Knowledge management as a mechanism for technological and organizational change management in Israeli universities

Snunith Shoham · Milly Perry

Abstract   During the last decade, the higher education sector has experienced many pressures and changes (Hanna, *Educause Review, 38*(4), 25–34, 2003; Scott, *Educause Review, 38*, 64–80, 2003; Waterhouse, *The power of e-learning: The essential guide for teaching in the digital age*, 2005). Universities around the world are facing the need to adapt to a rapidly changing educational and social landscape, in which technology is both the main cause of change and a tool for dealing with the change. This study examines the organization-wide technological changes that have infiltrated every aspects of life at all universities that are part of the higher education system in Israel during the last 7 years: the introduction of on-line instruction, e-learning and Enterprise Resource Planning (ERP) technology for university work processes

The research findings show that there is a mechanism for managing organization-wide technological changes at Israeli universities but it is not a rational one. This study proposes a model for managing organization-wide technological changes in universities on the basis of the existing mechanism, using knowledge management strategies for the purpose of change management:

KM-M-CM (Knowledge Management as a Mechanism for Change Management)

Implementation of this model will make it possible to realize the challenge of transforming the university from a "knowledge institution" to a "learning institution." It will come life to the extent that the higher education system in Israel, its leaders and decision-makers understand the need for a permanent mechanism to manage change and adopt this rational model in order to establish it.

Keywords   Change management · Higher education · Knowledge management · Technological changes · Israeli universities

S. Shoham (✉)
Information Science, Bar-Ilan University, Ramat Gan 52900, Israel
e-mail: shohas@mail.biu.ac.il

M. Perry
Research Authority, The Open University, Raanana, Israel
e-mail: millype@openu.ac.il

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Introduction

The twenty-first century is characterized by many, rapid changes (Toffler 1970). In an organizational environment, these changes effect the need for the organization to adapt itself to the demands of the environment and make internal structural and cultural changes (Jacob in Hellstrom and Husted 2004; Hanna 2003; Allen and Fifield 1999). The organizational structure and culture of academic institutions are different from that of companies, business organizations and non-profit organizations (Winston 1998). To facilitate initiation, ignition and implementation of change processes in institutions of higher education, it is necessary to research the processes of change that have occurred in universities and the ways in which they have been implemented. Furthermore, the unique characteristics that either promote or thwart change in university systems must be examined, so that the organization, despite its unique characteristics, can adopt systems that will adapt its activities to the demands of the environment and other intransigent systems.

This research was designed to determine if organizational theories from the field of change management are suitable for change management in an academic institution.

The purpose of this study is to present a grounded theory for the management of organization-wide technological changes in Israeli research universities. The research was guided by two principal questions: What are the sources for organization-wide technological changes in the high education system? What are the central processes used for managing change in organizations of this type?

This research is important because it identifies the variables that effect the management of organization-wide technological changes in institutions of higher education and relates to the characteristics of and influences on the change processes that are involved in the various stages of the process. This information will make it possible for universities to compile a body of knowledge, methodology and tools for the successful implementation of the change processes and adaptation of their organization to its surroundings. Its contribution focuses on creating knowledge and understanding of the behavior of a university as an organizational system in a changing environment. Furthermore, it clarifies which models and methods are used to manage, navigate and adapt universities to their frequently changing environment while maintaining the unique traits and culture that characterize them.

Literature review

Change management

Change is "Whatever a person himself or other people—reasonable people—consider replacing one situation with another, as long as the change does result simply from the passage of time, it is new, substantial and both relevant and significant" (Fox 2001, p. 27). In addition to external changes, internal changes and transitions, Fox distinguishes between first degree changes and second degree changes and discusses the elements that characterize changes, including the origin of the need for change, the essence of the change, the publicity surrounding the change, etc. There are criteria for classifying changes: field where the change occurred (purpose, structure, technology, personal, etc.); type of change (internal or external, forced or initiated, planned or unplanned, gradual change or comprehensive change) (Levy 2000). When discussing the depth of change, Levy (2000) and Fox (2001) use the definitions developed by Watzlawick et al. (1974). Changes of the first degree are changes *within* the existing thought framework or thought pattern. Changes of

the second degree are changes of the thought framework or pattern. This distinction is also relevant to Kuhn's definitions (1970) relating to changes in basic assumptions (parallel to an existing thought framework) and to changes that shape basic assumptions. Argyris and Schon (1996) return to this distinction when dealing with levels of learning (personal or organizational) and when defining "single loop learning," "double loop learning" and "triple loop learning." Triple loop learning is the highest level of the learning process; it relates to changes in the goal of the learning and the meaning created, even *beyond* the purpose of the learning (paradigm change).

The place and importance of technology in change processes

The changes in the world are many and various. Technological developments are among the most important, with the broadest influence on organizations and their environment. The role of technology in the organizational world is complex and significant because it has a role both as a creator of change and as a tool for dealing with change, sometimes simultaneously. Toffler (1970) claimed that few changes will occur in the coming century that are not closely connected to technology because technology is the main force behind changes in our world. There is no doubt that organizations around the world are being influenced by technological changes that effect central, significant parameters of the way in which the world, in general, and in the world of work, in particular, are managed. Examples of the influence exerted by technological changes on the organizational world include creation of the "global village," shortened response times, new products and changes in the lifecycle of products, increased competition and the centrality of the customer. Therefore, "Organizations that persistently ignore new technologies risk a slide into uncompetitiveness" (Fichman 2000, p. 2). In an information society, the most popular management techniques are those that connect the organization's management to its environment using technological means. Organizations must acquire the ability to integrate the market, their customers, advanced technologies and the new possibilities created by the Internet (Metcalfe 2006). The integration of continually-changing and developing technologies into all aspects of the organizational management, together with globalization and the "flat world," as defined by Thomas Friedman (2006), simultaneously expand both an organization's opportunities and its market of customers.

