Didactic architectures and organization models: a process of mutual adaptation

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Summary

This article aims to establish a parallel between the organizational models and the didactic architectures used by businesses to manage internal training. The objective is to understand whether so-called "eLearning 2.0" (eLearning based on the tools and approaches typical of web 2.0) can be useful in different frameworks and organisations. In this context, the paper looks at whether it is possible to identify a mutual process of adaptation among the organizational and training models we term didactic architectures. During the analysis, four different organizational models are introduced (industrial society, post-industrial society, enterprise 1.0 and enterprise 2.0), and the corresponding evolution of didactic architectures is suggested (web based training, eLearning 1.0, online education, eLearning 2.0).

In a knowledge society where time to market is fast and competence domains are widened and in rapid evolution, organizations are forced to move towards the so called enterprise 2.0 model, characterized by an intensive use of blogs, wikis, social bookmarking and RSS. These organizations have a flat structure and are based on the principle of autonomy. This article asserts that in these contexts, training and vocational systems based on the same principles - namely autonomy, informal style and an open approach - can be implemented. In other more traditional frameworks, formal eLearning based on LMS platforms will continue to represent an effective solution: as long as users do not become familiar with the functionalities offered by 2.0 technologies and thus become actors of change.

The document is structured in three parts: The first chapter analyses four different didactic architectures, highlighting the differences between eLearning 1.0 and eLearning 2.0; the second chapter describes organizational models and introduces the relation with the didactic architectures, and the third chapter highlights the process of mutual adaptation between didactic architectures and organization models.

Keywords: Informal learning, Training, LMS (Learning Management System), Pedagogy, PLE (Personal Learning Environment), eLearning 2.0., didactic architectures, online education, learning platforms

1 Didactic architectures

The analysis carried out in this document focuses on web-based distance training and its evolution. The survey also compares different didactic architectures, considered as models for training activities. Each type of didactic architecture is characterized by specific visions, objectives, technologies, methods and practices, and underpinned by a given pedagogic approach.

The analysis carried out in this document looks at four didactic architectures: web-based training, elearning 1.0, on-line education and elearning 2.0. The different architectures are described in terms of their pedagogic model, type of supported learning, the tools used and the characteristics of the content. Particular attention is devoted to highlighting the differences between LMS-based systems (elearning 1.0) and web 2.0 service-based systems (wikis, blogs, podcasts, social bookmarking, RSS,

etc.). As we will show in the following chapters, the two models are not only characterized by the use of different technologies but are founded on very different methods and can therefore satisfy the demands of different types of organizational systems.

1.1 Web-based training

The name of this didactic architecture recalls the Nineties term for the on-line training programmes implemented within the business framework and based on the on-line distribution of autonomously-used learning materials. The objective was "training" rather than education or learning, terms that today focus more on the active role of the end user in the learning process. This didactic method is nowadays used in training programmes that are based on contents, and is effective when the objectives are more focused on information acquisition rather than the attainment of analytical skills.

In general the term WBT (web-based training) covers the web-based didactic approach, the type of contents and the software used to manage them. The contents consist of a set of multimedia pages for the user to consult autonomously, while web-based software delivers additional services. Unlike the current LMS, with these systems it is not possible to monitor and trace users (elearning 1.0).

The underlying theory is **behaviourism**, according to which our brains, when subjected to a given stimulus, produce an answer that is a behaviour. In pedagogic theory this translates into the assumption that workers "exposed" to structured learning material learn the contents and are able to apply them when working. This is known as a **transmissive** didactic model (Trentin, 2001).

1.2 Elearning 1.0

The Web Based Training model evolved into the so-called Elearning 1.0 didactic architecture, which is based on elearning platforms called Learning Management Systems (LMS) or Learning Content Management Systems (LCMS). LMS are very effective in supporting content delivery, designing training, and registering, monitoring and certifying users.

The main strengths of elearning platforms, especially those implemented in a business environment, regard facilitating the administration and management of a large number of courses and users. Areas regarding communication, collaboration, knowledge creation and active learning receive less attention from both the producers and users of the platforms. Performance is mainly assessed by means of objective criteria, such as the number of pages used and multiple choice tests. Much attention is devoted to contents, using the model of interoperable and re-usable learning objects (SCORM), while the learning process is given less consideration.

