The relationship between engineers' information needs and information use with respect to the organizational culture- a case study / Michal Avda David

ABSTRACT

The search for information and its utilization are part of every day life, and they are applied in many aspects of the business world. Information sources originate from analogue sources (not computerized or electronic) and from digital sources (electronic and on-line). The position held by the latter source is steadily growing, even in fields that have not traditionally been defined as information based, such as the construction and infrastructure industry, which is the focus of this study.

The main purpose of this study is to examine the relationship between the information needs of engineers and their use of information, while relating to organizational culture. The study of these relationships was conducted using a case study of the information system at an engineering company engaged in the field of construction and infrastructure. The assumption behind the basis for this study is that the use of information and the definition of the company's information needs are not only a procedure related to the transfer of information from one point to the other. Situated between these two points are the company's executives and employees who are influenced both by the professional and organizational culture and by processes related to the information; and they, in turn, have an impact on these factors as well.

The main objective of the study is subdivided into a number of secondary goals. The study examines whether and how each factor influences the other, whether or not this is a one-sided or reciprocal relationship, questions are addressed as to whether the nature of these relationships influences (expands or restricts) the engineers' actions and their information needs and the company's culture is evaluated. The second objective is to examine the influence of these three factors on the flow of various types of information at the engineering company and in the information systems, which serve the engineers in their work, as well as the use made by the engineers of this information and the information systems for their needs.

A third objective is to examine how the information personnel fit into the company, the manner in which they perform their duties and their importance and contribution to the engineers' work process in the company.

This study has adopted an approach whereby information science is a field in which many methodologies may be applied and there is no one research field or method that can completely incorporate the complexity and many aspects of the company. Therefore, in the literature review, there is a description of the variety of research methods, theories and philosophical approaches in the

field of information needs, information systems, theories which deal with management culture and theories which provide a clear and coherent picture of the complexity of the field.

Research Design:

The company selected for this study is engaged in the management and planning of construction and infrastructure projects, The company employees approximately thirty engineers as product managers, inspectors and planning coordinators. Ten engineers were interviewed based on their position in the company, the degree of their familiarity with the information system and their experience with using the system for engineering work, the duration of their employment in the company, age, gender and the location of the engineers' work (at the head office or at the construction sites). In addition, we interviewed the human resources department manager, who also serves as the information department manager, an employee in the information department and the head of the secretarial staff, who helps with the ongoing operation of the information system.

The company was selected based on the familiarity of the researcher with the field of Israeli engineering companies. From among all the companies, the company was selected which best suited the following criteria:

- 1. A company defined as an engineering company that is engaged in the fields of construction and/or infrastructure.
- 2. A company with an information system and whose engineers use and produce information using this system.
- 3. A company that employs at least 20 engineers, a human resources department manager, an information department manager and a department that deals with the information.

These criteria reflect the attention the company pays to the field of information and the ability to assess, via study of the company, the complex processes related to the company's organizational culture and the usefulness of the information systems.

Research Methods:

The study was conducted using a case study method, which provided an extensive understanding of the company's information needs and culture, which was necessary to describe the dynamics existing in the use of information in this framework. The study made use of qualitative research tools in a number of stages. In the first stage, an interview was conducted with the company's information department employee in order to become familiarized with the company. The information gathered in this interview was cross-referenced with the study's literature review. This cross-reference produced a mapping of the central topics and questions necessary for the next stage: an additional interview with the information department employee and interviews with the managers of the information and human resources departments. In addition, an interview was conducted with the head of the secretarial staff with regard to subjects related to the use of the information

system by the engineers. Moreover, the relevant procedures for the study were gathered from the company's internal procedure book.

The results of the interviews and the procedures were summarized in a detailed fashion, in order to provide a description of the engineer's information needs, the company's culture and its use of information, including the advantages and disadvantages. After processing the interview data, supplementary interviews were conducted with an information department employee and the managers of the information and human resources departments.

In the second stage, and based on the interview data analysis of the first stage, questions for interviews with the company's engineers were formulated. The first interview with the population of engineers was an experimental interview – following which the questions to the engineers' questionnaire were modified to better suit the study and its limitations.

