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Information and Knowledge Management at Higher Education Institutions

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Summary

Higher education institutions (HEIs) are organizations staffed with experts in all sorts of fields who contribute their expertise and experience to the endeavor of producing and preserving knowledge. The modernization of higher education (HE) has forced the institutions to store, manage and use existing information and knowledge stores in a better way in order to meet new accountability, effectiveness and efficiency requirements. In this chapter we will discuss some strategic applications of information management at HEIs in addition to proposing a basic structure for IT-services if they are to provide support systems for knowledge management.

Keywords

information management, knowledge management, higher education

1. Introduction

Higher education institutions (HEIs) are organizations staffed with experts in all sorts of fields who contribute their expertise and experience to the endeavor of producing and preserving knowledge. As 'knowledge organizations', HEIs need to improve their information and knowledge management (IKM) to respond to the internal and external environments in which they operate. A very high percentage of their employees work as specialists in specific scientific fields and disciplines and are responsible for advancing various scientific disciplines through knowledge creation and development. However the intelligence of an organization depends not only on the sum total of individual knowledge, but on organizational knowledge, the sum total of accumulated knowledge, experience and networking at the HEI. Organizational knowledge is greater than the sum of its parts, therefore a crucial challenge for HEIs wishing to achieve more of it is the enhancement of processes of interaction across hierarchical and functional borders, transparency of competencies, learning from experiences, etc. The performance of the experts usually is best evaluated by their peers within and outside the HEI and by the relevant community, which will be found predominantly outside of the organization. Experts also tend to identify with their (external) community more than with their own organizations. HEIs increasing autonomy from government interference goes hand-in-hand with the implementation of new management approaches like IKM. That HEIs either are using or are planning to use new tools like internet services, document management, e-learning, e-library, centralized system administration (for students and employees), email, information servers, decision support systems, reporting solutions, etc. underscores the importance of professional IKM. The modernization of higher education (HE) has forced the institutions to store, manage and use existing information and knowledge stores in a better way in order to meet new accountability, effectiveness and efficiency requirements.

In this paper we will discuss some strategic applications of information management at HEIs in addition to proposing a basic structure for IT-services if they are to provide support systems for knowledge management. We will concentrate on knowledge management as a key aspect of expert organizations. Because IKM is underdeveloped at most HEIs, we will pay particular attention to the instruments and methods of knowledge management so that readers become familiar with the basic tools. Our case study focuses on one of the central instruments of knowledge management at expert organizations in Austria, namely the intellectual capital statement (ICS), which Austrian universities are required to prepare for the government nowadays. A specific instrument of IKM, ICS is designed to monitor the development of intellectual assets. At the end of this chapter we will provide some key factors for further improvement and development of IKM at HEIs.

2. Information Management

In the context of IKM, it is useful to define the difference between data, information and knowledge. Data are codified observances. Basically the quantity of available data is only limited to the

number of data sources or sources for observances, e.g. data on current and potential future students. Information may be defined as data relevant for a specific system, e.g. a person or an organization. Subjectively some data are not important at all, while some other data–like specific research results or recent publications–make a significant difference. Whether data are relevant or not depends on the filtering criteria pertaining to a subject. To become information, data need to be contextualized to a certain extent. Knowledge results from the integration of information into a context of experience and existing knowledge. This process could be called learning. Isolated information is not the same as knowledge because information by itself cannot be used to predict actions, consequences and interdependencies. (CEN, 2004, p. 6)

Scientific journals consist of a lot of data, so they can illustrate this point. If you browse through a journal, you may stop at a specific article because the headline or abstract caught your interest. You start to read the article and begin to absorb the quantity of information contained in it. As you work on the contents of the article more thoroughly, the information may begin to gel such that you understand the consequences, identify future actions and derive new knowledge from it.