The didactic model adopted is based on the distribution of specific learning material to a high number of users, while tools to support collaborative work are available, but seen as additional elements. In a lot of business LMS, there is no teacher figure to act as a content expert guiding the students. There is a training coordinator who supervises the course, and a mentor, a kind of tutor who provides help when requested, but does not actively drive the learning process. This didactic model, which closely resembles the transmissive one, can be defined as **assisted** (Trentin, 2001), as most of the learning is self-learning, with minimum support from the tutor.

The vision which underlies this approach is termed "curricular" by Sica and Scotti (Sica & Scotti, 2007), and is based on planning curricula and didactics in different stages: defining objectives, assessing entry knowledge, breaking down objectives into sub-objectives, etc. Much attention is devoted to identifying the user's most suitable learning path, which is automatically managed through skills balances[1].

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[1] A skills balance is a procedure which enables a worker's skills to be assessed in comparison to his or her professional profile. The gap between expected and real skills is filled by completing a curriculum or activity plan which includes all the courses that the worker attends in order to reach the objectives and eliminate the gap.

Cognitivism is the theoretical framework. It is worth noting that, in terms of learning approaches, behaviourism theories stress the incentive-answer, whereas cognitivism focuses on how the mind represents knowledge.

1.3 Online education

By the end of nineties, educational practices based on communication and collaboration, with the use of web-based training initiatives, became more and more frequent. These initiatives, more frequent in academic settings and schools than in the business environment, were initially based on very simple technologies such as mailing lists and newsgroups, and later on devoted frameworks such as conferencing systems[2]. Together with various types of content proposed by the teacher, not necessarily multimedia (books, lecture notes, etc.), there are also activities and discussions which actively involve students and produce output used as learning material in subsequent courses.

The theoretical frame of reference is **constructivism**, which upholds the importance of the active role of students in the processes of teaching and learning. The construction of new materials and meanings comes both from materials previously delivered by the teacher or simply from hints and stimuli provided by the teacher or tutor, figures which play a central role. It is in fact thought that the students have to be driven, addressed, involved and stimulated by the tutor-moderator. The courses are thus intended as social processes, because they are implemented by means of interaction among the different subjects involved: teacher, tutor and students.

The same approach has been adopted by some open-source LMS which focuses on communication and collaboration functions. Atutor, for instance, is a suite containing specific software to support communication and cooperation (Acollab, Achat, Acomm), integrated with the LMS. Dokeos (www.dokeos.com) includes tools for videoconferencing and the virtual classrooom.

This model has not been used much in organizations which started with web-based training systems then subsequently passed to elearning 1.0. It is more widespread in universities.

1.4 Elearning 2.0

With the diffusion of "social software", the way we use the internet for information and to communicate has changed greatly. User contributions are no longer restricted to newsgroups or forums: almost all websites now allow users to upload their own contents: this is called "user-generated content". The usage/creation process is continuous: multi-channel usage is now a reality, and wireless connections enable us to be online at all times wherever we are.

New practices in web use have further affected the elearning framework. In order to highlight these technological and methodological changes, the term "elearning 2.0" is frequently used. This term first appeared in an article by Stephen Downes in 2005 which showed how communities of practice can constitute an interesting new learning model (Downes, 2005).

We will now analyse elearning 2.0 from the pedagogic and technological points of view.

1.4.1 Definition

This definition of e-learning 2.0 is from Wikipedia:

> *eLearning 2.0 refers to a second phase of e-Learning based on Web 2.0 and emerging trends in eLearning. It can include such features as e-Learning where students create content, collaborate with peers to form a learning network with distribution of content creation and responsibilities, e-Learning that takes advantage of many sources of content aggregated*

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[2] Conferencing systems are software programmes which were used in the late Nineties for distance learning. They provide a forum-like communication environment, where messages are organized into thematic areas. Today the term has fallen into disuse and systems have evolved, providing various tools for collaboration and cooperation.

together into learning experiences and e-Learning that utilizes various tools including online references, courseware, knowledge management, collaboration and search.

The term suggests that the traditional model of eLearning as a type of content, produced by publishers, organized and structured into courses, and consumed by students, is reversed; so as that content is used rather than read and is more likely to be produced by students than courseware authors.