The engineers' interview stage may be divided into two parts (hereinafter: stage 1 and stage 2). In stage 1, six engineers were interviewed with diverse characteristics related to the study. At the end of the part one of the engineers' interviews, there was a reevaluation of the continuation of the study, and a decision was made as to which interviewees would be interviewed in stage 2 of the engineers' interviews, according to their characteristics, In stage 2, four interviewees were selected with characteristics that were similar but not identical to the first six, such that it was possible on one hand to show a repetition of the variety of questions and on the other, to show additional aspects of the use of the information system. After completing the ten engineers' interviews, an evaluation of the findings indicated that the range of the questions was diverse and comprehensive, and there was no need to increase the number of interviewees.

Findings and Conclusions:

This study indicates that the company's organizational culture influences the information system structure (one of the aspects of information use) and this structure influences the meeting to the engineers' needs.

The study found that the company's organizational culture is characterized by placing great importance on achieving engineering work goals. The information systems are built in such a way that they may help the engineers achieve these goals. The engineers use the systems in order to perform their jobs, even if they do not meet all of their information needs. In actuality, the company's information system functions because it incorporates the possibility of completing the work process to the relative satisfaction of the company's management. As such, the information system, despite the disadvantages indicated in the study, provides a partial answer to the engineers' needs, since it enables them to meet the company's requirements and to perform their engineering work.

The study indicated that the engineers' professional culture influences their preference to use various types of information systems, types of information and information channels (one of the aspects of the information needs) and that these preferences influences the use made by the engineers of the information system.

Use of types of information systems — The engineers' use of the non-electronic system is the most prevalent. Their use of the electronic system is partial and assists the mediating factors, and the use of the on-line system is the least prevalent. The engineers' preference is contingent upon their perception of the benefit produced by the use of the system, the ease of the system's use and operation, availability of assistance in using the system, its reliability, the engineers' technological know-how and skills, the support and supervision the engineers' receive from the company in using the systems and the flow of information within the company.

Internal or external information – The engineers prefer to use internal materials, which are found within the company. The engineers who work at the construction sites used the information that was received from outside the information system more often than the engineers who work at the head office.

The official nature of the information – The engineers' use of the official information depends on the party with whom they exchange information with, the working stage and the work method used by the engineer.

The study indicated that the engineers' organizational and professional culture influenced their preference to change the available information system and to modify it to meet their information needs.

The study indicated that there is partial coordination between the company's organizational culture and the components related to the successful assimilation of the information technologies. This partial coordination points to the partial assimilation of the company's information systems and specifically, the electronic and on-line systems. The problem with the assimilation stems from the fact that the engineers feel that the company does not meet their information needs. This situation creates a lack of satisfaction among some of the engineers due to the fact that the relevant parties in the company do not look for or offer solutions for these needs, such as a change in the information system.

In addition, according to their professional culture, the engineers expect the information system to suit their needs in the best possible manner. This suitability is sometimes expressed in the engineers' need to operate uniform methods for the use of information by all the engineers. The company policy facilitates work methods and flexible information uses, which do not

necessarily suit the engineers' information needs. Consequently, a conflict exists between the company's goals and the suiting of the information system to suit the needs of the engineers. An additional ramification is that the engineers identify more with their professional culture which is expressed in their expectation that the system be modified, rather than with the company's norms, as they are incorporated in the existing system.

The study indicates that there is an impact made by the company's values, norms and practices (one of the organizational culture aspects) on the engineers' needs and these needs influence the engineers' use of the information.

The study indicated that the engineers prefer to use the non-electronic system because there is uniformity between the values, norms and practices related to its use; i.e., the values, norms and practices do not contradict one another. This is in contrast with the electronic information system in which there is a contradiction between the three, which reduces the preference to use this system. This fact also indirectly influences the on-line information system that is based on the use of the electronic system.

The study indicates that involving the employees in the decision making process (one of the aspects of the organizational culture) did not influence the coordination between the engineers' information needs and the information system available to them.