Table 1 Characteristics of basic concepts (Willke, 2004)

	Data	Information	Knowledge
Base operation	Codified observances	Systemically relevant data	Integration of information into a context of experience
Restriction	Numbers, language/text, images	Information that is relative to the system	Common practice, "community of practice"

Application systems are understood as automated task managers for business processes. In the literature, information systems are differentiated based on their purpose and use. One purpose might be to provide a software framework for administrative tasks such as student registration, as well as leadership duties such as decision support (see Figure 1).

Systems to support administration and disposition indicate which tasks at the HEI should be supported with electronic data processing and which raw data should be collected. Decision support systems indicate how the existing reporting system should gather and process raw data and in what formats it is presented to management for decision-making. For example, data from every student application are entered as raw data. Only when various reports gather the data together does a demographic emerge. Maybe there are more students in a certain year who indicate on their applications that they will need financial aid. Management can use reports generated from the raw data to weigh how many students paying full tuition they will need to admit in order not to exceed the financial aid budget. Where there is limited integration between data collection and decision support, data may be found in various forms and thereby generate anomalous information. Information originates from the interplay between the need for and the availability of information, i.e., determining that the information is needed is demonstrably a necessary prerequisite to its collection. The availability of information is determined in part by the granularity of the data entry fields programmed into the software application and in part by the integration and further processing of the data through the decision support system.

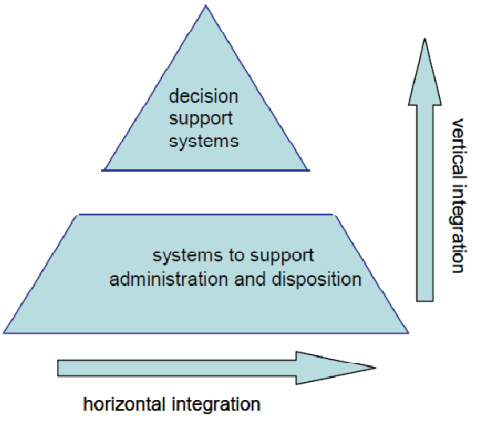

Figure 1 Application system pyramid (Nusselein, 2003, p. 9)

As its name suggests, an information system is so called because it provides information that is needed to perform a variety of tasks. In addition to supporting management functions lie decision support, information systems need to be able to support data entry-and retrieval-based administrative functions such as generating a mass mailing to all incoming students using address and class year information in the database. Bodendorf defines the requirements of an information system as: efficient, highly accurate information retrieval, efficient information preparation resulting in high quality information, as well as good analytical and search performance. (Bodendorf, 1998, p. 94)

The most important administrative responsibilities at HEIs are the house-keeping, supervision and management of financial resources, student administration, and administration of exams, as well as human resource management. Because these systems are often acquired or programmed as separate systems and because they often run on different

software platforms in terms of operating systems, database and application software tools, the weak link in the information systems as a whole is the degree of communication between specific applications and the horizontal integration of data processing. The consequence is multiple points of data acquisition, i.e., redundancy in data inventory, which can lead to contradictory information. In recent years, projects designed to deliver IT solutions for higher education-specific issues like alumni management, personnel development, student support, campus management, etc. have been started at various HEIs.

On the data entry/data retrieval level, the architecture of application systems is basically well developed. By contrast, decision support systems are still rather weak. (Nusselein, 2003, p. 15) Because it is much more oriented towards administrative tasks, hence less towards organizational responsibilities in HE management, information technology at HEIs currently offers only limited support for strategic decision-making processes.