1.4.2 Pedagogic Approach

On a methodological level, the typical elearning 1.0 transmissive/assisted learning model is turned round: with 2.0 tools learning is based on bottom-up contents and put into relation to forge new meanings. With reference to Trentin's classification (2001), we can define the didactic model as **peer to peer**, aimed at creating collaborative groups which share knowledge and experience to enable the whole group to grow.

Siemens coined the term **connectivism** (2005) to define this new way of learning, which is based on the following principles (Siemens, 2006):

– Learning and knowledge require a diversity of opinions to present the whole…and to permit the selection of the best approach.
– Learning is a network-forming process which connects specialized nodes or information sources.
– Knowledge resides in networks.
– Knowledge may reside in non-human appliances, and learning is enabled/facilitated by technology.
– Capacity to know more is more critical than what is currently known.
– Learning and knowing are constant, ongoing processes (not end states or products).
– Ability to see connections and recognize patterns and make sense between fields, ideas, and concepts is the core skill for individuals today.
– Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
– Decision-making is learning. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

As effectively explained by Bonaiuti (2006), "connectivism would like to criticize the main learning theories, synthetically identifiable as behaviourism, cognitivism and constructivism, as incapable of providing a suitable theoretical support to the demands of modern on-line learning modalities. (…) It is not a matter of considering the learning process as a progressive accumulation of knowledge, but rather as a set of connections which make access to knowledge possible."

If we consider the type of learning involved, there is another substantial difference between elearning 1.0 and elearning 2.0. While the first is based on formal learning, the second relies predominantly on informal processes.
– Formal learning is a process developed within a structured and organized context (formal school education, business training courses) leading to an official acknowledgement (diplomas, qualifications, certificates).
– Informal learning is the result of daily activities related to work, the family and leisure time. It is not structured in terms of learning objectives, time and support, and it does not usually lead to any kind of certification.

Jay Cross (2003) highlighted the fact that within organizations, most of the learning process (around 80%) occurs during informal moments:

*At work we learn more in the break room than in the classroom. We discover how to do our jobs through **informal learning** -- observing others, asking the person in the next cubicle,*

*calling the help desk, trial-and-error, and simply working with people in the know. **Formal learning** - classes and workshops and online events - is the source of only 10% to 20% of what we learn at work. (Cross, 2003)*

Moreover, Jay Cross draws attention to a sort of paradox between the results of formal learning and related investments.
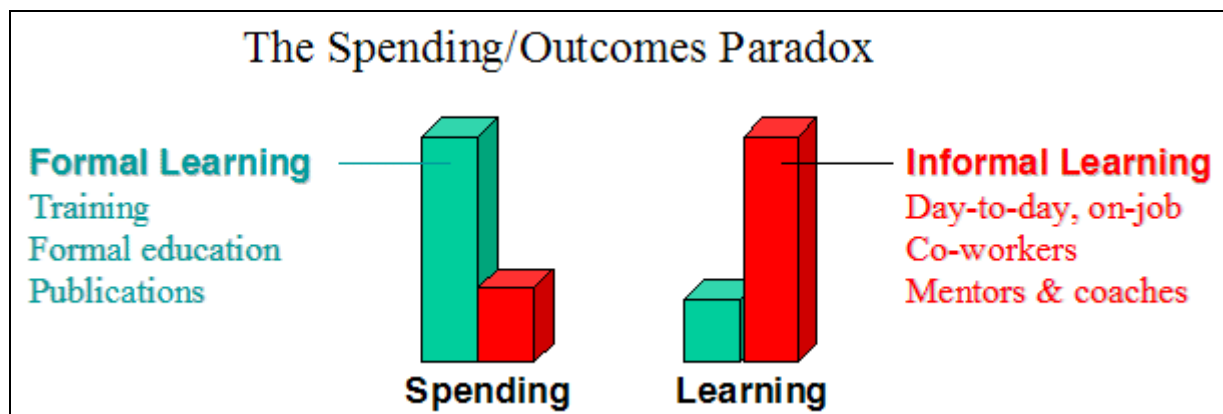

Figure 1. The spending/outcomes paradox in terms of education (source Jay Cross 2003)

As stressed by Bonaiuti (2006), formal education, workshops and other institutionalised training initiatives represent a poor alternative in comparison to natural and spontaneous learning. We could thus affirm that the model called elearning 2.0 fosters informal learning dynamics. The perspective consists in exploiting and improving the potential of the web's informal framework, and practical experience.