Change management (Nickols 2004) is defined as dealing with systematic, planned changes. Some researchers consider chaos theory a legitimate tool for change management and use the basic concepts of this theory to describe an organization's integration into and adaptation to its environment and the changes occurring within it (Fitzgerald and van Eijnatten 2002). The purpose of change management is to facilitate the efficient assimilation of methods and systems into an organization. The changes considered are those occurring within the organization and under its control, either at its own initiative or in response to changes occurring in the organization's vicinity but beyond its control. There are several models and methods for change management:

- *Dynamic stability model*: According to this model (Lewin 1952), the central concepts for change management are: unfreezing, changing, and refreezing. This terminology was influenced by a worldview that perceives an organization as balanced system that functions in an environment that is sometimes unstable and destabilizes the organization. The model strives to move the organization from a state of instability to a state of stability. Change is considered an interim stage and when completed, the organization returns to its stable state.

- *Problem solving model*: According to this model, change is the process of moving from a problem phase to a solution phase. If a problem is encountered during the first phase, it must be considered a fundamental problem. Then, goals that can be achieved in various ways are defined in a process that needs to be carefully planned. Critics of this model claim the term "problem" has negative connotations and not everyone can relate to this term with calm attitude needed for finding a solution (Nickols 2004).
- *Interactive, strategic planning model*: According to this model, there are three stages to managing changes: dissatisfaction, vision and the first step towards change. When dissatisfaction with the existing situation arises, a vision of the future is presented and the first steps for moving towards that vision are planned. According to this model, organizational structure also includes an "arthritic model" in which the organizations' ability to manage change is petrified by its intrinsic structure and therefore the management needs to devise an organizational structure in which the process of change will be an inherent component (Nickols 2004).
- *Eight stage model*: In Kotter's (1998) model for change management, the process of change has eight stages from the decision that change is necessary through actual implementation of the change. The stages include establishing a sense of urgency, creating a guiding coalition, developing a vision and strategy, clarifying the change and vision, empowering broad-based action, generating short-term success, evaluating change plus defining additional changes and anchoring new approaches in the culture.
- *Dynamic organizational systems model*: The model described by Burke and Litwin (1992) distinguishes between transactive systems (in which exchange activities occur) and transformative systems (in which the change activities occur). In a transactive system, the components join together to create the climate required for change while the components of transformative systems are the substantive behaviors that need to change during the change management activity within the organization. Transitive change is defined as change that occurs as the result of interaction between people and groups, while transformative change is change that occurs as the result of interaction with forces external to the organization and that require entirely new behaviors. This model emphasizes the complexity of relationships between forces in the organization's environment, its internal goals for change and the feedback systems between them.

These models were developed with reference to business and public organizations. This research examines whether they can be applied to the management of organization-wide technological changes in institutions of higher education. Are these models appropriate for the unique way in which universities are managed?

Models for educational change

Although most of the models for change management developed out of the business world, some of them have been adapted for use in educational organizations. There are also unique models that developed in the world of education, for change management in educational institutions, which describe models for "introducing changes" into educational institutions. The research examines the differences between the models developed in the business world and those developed in the educational world. The models from the business world emphasize management of the change *process*, unlike the models for the world of education that place greater emphasis on the *substance* and content of the change (educational/pedagogical content). The models originating in the world of business focus on *unplanned changes* resulting from global changes and changes in the organization's

environment while the process of change management in education deals primarily with changes that are *planned* in advance by researchers in the field and "introduced" into the educational system (teachers and students). In addition, it seems that the necessity of change is better *understood* in the business world where it is considered part of an organization's need to survive and changes are initiated by the *managers of the organization* itself whereas changes in the educational world are *penetrated* into the educational systems by *external agents* (government authorities, regulatory agencies, and academics) on a nearly individual level.

An additional difference is inherent in the fact that the models from the business world are oriented more towards managing the process of change while the educational models are directed more towards assimilating the change. The researchers who have examined the principal theories in this field are Ensminger et al. (2004) and Ellsworth (2000) who described two major models for implementing educational change: Rogers' (1995) model of innovation diffusion and decision making, which originated in the field of communications, and Ely's (1999a, b) theory of implementing technological and organizational changes.

Rogers' innovation diffusion theory describes five stages that occur one after the other: awareness of the innovation, developing an opinion regarding the innovation (negative or positive), decision to adopt or reject the innovation, implementation of the innovation and searching for additional information to confirm or reject further implementation. He also presents five elements inherent in the innovation itself that might influence the decision to adopt it: added value of the innovation, ability to complement previous innovations, complexity, the degree to which it can be tested and possibilities for observing it. This theory further categorizes five personality types (of individuals or groups) for the adoption of innovations: innovators, early adopters, early majority, late majority and laggards.

The theory of implementing technological and organizational changes formulated by Donald Ely (1999a, b) describes eight stages that make change possible: dissatisfaction with the status quo (similar to the interactive, strategic model), sufficient time for learning, resources, knowledge and ability, rewards and incentives, and commitment and leadership. These theories present different aspects of educational change management and each has different advantages when describing these changes. The theory of complex organizations, based on the work of von Bertalanffy (1968), influenced many models for change management and is considered an effective tool for use by researchers who want to identify the sources of change.

Lucas (2000) and Senge (2000) describe models based on various components including cooperation, team work and Community of Knowledge as recommended models for the change management in academic frameworks and university institutions, on the basis of systems theory or Kotter's (1998) eight stage model, taking balances of power and politics that are characteristic parts of academic systems into consideration but considering them the most significant factor.

