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Effects of Information Technologies on Organizational Culture: A Discussion Based on the Key Role of Organizational Structure

Eser Erdurmazli

Abstract

This chapter discusses the influences of information technologies on cultural features of organizations with an emphasis on the concept of “organizational structure” because research shows that organizational culture and organizational structure are in a very close relationship. In this regard, it argues that information technologies can have direct and indirect effects on organizational cultures based on the information technologies’ influences on organizational structures and the processes, activities, and human relations within these structures. Underlining different and controversial approaches and findings in the literature, this study makes some deductions by referring to important features of information technologies and organizational culture. Therefore, the approaches and evaluations given here are thought to be useful for the practitioners and students who are interested in the subject and the academic staff who are interested in doing research on this subject.

Keywords: organizational culture, organizational structure, information technologies, information, knowledge

1. Introduction

Today, information has become the main component of what we produce, do, buy, and consume. Having an economic value in almost all products and services that meet the needs of today’s societies, it has been now obligatory for individuals and organizations to obtain information technologies and to actively use them in both work and social life domains. Hence, in the current information age, where information is seen as power, this situation has made it imperative for organizations to become increasingly information-based and to benefit from information technologies in many processes and activities.

The intensive use of information technologies in many functions and processes has also required some changes in organizations [1]. This is due to the fact that information technologies, unlike traditional technologies, do not only change the technical fields but also affect the communication channels, decision-making functions and mechanisms, control, etc. [2]. Consequently, one of the most striking

developments is on organizational structures that are becoming increasingly flattened and horizontal. Relatedly, information technologies have begun to take over the role of middle management, which supports decision-making processes of senior management and has reduced the importance of this level [3–5]. Similarly, while information technologies enable managers to obtain faster, more accurate, and more information [6–8], it also provides lower-level managers with more information about the general situation of the organization, the nature of current problems, and important organizational matters [9–12].

Moreover, information technologies also have an important potential in determining whether organizations have a mechanical or an organic structure [13]. Within the mechanical organizational structures, people do not have much autonomy, and behaviors expected from employees are being careful and obedience to upper authority and respect for traditions. In such organizations, predictability, consistency, and stability are desirable phenomena. In contrast, people in organic structures have more freedom in shaping and controlling their activities, and being enthusiastic, creative, and taking risks have important places among the desired behaviors [14].

Accordingly, information technologies begin to influence the cultural values of the organization over time, through these transformations they create on organizational structures, processes, and operations. In other words, the fact that organizational structures are mechanical or organic causes the formation of diverse cultural values in organizations [15]. Therefore, the desired cultural values in mechanical organizations are quite different from those in organic structures [1, 16, 17]. In this context, *this chapter deals with the influences of information technologies on cultural characteristics of organizations along with the reflections of the use of these technologies on organizational structures and their functioning.*

When we look at studies on the relations between organizational culture and information technologies, we generally see the studies on the effects of culture on technology adaptation or use [18–21], as well as on the effects of certain specific information technologies and applications (e.g., e-mail use, group support practices, etc.) on some aspects of any organizational culture [22–31]. However, the number of studies that consider the use of information technologies as a “whole” and that address “why” and “how” its effects on organizational culture occurred is still limited. And so, *this chapter aims to examine and discuss the overall effects of the usage and intensity of information technologies established in organizations on the cultural life within.*

In this context, the chapter plan is as follows: *Firstly*, the basic concepts related to information and information technologies are included. Emphasis is placed on the meaning differences between knowledge and information, and their connections to information technologies are tried to be explained briefly. *Secondly*, the effects of information technologies on organizational structure are given particular attention. The reason for this is that as a system of values, beliefs, assumptions, and practices [32], organizational culture encompasses many features closely related to structures of organizations. *Thirdly*, possible links between organizational structure and organizational culture are included. *Fourthly*, important theoretical approaches and studies on the relationships between information technologies and organizational culture are provided. *Finally*, by deepening a bit more and by emphasizing key points, some important arguments are discussed.