1.4.3 Technologies

The concepts explained above in methodological terms can be implemented in practical terms using the tools offered by web 2.0. Such tools include: blogs, wikis, social bookmarking, podcasts, collaborative conceptual maps, web feeds and tagging. Some of these tools can be integrated into platforms, and the basis of this new approach consists in using these tools directly online, exploiting the flexibility of the web.

In October 2004 Tim O'Reilly began talking about the concept of "the web as platform", describing a scenario where the user is centred with respect to services (O'Reilly 2005) and can work on-line from different places in a kind of virtual office. The different services can be "aggregated", in order to implement an operational and study environment centred on the user and on his or her network of personal resources.

As for elearning, we can talk about PLE (*Personal learning environments*) or *elearning frameworks* (Jones, 2005). George Siemens (2004) describes a *learning environment* as based on *decentralized, learner-in-control, piece-it-together tools*.

Siemens underlines that a single tool cannot do everything and that it is necessary to connect different functionalities or specializations in a set of tools, making the user the leading actor in terms of different areas and personal interests. Some functions are also available on the current platforms that Siemens (2004) defines in his article as "the wrong place to start learning".

Attwell (2007) recently analysed the PLE concept, highlighting its importance from an ethical and pedagogic point of view. The following is a summary of Attwell's thoughts:

> *Personal Learning environments are not an application but rather a new approach to the use of new technologies for learning. (…) PLEs provide learners with their own spaces under their own control to develop and share their ideas. Personal Learning environments are not an application but rather a new approach to the use of new technologies for learning. Moreover,*

PLEs can provide more holistic learning environments, bringing together sources and contexts for learning hitherto separate. (…)

1.5   A comparison

The following chart describes the elements which constitute and characterize the four didactic architectures mentioned.

DIDACTIC ARCHITECTURE	WEB BASED TRAINING	ELEARNING 1.0	ONLINE EDUCATION	ELEARNING 2.0
Theoretical Framework	Behaviourism	Cognitivism	Constructivism	Connectivism
Pedadogic approach	Transmissive (autonomous)	Assisted	Collaborative	Peer to Peer
Tools	Web-delivered	LMS	LMS + collaborative tools	Web as a platform
Contents	Course-based training	Learning objects	Mixed production by teachers and students	Community based, user-generated contents

Figure 2. Comparison between didactic architectures

The first row lists the theoretical approaches which underpin the didactic models in the second row. The terms refer to the classification by G. Trentin (2001) that highlights the use of the web to support learning processes. The "tools" row underlines the differences in the technologies used, while the bottom row shows the type of content.

In which contexts or organizational systems is elearning 2.0 most effective? Where can elearning 2.0 be effective? In the following chapter we describe a reference framework which highlights the process of mutual adaptation between didactic architectures and organizations.

2   Didactic architectures and organizations

In this chapter the didactic architectures mentioned are compared to organizational systems, namely the organizational and cultural models that characterize organizations.

2.1   Organizational systems and training

We shall start by considering Domenico Lipari's observations on how training has evolved within organizational systems, together with economic and organizational models (Scotti & Sica, 2007). The evolution of organizational systems followed action logic and related equipment used in training processes. Lipari identifies three stages:

- **The Ford model:** within the Ford-inspired organization, the training approach consists in education, i.e. the transfer of operational notions to help the worker use machinery and implement production techniques.

- **The Taylor model:** in the huge international corporations typical of the Taylor model and neo-modernism, the training methodology is more structured and involves a number of phases: requirement analysis, planning, didactic management, assessment. Learning objectives are codified and broken down; didactic activity is designed around the cognitive mechanisms of the individual.

– **The Post-industrial model:** today the value of organizations is less bound to products and more centred on intellectual capital, i.e. the full set of intangible assets such as strategic skills, people, background, experiences, traditions and values. Training models are based on an organizational form of learning, based on the ability to capitalize on the tacit knowledge produced.