The inadequate development of the decision support level is directly related to the reporting system used at the HEIs. There is a strong need for development of a flexible reporting system that can be used by an end user to consolidate and analyze data in new and unique ways, ways perhaps not foreseen in a set list of pre-programmed reports. It may be stating the obvious to say that reports on intellectual capital will necessarily only be as good as the data they are based upon. If data collection and data entry are inaccurate, insufficient or not granular enough, any report based on these data will be sub-optimal in terms of the information it can convey–no matter how flexible or sophisticated the reporting application! Many applications do not demonstrate the requisite flexibility when it comes to comprehensive reporting, especially ad hoc reporting. (Nusselein, 2003, p. 16) Rather than being able to generate needs (ad hoc) reports looking at data in new ways through different prisms and lenses or aggregating data on the fly, managers often are limited to a set of standard system reports. Add to this the noticeable length of time needed to generate a report and a resultant delay in producing the reports and you have information that is not only pre-packaged but has grown stale by the time it reaches a manager's desk. Flexible consultation of relevant and reliable data for decision-making and HE management will only be possible when expedient data processing and information retrieval are available on an ad hoc basis at every manager's desk. Only when the information is timely and relevant does knowledge become possible. And real value can only be achieved through the use of knowledge and competences.

3. Knowledge and Competencies in Organizations

In order to identify the core elements of your accumulated knowledge and competences, you are invited to ask yourself the following question: "Which knowledge and competencies do I use every day to attain my goals?" If you think about it for a few minutes, you probably will identify a set of different types of knowledge and diverse competencies[1]. When confronted with this question in courses, participants generally name things like: factual knowledge, application of methodologies, experiences, communication competence, social competence, leadership competence, personnel contacts and networks (i.e., knowledge about the knowledge and competencies of other people) and self-reflection. We can differentiate further between the types of knowledge mentioned above. Explicit knowledge can be transferred to a greater or lesser extent from one person to another via language, while tacit knowledge is not transferable at all or only partly transferable to a very nominal degree even if it is written down or verbalized (Polanyi, 1997; Nonaka, 1991).

Another important distinction among types of knowledge maybe illustrated by a simple thought experiment. Imagine a gathering of about twenty people who don't know each other very well . You ask them an easy question: "Which person in the room has the next birthday?"

Usually no one will be able to answer the question confidently. The knowledge necessary to answer the question is available in the room because everyone there knows his own birthday. This knowledge is individual knowledge. The individual knowledge in the room is sufficient only if it has been organized in such a way as to enable this group of people to answer the question. To organize the data, each person could write down his or her date of birth on a sheet of paper; these slips of paper could then be ordered chronologically. In this example, the participants created an organizational basis to answer the question at any time of the year and even into the future. By organizing themselves, these people increased their organiza-

[1] In this article we will not distinguish knowledge and competencies. This is due to the fact that the chosen understanding of knowledge includes its application which is described as an attribute of competencies oftenly. See e.g. North, 2005, p. 33.

tional knowledge. Most complex tasks are like this, in that they can only be fulfilled by groups of people who succeed in arranging their individual knowledge, competencies and activities in a coordinated way. This organizational capacity depends on individuals but not solely. Imagine if the people in the room had had to enter their birthdates into a software application running on a laptop as a prerequisite to entering the room. Now the knowledge is no longer the sole province of each participant, but is stored in a computer program. The organized group of people, i.e. the organization, has acquired the ability to show goal-oriented collective behaviour with the support of information systems. It takes time to build up this ability, and the specific characteristics of this ability always depend on the history of a particular organization.

If we combine these two categories of different types of knowledge and competencies we get four different categories of knowledge, i.e. knowledge media. What are two or three examples for each of the four categories of knowledge in the organization you are working in?

Table 2 Examples of different types of knowledge and knowledge media

Knowledge is ...	individual	organizational
explicit Easily transferable by means of language, may be saved and passed on	Factual expert knowledge, personal notes, etc.	Process descriptions, organizational documentation, checklists, etc.
tacit Hardly or not at all transferable, is tied to people and actions	Personal experiences, ability to abstract, interpersonal competencies, intuition, etc.	Unwritten laws, common routines, traditional values, etc.

On the basis of the above definitions we conclude that neither information nor knowledge is objective. Individuals, organizations and social systems construct knowledge based on their observations, filtering modes and individual history. In order to reduce the complexity of the perceptions, it is necessary for every individual and every organization to construct theories that serve as a basis for actions and decisions. These theories may be called mental models. "Mental models are deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action." (Senge, 1990, p. 8) Organizations also develop specific mental models. (Kim, 1993) Even scientific knowledge may be regarded as mental models that are as much as possible kept free from personal biases.

