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Implementing continuous adaptation to technology innovation in complex adaptive organizations

Alon Hasgall[a,*], Niv Ahituv[b]

[a] The Center of Academic Studies, Pob. 5203, Shoam 6085000, Israel
[b] Tel Aviv University, 33 Drezner Street, Tel Aviv 6949776, Israel

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ABSTRACT

Purpose: Most organizations integrate technology innovation through a complex, ad-hoc, top-down model of assimilation. However, a continuous and autonomous adaptation process may be more natural and improve the quality of assimilation. Organizational workers who function as "fractals" in a Complex Adaptive System (CAS) demonstrate higher quality of digital technology usage. The current study investigates whether "fractal workers" demonstrate more positive attitudes toward technology innovation, and whether these attitudes translate into quality technology usage.

Design/methodology/approach: Online questionnaires were completed by a sample of 300 workers in 20 organizations that have recently introduced technology innovation. Pearson and regression analyses were used to examine the relationships between the functioning of workers as CAS fractals and their attitudes toward the innovation, and between their attitudes and the quality of technology usage.

Findings: A strong positive correlation was found between functioning as CAS fractals and the attitudes toward technology innovation, and between these attitudes and the quality of technology usage.

Practical implications: Increasing the autonomy of workers and encouraging them to function as CAS fractals within the organizational environment can facilitate an efficient, dynamic, and continuous process of adaptation to technology innovation.

Originality/value: To the best of the authors' knowledge, this is the first empirical research to study how functioning as a CAS fractal translates into attitudes toward technology innovation and to technology usage within organizations. It sheds light on the important differences between assimilation and adaptation of technology innovation.

1. Introduction

The development of digital technologies and the Internet has had a remarkable impact, not only on the lives of individuals, but also on the organizational working and decision making process. Digital information technologies (IT) can facilitate the conversion of information collected in the organization and from specialized workers in it into organizational knowledge, by allowing global and updated communication, distribution of relevant content, and the sharing of work between workers, while transcending the limitations of time, place, and specialties (Potter & Mcgittigan, 2013; Tsui & Malhotra, 2005). As such, digital IT facilitate the generation of customer-tailored solutions and products in organizations (Stacey, Griffin, & Shaw, 2000) and shorten the duration required to

* Corresponding author.
E-mail addresses: alonh@mla.ac.il (A. Hasgall), ahituv@post.tau.ac.il (N. Ahituv).

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integrate these solutions and products into the market (Jackson, 2008).

Today, small organizations appear to increasingly use multidirectional communication applications (e.g.,Twitter) to better cope with a complex market and strong competition, while organizational workers use digital applications to enhance communication capabilities, distribute information, and make shared decisions within the organization. The type of digital applications that organizational workers use within the organization is influenced by the type of digital applications that they use in their personal lives, namely, by the culture, communication methods, and commerce that are typical of the surrounding environment (Gálvez-Rodríguez, Caba-Pérez, & López-Godoy, 2016). Nevertheless, in contrast to how digital applications typically enter the personal surroundings of the workers, many organizations still employ a relatively slow and complex process of implementing information systems, including digital applications. Such complex processes may detach the daily functioning of the workers from their organizational functioning, thus impairing the ability of the organization to connect with its environment, sell its products, or match between its products and the needs of clients.

To improve communication and Internet-mediated content management within the organization, contemporary digital technologies utilize designated applications, which facilitate social networking and enable the management of global and updated interactions between workers, distribution of information in real-time, maintenance of information clouds, and sharing of user-specific multimedia content (Potter & Mcgittigan, 2013). Accordingly, in recent years, organizations have begun to share intra-organizational knowledge, exchange solutions, manage work processes, and cope more efficiently with rapid changes in customer demands. This was achieved by employing various innovative digital means – such as intra-organizational employee communication networks, information clouds, and digital applications – which allow lateral updating, transparency, sharing, and complex analysis of organizational information, in addition to empowering workers (Hartono & Basuki, 2015). However, as technological innovation in the digital sphere is characterized by rapid development and a short interval between product development andmarket implementation (Brock & Moore, 2006), the integration of digital technology innovation – and of its associated applications – within organizational processes must be rapid, continuous, effective, flexible, and long-lasting.