Conrad (1978) attributes considerable importance to the nature and position of academic and political-organizational power in the process of change and presents a model that is based on five main stages: the social framework stage, the conflict and interest group stage, the administrative intervention stage, the policy recommendation stage and the policy implementation stage. Power plays a central role in the last two stages.

General theories of change management in organizations and specific theories of educational change are the foundation on which this study is built. Its purpose is to cast a critical eye on current reality in the participating universities where organization-wide technological change is occurring.

The higher education system

Educational organizations are different in essence from business or commercial organizations. The managerial parameters are different, the organization functions differently and the organizational values and methods by which it is judged for its activities are often different in substance. An educational organization fits the definition of a "loosely-coupled" organization. The term "loosely-coupled" is used to describe a situation in which two phenomena share several common variables.

In a loosely-coupled system, the subsystems are partially connected to each other, as are their operations while each subsystem maintains its own identity and autonomy. There are only limited relationships of dependence and supervision between the various parts of the system. Loose coupling in an organization is primarily expressed by the limited guidelines provided to direct the activity of any particular unit, yet all of the various units are included in a single, more comprehensive organization, whose instructions do obligate people working in those units yet the degree of connection between the two systems depends on the activity of the common components.

Researchers have also defined universities as "organized anarchy" (Cohen et al. 1972). Since a university does not have unequivocal goals but rather goals that are unclear or even contradictory, standard theories of management, decision-making and control are inapplicable. The goals of the university despite their universal definition do not meet the basic criteria for well-defined goals. Questions regarding the university's goals—Have they been achieved? Are they problematic? Might they be achieved in the future? Do most factions within the university agree to the goals?—cannot be answered. In most cases, overly general definitions of goals are detrimental to clarity but focusing clearly on a defined goal thwarts any possibility of the goal's acceptance by a majority of the university's senior decision makers (Cohen et al. 1972). The researchers noted that policies of higher education systems are characterized by a lack of consistency that, combined with the inability to reach agreement in those cases where operating goals have been defined, makes universities difficult to manage.

The changes that are occurring around the world influence not only organizations and government agencies but also universities. The forces of change acting on higher education are varied (Scott 2003):

Increased competition: Competition with other domestic universities as well as with foreign universities and private institutions.
Significant decrease in government funding and public scrutiny: This change is primarily a result of a changed perspective, one that sees public education not as a service but rather a valuable product. Education is not an investment but rather an expense that requires strict scrutiny of government spending on it.
Mounting trend towards consumer rights: The high cost of education leads students to insist on receiving a quality product and good service from the university. Students are even willing to initiate legal action.
Increased distribution of communications and information technology in all areas of life: In the past, colleges and universities had a monopoly on up-to-date, quality information. Today, this information is available on the Internet and in many other formats, some of which do require payment (Kaiser et al. 2003). The higher education system has been transformed into a complex system that is open to external influences, from domestic and international forces. The system has become dynamic and therefore control, current data and information are needed.

Changes in the Israeli higher education system

The accelerated changes that began in the late twentieth century had a major effect on Israeli universities. As elite institutions, the universities must compete for students and an ever-shrinking pool of resources while also contending with a trend towards increased government intervention (Guri-Rosenblit 2002). Competition for students intensified even more following the establishment of the first private colleges in Israel and the transformation of the public teachers' colleges into academic colleges that began to offer bachelor's degrees in a wider range of subjects.

On one hand, the society that funds the universities' cultural and scientific activity demands accountability and managerial leadership. On the other hand, the demands of the economy, technology and clients require that the university abandon the "ivory tower" in which it has long resided without major changes, and adapt itself to the environment. The Meltz Committee Report on Higher Education recommended structural changes and noted that the current structure of the universities prevents free movement between units and limits the possibilities for essential changes and renewal. The current structure of most academic institutions is characterized by loose coupling between its academic and general units. At several central weak points, the system has deficiencies related to the work patterns of its official bodies, the distribution of functions and authority, and the mutual relationship between them (Council for Higher Education, Planning and Budgeting Committee 2000).

In 1999, the Council for Higher Education's Committee for Planning and Budgeting appointed a subcommittee to examine the integration of information systems into institutions of higher education. The committee decided that the incorporation of technology is important for the processes of teaching and learning, for research and for developing the hi-tech industry. The committee members assumed that without the allocation of designated resources and other incentives, the universities would not initiate a systematic process of technology adoption. The Meltz Report (Council for Higher Education, Planning and Budgeting Committee 2000, p. 4) notes, "In the organization of the university, there is a gap between the needs for using new information technology and what actually exists. The university's current infrastructure for information technology requires an integrative perspective and there is a need, in large business frameworks and universities around the world, to establish a position for a person to be responsible for information systems." The recommendations were intended to help the universities achieve their goals and respond quickly to changes taking place in their scientific, social and economic environment, in Israel and internationally.

Technological changes in the higher education system in Israel and internationally

According to the National Research Council report (2002) published in the United States, digital technology will not only change the intellectual activity of the research university but also its organization, funding and management. Technology will make the connection between higher education and other hi-tech sectors including publishing, communications and edutainment, to create an industry of education and learning.

In recent years, however, these optimistic expectations were replaced by the financial difficulties experienced by universities around the world and in Israel, too. As part of their attempt to overcome system-wide managerial problems, some universities find that technology is a way to deal with the changes and difficulties they are confronting and try to

solve problems by using advanced technologies in a more efficient manner. For example, Ohio University changed its statistics courses by reducing the amount of time invested in classroom learning and increasing the independent studies components that utilize the Internet (Zilberg 2003). These developments stimulated two organizational-technological changes that occurred in Israeli research universities during the last 7 years, E-learning and Enterprise Resource Planning (ERP).