2. Information and information technologies

In the literature, the concepts of information and knowledge are sometimes expressed by a single term, “information.” However, although the concepts of knowledge and information are intertwined, they are two different concepts that

have different meanings and describe different phenomena. The reason for this is that knowledge is also included in the concept of information as it is transformed into a commodity when it begins to be processed, stored, and shared by information technologies.

Becoming the basic elements of today's economic, social, and cultural systems, information is obtained in a certain hierarchy. The images are at the beginning of the process, and the process is completed with a hierarchical staging in the form of data, information, and knowledge, respectively [33]. *Image* is located in the first step of the process. Humans copy the picture of any object and event they previously perceived by sensory organs. When faced with a similar phenomenon in the later stages of life, these pictures in the mind are redesigned. We call these pictures of realities occurring in the human mind as images [33]. The next stage, the *data*, contains symbols that represent events and their properties. For this reason, data are expressed as figures and/or facts without content and interpretation [34]. *Information* that constitutes the next stage of the process and is mixed with knowledge and used interchangeably is expressed as a reporting of one system's own status to another system [33]. In information, associated data are combined for a specific purpose. Therefore, we can explain information as meaningful data [35]. *Knowledge*, on the other hand, is defined as personalized information that allows people to fully and accurately grasp what is happening around them and manifests itself in the form of thoughts, insights, intuition, ideas, lessons learned, practices, and experiences [36]. According to Kautz and Thaysen [37] who stated that knowledge is found only in the people's minds, knowledge is, therefore, a subjective formation. In other words, knowledge is the form of information enriched with interpretation, analysis, and context [38]. However, here, it should be emphasized again by highlighting a very important issue that *knowledge is also accepted as information when this knowledge begins to be processed, stored, shared, and used over information technologies*. Therefore, after this, when talking about information, one should consider not only the information created by the data brought together in a meaningful way but also the knowledge shared and used over information technologies.

On the other hand, *information technologies*, used as the most important tool of generating value today, are defined as the technologies that enable processes such as recording and storing data, producing information through certain operational processes, and accessing, storing, and transmitting this produced information effectively and efficiently [39–46]. The term information technologies is used to cover computer and electronic communication technologies, as they are now inseparably intertwined in literature and everyday use and are generally used in this way [47]. In this context, data processing systems, management information systems (MIS), office automation systems, executive support systems, expert systems, intranet and extranet, electronic mail (e-mail), group applications (groupware), database management systems, decision support systems, artificial intelligence, and telecommunication systems can be given as examples of information technologies [33, 48, 49].

3. Information technologies and organizational structure

Towards the end of the twentieth century, the rapid changes with the impact of developments in information technologies led to the emergence of customer satisfaction-based, learning, knowledge-based, and constantly changing organizations [50]. The fact that organizations have become considerably information-based and benefit from information technologies intensively in their activities and processes has made also the changes in their organizational structures mandatory [1]. Accordingly, the effects of information technologies on organizational

structure will be summarized under the subtitles of differentiation, centralization, and standardization/formalization, which are the three main components of organizational structure [15].

3.1 Effects of information technologies on differentiation

Differentiation within an organization occurs in three ways: Specialization/division of labor, horizontal and vertical differentiation, and hierarchy and size [15]. Specialization refers to the amount of different expertise or types of work [51, 52]. Specialization generally increases the number of subunits and makes it harder to understand the larger structure that people contribute to with their skills and expertise [53]. Information technologies have the potential to reduce this tendency by providing more access to information and experts at this point. In this way, access to information resources provides synergy [54].

Vertical and horizontal differentiation refers to the amount of hierarchical levels in an organization [55]. Information technologies, with the support of problem solving and decision-making, lead to the emergence of more flattened organizational structures as they require fewer levels within the hierarchy [56]. Since information technologies give employees in lower positions more autonomy to harmonize their activities, this can allow them to find and try better methods while performing their work. In this context, we can increasingly see that organizational structures have become horizontal and strengthened and that virtual organizations have begun to emerge as the most cost-effective structure [17].