The purpose of this article is to delineate a study that compared the pros and cons of continuous adaptation – relative to instant assimilation – of digital IT innovation in organizations characterized as Complex Adaptive Systems (CAS). The study investigates whether an ad-hoc model of technology assimilation, which characterizes most organizations today, is sufficiently equipped to integrate new technologies within the organization, or, alternatively, whether the complex reality of the digital era and its characteristic rapid advances necessitate a change in the attitudes of workers and managers toward the technology and its assimilation process (and, if so, which conditions are required to facilitate this change in attitude). To answer these questions, 300 workers were sampled from organizations that had undergone a process of implementing technology innovation, e.g.,integrating novel information systems, social networks, or digital applications, for organizational purposes.

Described below are the theory and paradigms on which this study was based, followed by a description of the empirical study. Finally, the findings are discussed and conclusions are drawn.

2. Background and pertinent paradigms

2.1. Assimilation versus adaptation to technological innovation in organizations

To extract the advantages of technological innovations, working processes and organizational resources must be adjusted (Burge, 2014) such that the structure of the organization, its worker management and control methods, and its time and resource allocation all take advantage of the technology (Chen, 2007). However, another crucial aspect in the assimilation of technological innovation is the psychological needs of the workers and their attitudes toward these innovations and to the accompanying changes in organizational processes. Indeed, workers usually resist to changes and are inclined to prefer the known organizational culture and climate over novel ones; thus, the integration of technological innovation may raise feelings of uncertainty and imply the addition of new assignments, which many workers prefer to avoid (Wadmany, 2012).

The process of integrating innovation within known frameworks is often termed an “assimilation process”—a term that is taken from the field of natural sciences, where it expresses a continuous process in which an organism develops features, capabilities, and a lifestyle that can optimally meet the changing environment (Thorndike & Hagen, 1961). Unlike in the natural world, however, the social information processing model (Fulk, Steinfield, Schmitz, & Power, 1987) postulates that “assimilation” in people also involves a conscious aspect of adjusting one's culture and lifestyle to the environmental change. Thus, while the effect of the assimilation process on the organizational lifestyle is unconscious, the assimilation process itself is made consciously and includes the processing of new information, receiving feedback from the environment (e.g.,from other workers) regarding the change, and analyzing the impacts of the change on the known working processes as a basis for decision-making and adjustments (Hartono & Basuki, 2015). Therefore, maximizing the assimilation of technological innovation in organizations requires that the workers consciously and willingly accept the change [For a quantitative model of the IT evolution in organizations, see (Ahituv & Greenstein, 2010)].

The traditional approach to assimilating new technologies in organizations is a hierarchical approach, which emphasizes top-down control (Knight, 2006). According to this approach, managers maintain control by adjusting the organizational reward system and by being involved in all aspects of the assimilation process – both at the level of managerial activity and at the level of goal implementation. Such a top-down process is conducted in steps, namely, by determining specific milestones, such as learning the new terminology, analyzing the capabilities of the new technology, adapting the technology to the working environment and to the organizational goals, and forming a framework for instructing and constructing the novel technology within the working environment (Wadmany, 2012). Accordingly, this approach requires that the managers cope with the psychological and perceptual aspects of

the workers –e.g.,their perceptions of personal threat, their concerns that their workload will increase, and their resistance to the process or to the technology itself – by "selling" the innovation to the workers (Armstrong & Sambamurthy, 1999).

In accordance with the need to "sell" the relevant applications to the workers, one study has found that, to encourage internet use and the creation of user-generated media (UGM) such as Wikipedia and YouTube, two usability attributes should be employed: "easy to use" and "let users control". These attributes can enable people to perform activities efficiently, so that people can derive greater gratification from their UGM use (Shao, 2009). However, the hierarchical approach to the assimilation of technological innovation tends to ignore the motivation of workers to affect working processes (Potter & Mcgittigan, 2013) and does not allow the workers to meet the organizational demands and produce relevant knowledge (Burge, 2014). In addition, this hierarchical approach is slow due to the need to control and monitor the workers, and may thus nullify the competitive advantage of the organization with respect to the rapid environmental changes characterizing our current dynamic digital era, in which customer demands, business competition, and environmental complexity necessitate upgrading the existing technologies or integrating new technologies in a rapid and efficient manner (Oliveira & Martins, 2010). According to the Technology Acceptance Model – TAM(Venkatesh & Davis, 2000), the optimal extraction and investment return of a new technology (or of upgrading an existing technology) in organizations is based on a conscious and educated process that all workers and managers undergo, including their personal and daily involvement in the process. Acceptance of working methods, changing the lifestyle, and the post-change organizational environment should be developed in parallel for both workers and managers throughout the organization (Hartono & Basuki, 2015). Thus, taken together, it appears that integrating technological innovation in organizations should be accomplished through a rational, educated, and consensual process, and that this process must also be quick, flexible, and constantly updated to ensure a rapid and effective adaptation to the change (Hartono & Basuki, 2015).