ERP is a process that integrates the software infrastructure, the internal information (employees, work processes) and external information (processes, suppliers and students) that an organization uses into one system (Aberdeen Group 2004).

The literature reviewed above would indicate that the change management in an academic institution is always a complex, problematic and multi-dimensional process and even more so for highly technological changes. Although universities, as organizations, are now frequently required to adapt themselves to the demands of society, the environment, their budget, competitors, clients and technological standards, they lack a method or model for effectively managing their adaptation to the environment, while also maintaining their unique character. The contribution of this research will be identification of a model that exits in the field and constructing the method that is lacking.

Methodology

The main research question in this study is: What are the change management methods used for organization-wide technological changes in Israeli universities?

Internal and external factors that influence the initiative for change (innovators-opponents), the identity of the change agents in academic systems, the direction of change and the way in which it is managed (main processes for change management) were examined. This is a grounded theory study in which the theory is based on systematic analysis of data using the constant comparative method.

Description of the study

This study examines two organization-wide technological changes occurring in Israeli universities: the E-learning process and the ERP process. The research was conducted at two large research universities and studied both the administrative sector and the academic sector of each university, using the grounded theory methodology that is derived from the philosophy of qualitative research. This methodology was used in a study of educational change that developed a model for change management that was later validated through a comparison with existing models for change management (Conrad 1978). The exact research questions were refined during the field research and the significant variables are those that surfaced while gathering preliminary data.

This study was based on the working assumption that the system of higher education in Israel lacks a clear, rational and systemic model for change management. This research examines the processes that actually exist in the daily life of Israeli academia and its subsystems (the universities) for the purpose of identifying the existing practice in a limited, local system (in terms of its validity or field of implementation). An example would be a model for change management that is actually being implemented in a single Israeli university. Furthermore, the possibility that a model is being actually being implemented across the system but only in a specific area was also examined. For example,

a model for managing organizational-technological changes might be implemented only for changes related to learning. The research was conducted on the basis of existing theories for the purpose of distributing and implementing a recommended model for managing organization-wide technological changes in all higher education institutions in Israel or even internationally.

The field research was based on thirty-four interviews with key actors in the higher education system and in the universities themselves. "Key actors" were defined people who were involved in the process of deciding on change, before it was implemented, and functionaries who worked on the actual implementation. We also interviewed some university staff members at whom the change was directed. The interviewees included officials on the Planning and Budgeting Committee and other inter-university frameworks who are involved in changes of types being studied, the managers of the E-learning programs and ERP project coordinators at each university, managers of the computerization and technology units, senior officials of the universities and faculties, as well as the objects of change, academic faculty members and managers of various university departments, on different levels. During the interviews both types of change processes were considered.

Research method

The constant comparative method, an inductive method for theoretical discovery (Sabar Ben Yehoshua 1990), was used as the basic research method. It includes systematic coding and analysis of a theoretical sample for theoretical generalization that is integrative, consistent and closely linked to the data. The method offers a flexible space that supports the construction of a creative generalization of the theory. The constant comparative method includes five stages:

1. Comparison of events and placement in a set category ("open coding");
2. Integration of categories (according to variables and sub-variables) ("axial coding");
3. Definition of a hierarchy, connections and relationships between categories ("selective coding");
4. Develop a theoretical framework;
5. Writing the theory and comparing it to existing theories.

During the first stage, "open coding," the initial findings of the research (the information derived from the interviews with key actors in the universities, faculty members and officials) were examined and repeated, characterizable themes, subjects and headings were identified and named. The material was then sorted, on the basis of these subjects and themes, according to established analysis units. The themes served as preliminary categories and guidelines for the process of structuring the research, "the theoretical sample." The second stage, "axial coding," analysis was done along the axis of the categories that had been formulated, which were refined and precise definitions were developed for the categories, on the basis of information gathered during the interviews.

This was followed by "selective coding" in which more data is gathered and coded according to the existing system of categories, in order to enhance the internal validity of the findings. Augmenting the amount of data belonging to each category is necessary to confirm that the existing structure and categories do indeed exist in the reality being studied. These stages are conducted simultaneously. During each stage it is possible to return and redesign the categories, criteria and information sources. To develop the

theoretical framework, connections of many types are made between the various categories. One category might be interpreted in terms of another and an effort made to determine which category is the cause and which is the effect. Possibilities examined during this stage include connecting categories via a hierarchical, conceptual model, resemblances between categories, division of categories into groups with similar characteristics or representing them in graphic form to enhance understanding of the process.

The final stage consists of describing the findings and conclusions in theoretical terms relevant to the research field and constructing a system of constraints or rings that situate the research object (the universities being studied) in the broadest possible, universal terms.

Description of the technological changes in the two universities

In the two universities included in this study, the process of incorporating E-learning began with local initiatives of innovative lecturers in the Education Department. In University A, the Education Department decided to conduct an experiment, which lasted 2 years, and construct websites for 20 courses, as part of the Masters Degree Program in Computer Communications. They obtained software for setting up the infrastructure for Internet learning from a non-profit organization, The Center for Education Technology. This educational experiment was largely made possible due the support of a senior academic figure in the university.

At University B, it was decided to use E-learning for large courses in the School of Education and for several courses that focused on the learning how to search the Internet in the Information Science Department. The technological infrastructure for both departments was developed by the Department of Information Science.