The mental models of individuals and organizations are shaped by their experiences and by the interpretations and conclusions they constructed to organize these experiences. Mental models both enable as well as limit further thoughts and actions. The synergy between expectations, unquestioned theories, convictions etc. results in a very specific corridor of possibilities for a person or social system. Specific thoughts or actions are thinkable and viable, others are not. (Maturana & Varela, 1988) Different individuals (or organizations) have different corridors of possibilities because they have established different mental models. The differences between corridors of possibilities are easily observable if we compare different lifestyles or very diverse cultures. Hence the exchange of data and construction of new knowledge always requires the selection of systemically relevant data and integration of information with mental models.

4. Knowledge Management

We define knowledge management as a process that forms determining factors for employees so as to foster the transfer, development and utilization of the knowledge of the organization (individual, organization, explicit, tacit) in the best possible way in order to be able to achieve the strategic aims of the organization.

Knowledge as such cannot be managed in a top-down, mechanistic way. Individuals themselves determine how to acquire, use and develop their knowledge, thus "command and control" is not an effective way to encourage successful sharing and development of knowledge. For this reason knowledge management above has been defined as management of the determining factors for employees. Knowledge of the organization ought to allow the achievement of its strategic aims, so strategic goals should be the starting point for the definition of knowledge management goals and for the selection of specific instruments and methods in a knowledge management project.

A basic model for knowledge management shows two different subsystems. Human beings in the social subsystem possess knowledge about partly overlapping areas. This knowledge is the basis for actions. These actions generate experiences that in turn may trigger learning processes with new knowledge as a result. Actions may also lead to documentation in analogue or digital form– e.g., check lists, process definitions, learning results or best practices guides. The documents are a second subsystem that provides a way for humans to develop knowledge.

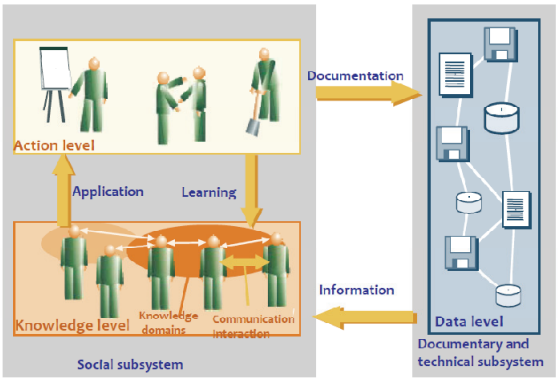

Figure 2 Basic model for knowledge management (An illustrated Guide to Knowledge Management, 2003)

Two different strategies for the transfer of knowledge appear to be very useful in practice. One of those strategies is called codification aka the people-to-documents strategy, where human knowledge is captured in documents. Juxtaposed with this approach is the personalization or people-to-people strategy whereby people transfer knowledge directly to each other without codification. (Hansen, Nohria, & Tierney, 1999) Both codification and personalization have advantages and disadvantages. Depending on the specific point of departure in the organization and the aims of the knowledge management project, an optimal combination of codification and personalization measures can be defined.

5. Instruments and Methods for Knowledge Management

We regard instruments for the realization of knowledge management as intervention tools that foster the transfer and development of knowledge within an organization in a way that leads to achievement of the knowledge goals and also of the organizational goals. (Maier, 2007, p. 196) The status quo and priorities of an organization should be analyzed using one of the available assessment methods in order to identify suitable knowledge management measures.

