A Cognitive Model for Imparting an Effective Skill to Manage Information Overload, for the Sake of Improving the Solution Quality of Complex and Ill-Structured Problems

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Abstract

In our globalized world of an ever-changing reality supported by evolving technology, vast amounts of universally available information keep being produced constantly. The accelerated growth in the quantity of information strains the human brain beyond its capacities. In industrial and other organizations, the immediate consequences are economic, physical and emotional damage, both to the organization and to the individual. Technology attempts to offer solutions for the problem of coping with information overload, and the current study focuses on one such a solution in the assembly line of high-tech industry.

The aim of this study wasto tes a tool for optimal decision-making processes in solving technological problems. An optimal decision-making process requires the correct use of databases, the drawing of new data and the updating of existing data. Therefore, we assumed that an intervention that supports data processing by adjusting the information load to the worker and his or her needs might relieve the worker's sense of information overload. This relief might contribute to improvement in the quality of problem solutions and worker performance, and in all probability free human capacity for the benefit of a process of learning. The assumption was that the users' recognition of the system's contribution would lead them to have an interest in using it regularly.

The purpose of the study was to examine a cognitive model for acquiring effective information-overload management skills, to improve solutions for complex problems. The model is expressed by a regulative intervening computerized system, whose objectives were defined (vis-à-vis the implementing organization) as following: 1. To manage and process information for the sake of solving ill-structured problems, that is, problems of unclear purposes and missing information; 2. To present data visually and in quantities that fit human cognitive capacities. 3. To lead a process of problem solving that supports human procedures of data processing. 4. To record fully all the processes performed by the system. 5. To create a tool for enquiry and learning from historical statistical information, for the sake of improving the system performance. 6. To create a tool for investigating the human process of learning and decision-making, in order to construct a dynamic adjustment model for continuously improving the tool and the process of working with it.

The research question was how a dialogue with a regulative intervening computerized system would relieve the sense of information overload as perceived by the worker using this system and improve the quality of his solutions for complex and ill-structured problems.

Research procedure, method and tools: This study was conducted during a period of about 1 year, in the production organization of an international science-based high-tech firm. The process started at the stage of planning the system, proceeded with its practical development and ended with a pilot of its acceptance process. The process related to organizational needs and was accompanied by leaders and key players in the organization with their full support. The study was quantitative in its core (self-filled and supported questionnaires, observations, documents and data reports from the organizational information records), reinforced by a complementary qualitative study (focus groups, semi-structured personal interviews and open interviews).

The sampling comprised 25-30 of the plant production workers, at different points in time (the numbers changed due to personnel changes). The study group was examined in relation to its role as control group in the previous year.

The research assumptions and findings were as following. The first

Assumption 1, using the system will reduce employees' perceived overload, was corroborated by the results of the questionnaires that examined the sense of load, including perceived overload, emotional load, and task load. The findings support the assumption that the use of an "intervening system" will reduce the perceived overload among employees in all dimensions: perceived overload, emotional load, and task load.

Assumption 2, there will be a negative correlation between overload perception and employee willingness to use the system. This assumption was not confirmed. In contrast to the assumption, it was found out that the higher the perception of overload among employees, the greater the willingness to use the system. A medium positive correlation (Spearman's Rho) was found between willingness to use the system and overload, emotional and tasks. That is, the rising pressure also increased willingness to use the system. It is possible that in times of distress and pressure, workers have turned to the system as another channel through which a solution can be reached, and as a result, the willingness to use the system increased.

Assumption 3, there will be a positive correlation between the enjoyment and perceived ease of use in the system and employees' willingness to use the system. This assumption was not confirmed, based on the findings that indicated a lack of statistical significance in results the questionnaire that examined perceived ease of use and enjoyment. The findings were also supported by Spearman's rho correlation, which found no correlation between enjoyment and ease of use and the willingness of employees to use the system. Depth analysis examining each question individually, strengthened following insights: There was no frustration whatsoever when using the system; The more employees used the system, the greater their enjoyment; And even though the employees benefited to some extent from the use of the system, it was not created any conditional willingness to use it later on.

Assumption 4, using the system will improve the quality of solutions and employee's performance. This assumption was confirmed to some extent, based on the results of the questionnaire that examined the perceived characteristics of output and employees' performance. The questionnaire examined the extent to which the examinee assessed that the use of the system contributed to raise the quality of the workers' solutions and performance. There was a tendency to statistical significance, the more the system was used This confirms to a reasonable extent the research assumption that the use of the system will contribute to improving employees' solutions' quality and the performance. It seems that hints to lack of clear statistical significance was found in the quantitative questionnaire findings. Most employees thought that the system contributes only partially to improve quality of employees' solutions and performance, therefore they did not attribute any direct impact on the results to its use.