In 1999, an initiative for introducing distance learning technologies in the universities came from above, sponsored by Council for Higher Education through its Committee for Planning and Budgeting. This move was motivated by pedagogical considerations and the Committee for Planning and Budgeting explained that it wished to upgrade and improve traditional education, train the instruction staff to use advanced educational technologies, make the relationship between the university, the lecturers and the students closer, make existing educational frameworks more flexible and be more accessible to additional audiences. Beyond this, there were clear economic considerations. Only when the initiative came from above and included a uniform technological infrastructure provided to all Israeli universities, as well as funding for the establishment of a support centers for online learning at each university, did E-learning become a very significant part of the Israeli system of higher education. The E-learning support centers train faculty members in the use of new technology and also evaluate the effectiveness of the new Internet-based learning processes. Gradually, many courses went online while courses that were frontal or semi-frontal also began to use course websites to upload educational materials for students' use. In the first years, financial incentives are paid to instructors in order to encourage them to convert courses from frontal instruction to Internet-based distance learning. The universities' deployment for the technological change included the establishment of a steering committee and coordination of the issue from above. Today, University A has about 4,000 course websites that complement the frontal teaching and University B has 1,500 online and semi-online courses.

In the late 1990s, universities in Israel began showing interest in the concept of integrating managerial thinking and organization-wide computerized tools. Many Israeli and

international companies began assimilating comprehensive computer systems (ERP), which integrate subsystems that interface with each other and enable support of decision-making and implementation processes, in order to coordinate and streamline them.

In early 2000, the universities finished dealing with a Bug 2000 and turned their attention to the continued development and progress of their technological information systems, which were largely outdated and in need of re-evaluation.

The assimilation of sophisticated computer systems for managing university processes and information using ERP systems was also started at the university level but this time it was the upper echelons of university management rather than lower ranking faculty members who took the initiative. For example, the process at University A was led by the University CEO who was an expert in information systems and a well-known researcher in the field. Since introduction of the systems was a large financial burden for the universities, administrators requested financial assistance from the Committee for Planning and Budgeting, which responded positively. The ERP systems were perceived as an inherently managerial matter rather than an academic one. The systems are used by top administrators, the rector and CEO, and the offices involved in their implementation are administrative: human resources, finance, maintenance, and student administration. The process of assimilating ERP systems began in 2002. The first module installed by the two universities was a human resources module used for managing personal and professional information regarding the employment of academic and administrative staff of the university and research authority.

Field research: data and findings

Findings

Several themes emerged from the 34 interviews conducted during the information gathering stage and these were sorted into categories defined by set criteria. Within the framework of these criteria, the various themes and subjects that arose from the interviewees' comments were gathered into general fields, each with a clear central idea. Criteria for distinguishing between the various fields and defining the "threshold" for assignment to each category were established to ensure that each particular expression or idea was relevant to the category and to differentiate between the various ideas and categories. The main categories were further sorted into subcategories.

The following findings are the result of the initial stages of the constant comparative method: identifying the preliminary categories, designing the categories, refining criteria and final design of the categories. Tables 1 and 2 lists the categories and sub-categories that emerged from the interviews.

So as to not overburden the reader, only a few examples of expressions that were assigned to three research categories: cooperation and learning, external forces for change and opposition to change, are presented below.

Expressions included in the cooperation and learning category included: "The co-operation with University X is very close" (Head of Computation Center). "You cannot receive unless you cooperate, you must also give" (Head of Computation Center). "There are questions and consultations and very large amount of information is shared" (senior faculty member). "We have many joint professional forums, on almost all levels" (Library Director). "The cooperation between us is exceptional. The cooperation goes beyond sharing information, it is the foundation for taking action and making decisions (senior

Table 1 Categories, sub-categories and criteria

Categories	Sub-categories	Criteria
Cooperation and learning	Types of cooperation Areas of cooperation	Themes and expressions that related to cooperative or group work (inter-university), different types of cooperation, whether it was voluntary or directed.
Internal forces for change	Managerial Budgetary Technological	Themes and expressions that related to field of activity within the organization that has significant influence on the change.
External forces for change	"From above" "Neighboring" "Distant"	Themes and expressions that related to the sector from which the external officials, who had the power to cause or influence the change, came.
Change agents	Initiators Catalysts Assimilators Leaders	Themes and expressions that related to officials in the organization who also have a role in the change process.
Change leader	Identity Seniority Professional identity Personality	Themes and expressions that related to a particular individual who had significant involvement in the change.
Testing and mapping		Themes and expressions that related to review, examination and definition (knowledge, information or data) of solutions, suppliers or alternatives for the defined problem.
Objectives	The organization The change	Themes and expressions that related to objectives towards which the organization or the change are directed.
Managing the process of change		Themes and expressions that related to activities directed towards change in current activities that were once done differently.
Opposition to change	Force Origin Type Identity	Themes and expressions that related to actions and emotions that are not consistent with the substance and direction of the change or planned/implemented activities.
Substance and subject of the change	E-learning ERP	Themes and expressions that related to technological content, products, modules, computerized tools or software/hardware solutions.
Transmitting the message	Communications Support Cooperation	Themes and expressions that related to activities within the target population to assimilate the change.

administrator). "The universities decided to work together" (ERP Project Manager). "There is complete cooperation; materials and samples are submitted (ERP Project Manager). "University A requests materials and our opinion of processes or ways for implementing them, it's a two-way street" (consultant). "Other universities work together closely even if the projects are dissimilar" (ERP Project Manager). "We planned this project together with University A" (Computer Unit Manager). "Cooperation is important for making the system more efficient" (Senior member of the Computation Center

Committee). "Cooperation is educational for everyone, too bad it is not done with greater vigor" (consultant). "Everything is done with close cooperation, throughout the entire process, even now (senior technology official). "Although we are currently at different points in terms of the process, there is complete cooperation for personnel, managers, experts and experience" (senior faculty member).