In terms of hierarchy and size, Heinze and Stuart [4] argue that the mid-level management staff is unnecessary, increases bureaucracy, reduces efficiency, and has no function in organizations any more. Since most of the tasks performed by mid-level executives can be fulfilled by computers, both less costly and faster, information technology has begun to take over the role of mid-level management, which supports the decision-making process of senior management [5]. Sharing the same opinion, Fulk and DeSanctis [57] also stated that the largely witnessed situation in modern organizational designs is the reduction of intermediate-level managers and administrative support.

3.2 Effects of information technologies on centralization

Centralization points to the extent to which decision-making power within an organization is scattered or centered [58]. Due to increasing local and global competition, many companies have started to leave their strategic decision-making task further down the organization to benefit from the expert people with more precise and timely local knowledge [10]. Information technologies affect these efforts directly in two ways. Firstly, information technologies increase local knowledge by contributing to obtaining closer information about market trends, opportunities, and customers. Secondly, information technologies can create synergies for organizations because, thanks to information technologies, communication and coordination between distributed decision makers, central planners, and senior managers can be realized more effectively and efficiently [59].

However, whether information technologies will lead to centralization or decentralization is a very controversial question. Regarding centralization, it enables managers to acquire faster, more accurate, and more information, reduces uncertainty, and allows them to make decisions that they cannot make before [6–8]. Conversely, by the use of other forms of information technologies (e.g., electronic bulletin boards), decentralization provides more information to lower- and mid-level managers about the general situation of the organization and the

nature of current matters and problems [9–12]. Raymond et al. [60] argued that because information technologies facilitate the use and transmission of information by all levels and units in the organization, it enables top management, which is the decision authority, to be disabled in certain areas and the decentralization of control. Thach and Woodman [61] maintained that this is due to the fact that as a result of sharing information at lower levels with the help of information technologies, this power of senior management has decreased to a certain extent, and the knowledge and participation of the staff in organizational matters have increased.

The literature shows that information technologies allow both centralization and decentralization. Researchers are in the agreement that information technologies make it possible for organizational managers to leave their decision-making power to a large part of the hierarchical levels without compromising the quality and timeliness of the decision [62, 63]. Keen [64] combined the concepts of centralization and decentralization and used the term “federated organization” in which organizations do not have to choose either because information technologies simultaneously allow centralization-decentralization [64, 65].

3.3 Effects of information technologies on standardization/formalization

Formalization is the process of detailing how activities are coordinated for organizational purposes in order for employees and organizational units to respond routinely to recurring situations [51, 66]. Formalization involves rules, instructions, shared values, and norms [67]. In fact, formalization is based on the objective of more efficiency and less uncertainty [13].

Information technologies provide the ability to reduce the negative effects of formalization by facilitating the documenting and retrieving of information on organizational occurrences and endeavors that make behaviors and processes more consistent through formalization [63]. The more information technologies assist in reducing search times and preventing downtime, the more the administrative cost of formalization decreases and the productivity increases, which ultimately benefits the path to innovation [68].

4. Organizational structure and organization culture

Different organizational structures lead to the development of different cultural values [15]. The fact that the structure which an organization has established to control its activities and is defined as a formal system consisting of duties and authority relations is mechanical or organic causes the emergence of completely different cultural values, rules, and norms [69]. While mechanical structures are vertical, highly centralized, and almost everything in them are standardized, organic structures are horizontal, decentralized, and based on mutual adaptation [14]. People feel relatively less autonomous in vertical and centralized organizations, and being careful, obeying the upper authority, and respecting traditions are among the desired behaviors. Therefore, in a mechanical organizational structure, there are cultural values where predictability and stability are important [69]. In contrast, in horizontal and decentralized organizations, people can freely choose their own activities and control them. Creativity, courage, and risk-taking are given importance as desired behaviors. Therefore, organic structures contribute to the formation of cultures that value innovation and flexibility [15].