The instruments and methods used in a knowledge management project can be categorized according to their predominant functions. See below for examples of instruments arranged according to their functions (CEN, 2004, p. 22; Armutat, Krause, Linde, Rump, Striening, & Weidmann, 2002, p. 147; Maier, 2007, p. 196; North, 2005, p. 282; Roehl, 2000):

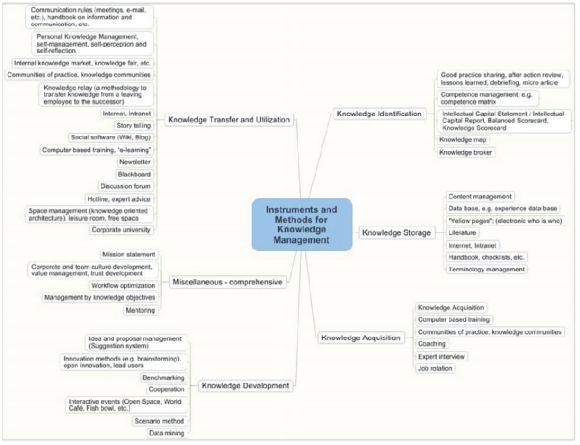

Figure 3 Instruments and methods for knowledge management

6. Knowledge Management in Higher Education Institutes

We can identify several topics for knowledge-oriented management of HEIs (Pellert & Pircher, 2006). First of all, an inclusive participatory process of strategy development appears to be crucial for determining organizational goals and enhancing social commitment. Organizational networking can be promoted by lessening the importance of hierarchies, by interactively reflecting on experiences and different perspectives across organizational barriers and by acquiring tools that foster transparency of knowledge. Creativity and high performance with regard to knowledge work require freedom and a beneficial organizational framework as core enablers. Open communication and learning partnerships are characterized by "listening with care, creating opportunities for dialogue, including underrepresented voices, asking difficult questions and encouraging dissent" (White & Weathersby, 2005). Students may teach themselves, each other, the teachers and the HEI. Stakeholders of the HEI also can provide valuable stimuli for organizational development. Communities of practices (Wenger & Snyder, 2000), mentoring and coaching are examples of instruments that could leverage organizational intelligence.

Generally speaking, the better the HEI succeeds in understanding its stakeholders' points of view, the better it will succeed in receiving funds and social support.

Therefore a kind of co-evolution between societal stakeholders and HEIs leads to a balance between the requirements and goals of the involved partners.

7. Case Study: Intellectual Capital Statements at HEIs

Intangible assets like individual and organizational knowledge and competencies are regarded by many organizations as increasingly important for their effectiveness. However they are hardly represented by standard financial reporting. An intellectual capital statement (ICS) or intellectual capital report is an instrument that can help bridge this gap in standard financial controlling by creating a valuation for the intellectual assets of an organization. "An intellectual capital statement is an integrated part of company knowledge management. It identifies the company's knowledge management strategy which includes the identification of its objectives, initiatives and results in the composition, application and development of the company's knowledge resources. It also communicates this strategy to the company and the world at large." (Danish Ministry of Science, Technology and Innovation, 2003). There are diverse formats for ICSs, as the definition of an ICS is ambiguous and its reports usually disparate lists of financial and non-financial information. In addition to quantitative measures and indicators it includes also a harder to quantify narrative section where the strategies and important developments of the organization are explained and illustrated. (Mouritsen et al., 2004, p. 50)

Methods for knowledge accounting like intellectual capital statements or knowledge scorecards have been used in practice to introduce knowledge-oriented management perspectives to various organizations. Since intellectual capital at any university is arguably its most important asset, it is not surprising to find HEIs at the forefront of knowledge valuation. Because the strategic management and development of their knowledge capital is so critical for HEIs, the case study in this chapter focuses on intellectual capital statements at HEIs.

The Austrian Research Center (ARS) first published an ICS in 1999. They used a process-oriented ICS model that included quantitative and qualitative measures as well as a narrative section. The mission statement and the strategy of the organization served as the basis from which to derive knowledge objectives along with relative measures. These indicators are ordered in three columns: 1) intellectual capital (i.e., human capital, structural capital and relational capital), 2) results and 3) impact as experienced by the stakeholders.