The cooperation that exists throughout the system is not specific to a particular technological change. All interviewees on all levels and from all parts of the system (academic, administrative, internal and external) spoke about cooperation and learning.

The external forces for change category included expressions like these: "There are external factors, unrelated to organizational change [the colleges] that are gnawing [at the university] and are frightening (ERP Project Manager). "If you want to be up-to-date and provide services for students you use technology" (Computation Center Project Manager). "On the level of declared priorities, this is still not apparent but there are some areas in which change is already being observed. Internet is good" (Computation Center Project Manager). "The colleges invest a large amount of money in attracting students and lecturers and we need to offer a university with an innovative style in order to compete with them" (senior administrator). "The truth is that today everyone is competing with everyone, even if they won't admit it. The university is no longer in an ivory tower" (faculty member). "We're attempting to survive in face of both the colleges and our colleagues" (faculty member).

Speaking about students, interviewees said, "Access to databases via the Internet from home is very common today at all universities. Indeed this is something that has been promoted by the students" (Library Director). "Around us we see that everyone is beginning to work via the Internet, students are accustomed to working on the computer and this is also an influential factor" (Computation Center Project Manager). "There is pressure from the students to begin more activity using the Internet because these are the tools that they are used to using. This forces the system to introduce additional technological changes" (senior administrator). "Competition for students and the rate at which the colleges are fighting for students requires us to be proactive and modern. It is no longer the way it once was, when the university did whatever was convenient for the university" (senior faculty member). "The university system 'translates' improved services for students into technological tools and considers this technology a way to improve student services while also making the university appear more up-to-date and innovative. We need to plan services for the Internet generation" (senior technology official).

In the category of opposition to change, the comments included: "Lecturers and students are not thrilled about this technological change" (E-learning Project Manager).

Table 2 Meta-categories and sub-categories

Meta-categories	Sub-categories	Sub-categories	Sub-categories	Sub-categories	Sub-categories
Causes of change	Internal factors	External factors	Objectives of the change		
Agents for change	Change agents	Change leaders			
Substance of the change	Substance of the change				
Mechanism for change	Analysis and mapping	Cooperation and learning	Managing the change process	Transmitting the message	Opposition

"It was more difficult for the end-user" (Technology Manager). "On one hand, everyone is opposed and doesn't like it but, on the other hand, they are cooperative" (ERP Project Manager). "Sometimes, even I am fearful of changes" (senior technology official). The intensity of opposition to change was expressed in different ways, for example: "Change in a public institution is a difficult process. People do not always welcome changes and the population is not suited for change" (senior faculty member). "Academics complain loudly about technology as if it were diminishing their livelihood" (technology employee). "We've complained to the administration that there is no reason for comprehensive technological changes. There are better uses for this money, in other areas of academia" (senior faculty member). "Many academic officials were opposed and made it difficult for us to allocate the budget required at the appropriate time" (senior faculty member). "The women who work here did not agree to participate in this and I almost needed to force them" (senior faculty member). "Even today some of the lecturers do not agree to use the system" (senior administrator). "Many people who are disconnected from the process. We don't require it of them" (senior technology official).

Discussion

To further elucidate the process, the mechanism that activates it and the main questions, it is necessary to refine the research questions and focus them on the *meta-categories* that are examined in this chapter:

- Causes of change (why?);
- Agents for change (who?);
- Substance of the change (what?);
- Mechanism for change (how?).

These four meta-categories comprise the process of change management. The first three meta-categories have relatively few subcategories and are familiar from the research literature. In the interviews, it emerged that they are understood by both university employees and the systems external to the university. The interviewees generally had prior familiarity with the cause of change, the agents of change and the substance of the change even if the technology itself had changed. By contrast, the mechanism of change, which is much more complex (consisting of five components), was perceived by the interviewees as a generalized process whose details are unclear and its conduct often lacked clarity even for the most senior officials. To some, change appears as a collection of circumstances promoted by "fanatics" working in a haphazard manner largely dependent on their personality and other environmental factors, while others think that the process of organization-wide technological change management is an evolutionary process whose details and components are unclear. The primary innovation in this study is, therefore, the clarification of the mechanism for organization-wide technological change management in Israeli universities and shedding light on how this type of change develops in the higher education system.

From the research, it emerges that the change management process occurs primarily in inter-organizational frameworks. The process itself utilizes activities, terminology and frameworks taken from the academic side of the university's work developing new knowledge in academic disciplines and it is very similar to the process of knowledge management. The process of knowledge management begins by relating to a defined organizational purpose or organizational need, knowledge inputs are examined within the

organization or in its vicinity, the existing knowledge, both internal and external to the organization, is analyzed and alternative activities are mapped. The processes of cooperation and transmitting accumulated knowledge and experience between members of the group creates new knowledge to be used for decision-making and activating the change. The process is accomplished through cooperation and sharing of knowledge between participants.

"Knowledge management" is a concept that was coined as an advanced management concept for the most important of all organizational resources, intellectual capital. Financial organizations, computer companies and high-tech corporations recognized the tremendous importance of intellectual capital and believe that developing and investing in intellectual capital is the critical path for organizational success. Unlike the traditional assets of an organization, the quality of an organization's Knowledge is evidence of future ability to earn profits and maintain an ongoing relative advantage that distinguishes the organization from its competitors. Organizations that understand the importance of knowledge learn to identify, map, nurture and preserve it. Managing knowledge is different than managing other resources, it requires a different kind of thinking: thinking about thinking (meta-cognition) and breaking out of standard management frameworks. Unlike tangible resources, knowledge is very difficult to capture and define, not to mention manage. The concept "knowledge-rich organization" is generally applied to hi-tech organizations even though the ultimate knowledge organization has existed for centuries and it is none other than the university. Universities, by their very essence, were intended to meet exactly the needs that the prophets of knowledge management spoke of in the 1990s. For generations, universities have dealt with the creation and preservation of human knowledge through research and evaluation, in a society that places the highest value on physical and financial assets. In a knowledge society, where the most important assets are knowledge assets and human capital, instruction and education play a very central role; they are its core business.