Organizational structure is also important for the development of cultural values that support integration and coordination. In a structure with stable task and role relations, sharing of rules and norms is more since there will be no

communication problems and the information flow will be fast [70]. In organizations where the sharing of cultural values, norms, and rules is at a high level, the level of performance also increases [15]. Particularly in team or matrix structures where face-to-face communication is intense, the sharing of these cultural values and common reactions to the problems develop more rapidly [9].

Whether an organization is centralized or not causes different cultural values to emerge. In decentralized structures, authority is divided into subordinate levels, and an environment is created for the formation of cultural values in which creativity and innovation are rewarded [13]. Employees are allowed to use the organization's resources and work in projects that they want, by spending some of their time in these projects, thus contributing to the production of innovative and creative products and services [15]. The structures of such organizations constitute the cultural values that give their employees the message "as long as it is in the interest of the organization, it is okay to do things in an innovative and the way you want."

Conversely, in some organizations, it may be more important for employees not to decide on their own and all activities to be followed and controlled by their superiors. In such cases, a centralized structure is preferred to create cultural values that will ensure accountability and obedience [71]. Through norms and rules, all employees are expected to behave honestly and consistently and inform their superiors about wrongs or mistakes, because this is the only acceptable form of behavior within these structures [72].

5. Information technologies and organization culture

Since working on the factors that determine the consequences of the adoption and use of information technologies, researchers have focused on people's beliefs, values, assumptions, and codes of conduct. As a result, they have given names to this research field such as "socio-technical systems," "social system," "social structure," and most recently "culture" [73]. For example, Markus and Robey [23] using "social elements" and Barley [26] using "social system" or "social structure" tried to explain this phenomenon. When examined more closely, it is seen that the details that these authors emphasize while depicting the case are the assumptions, beliefs, and values that exist in common among the group members, and this corresponds to the definition of organizational culture.

Research examining the relationships between information technologies and values, beliefs, and norms belonging to a particular group has gone through certain stages and used rich and complex research models to explain the relationships in each of these stages [74]. In the first studies on information technology applications, it has been suggested that information technologies cause changes in various organizational phenomena including structural features and thus have certain effects on organizations [74]. For instance, in some studies on adoption of groupware software, several researchers have used this deterministic approach to describe how groupware use affects communication and collaboration among employees and their productivity [27, 28]. These studies assume that certain results will certainly emerge after the adoption of information technologies, without considering the motives or activities that shape the use of information technologies by managers and employees. Like much more deterministic studies, these authors often assumed that information technologies would have predetermined influences on the adoption of information technologies, regardless of the environment in which information technologies were applied, how they were applied, and the users' specific behaviors and particular purposes.

The second group of views concerning the relationships between organizational culture and information technologies includes the fact that information technologies are seen as a tool that can be used for any change that managers desire to make in organizational practices [22]. In studies in this approach, researchers believe that there is a wide range of possibilities to identify changes in organizational culture, structure, processes, and performance [22, 75]. Researchers from this tradition presume that with the right choice of information technologies and appropriate system design, managers can achieve whatever goals they desire.

These works were mostly adopted in the 1980s and reflect a perspective that managers think can manipulate organizational culture in the way they want. Often called “management and control,” “a functional or instrumental approach” to organizational culture, this methodology has caused serious debate in the literature [76]. This approach attributes great powers to the management level in this regard, which conflicts with anthropologists’ views that culture cannot be consciously controlled and goes much deeper to understand it [76]. Robey and Azevido [77] also do not accept the rational thought on the assumption that culture can be manipulated directly in this way.