The study indicates that involving the employees in the decision making related to information does not bring about the desired results - suiting the information system to the engineers' needs. For example, it was found that the process of including the engineers while relating to their needs when planning the on-line information system was unsuccessful: The engineers are not satisfied with the use of the system and their needs for saving time and for more efficiency were not fully met. One of the reasons for the problems in assimilation is the difficulty in assimilating the use of the system among parties related to the project, and the engineers themselves are also hesitant to use the system. Moreover, the company management does not completely support the use of the system, despite its declarations. This is due to the fact that the company management is aware of the engineers' problems in using the system, but it does not maintain an open dialogue with them to find a solution and suit the system to their needs. Another reason for the problem in assimilating the system is the fact that the engineers do not receive assistance in using the system, although this assistance is provided as a company norm when using the electronic system.

The study indicates that the company's norms (one of the organizational culture aspects) have an impact on the information system structure (expressed in the use of information) and this use influences the ability to meet the engineers' needs.

The study indicates that there is a problem with the flow of information between the head office and the construction sites (and among themselves). With the exception of two cases, the computers at the construction sites are not connected to the computer network at the head office. The engineers have expressed a need to be connected to the head office, but only a very small number of them know that a solution exists, and an even smaller number have actually been connected. This need of the engineers is practically unsatisfied, and the engineers are forced to come to the head office or to ask for assistance from its employees, in order to search for information necessary for their work. The structure of this information system is influenced by the company's existing norm whereby it is not possible to create one computer network that connects the main office and the construction sites, due to security considerations. The company perceives itself as a company which does not specialize in the field of computers and therefore has chosen not to find a solution to the security problems and not to create one computer network.

The study found that the norms set forth by the company's general managers for the use of information (one of the organizational culture aspects) impact their use of the information, and this use influences the meeting of the engineers' needs.

The study indicated that there is a lack of consensus among the general managers and a disconnection in the flow of information between them; i.e., with regard to operating a joint computer network for the entire company and meeting the security requirements. The fact that the general managers express different options that influence the company's work methods, the flow of information between them and the various work methods employed b them, has a negative influence on the engineers' use of the information system and the meeting of the engineers' needs.

The study indicates that the engineers' needs influence the use of the information system and the information system influences the meeting of the engineers' information needs (reciprocal influence).

Many of the engineers are not trained to use an electronic information system and therefore, are dependent on the information department in order to utilize it. This situation does not enable a speedy and immediate answer to the engineers' needs. In order to make the work more efficient, auxiliary staff is used, which creates dependence the staff and slows down the service it provides to the engineers. In effect, the use of auxiliary staff leads to a lack of efficiency in the work process.

The study found that the policy of the information and human resources departments (one of the organizational culture aspects) has an impact on the use of the information, and this use influences the meeting of the engineers' needs.

The study found that the information and human resources departments have a great impact on the organizational culture through their policy regarding the use of information (the use of the information system and particularly computers and software, supervision policy, work methods and procedures) as well as attitudes toward the engineers' information needs. Additionally, the information department employees and other auxiliary parties at the company (the secretarial staff and the typist) help in the practical application of this policy.

The information department manager's policy (with regard to the use of information) and the policy of the human resources manager (with regard to procedures, work methods and supervision) are policies which at first glance do not pertain to the needs of the engineers, enable them to use the information in a manner which suits them and place the responsibility in their hands as to finding solutions to their needs. In actuality, the engineers rarely use the information outside of the information system and note that the company management (namely, the information department) should be responsible for finding solutions to problems faced by the engineers when making use of the information.

Moreover, the information department and human resources department managers have become resigned to this situation where the engineers who lack technological skills do not fully utilize the information system. In this way, the company's lack of use of the information becomes a given, since even those with skills do not fully utilize their potential ability, and become accustomed to not utilizing the information system themselves, since the company enables them to become dependent on the auxiliary staff at the main office.