The process described as the activity of a "Community of Practice" is a mechanism of learning, knowledge management and change management. A majority of the changes (learning) that result from this process are first-degree changes (learning) some are of the second-degree changes (learning) and a few are of the third-degree. These concepts, as described in the literature review (Fox 2001; Levy 2000; Watzlawick et al. 1974; Argyris and Schon 1996), relate to the different levels of changes and learning.

The Communities of Practice in Israeli higher education, where the knowledge and learning management processes occurs, consist of representatives from all of the universities. They can be either voluntary entities (not legally mandated) that grow naturally out of the members' work or obligatory, legal entities that are established by the National Committee for Planning and Budgeting Higher Education or another relevant government agency. They are cooperative frameworks that bring together professionals in a variety of fields (for example: research, senior administration, library, computerization, E-learning, human resources), with similar seniority. Leadership of the communities rotates between the representatives of the different universities who serve as chairperson for a given period and assist with the organization of meetings and activities. The committees function as expert Communities of Knowledge whose goal is cooperation for the purpose of facilitating the best possible implementation of the tasks for which the members are responsible and achieving the universities' goals. While promoting the purposes of each organization (university) this framework also brings together change agents from across the higher education system. They meet for on-going activity at regularly scheduled intervals, by demand or as necessary.

The Communities of Knowledge were initially founded to help representatives of the universities function more efficiently and guide the university's work in a particular field, not specifically to deal with technology. The technology communities were mostly established as the result of decisions made by the Committee for Planning and Budgeting or other legally and organizationally mandatory frameworks.

Examples of these technological communities include the Inter-University Computation Center (*MACHBA*), the Israel Center for Learning Technologies (*MEITAL*) and Information Services (*MALMAD*), whose main function is the acquisition, licensing and operation of information services for all the Israeli universities, the Committee of Library Directors, the Standing Library Committee and the Computation Center Committee of the Committee for Planning and Budgeting.

This process of knowledge management used by the inter-university Communities of Knowledge is a mechanism for change that enables the universities to adapt themselves to the environment using a process that includes mapping and analysis of knowledge, cooperation and collaborative learning. Change management is accomplished by mapping existing knowledge and cooperative learning. Transmitting the message of change and dealing with opposition are handled through cooperative effort, support and intervention, which all of the theories define as building an organizational climate that encourages experimentation and change, reduces opposition and diminishes its force, sometimes eliminating its very source. Cooperation and support from the Community of Knowledge lessens the politicization of organization, eases anxiety about the future and increases commitment to the change, as well as contributing to a deeper understanding of the need for change and the opportunities that it creates. The learning process facilitates acquaintance with the people initiating the change and with the internal and external agents of change, making it possible to deal cognitively, emotionally and behaviorally with the expected change, thereby increasing commitment to it. The diagram below portrays a comparison between the change mechanism (gray) and the knowledge management mechanism (white) and shows that there are many points where the two processes overlap.

Summary and conclusions

Summation of the data gathered in this study indicates that management of organization-wide technological changes at Israeli universities occurs without a directed, rational model for its management. Furthermore, there is no methodology, guidelines or even defined know-how, either in the universities or outside of them, in the regulatory agencies. It should be noted that the entire system (universities and regulatory agencies) considers technological change essential and some are even alert to the need for a clear mechanism for managing these changes. There is a trend towards encouraging local technological change, meaning that if a need emerges or a critical mass of requests accumulates from differing directions, resources are allocated or instructions of some type are issued to implement a technological change (providing ready-made solutions—"fish"—rather than tools and work processes—"fishing rods"). The system has not defined a need to establish an infrastructure for technological innovation or long-term change management and there is no technological infrastructure, process or guiding mechanism to implement change management in the universities or throughout the entire system ("fishing rods").

Analysis of the research data reveals that an (irrational) mechanism for managing organization-wide technological changes is operating in Israeli universities and in their environment; through it the universities also influence each other. Information is received

by the Community of Knowledge, which serves as a catalyst for change. Members of the community "digest" and "process" the information they receive from the university's immediate and distant environment and raise problems, difficulties, challenges and issues that require response and action. The Communities of Knowledge map the knowledge in their possession (either in the community or their home institution), analyze the alternative solutions available in Israel or abroad while developing a stance and new information. On this basis, they then make decisions and lead transmission of the message that change is necessary at their home institution or throughout higher education system until implementation of the change is completed in one or more universities and the change itself become "new knowledge" that can be input into the system and influence future change processes.

This system is undefined and unnamed yet it is a process of knowledge management. Although the process is directed at other goals and is intuitive (at best) or partial (a less desirable case), it is a well-established foundation upon which orderly, significant knowledge management process can be devised and constructed. This understanding, which emerges from the research findings, facilitates description of consolidated model that is recommended for use as a rational mechanism for managing organization-wide technological changes in Israeli universities (Fig. 1).