An important model for the process of assimilating technological innovation in organizations is the Technology Adoption Decision and Use (TADU) model, which considers two fundamental components: intention and actual usage. These two components are governed by six core determinants: perceived desirability, perceived feasibility, performance expectancy, effort expectancy, social influence, and facilitating conditions, which include two new moderators: precipitating events and the propensity to act. These determinants were found by Moghavvemi etal. (2016), in a study that examined the assimilation and utilization of information systems by various entrepreneurs in start-up companies. These information systems were indeed of research, developmental, and business value to the entrepreneurs, but the authors found that the six determinants had a considerable weight in the willingness and ability of the entrepreneurs to utilize the information systems.

2.2. Organizations as complex adaptive systems

One of the systemic models that enables us to understand how organizations can rapidly and effectively adapt to environmental changes is the Complex Adaptive System (CAS) model, which is based on the principle of the survival of individuals in natural systems (Holland, 2006; Zimmerman & Hurst, 1993). In CAS, a distributed array of subsystems, termed "fractals", act autonomously according to environmental demands while maintaining constant connection with other fractals in the system, such that each CAS fractal can continuously benefit from the knowledge and resources of the other fractals (Holland, 2006). This distributed structure allows each CAS fractal to respond immediately and directly to changes in its environment, while, in parallel, updating the other fractals in the system about the environmental changes that it recognizes.

Unlike traditional organizations, which are constructed as a system of individuals within a hierarchy, and functioning according to a unified model (procedure) of organizational goals, a CAS-like organization comprises autonomous elements (workers and managers), which have apparently similar functions and a shared-learning capability. A worker in a CAS-like organization is considered to be a knowledge-worker, who has access to organizational resources while constantly integrating information within the other elements of the system (Shoham & Hasgall, 2005). It was two decades ago that Roos and Oliver (1997) identified, in modern organizations, the connection between the characteristics of the CAS model and the function of the organization. Subsequently, Shoham and Hasgall (2005) found a positive correlation between the degree to which business and governmental organizations can be characterized as a CAS and the ability of workers in these organizations to successfully cope with environmental changes. For instance, it was found that the more an organization is characterized as a CAS, the higher the synchronization in the activity of its workers and the higher the ability of each individual worker to obtain innovative solutions and distribute knowledge among the other workers, such that the entire organization deals with a dynamic environment more productively (Shoham & Hasgall, 2005). Thus, it is plausible that workers in CAS-like organizations will also better adapt to the integration of technological innovation within organizational processes. However, this hypothesis has, to date, not been investigated.

Workers in organizations that function as a CAS show four distinct behavioral characteristics, which allow them to function as autonomous fractals and to constantly update and be updated of organizational activities (Shoham & Hasgall, 2005):

1. Self-branding: The worker brands him/herself as a professional in a specific field and presents his or her capabilities, expertise, and interests, in accordance with organizational goals. Thus, integration between the personal goals of the worker and the goals of the organization is made possible, allowing the worker to function as a CAS fractal.
2. Environmental sensitivity: The worker is granted the ability to sense the external environment and to respond to changes in this environment in a consistent and methodological manner. This capability allows the worker to adjust the relevant solutions to the needs of the managers and to the demands of the customers.
3. Integration of information: The worker can integrate various types of information that are found in shared databases and in the databases of other workers.

4. Social networking: The worker can manage his or her social resources in a distributed and synchronized manner to share information, find innovative solutions, and self-develop.

A recent study has shown that allowing workers to function as CAS fractals increases the quality of digital technology usage for personal information management, social communication, and self-branding(Shoham & Hasgall, 2005). Thus, it can be expected that organizations that allow their workers to function as CAS fractals (according to the four characteristics mentioned above) will be disposed to more rapidly and effectively materialize the advantages that digital technology offers to the knowledge worker. Accordingly, it can be expected that, in such organizations, the integrated technology will be better employed as a platform for distributing knowledge, searching and retrieving relevant solutions, and updating other workers of environmental changes.

