

[90] Leidner, D. E., Elam, J. J. (1994). Executive information systems: Their impact on executive decision making. *Journal of Management Information Systems*, 10 (3) 139-155.

[91] Libby, T., Waterhouse, J. H. (1996). Predicting change in management accounting systems, *Journal of Management Accounting Research*, 8, 137-54.

[92] Light, B., Holland, C. P., Wills, K. (2001). ERP and best of breed: a comparative analysis. *Business Process Management Journal*, 7 (3) 216-24.

[93] Maes, P. (1994). Agents that reduce work and information overload. *Communications of the ACM*, 37: 31-40

[94] Malhotra, N. K. (1982). Information load and consumer decision making. *The Journal of Consumer Research*, 8, 419-431.

[95] Malmi, T. (1997). Towards explaining activity-based costing failure: accounting and control in a decentralized organization. *Management Accounting Research*, 8, 459-480.

[96] March, J. G. (1994). *A Primer on Decision Making: How Decisions Happen*. New York: The Free Press.

[97] Markus, L. M. (1984). *System Design features, in: Systems in organizations*. Marshfield (MA): Pittman Publishing.

[98] Martin, W. (1995). *In*: The global information society (p. 170). Hampshire: Aslib Gower.

[99] McGowan, A. S., Klammer, P. (1997). Satisfaction with Activity-Based Cost Management Implementation. *Journal of Management Accounting Research* (9) 216-237.

[100] Merchant, K.A. & Manzoni, J. (July 1989). The Achievability of Budget Targets in Profit Centers: A Field Study. *Accounting Review*, July, p. 539-558.

[101] Meyer, J. (1998). Information overload in marketing management. *Marketing Intelligence & Planning*, 16, 200-209.

[102] Mia, L., Goyal, M. (1991). Span of Control, Task Interdependence and Usefulness of MAS Information in Not-for-profit Government Organizations. *Financial Accountability & Management*. 249-266.

[103] Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 63, 81-97.

[104] Mintzberg, H. (1973). *The Nature of Managerial Work*. New York: Harper & Row.

[105] Moutinho, L. (1993). The use of the analytic hierarchy process (AHP) in goal setting and goal assessment: The case of professional services companies. *Journal of Professional Services Marketing*, 8, 97-115.

[106] Nah, F. F. H., Lau, J. L. S., Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business Process Management Journal*, 7 (2), 285-96.

[107] Nelson, M. R. (2001). We have the information you want, but getting it will cost you: Being held hostage by information overload. Online [6/14/02]. Available at: http:// www. acm.org/crossroads /xrds1-1/mnelson.html.

[108] Nordgren, L. F., Bos, M. W., Dijksterhuis, A. (in press). The Best of Both Worlds: Integrating conscious and unconscious thought best solves complex decisions. *Journal of Experimental Social Psychology*.

[109] O'Connor, E. S. (1995). Paradoxes of participation: textual analysis and organizational change. *Organization Studies*, 16 (5) 769-803.

[110] Oppenheim, C. (1997). Managers' use and handling of information. *International Journal of Information Management*, 17 (4) 246.

[111] O'Reilly, C. A. (1980). Individuals and information overload in organizations: Is more necessarily better? *Academy of Management Journal*, 23, 684-696.

[112] Palaniswamy, R., Frank, T. (2000). Enhancing manufacturing performance with ERP systems. *Information Systems Management*, 17 (3) 18-28.

[113] Paul, D. R. (n.d.). Executive Information Systems: A Means of Eliminating Informational Overload Through Improved Decision Making. *St. Ambrose University*.

[114] Poston, P., Grabski, S. (2001). The impact of enterprise resource planning systems on firm performance. *In*: Proceedings of the First International Conference on Information System, Philadelphia, PA.

[115] Reuters Limited. (1996). Dying For Information? An Investigation into the Effects of Information Overload in Australia and Worldwide. London: Reuters Business Information.

[116] Rogers, E. M., Agarwala-Rogers, R. (1975). Organizational communication. *In:* Hanneman, G. L., McEwen, W. J. (eds.) Communication Behavior. Addision Wesley, Reading, Massachusetts, p. 218-236.

[117] Sagie A., Elizur, D., Koslowsky, M. (1996). Work Values: A Theoretical Overview and a Model of Their Effects. *Journal of Organizational Behaviour*. 17, 503-514.

[118] Scapens, R. W., Roberts, J. (1993). Accounting and control: A case study of resistance to accounting change. *Management Accounting Research*, 4, 1-32.

[119] Scapens, R. W., Jazayeri, M., Scapens, J. (1998). SAP: Integrated information systems and the implications for management accountants. *Management Accounting* (UK), September, p. 46-48.