Proposed model

The model proposed on the basis of this research takes advantage of the existing infrastructure of organizational processes and the characteristic organizational culture of the
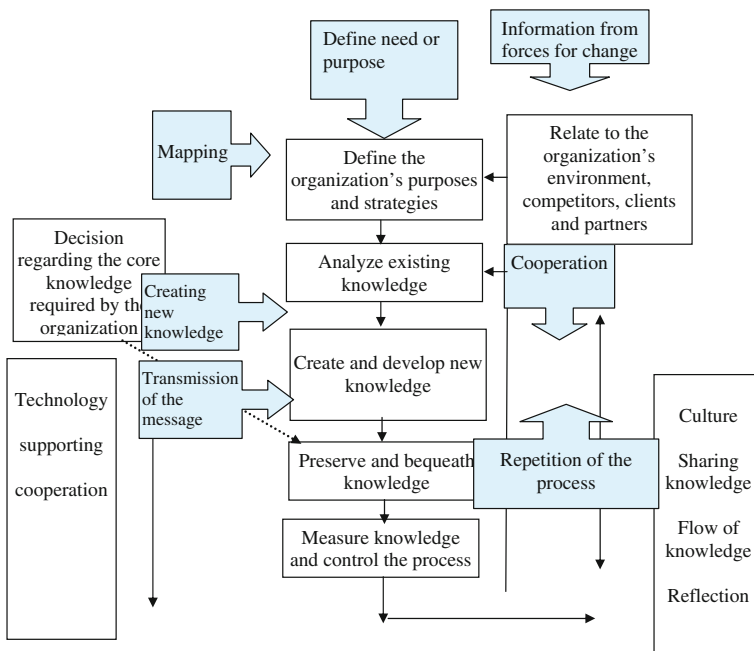

Fig. 1 Comparison between the change mechanism and the process of knowledge management

academic world, utilizing concepts that are accepted in academic institutions and the prevailing scholarly work-patterns to devise a model for action that will be referred to as *KM-M-CM*, which stands for *K*nowledge *M*anagement as a *M*echanism for *C*hange *M*anagement.

The model is dependent on the (sometimes partial) processes and culture that already exist and organizes them into a rational, orderly structure. This formulation achieves two main goals: first, definition of a *rational* mechanism for managing organization-wide technological changes, where *none has existed*. Second, construction of a *new* mechanism with the assistance of existing processes in the organizational and cultural environment of the university. This will facilitate straightforward absorption into the conceptual world of knowledge management and reduce the opposition to its implementation, since the acceptance of a new pattern of activity creates changes even if the activity is change management.

Knowledge management offers a systemic strategic approach to managing complex organizations. This system sets up an infrastructure that makes it possible to integrate interactions and complex structures, occurring on different, even separate, levels in the organization and its environment (Senge 1990). Knowledge management requires locating and identifying all of the concealed and open knowledge assets of an organization so that they can be used to attain the organization's goals. For this purpose, it utilizes organizational agents, technologies, actions, processes, products and values that result from them, including all of the interactions between them. Research universities were the cradle for many types of technical knowledge that have been created and developed by knowledge companies in the twenty-first century. The paradox is that these organizations lack the consistent ability to use that knowledge and information technology for organizational innovation and creating cooperation with the society and economy that value learning and research.

Historically, the higher education system was the first knowledge economy but today it is no longer alone; it is but one knowledge industry among many. Academia is currently facing many challenges, including new laws (such as those relating to intellectual property) and competition from electronic commerce and biotechnology for the best brains. Furthermore, the boundaries between industrial and academic research have blurred. Internal challenges such as the financial problems of the academic publication system, technological learning that makes it difficult to develop standards and the development of joint research that goes beyond the boundaries of institution, nation and discipline. The higher education system needs to take action to rationally manage both internal and external knowledge, to structure and organize orderly, consolidated learning procedures (some of which, as noted, exist and are based on the academic culture) into an active, smoothly functioning mechanism which regularly examines the position of the university in comparison to its goals, environment and future. A mechanism of this type will manage the change process in the continuous manner required for organizations to survive and succeed in the long term.

Knowledge management offers higher education an infrastructure for planning and managing innovation and change powered by cooperation, collaboration and transmission of knowledge, as part of the organization's activity, while relying on and using information technology and supporting cooperation. Metcalfe (2006) notes that institutions of higher education can develop knowledge management strategy with a defined policy so as to explicitly encourage change and progress. Proper management makes it possible for an organization to build its ability to deal with long-term, wide-reaching changes. Accountability, which is repeatedly mentioned as a demand made of universities, is the added value that accrues to organizations that adopt the knowledge management strategy, which can also help educational organizations create the ability for reflective thinking in all areas of

their activity, provide them with the means for substantiating their positions and with an organizational culture that encourages ongoing research and learning (Petrides and Nguyen 2006).

Conclusions

In conclusion, should be stated that the understandings that emerge from this research indicate that Israeli universities and the higher education system have used information management processes and mechanisms for managing the organization-wide technological changes that have occurred during the last decade. The organizational and cultural framework and infrastructure already exists; it is functional but there is a clear need to structure orderly, rational processes and create the additional processes that are necessary for the efficient operation the entire mechanism. Clear, public guidance is necessary in order to provide a foundation for organizational and inter-organizational processes for managing innovation and change in the long run and thereby shaping the university into an organization that learns and manages knowledge. The change required of the higher educational systems is significant but it not great. Not only does it not break out of existing thought patterns, it actually is well-suited to them because it makes use of existing academic, language, culture and ethos.

According to Peter Senge (2000, p. 276), The challenge of converting the university from a 'knowing institution"' to a "learning institution" can be realized if the higher education system in Israel, its leaders and policymakers understand the need for a permanent mechanism for change management and adopt a rational model for its establishment. The model proposed in this research, based on cooperation and knowledge management, can contribute much to the system and help it adapt itself to the environment by providing a foundation for learning processes in all areas of its activity.

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