3. Research questions and hypotheses

The study described here investigates whether an ad-hoc model of technology assimilation – which is typical of organizations today – is sufficient to integrate new technologies within the organization, or, rather, the complex reality of the digital era and its characteristic rapid advances necessitates a change in the perceptions of workers and managers toward the technology and toward the process of its assimilation. If so, which conditions are required for this change in perception? The sample of 300 workers was selected from organizations that had undergone a process of implementing technological innovation, e.g.,integrating novel information systems, social networks or digital applications, for organizational purposes. In this sample, two major questions were tested:

(a) Is it true that organizational workers who function more as CAS fractals demonstrate a more positive attitude toward technological innovation (which, in turn, is expected to increase their adaptability to the innovation)?
(b) Do workers with a more positive attitude toward the technological innovation show an increased actual usage of the technology, in terms of both the quality and the quantity of usage?

The first hypothesis of this study aims at determining whether workers who function more as CAS fractals within the organization demonstrate more positive attitudes toward integrating technological innovation within the organization:

Hypothesis 1. The degree to which workers function as CAS fractals is positively correlated with the attitude of the workers toward the integration of technological innovation within the organization.

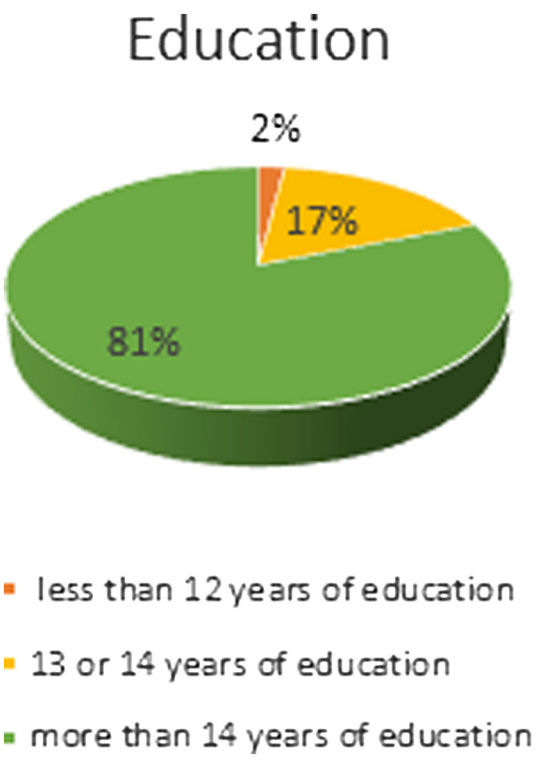
Next, under the assumptions that (a)workers who demonstrate more positive attitudes toward technological innovations will better adapt to them (Wadmany, 2012), and (b)the actual use of the technology improves the understanding of the workers of the method of working with the new technology and better connects them to the technology (Burge, 2014), the second hypothesis of this study examines whether a more positive attitude toward technological innovation is indeed manifested in the organizational reality:

Hypothesis 2. The attitude of the worker toward integrating technological innovation in the organization is positively correlated with the quality and quantity of the worker's usage of the applications of the new technology.

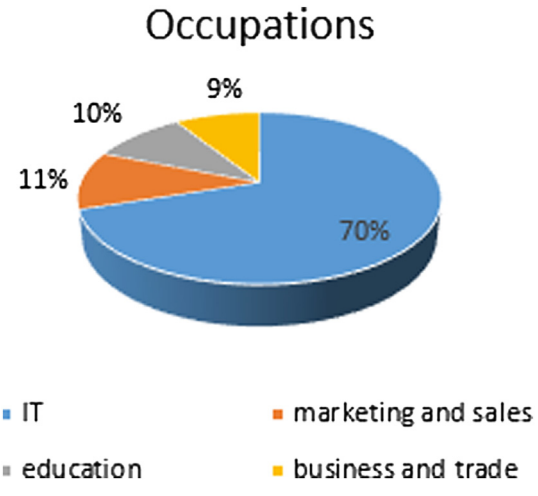
4. Methodology

4.1. Sample

During 2014, 350 workers from 20 different organizations were sampled randomly through a designated digital system (IBM SPSS Data Collection Divestiture; data collected by iPanel, Israel; http://www.ipanel.co.il/en/academic-research/). Of all respondents, 50% worked in educational organizations, 20% in high-tech organizations, and the rest in various industries or services. Of the 350 workers who were initially sampled, 300 workers (145 men; 48%) were sampled randomly according to a predefined criterion that the organization in which they work had recently undergone a process of integrating technological innovation within its working process (e.g.,introducing a novel information system, employing social networks or digital applications for organizational needs, or using new technological equipment). Approximately 2% of these 300 workers had < 12 years of education, 17% had 13 or 14 years of education, and the rest had > 14 years of education.