Studies with this rational perspective in the information technology literature assume that managers can use information technologies as a leverage to make changes in the norms of behavior, strategy, structure, and performance among members within the organization. For example, in studies on group support systems (GSS), we find managers’ beliefs that they can use collaborative technologies to create a more cooperative organizational culture. This perspective was not accepted by Karsten [78] and some experimental research on GSS [30, 79]. Organizational necessity is no longer accepted, as it is viewed by information technology researchers as an overly simple approach [23, 80].

Researchers who take another approach suggest that information technologies and organizational culture can interact with each other to produce various results [22, 23]. These results can be in the form of adoption and effective use of information technologies (if there is a harmony between organizational culture and information technologies) or user reluctance, refusal, or sabotage (if no fit). Researchers who have been working on information systems since the 1980s have focused on understanding information technology features and functionality that cause effective or problematic information technology applications and the interaction between users’ values, assumptions, and other elements of organizational culture. In this regard, Romm et al. [81] argued that many forms of information technologies comprise cultural assumptions embedded within themselves and these assumptions may conflict with existing values of a particular organization. The authors argued that these embedded assumptions present information technologies as a “cultural boundary” and that a cultural analysis should be made to predict compliance or incompatibility. The authors in this approach warn managers to think of organizational culture as a binding limitation in information technology applications. In a warning by Pliskin et al. [76], managers are advised not to try to change the culture of the organization. Regarding this issue, Orlikowski [30] cites Lotus Notes (a group software) application at Alpha Corporation, a consultancy company. In this example, this system, which was established by the CEO of the company only with the benefits to be obtained, did not create the expected effects, became unsuccessful, and disappointed due to reasons such as no cultural analysis and inadequate training. Employees responded to the use of Notes with resistance and refrained from using it. The reason for this was that the employees in this organization, which had a competitive culture where information was seen as a power, avoided sharing information with others. As a result, this incompatibility between

the collaborative culture that Notes had in itself and the competitive culture of the organization in question had failed this application of information technologies.

In a different approach, it is stated that information technologies and culture are not fixed and they are more flexible in terms of change [23, 75]. Managers in this approach may set specific goals for the use of information technologies, but actual results of the use of information technologies are not deterministic, and results cannot be predicted or controlled even under the best conditions [23]. The effects of information technologies are not deterministic because technology has interpretable flexibility considering that it can have different meanings for different employees. Similar technology can be interpreted in a different way by distinct people, based on certain assumptions, beliefs, and values. Robey and coauthors [24, 25], for instance, showed that it would be an empty attempt for organizational managers to try to intentionally manipulate the effects of these technologies, since there are many ways that diverse employees can configure a particular technology in different social environments.

Gopal and Prasad [31] also achieved similar results in their work on group support system (GSS), claiming that for researchers seeking fixed laws or regulations on how information technologies affect user behaviors, this would be an impossible goal to pursue. Conversely, the results of using information technologies depend on the symbolic meanings that information technologies have for a particular user. This work of Gopal and Prasad [31] expresses similar results with the work of Barley [26] and Robey and Sahay [25]. The authors stated that the symbolic meanings of certain technologies for users affect their perceptions of information technologies and their specific behaviors.

6. Discussions

In the light of the above-mentioned approaches, arguments, and important studies in the literature, it will be useful to discuss some important points by deepening a little more and by emphasizing the key features related to the concepts of information, information technologies, and organizational culture.

First, organizational culture is a complex phenomenon that develops and changes in a historical process [32, 82, 83]. Thus, although it might seem like a plain and simple concept, organizational culture includes many subdimensions and processes. When considered as a complex pattern of these interactions of many factors with each other, it is also a difficult process to identify the direct and indirect effects of information technologies on organizational culture within this cluster of relationships and interactions. Moreover, culture is not a phenomenon that changes and develops in a short time and is therefore open to manipulations of managers. On the contrary, from this point of view, it is not possible to easily achieve control over cultural changes, and it is necessary to go much deeper [76]. So, it is not rational to expect that the rapid developments and changes in information technologies will cause changes in cultural characteristics at the same speed. In this sense, it could be inaccurate to seek direct relationships between two phenomena in question, whose rates of change are quite different.