Several lessons are illustrated by their experiences. First of all, the function of an ICS should be considered. One function is to communicate the valuation of intangible assets and their development to interested parties both inside and outside the HEI. Internally, the ICS can serve as a foundation for management to make decisions which are expected to have an impact on the intellectual capital and the institutional results of the organization. Austrian Research Center's experience also demonstrated the need for organizational goals in an ICS and the necessity of concentrating on essential indicators. The ICS should try to explain the causal connections between intellectual capital, business processes and results – financial and non-financial – netted by the organization as a whole. The ICS is no substitute for evaluation, but it can serve as the foundation for better self-monitoring by providing data for evaluation in the form of benchmark results. These benchmarks have to be interpreted according to the specific organizational context and goals before they can begin to provide valuable information to the stakeholders of the organization. (Leitner, 2005, p. 217)

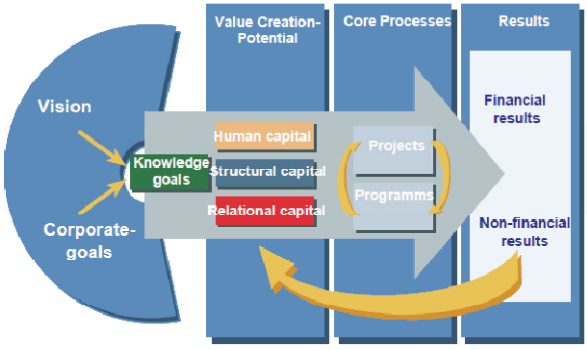

Figure 4 The ARC ICS model (Leitner, 2005)

Since public HEIs in Austria receive substantial government funding, the Ministry for Education, Science and Culture has decreed that universities have to submit an annually ICS as a part of their accounting and performance agreement with the ministry. (Federal Ministry of Education, Science and Culture of Austria, 2002; Federal Ministry of Education, Science and Culture of Austria, 2006b; Pircher & Risku, 2005; Koch & Pircher, 2005) The ICS communicates knowledge and competency-oriented indicators to help the ministry with strategic supervision of public funds (external communication). At the same time, the ICS is a tool the HEI can use in the strategic management of its intellectual capital (internal communication).

The law (i.e., the ministry decree mentioned above) defines human capital as the knowledge of the employees relevant for the functions of the universities, structural capital as non-human capital

or equipment like laboratories, databases, organizational solutions, etc. and relational capital as the networks of social relations that support the university in the delivery of achievements. (Federal Ministry of Education, Science and Culture of Austria, 2006a)

Let us look more closely at the ICS developed by the Universities of Applied Sciences (UAS) in Austria. Since the UAS Vienna had no legal obligation to the ministry, they developed their own ICS independently and began publishing it in 2003 (Fachhochschule des bfi Wien, 2004). While based on the model defined by the ministry, the ICS model and indicators were adapted to UAS knowledge objectives and mission statement. Teaching, research and development and internationalization were defined as core processes. Indicators were selected based on their significance as well as on the availability of the requisite data. (Schlattau, 2007; Schlattau, 2009) The five ICSs published since 2003 have contributed to a growing pool of data that now contains enough information to allow interpretation and assignment of measures. In the following example, we shall focus our attention on the knowledge objective of internationalization and its corresponding indicators:

Table 3 Examples of indicators related to the knowledge objective of internationalization (Fachhochschule des bfi Wien, 2008)

Knowledge objective: The *UAS bfi Vienna aims at an intensive international orientation in teaching,organization, knowledge transfer and projects.*						
Core indicators internationalization	**2003**	**2004**	**2005**	**2006**	**2007**	**Goal 2008**
Intellectual capital						
Number of foreign R&D partners	1	2	2	4	6	⇔
Number of foreign higher education partners	13	33	54	77	66	⇔
Number of outgoing teachers	1	6	8	2	3	⇧
Results						
Number of outgoing students	30	34	35	48	43	⇔
Number of internships abroad	28	29	32	20	26	⇧
Number of optional foreign language courses	2	5	5	6	8	⇔
Number of internationally accredited diplomas in foreign languages obtained by students (Cambridge, DELF)	28	29	41	42	15	⇧
Impact						
Number of incoming students	3	19	54	74	76	⇔
Number of outgoing lecturers	2	19	8	20	6	⇧
Satisfaction with lecturs on foreign languages	2,45	2,53	2,35	2,7	2,5	⇧