The most prominent occupations in this sample were in IT (approximately 70% of the workers), marketing and sales (approximately 11%), education (approximately 10%), and business and trade (approximately 9%).



4.2. Research tool

The respondents were asked to respond to 30 questions through an online textual questionnaire (Appendix 1), which was handled by a company that specializes in social surveys (iPanel, Israel). The questions were designed to examine various dimensions of the work of the respondents within the organization, their attitudes toward the Internet technology innovation, and their actual usage of the novel technology, as follows:

A. Four dimensions of the work of the respondent examined the degree to which the worker functions as a CAS fractal within the organization (Hasgall & Shoham, 2015):
   a. The "Self-branding "dimension was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to anonymity within the organization) to 5 (corresponding to a high degree of self-branding among the organizational workers). The average response to the four questions was then calculated and used as a measure of the "self-

branding" dimension.

b. The "Environmental sensitivity" dimension was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to not sharing organizational information and to organizational obscurity) to 5 (corresponding to sharing organizational information to a high degree and to a high sensitivity to environmental changes). The average response to the four questions was calculated and used as a measure of the "environmental sensitivity" dimension.

c. The "Integration of information" dimension was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to being unable to integrate information from organizational sources and other workers) to 5 (corresponding to being able to integrate, to a high extent, information from various sources and from other workers). The average response to the four questions was calculated and used as a measure of the "Integration of Information" dimension.

d. The "Social networking" dimension was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to organizational isolation) to 5 (corresponding to a high degree of continuous social networking). The average response to the four questions was calculated and used as a measure of the "social networking" dimension.

B. Three dimensions of attitude examined the attitude of the worker toward integrating technological innovation in the organization (Oreg, 2003):

a. The perception of the worker toward the degree of influence of the technological innovation on organizational processes. This dimension was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to the perception that the technological innovation does not affect organizational processes) to 5 (corresponding to the perception that the technological innovation greatly affects organizational processes). The average response to the four questions was calculated and used as a measure of the "degree of influence" dimension.

b. The degree to which the worker is personally involved in the process of integrating the technological innovation in the organization. This dimension was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to minimal involvement in the process) to 5 (corresponding to high involvement in the process). The average response to the four questions was calculated and used as a measure of the "personal involvement" dimension.

c. The type of emotional response of the worker toward the integration of technological innovation in the organization. This dimension was evaluated through five questions, to which the respondents answered on a scale of 1 (corresponding to stress and anxiety with respect to the technological innovation) to 5 (corresponding to calmness with respect to the technological innovation). The average response to the five questions was calculated and used as a measure of the "emotional response" dimension, with higher values indicating a less anxious attitude toward the technological innovation.

C. Technology usage, namely, the degree to which the worker factually uses the applications of the new technology. Three dimensions of the factual usage of the technology were examined (Burge, 2014):

a. The quality of technology usage. This dimension was assessed in two aspects: (a)an accessibility aspect, which was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to not accessing the applications of the new technology) to 5 (corresponding to an immediate and free access to the applications of the technology); and (b)an availability aspect, which was evaluated through four questions, to which the respondents answered on a scale of 1 (corresponding to the unavailability of the technology to the worker) to 5 (corresponding to free usage of the technology, namely, through computers, smartphones, or laptops). The answer to these questions were averaged and used as the "quality of use" dimension.

b. The degree to which the technology is used. This dimension was assessed through four questions, to which the respondents answered on a scale of 1 (corresponding to the inability to use the technology) to 5 (corresponding to the free usage ofthe-technology throughout the day). The answer to these questions were averaged and used as the "degree of use" dimension.

c. The variety of means available to use the technology. This dimension was assessed through four questions, to which the respondents answered on a scale of 1 (corresponding to the lack of means to use the technology) to 5 (corresponding to a wide variety of means, including databases, social networks, Internet searches, communication, content management, information collection, and the use of multimedia). The answer to these questions were averaged and used as the "variety of use" dimension.

4.3. Statistical analyses

For each hypothesis, the relationships between the variables and between the different dimensions of each variable were examined through a Pearson analysis, as shown in Fig. 1. Then, a regression analysis was conducted to identify any influence of each independent variable on the dependent variable through the degree of explained variability.

In testing Hypothesis 1, the relationship between the four dimensions of the worker functioning as a CAS fractal (independent variables) and the three dimensions of the worker's attitude toward the technological innovation (dependent variables) was examined.