Assumption 5, there will be a positive correlation between improving employees' quality of solutions and performance and the willingness of employees to use the system. This assumption was not confirmed, based on Spearman's rho results. No correlation was found between employees' quality of solutions and performance and willingness to use the system.

Assumption 6, using the system will improve the employees' sense of satisfaction, of the system's contribution to the decision-making process in order to solve problems. This assumption was clearly confirmed, based on the results of the questionnaire that examined satisfaction with the achievement of the goal, process and outcomes. (SAT -

Satisfaction Attainment Theory). The questionnaire examined the extent to which the examinee assessed the benefit derived from the system in the process of solving the problem, while evaluating the entire process and the final outcomes that may be related. It was found that, over time, the level of employees' satisfaction with the use of the system increased. The results confirm the assumption that continued and constant use of the system will raise the level of satisfaction among users. This finding was also supported by qualitative findings that addressed the accompanying processes that included management focus, improvement of conditions on the ground, and the fact that the system improved and the user experience was taken into account.

Assumption 7, there will be a positive correlation between the feeling of satisfaction from the contribution of the system to the decision-making process in order to solve the problems and the employees' willingness to use it. This assumption was not supported, based on the Spearman's rho results, whereby not found a correlation between employees' quality of solutions and performance and employees' willingness to use the system.

Assumption 8, using the system will increase the assessment of its perceived benefit among employees. This assumption was confirmed to a great extent. The assumption was examined in light of the confirmation or negation of statements that related to the workers' sense of perceived usefulness of the system. That is, to what extent the examinee believed that the use of the system contributed to the improvement of his performance. It seems that most employees thought that using a computerized system is desirable and logical. Most of them noted that the use of the system does not impair the status of the worker, and they did not view it as a disruptive element in the work process.

Assuming 9, using the system will contribute to employee's performance improvement (both, at individual and organizational level), in terms of: increase the level of knowledge, improve learning ability and professionalism. This assumption was partially confirmed, based on informational questions and organizational data-based findings. The findings were examined by means of the following trends: one, an increase in the number of workers who applied directly to the system when a malfunction was identified, and the frequency of its use. Second, an increase in the number of employees who offered up-to-date information after the problem was solved

to ensure an up-to-date learning system. And third, an improvement in the six measures that assess organizational performance.

The findings from organizational systems indicated a trend of increased use of the system and more entrances as there were more failures. Although beyond a certain point of multiple malfunctions there was a significant drop. It seems that constant use of the system has facilitated overload perception and "increased" the employee's problem-solving ability both in terms of reducing the cognitive load level and in the sense of the number of mishaps they could cope with simultaneously or sequentially. As for the increase in the number of employees who offered up-to-date information after the repair of the problem, to ensure an up-to-date learning system. Findings from organizational systems showed that the number of "donors" to the quality of the system remained small, and only "devotees" took the trouble. The qualitative aspect offers several reasons for the unwillingness of most employees to contribute to the system, such as: harm to personal interests (prestige, status) or beliefs regarding the damage caused to the employee's independence and professionalism because of the technological system. As to the improvement in the six measures of organizational performance evaluation. The organizational reports collected from the machines and the reports of managers and employees in the organizational reporting systems reflected an improvement that was reflected in a significant reduction in the time of construction of each machine, an increase in the quality of the machines that reached the packaging quickly and an increase in the quality of the employees in terms of knowledge and professionalism, with all that this implies.

Additional findings relate to other aspects that inhibit the willingness of individuals to endorse and implement technology and innovation. For example, at the cognitive level these aspects are the lack of rationality in the process of decision-making, the power of habits, and the brain's tendency to avoid effort as much as possible. At the business level theses aspects include organizational commitment and resource-investment in the processes of adoption and acceptance, relating and committing to the optimal learning method for the individual as fitting learning principles commonly accepted today, from perspectives such as personalization and sharing. Finally, at the research level, the aspects are examining the trustworthiness and

up datedness of the research methods and tools, while relating to human cognitive limitations.

The theoretical contribution significantly exceeded the expected initial assessment. Originally, the estimated contribution referred to the level of the system only, and was intended to assess the compatibility between prior knowledge and information to which the user was exposed in the decision-making process through the intervention. In practice, the study contributed to expand knowledge related to human coping with the adoption of technology and information systems. It seems that technology adoption models that rely solely on quantitative measures and are focused only on technological aspects offer only partial insights and are not sufficient to predict optimally the actual willingness to adopt and use the technology or system. The research findings related to behavioral intentions and the best conditions in which the willingness to use technological information systems as tools for decision making and problem solving will be found. The information is relevant to all populations in every aspect of life.

On the practical level, the research contribution was initially perceived only at the level of the system, and focused on reduce information overloads and improve performance of individuals and groups in the organization. Here too, the research findings contribute significantly to the development of areas of learning and inclusion in every organization and aspect of life, beyond the use made at the local level.