8. Critical Reflection

Experience shows that ICS indicators should be based on an organizational mission statement and strategy as well as on specific knowledge objectives. For this reason a "one size fits all" approach is not suitable. Prior to generating an ICS, a university first has to clarify its core competencies and goals. As a consequence, the indicators of different organizations or universities may not be comparable on a one-to-one basis. The unique context and the specific goals have to be taken into account. The ICS seems to be most useful to organizations when the indicators are surveyed repeatedly and developments and the impact of measures are observed over time.

The ICS should be used to meet communication objectives and to guide internal management toward reaching a sustainable position. Its use as a communication or marketing tool is limited and will more than likely not create enough benefit for the organization to justify its continued use for more than a few years. ICS (and knowledge accounting as such) is a specific instrument to manage knowledge by monitoring the growth and development of the intellectual assets. The ICS is a report that in and of itself does not influence an HEI's knowledge objectives. By measuring the impact of knowledge management measures, the ICS gives the information necessary to make course corrections and a way to assess their effectiveness. Correctly selecting and identifying indicators according to the organizations goals is essential if organizations want to avoid the danger of a too limited number of inappropriate indicators yielding misleading information.

9. Conclusion and Recommendations

IKM at HEIs is more the result of problem-oriented and decentralized IT development than a reflection of a strategic IT direction. Information management and the deployment of existing technologies to support the HEI are predominantly driven by administrative rather than management, executive or service-oriented needs.

For a university to function as an integrated whole, it needs IT infrastructure that adequately handles all the institutional processes and administrative functions and that also supports strategic decision-making by management. The meaning of IT as "enabler" is becoming ever more important. IT at HEIs must be able to provide a reliable and coordinated technology infrastructure that is able to handle data (including data entry, data sharing, data retrieval, and information generation), communication, and multimedia.. Only then will it be possible to fully exploit the potential for improvement possible through integrated and comprehensive deployment of IT resources that addresses the needs of the organization via a strategic top-down perspective.

Departmental level technical support staff must actively participate with central IT in their role as service providers to the HEI in order to get the integrated systems and applications that meet their

needs. Absent a comprehensive IT service and organization concept for research, teaching and administration, departmental IT staffs often fail to achieve such coordination much less the necessary level of quality. Reasons include the lack of means to deliver and support the services they offer, lack of timeliness and completeness of centralized IT services, and inadequate quality and availability of some services. Failure to coordinate campus-wide IT services leads to high personnel costs for supervision of systems and machines, to expensive procurement processes, to inefficient administrative activity and to critically insecure modes of operation.

Many enterprises hire a Chief Information Officer26 (CIO) who is responsible for the information and communications technology infrastructure management at the HEI at the most nuts and bolts definition of his job and for the strategic value proposition of information processing at the executive level. Through the deployment of IT, the CIO effectively takes responsibility for implementing technology solutions to undergird the strategic initiatives of the institution, an endeavor that presupposes an intensive understanding of the business processes. As part of the executive team, the CIO is both an IT administrator as well as an IT shaper. The CIO should ensure that institutional-level and campus-wide cooperation is established between the data processing center, library, media center, administration and faculties, departments and schools. This requires technical, organizational and legal (right of utilization) coordination, i.e., integration of IT in all areas as well as implementation of concepts for integrated data management, cooperative utilization of resources, and IT security. In addition, policies and lines of responsibility must be clearly established. Without these IKM could be not implemented at HEIs.

This strategic orientation toward the necessary information that HEIs require in order to optimize their business processes–Davenport (2000) calls this "Putting the I in IT" – is an essential condition for the better deployment of IT at HEIs and for the improvement of IT service quality.

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