	Organizational asset	Pedagogic approach	Approach	Logic
Ford	Production system	Behaviourism	Teaching	Training
Taylor	Dimension, marketplace/products	Systemic approach	Instructional design	Individual and organization integration
Post-industrial	Intellectual capital	Constructivism	Skills and community management	Organized learning

Figure 3. *The Lipari model of training logic within organizations (Scotti & Sica, 2007 page 41)*

2.2 Company structures and organizational models

Company structures are described in terms of the hierarchic/flat dichotomy, while the classification proposed by Nonaka and Takeuchi (1995) is the basis for the organizational model. They analysed the relationship between knowledge management and the administration of production processes, suggesting an interesting classification of the different trends based on three management models: bottom-up, top-down and middle-up-down. The following paragraphs provide a brief description of these.

2.2.1 The top-down model

The top-down model regards the classical vertical hierarchical model founded on Max Weber's (1968) observations on bureaucracy and Frederic Taylor's (1967) "the scientific organization of work". This model was systematically elaborated by Herbert Simon and asserts that knowledge creation is a simple matter of processing information: the top receives simple and selective information from the bottom, and uses it for planning before returning it to the bottom (Weber, 1968; Simon, 1967). The information is processed at different levels throughout the hierarchical chain: top management defines the basic concepts that become the operating conditions for the middle managers, who have to choose the tools to implement them. The decisions of middle management in turn determine the operating conditions of the employees applying the decisions. At the production line level, the execution of the operations is mainly routine. The knowledge produced within this model is predominantly encoded and stored in files or database.

This model characterised the large-scale companies of the fifties and sixties or bureaucracy, which called for clear and precise rules. Nevertheless, less complex forms of this model also suit SMEs where the manager is also the owner of the firm. In general terms, the top-down model is the basis for the management of information needed "to define, transmit and achieve assignments; to define and transmit rules; to measure and assess performance" (Shockley & Zalaback, 1991).

Within this model, two different orientations can be identified: **top-down task-oriented**, as described above, and **top-down people-oriented**, with more attention to people, roles and individual abilities, albeit still based on a hierarchical model.

2.2.2 The bottom-up model

The bottom-up model essentially mirrors the top-down model, as shown by the schools of human relations (Mayo, 1949) and motivation (Likert, 1961).

The principles of vertical hierarchy and activity control are in opposition to autonomy. Instead of a form of knowledge created and checked by top management, this model represents a knowledge process which is established and, to a certain extent, also checked from the bottom. The flattening of the hierarchy (by eliminating a number of levels) and a reduction in the division of work shortens the distance between top management and the production line to three or four managerial levels.

Bottom-up organization is therefore flat and horizontal. As for the managerial behaviour that characterizes this type of organization, Likert (1961) came up with the concept of "participative" leadership: the management gives few orders and instructions, but contemporarily stimulates collaboration through communicational channels "from the bottom", thus exploiting produced knowledge.

2.2.3 The middle-up-down model

The middle-up-down model was conceived by Nonaka and Takeuchi (1995) and aims to merge the advantages of the top-down and bottom-up models, as part of that body of organization theories defined as post-Fordist. Without analysing the various different schools in depth, post-Fordist theories supersede the Taylorite conception of knowledge as a set of practical rules for efficient production and emphasise their role as a resource to increase the value of the business (Di Bernardo & Rullani, 1990).

The middle-up-down model is based on analysing the role of middle management, which represents the real structure for the creation and management of business knowledge: it represents an interface between top management and line operators, because it lies at the intersection between the enterprise's horizontal and vertical information flows and is able to combine operational demands with business strategy. More in detail, the role of the so-called "knowledge manager" consists in identifying, collecting, synthesizing, organizing and administrating all the information in his/her possession or belonging to his/her range of competences, in order to place it at the company's disposal.

This model, which is based on an analysis of Toyota in the '90s - characterized by just-in-time production and different operational procedures in comparison to traditional production lines - provides some insight into, and interesting connections with, knowledge management: in fact knowledge circulates within the whole firm and anyone can contribute to its production and development. This process is facilitated by "interface structures", people and technological tools that foster, stimulate and enable the management of knowledge circulation within the company. In the first case, as described, this regards middle managers; in the second case ICT.

3 Mutual adaptation

Here we revisit the Lipari model shown in Figure 3 (Scotti & Sica, 2007) in greater detail in order to highlight the mutual relationship between organizational systems and didactic architectures (Figure 4).

The four didactic architectures illustrated in the first chapter (Figure 2) are connected to the organizational structures defined in the second chapter: we have added **Company Structures** and **Organizational Models**, both described in the previous paragraph.

The chart below highlights the existing relationship between organizational models and didactic architectures.