Second, for cultural changes, there must also be changes in the basic assumptions, beliefs, and values on which the culture is built [84]. It would be misleading to expect little or intensive use of information technologies to cause changes in these rooted assumptions. For the desired changes in these basic assumptions, beliefs, and values, it is necessary to design the structure accordingly, to recruit employees who are qualified for the targeted culture, and to set ethical values and property rights to employees in accordance with this culture [15]. In this sense, information technologies may only catalyze the contribution of organizational structure to organizational culture.

Third, there are many and different types of hardware and software that fall under the scope of information technologies. It is not logical to accept all of them as homogeneous technologies in all aspects (with the same functions and features, similar usage areas, standard conditions they are applied, similar intentions, and behaviors of all users), and it can be, therefore, misleading to carry out research under a single “IT” concept from this perspective. The reason for this is that, as stated in the sections above, cultural features of each information technology application or product embedded in it might be different. The interactions between the cultural characteristics of the environment in which information technologies are applied and the unique cultural contents of information technologies may cause different results on the culture of the organization.

Fourth, contrary to what is believed, some of cultural features that we anticipate to support information technology applications and products may be interpreted otherwise by diverse people contingent on different assumptions, beliefs, and values. In fact, Robey et al. [24, 25] showed that managers cannot control the effects of these technologies, since different users can configure a particular technology in numerous ways in different social environments. Also, Gopal and Prasad [31] argued that this would be an impossible achievement for researchers looking for fixed laws or regulations on how information technologies affect user behaviors.

Fifth, information technologies were defined above as technologies that enable processing, storage, and sharing of information. The key concept in this definition is “knowledge-based” information and not the technology itself. Therefore, what makes information technologies essential and important is the information itself. According to the definition of knowledge, the most significant characteristic that differentiates it from information is its being a product of the human mind [37]. Because knowledge is the interpretation of information and expresses the value produced from it, qualifying information technologies as good-bad, useful-useless, and necessary-unnecessary can be a meaningless evaluation. So, the basic thing that creates value-added for organizations is not the technology used but the information itself, which is processed, stored, and shared on this technology. In this context, even if it is the latest, most advanced, and most expensive technology in the world, if the organization does not have a qualified human resource capable of producing knowledge that will create value-added, an appropriate organizational structure and culture that will activate this creative potential, and a management approach, all investments in these technologies will also be wasted.

7. Conclusions

This chapter has aimed to examine the impacts of information technologies on organizations’ cultures, and for this purpose, a special emphasis is given to the concept of “organizational structure” within the theoretical framework presented above. The most important reason for this is that relevant literature shows that organizational culture and organizational structure are in a very close relationship. Indeed, when the question items in the Denison organizational culture scale [85], which is the most frequently used in the literature, are examined, it is possible to see that most of these items point to many features of organizational structure concerning centralization, formalization, and differentiation dimensions. Therefore, it is a very rational approach to expect that information technologies can have direct and indirect effects on organizational cultures based on the influences of information technologies on structures of organizations. However, it should be underlined that different and controversial approaches and findings in the literature mentioned

above on the relations between information technologies and organizational culture generate question marks in the minds as well.

In this regard, it is already quite difficult to draw a clear picture of the impacts of information technologies on cultural characteristics of organizations. The number of studies on the subject in the literature is still very limited. Accordingly, it is necessary to underline the great need for interdisciplinary studies in this field. But still, this study argues that the main factor that determines the actual impact and value of information technologies, which have become an integral part of human life in today's world, is the information itself rather than technology, and it should be kept in mind that information technologies can only function as a means or tool in this knowledge-based social, economic, and cultural life. In other words, the determinant of the benefits, meaning, and importance of information technologies might be the conditions created by organizational factors such as cultural environment and organizational structure where knowledge is created, developed, and used and human resources have become the most important capital element and source of wealth.

Conflict of interest

The author declares no conflict of interest.

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