In addition, a regression analysis was employed to examine the cumulative effect (explained variability) of the four dimensions of the independent variables (functioning as a CAS fractal) in each interaction on the three dimensions of the dependent variables (attitude toward the technological innovation). Finally, the unique contribution and the significant contribution of each of the dimensions in the interaction was examined.

In testing Hypothesis 2, the relationship between the three dimensions of the worker's attitude toward technological innovation (independent variables) and the three dimensions of the degree to which the worker factually uses the applications of the new technology (dependent variables) was examined. In addition, a regression analysis was used to examine the cumulative effect

CAS Dimensions	Variable: "Attitude toward integrating technological innovation in the organization		
	Significant	Explained variability, to all dimensions	**explained variability Only to dimension: "personally involved"**
"Self-branding "	P=0.120	0.016	**0.114**
"Environmental sensitivity"	**P=0.035**	**0.025**	**0.118**
"Integration of information"	P=0.457	0.006	**0.089**
"Social networking"	P=0.963	0.000	**0.067**

Fig.1. Degree of explained variability.

(explained variability) of the three dimensions of the independent variables (attitude toward the technological innovation) in each interaction on the three dimensions of the dependent variables (using the applications of the new technology). Finally, the unique contribution and the significant contribution of each of the dimensions in the interaction were examined.

5. Findings

5.1. Descriptive statistics

The means and standard deviations of all variables examined in this study are presented in Table1.

5.2. Hypothesis testing

Hypothesis 1. The relationship between the functioning of the worker as a CAS fractal and the worker's attitude toward the technological innovation.

The ability of each of the four dimensions of the independent variable (self-branding, environmental sensitivity, integration of information, and social networking) to predict each of the dimensions of the dependent variable (degree of influence, personal involvement, and emotional response) was examined (Table2).

When testing the relationship between the degree of self-branding and the attitude toward the technological innovation, it was found that the model comprising the four predicting variables is significant (adjusted $R^2 = 0.119$, $p < 0.001$). In addition, the degree of self-branding had a positive significant unique contribution to the dimension “personal involvement” of the dependent variable (Beta = 0.369, $p < 0.001$), such that workers who demonstrated a higher degree of self-branding were also more personally involved in the process of integrating the technological innovation within the organization.

When testing the relationship between the degree of environmental sensitivity and the attitude toward the technological innovation, it was found that the model comprising the four predicting variables is significant (adjusted $R^2 = 0.132$, $p < 0.001$). In addition, the degree of environmental sensitivity had a positive significant unique contribution to the dimension “personal

Table1
Descriptive statistics.

Variable	Dimension	Mean	Standard deviation
V1: Functioning as a CAS fractal	Self-branding	2.7	0.07
	Environmental sensitivity	2.8	0.07
	Integration of information	2.4	0.07
	Social networking	2.2	0.06
V2: Attitude toward the technological innovation	Degree of influence	2.2	0.05
	Personal involvement	2.8	0.06
	Emotional response	2.5	0.04
V3: Technology usage	Quality of use	1.7	0.06
	Degree of use	1.8	0.06
	Variety of use	2.5	0.07

Table2
Predictive indicators of the variables: degree of influence, personal involvement, and emotional response.

V1	V2	R^2	significant unique contribution	Beta
CAS: Self-branding	Attitude toward the technological innovation	0.119***	Personal involvement	0.369***
CAS: Environmental sensitivity	Attitude toward the technological innovation	0.132***	Personal involvement	0.368***
			Emotional response	– 0.203*
CAS: Integration of information	Attitude toward the technological innovation	0.084***	Personal involvement	0.317***
CAS: Social networking	Attitude toward the technological innovation	0.055***	Personal involvement	0.264***

Notes: n = 300.
* $p < 0.05$.
*** $p < 0.001$.

involvement" of the dependent variable (Beta = 0.368, $p < 0.001$) and a negative significant unique contribution to the dimension "emotional response" (Beta = −0.203, $p = 0.014$), such that workers who demonstrated a higher degree of environmental sensitivity were also more personally involved in the process of integrating the technological innovation within the organization and were less anxious regarding this process.

When testing the relationship between the degree of integration of information and the attitude toward the technological innovation, it was found that the model comprising the four predicting variables is significant (adjusted $R^2 = 0.084$, $p < 0.001$). In addition, the degree of integration of information had a positive significant unique contribution to the dimension "personal involvement" of the dependent variable (Beta = 0.317, $p < 0.001$), such that workers who demonstrated a higher degree of integration of information were also more personally involved in the process of integrating the technological innovation within the organization.