[120] Schick, A. G., Gorden, L. A., Haka, S. (1990). Information overload: A temporal approach. *Accounting Organizations and Society*, 15, 199-220.

[121] Schneider, S. C. (1987). Information overload: Causes and consequences. *Human Systems Management*, 7, 143-153.

[122] Schroder, H. M., Driver, M. J., Streufert, S. (1967). *Human information processing – Individuals and groups functioning in complex social situations*. New York: Holt, Rinehart, & Winston.

[123] Schultze, U., Vandenbosch, B. (1998). Information overload in a groupware environment: now you see it, now you don't. *Journal of organizational computing and electronic commerce* 8 (2) 127-148.

[124] Scott, E., Kaindl, L. (2000). Enhancing functionality in an enterprise software package. *Information and Management*, 37, 111-122.

[125] Shang, S., Seddon, P. B. (2000). A comprehensive framework for classifying the benefits of ERP systems. *Information and Management*.

[126] Shapira, B., Shoval P., Hanani U. (1999). Experimentation with an information filtering system that combines cognitive and sociological filtering integrated with user stereotypes. *Decision Support Systems*, p. 5 – 24

[127] Shenk, D. (1997). *Data Smog: Surviving the Information Glut.* San Francisco: Harper.

[128] Siriginidi, S. R. (2000a). Enterprise resource planning: Business needs and technologies. *Industrial Management & Data Systems*, 100 (2) 81-88.

[129] Siriginidi, S. R. (2000b). Enterprise resource planning in re-engineering business. *Business Process Management Journal*, 6 (5) 376-91.

[130] Slack, N. (1991). *The Manufacturing Advantage: Achieving Competitive Manufacturing Operations*. London: Gold Arrow Publications Limited.

[131] Sorohan, E. G. (1994). Coping with overload. *Training & Development*, 48, 13

[132] Sparrow, P. R. (1999). Strategy and cognition: Understanding the role of management knowledge structures, organizational memory and information overload. *Creativity and Innovation Management*, 8, 140-149.

[133] Stadnyk, I., Kass, R. (1992). Modeling users' interests in information filters. *Communications of the ACM*, December, 35 (12) 49-50.

[134] Stefanou, J. C. (1999). Supply chain management (SCM) and organizational key factors for successful implementation of enterprise resource planning (ERP) systems. *In*: Proceedings of the Americas Conference on Information Systems (AMCIS), p. 800.

[135] Stefanou, J. C. (2002). Accounting information systems (AIS) development/acquisition approaches by Greek SME. *European Accounting Information System Conference* (ECAIS).

[136] Stevenson, M. (1994). He Sees All, He Knows All. *Canadian Business, Special Technology Issue, Spring*, 26-35.

[137] Swain, M. R., Haka, S. F. (2000). Effects of information load on capital budgeting decisions. *Behavioural Research in Accounting*, 12, 171-199.

[138] Tegenbos, J., Nieuwenhuysen, P. (1997). My kingdom for an agent? Evaluation of autonomy, an intelligent search agent for the internet. Online & CDROM Review, 21 (3) 139-145.

[139] Teng, J. T. C., Cheon, M. J., Grover, V. (1995). Decisions to outsource information system functions: testing a strategy-theoretic discrepancy model. *Decision Sciences* 26 (1) 75-103.

[140] Themistocleous, M., Irani, Z., O'Keefe, R. M. (2001). ERP and application integration: exploratory survey. *Business Process Management Journal*, 7 (3) 195-204.

[141] Tiessen, P., Waterhouse, J. H. (1983). Towards a descriptive theory of management accounting. *Accounting, Organizations and Society*, 8 (4/5) 251-267.

[142] Tushman, M. L., Nadler, D. A. (1978). Information processing as an integrating concept in organizational design. *Academy of Management Review*, 3 (3) 613-24.

[143] Vandenbosch, B., Huff, S. L. (1997). Searching and scanning: how executives obtain information from executive information systems. *MIS Quarterly*, 21 (1) 81-108.

[144] Wang, R. Y., Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems*, Spring, p. 5–33.

[145] Wood, T., Caldas, M. P. (2001). Reductionism and complex thinking during ERP implementations. *Business Process Management Journal*, 7 (5) 387-93.

[146] Wurman, R. S. (1990). Information anxiety. What to do when information doesn't tell you what you need to know. New York: Bantam Books.

[147] Young, D., Watson, H. J. (1995). Determinates of EIS Acceptance. *Information and Management*, 29 (1) 153-164.

[148] Zach, L. (1998). Executive Use of Information Technology. p. 1-5.

[149] Zimmerman, J. L. (2000). *Accounting for Decision Making and Control*, (3rd ed). New York: R.D. Irwin.