ORGANIZATIONS	INDUSTRIAL SOCIETY	ENTERPRISE 1.0	POST-INDUSTRIAL SOCIETY	ENTERPRISE 2.0
Production model	Fordism	Taylorism	Post-industrial	Knowledge society
Company structure	Hierarchical	Hierarchical	Flat	Flat/Liquid
Organizational model	Top-down task-oriented	Top-down people-oriented	Middle-up-down	Bottom-up
Theoretical Framework	Behaviourism	Cognitivism	Constructivism	Connectivism
Pedadogic approach	Transmissive (autonomous)	Assisted	Collaborative	Peer to Peer
Tools	Web-delivered	LMS	LMS + collaborative tools	Web as a platform
Contents	Course-based training	Learning objects	Mixed production by teachers and students	Community-based, user-generated contents
DIDACTIC ARCHITECTURE	**WEB BASED TRAINING**	**ELEARNING 1.0**	**ONLINE EDUCATION**	**ELEARNING 2.0**

Figure 4. *The relationship between didactic architectures and organizations*

The white part of the chart shows the characteristics of the organizations: industrial society, post-industrial society, enterprise 1.0 and enterprise 2.0. The four models are characterized by different business structures and different organizational models (described in the previous chapter). In the grey part of the chart are the didactic architectures described in the first chapter.

The analysis of the four models and the mutual relations follows.

− The **industrial society** is characterized by a hierarchical, top-down, task-oriented model. Training is seen as the transfer of operational instructions to enable workers to use machinery and implement operational techniques. The didactic architecture most suited to this model of enterprise is **web-based training**.
− The so-called **enterprise 1.0** model is a very similar organizational model but more people-oriented: the hierarchy and delegation mechanisms are handled less rigidly. Communication technologies have an important role and business intranets are widely used. In these organizations both knowledge management and the training model are more structured. Didactic activity is organized into stages, by objectives and based on the individual's cognitive mechanisms (cognitivism). For these reasons the most appropriate didactic architecture is the so-called **elearning 1.0**.
− The third column of the chart shows the relationship between the so-called **post-industrial** organizational system, based on a middle-up-down model, and the so-called **online education** didactic architecture. Both organizational and training systems are based on intermediate roles: middle management in the business organization and the tutor in the training activities. Middle management acts as a bridge between top management and operators in terms of organization of work and information flows, as the tutor is crucial for communications between teacher and student in training activities. On a technological level, the most important systems are those which promote and support communication.

- The fourth column introduces the features of the so-called **enterprise 2.0**[3], characterized by a bottom-up structure and the intensive use of web 2.0 tools and technologies. This kind of company is linked to a productivity model that we define the "knowledge society", where intellectual capital and the competences involved in updating and managing one's own knowledge are more important than the production of goods and services. For the enterprise 2.0 model, the most effective didactic architecture is **elearning 2.0**, as this is mostly based on informal learning and contents generated by social processes.

4 Conclusions

This document aims to show how training systems have to adapt to the emerging demands of different business contexts, and that such demands are strongly influenced by the business's structure and culture. Where business culture is based on hierarchical principles and production procedures are founded on the scientific organization of work, a Web-based training architecture is justified.

This model evolved into the so-called elearning 1.0 system, based on a more attentive management of the training process, which is organized into phases, modules and units. The technology not only delivers multimedia contents, as in the Web-based training model, but also covers administrative management and the assessment of processes, entailing assistance and tutoring from trainers. This kind of training model, based on skills balances and managed by means of learning management systems, is suitable in contexts where business culture is still primarily top-down, while it is not effective or suitable for the emerging models of business organization which characterize companies operating in the knowledge society.

Acknowledgements

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[3] The term Enterprise 2.0 was introduced by Andrei McAfee, professor at Harvard Business School. It refers to the use of blogs and wikis, social bookmarking, RSS and social networking for connecting people, communications in real time, audio-conferencing and video and virtual environments. These technologies go along with a "philosophy", as in the enterprise 2.0 model hierarchies and business schemes fail and a democratic, informal style of communication develops. For further information see the post by McAfee, *The Impact of Information Technology on Businesses and their Leaders*, (March 2006) http://blog.hbs.edu/faculty/amcafee/index.php/faculty_amcafee_v3/the_three_trends_underlying_enterprise_20/

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