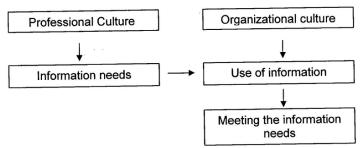
A summary of the findings and conclusions indicates that:

- 1. The organizational culture influences the use of information.
- 2. The use of information influences the meeting of the engineers' needs.
- 3. The engineers' professional culture influences the engineers' information needs.
- 4. The information needs influence the use of the information system.

These conclusions show that there is a great importance to the culture in influencing the information needs and the utilization of the information at the company. The organizational culture, outlined by the management, influences the structure of the information system and its use by the engineers. Depending on this use, the engineers' needs are or are not met. On the other hand, the engineers' professional culture has a direct connection to the definition of their needs, which also influence the use of information.

The connection found between the needs, the uses and the company's culture may be seen in Diagram no. 1:

<u>Diagram no. 1: The connection between the needs, uses and company</u> culture



The following recommendations are indicated by the research conclusions:

As indicated in this study, the company management feels it is important that the engineers use the technology that suits them. However, due to the dependency the engineers have upon the information system that the company makes available to them (for example, due to the information system structure, the management's resignation with the engineers' skills and the partial and selective operation of the company's supervision system), the technology is not flexible nor is it available to all the engineers; and as such, this decreases the engineers' willingness to use it. Consequently, the solutions for the engineers' needs must be examined using a broader perspective, in order to create more appropriate patterns for the use of the company's information.

These findings indicate the importance of the company in managing the changes that transpire, including the establishment of a supervision system with clear objectives, creating basic uniform skills of all the engineers and providing closer support for the assimilation of complex systems, such as the system for managing projects on the internet.

Many of the solutions for the engineers' needs and the ability to suit the information system to these needs may be applied, provided that the company chooses to adopt an official strategy and apply it among the engineers. In addition, the company's attempt to study the engineers' needs in an active manner, may help these needs rise to the surface, and bring about solutions, including the application of solutions which are found outside the framework of the company's existing information system. For instance, a solution for the engineers' need to take unofficial steps in order to use the information system may be found by simplifying the information system and searching for technologies which enable the engineers to use the official information system in an efficient and orderly fashion.

Accordingly, the information department must conduct an evaluation of the information needs of the engineers on a regular basis in order to suit the system to them. However, at the same time, it must define the systems boundaries and assist the engineers in suiting themselves to the system and the company's information policy. For example, instead of accepting the

technological skills and given practices of the engineers working at the company, norms may be created regarding the use of information, in order to facilitate the creation of strategies for the proper use of information in the entire company; to assimilate the importance of the use of the information system among the engineers; to designate uniform work methods among the general managers who set an example; to provide equal assistance to the engineers' work in the various locations and positions and to operate a supervision system to support this strategy. In this way, the needs of the engineers may be met and the company's work will be made more efficient.

This study found that there was no uniformity between the values, the norms and the practices in the utilization of the electronic and on-line systems. One of the central reasons for this is the fact that the company's management does not have one strategy designed to facilitate the use of its desired information and to do away with its undesired use. It operates various strategies with the various engineers. The unification of the values, norms and practices related to the field of electronic and online information systems will convey a uniform message to the engineers and help in the use of these systems.

One of the reasons for the difficulties in assimilating the on-line system is the fact that among the engineers themselves there are reservations with regard to the use of the system, and the company management does not completely support this use, despite its declarations. This is because the company management is aware of the engineers' problems in using the system, but does not maintain an open dialogue with them to find a solution. The solution to the problem of assimilating the system may be seen as an attempt by the company management to continue the dialogue with the engineers even after the system is planned and support for its use is provided, in light of failure in this field in recent years.

Use of this on-line system necessitate a significant change in the company's organizational culture, since it not only involves the teaching of electronic and on-line skills to the engineers necessary to use the system and reducing their dependency on the information department and the secretarial staff, but also necessitate a change in the company's perception that the use of an on-line information system do not require special specialization and can be utilize in the engineers' work process. This change must include the company's management and the senior engineers, whom some of them possess perceptions and work methods that oppose it.

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