When testing the relationship between the degree of social networking and the attitude toward the technological innovation, it was found that the model comprising the four predicting variables is significant (adjusted $R^2 = 0.055$, $p < 0.001$). In addition, the degree of social networking had a positive significant unique contribution to the dimension "personal involvement" of the dependent variable (Beta = 0.264, $p < 0.001$), such that workers who demonstrated a higher degree of social networking were also more personally involved in the process of integrating the technological innovation within the organization.

Hypothesis 2. The relationship between the attitude of the worker toward the technological innovation and technology usage.

The degree to which the independent variable (attitude of the worker toward the technological innovation) predicts each of the dimensions of the dependent variable (quality, degree, and variety of use) was examined (Table3).

When testing the relationship between the attitude of the worker toward the technological innovation and the quality of using the technology, it was found that the model comprising the three predicting variables is significant (adjusted $R^2 = 0.037$, $p = 0.007$). In addition, the dimension "personal involvement" had a positive contribution to the quality of use (Beta = 0.227, $p = 0.001$), such that workers who were more personally involved in the process also demonstrated a more quality usage of the applications of the novel technology.

When testing the relationship between the attitude of the worker toward the technological innovation and the degree of using the technology, it was found that the model comprising the three predicting variables is significant (adjusted $R^2 = 0.049$, $p = 0.004$). In addition, the dimension "personal involvement" had a positive contribution to the degree of using the technology (Beta = 0.232, $p = 0.001$), such that workers who were more personally involved in the process also used the applications of the technology to a higher degree.

When testing the relationship between the attitude of the worker toward the technological innovation and the variety of means available for using the technology, it was found that the model comprising the three predicting variables is significant (adjusted $R^2 = 0.039$, $p = 0.007$). In addition, the dimension "personal involvement" had a positive contribution to the variety of means available for using the technology (Beta = 0.195, $p = 0.004$), such that workers who were more personally involved in the process also used a wider variety of applications. The dimension "emotional response" had a negative contribution to the variety of means available for using the technology (Beta = −0.181, $p = 0.035$), such that workers who were less anxious of the process also used a

Table3
Predictive indicators of the variables: quality, degree, and variety of use.

V2	V3	R^2	Significant unique contribution	Beta
Attitude toward the technological innovation	Quality of using the technology	0.037**	Personal involvement	0.227***
Attitude toward the technological innovation	Quality of using the technology	0.049**	Personal involvement	0.232***
Attitude toward the technological innovation	Quality of using the technology	0.039**	Personal involvement	0.195**
			Emotional response	– 0.181*

Notes: $n = 300$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

wider variety of applications.

6. Discussion

The empirical data confirmed both hypotheses of this study: (a)functioning as a CAS fractal (Hasgall, 2013) positively affects the ability of the worker to adopt a positive attitude toward technological innovation; and (b)such a positive attitude is indeed translated to more effective usage of the new technology.

The following discussion will be divided into four parts:

1. The contribution of the study to the body of research in this area
2. Practical conclusions derived from this study
3. The limitations of the study
4. Suggestions for further research

6.1. The theoretical contribution of the study

Various studies have shown that the use of digital technology can enable cross-organizational updating, transparency in information, and empowerment of employees to function more autonomously (Hasgall, 2013).

Enterprise managers have tried to use digital technology such as social networking applications, instant messaging, and e-mail messages, for information sharing, dissemination of procedures, solutions and instructions. The goal was to deal with the ever changing customer demands, and the rapid external changes in competition, both in technology and in working methods (e.g.,online sales). However, it soon became clear that the use of digital applications in organizations requires a process of updating and assimilating novel behavioral and procedural thinking among the employees. This process of assimilation of digital systems, in organizations based on today's hierarchical systems, turned out to be slower than expected. Switching versions required ongoing learning and raised antagonism among users and employees. There is not always a correlation between the traditional organizational methods and processes and the new digital applications. It also turned out that a worker who uses digital technology for internal organizational use did not always comply with the relevant organizational hierarchy and the usual methods of work (Oliveira & Martins, 2010).

The overload of information and the multiplicity of work methods have necessitated a process of change in the organization which must be adapted to the new means (Chen, 2007). These measures require an orderly process of implementation over time at all stages. A process that will be tailored to the individual needs of each employee and his interests, in accordance with the Armstrong and Sambamurthy (1999) technologies consent model. Hence, the traditional approach to technology assimilation, which emphasizes the top-down direction. (Knight, 2006) allows managers to cope better with the difficulty of losing control, but the employee's involvement in the change program is determined and implemented systematically, both at the level of administrative activity and at the level of implementation of the goals. Thus, the basic assumption (Oliveira & Martins, 2010), as well as the organizational innovation required modifications under changing market conditions (Potter & Mcgittigan, 2013).

In contrast with the existing hierarchical, bureaucratic method, the complex adaptive systems (Zimmerman & Hurst, 1993) allow rapid adjustment and adaptation of employees' reaction to various changes, such as technological, environmental and market changes, and provide the ability to respond quickly and accurately to changes in the requirement of customers, suppliers, competitors and market conditions.

The contribution of this study to prevailing paradigms is the finding that the advantage of organizations with CAS characteristics focused on a fundamental change and variety of work patterns of employees and managers. The adoption of CAS characteristics in the organization enabled the employees of the organization to respond quickly to various changes. Consequently, the degree of update in the organizational information increases. Employees reported a higher level of personal responsibility, as well as willingness to interact and integrate, and a better sense of ability to cope with changes and challenges in the organization and outside of it. (Hasgall, 2013). It was found that in an organization with CAS characteristics, employees reported the ability to produce effective solutions in practice, knowledge development, production, and distribution of rapid solutions, sharing and updating digital applications that enabled them to develop as autonomous, synchronized and interactive units. This means that the CAS organization has increased the ability of employees to function as autonomous experts with digital applications, so that changing and upgrading these applications did not lead to objections, but enabled employees to continue their functions while adapting quickly and continuously to the new digital technology.

6.2. The practical contribution

The results of this study indicate that in order to achieve an effective process of coping with environmental challenges, it is necessary to avoid objections to the assimilation of technological technologies, which will slow the process as well as avoid the need for physical and immediate control of managers. This means that in order to develop a situation of rapid and continuous adaptation, which will lead to increased efficiency of work, solutions to changing demands, and concurrent integration of information among all employees, the organization's management must create conditions for the development of an adaptive complex system.

First, at the outset, the organization must recruit workers with autonomous work ability and technical understanding of digital applications. So are managers. But no less and at the very beginning, to get the employees and managers to an organization that

knows how to function through digital applications. The knowhow of the way to communicate, integrate, and keep up to date information, and especially allow employees an autonomous process of work. The organization's management is committed to providing every employee with a quick and accurate orientation of the organization's goals, business models, description of the organization's environment and the main challenges facing the organization at any moderate time.

In addition, employees should be given in-depth training to work with the company's digital applications, to familiarize themselves with all the personal and digital update methods in the organization, including stationary information systems and mobile applications.

The organization's management must understand that the governance system of the organization should change. Organizational transparency is a keyword. An employee who knows what is in front of him and what is required of him can make a better balance between his/her needs the interests of the organization. The transparency can be done quickly with the digital social applications. Managers can identify the challenges and track the development of coping, and work processes through the information that passes through the digital applications without direct interference to the work of the autonomic employee. For the sake of this activity, it is desirable that the organization's management develop innovative managerial functions whose role will be to adapt technological innovation, and to apply them r the work of the employees and the managers. The Innovation Manager will work with the Information Manager, also known as the CIO, and will be able to help adapt the innovative technology to the requirements. Another function is the Digital Director of the Organization [CDO], which is responsible for adapting the marketing, labor and communication methods to digital technology and digital social means which are developing rapidly in the current period. These managers must be leaders in the organization, carrying a senior VP status.

6.3. The limitations of the study

First, while this study focused on describing a phenomenon, future studies could further develop the findings by testing the effects of manipulating some of the variables examined here. Second, as the study was conducted through an internet survey, the responses do not include individuals who generally avoid responding to such questionnaires. Third, the study was conducted in only one country; notably, however, this country is well advanced in the fields of High-Tech and information technology, and it can thus be assumed that the sample can also represent populations in other developed countries. The size of the sample appears to be large enough for drawing conclusions, and the findings presented here appear to be reliable – at least as a basis for a wider, multinational research.

6.4. Suggestions for further research

The process and the methodology by which the organization can adopt such a dynamic approach, form CAS-like characteristics, and transform from an ad-hoc assimilation to an efficient, swift, and continuous process of adaptation to technological innovation are subjects for future studies, which will complement the findings and recommendations of the current work. This conclusion is also in line with contemporary approaches to system development, maintenance and management known as ***agile development.***

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