

Centro nazionale per l'informatica nella pubblica amministrazione

Guidelines for e-learning projects in the Public Sector

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1. Objectives

The main objective of these “guidelines” drawn up by the CNIPA (Italian National Centre for the Information Systems in the Public Sector) is to foster throughout the Public Administrative structure a correct use of the new technology and methodologies to train and skill up civil servants. This is to come about on the basis of a series of steps described by the government directive dated 13 December 2001; such a document has been issued by the Minister for Public Function in agreement with the Minister for Innovation and Technology under the heading “Training and Skill Enhancing on behalf of Public Administration (P.A.) Personnel”.

The Directive in question has already provided the opportunity to make it clear that using new technologies and the existence of a nation wide network as well as the ever increasing number of tele-workers represent significant aspects, which necessarily call for a thorough analysis of the ways training activities are carried out and of the related technical aspects.

Therefore, when devising training activities, e-learning methodologies will also need to be considered so as to improve training efficiency and effectiveness. E-learning methodologies, however, should not be regarded as an alternative to more common methods: they rather constitute a new possibility to be added to a more traditional approach.

An e-learning based training project has an impact on organization, as well as on the methodology and technology involved; such feature requires relevant initial investment, which in turn makes it necessary to monitor the project in all its implementation stages.

Moreover, the high production costs for materials to be used in high quality e-learning activities make it very convenient to increase cooperation among different structures, so that the teaching resources can be reused in a clever way. This requires teaching materials to be devised in compliance with international standards that guarantee portability in different operational environments.

The complex nature of such projects can, in some cases, require proper outsourcing. This, however, should not exonerate P.A. officials and staff from actively participating in the planning, provision, monitoring and control stages. It is therefore necessary to set up a preliminary phase aimed at providing with suitable skills all those involved in devising training activities; such individuals should be put in a position where they can exploit their own competence to the full and in the new environmental context which has been brought about, on the ground of all the changes that took place over time.

The present document provides some information on methodology and organizational impact, it also aims at stressing the relevance of technology and technical problems to do with producing and using teaching materials that conform to the standards and that, as it was mentioned before, can be portable and reusable.

2. Management and Coordination

E-learning projects, like many traditional training activities, take place along with the change processes that often entail defining new objectives and professional profiles.

Earmarking such goals and the related training requirements represents a task which can only be properly tackled within Public Administration structure as it presupposes a

thorough understanding of the following aspects: mission, functioning of public administrative structure, mapping between structures and competence spheres and relationship among the various operational units.

However, the active role played by the P.A. is not confined to the planning stage, which, among other things, entails analysing management activities and related cost factors. The P.A. should on top of that exert its control over all the process stages.

More specifically, in the service provision stage the operational management requires an efficient coordinating strategy as well as thorough control and monitoring action aimed at establishing whether the objectives are being reached. To this end it is necessary to create a managerial position within the P.A. – that should not necessarily be identical with the responsible for planning activities – who carries out the following tasks: coordinating teaching activities, guaranteeing service levels, interacting with all the components involved: the demand represented by the learners and the suppliers (*tutors, technical team, etc.*).

In the case of outsourcing, the contractor will have to appoint a person responsible for the project; such an individual will work in close cooperation with the internal coordinator who, as it was mentioned before, plays a pivotal role stressed in the previous directive.

Last but not least, it should be pointed out that monitoring activities could be carried out both using internal resources and drawing upon specialized firms operating outside the P.A. In any case human and economic resources, that are deemed necessary, are to be carefully gauged as part of the project related costs.

3. Organizational Impact

The above mentioned directive dated 13 December 2001 has pointed out the need for the training plans to be set up in the very organizational environment they are destined for; it has also made clear that such plans have, in turn, an impact on work organization.

This remark holds all the more true in the case of *e-learning* projects.

In the Public Sector quite often this kind of project is started and managed by the sector responsible for training activities. The emerging trend is to provide the above-mentioned structure with managerial, technical, operational and financial autonomy. This is also due to the evolution of the legislation and technological framework, which is having an ever increasing impact throughout the P.A.

In a nutshell, activities carried out in the training sector generate innovation, which cascades down various processes.

In the Public Sector characterized by a particularly solid organization and structure, the competence concerning training activities is attributed to a specific core component – set up within the training sector – which carries out coordinating and supporting tasks concerning methodology. Furthermore it deals with detecting and pinpointing requirements, which have an impact on the overall structure of the Public Body in question. Moreover, there exists a network of reference individuals, working in the various sectors of the Public Body. Such individuals play a very important role in the following: detecting training needs to do with carrying out the various activities, evaluating the competence degree reached by the learners as well as the related impact.

In the wide organizational scenario that has been briefly outlined, it is evident that *e-learning* activities make a relevant contribution towards creating shared knowledge on specific topics to do with various skills, thereby representing a momentum generating factor to achieved concrete innovation objective both organizationally and technologically.

The *e-learning* activities planning stage requires active participation of the following structure: interested Offices, the training office – which must cope with new problems and use new technology and methodology – and the information system office. Bringing up to date the knowledge of those employees working in offices dealing with training activities and setting up cooperation with structure responsible for information system are indispensable precondition for the training project to be successful.

The service delivery stage throws up remarkable organizational problems in spite of a wide spread optimistic view on *e-learning* flexibility. Indeed the *e-learning* mode allows the delivery of training services without the employee having to leave their workplace and irrespectively of any time constrain. However, e-learning does require a workload redistribution during the training period, so as to allot a proper amount of hours per week to be devoted to the planned learning activities. Moreover, suitable workstations have to be set up or small decentralized labs, which should enable to take advantage of teaching material and to carry out cooperation based activities. Furthermore in many cases the employees will need to become familiar with a tool they don't use very often; the training path will have therefore to start with providing basic IT competence.

Given all these aspects, during the training period employees will have to be guaranteed suitable technical support as well as a logistical setting enabling them to take full advantage of the opportunities provided by the *e-learning* mode.

Furthermore it has to be born in mind that technology infrastructures (*server*, networks and *workstations*) available within the P.A. have been designed in view of a normal workload. This makes therefore necessary to check whether such infrastructures can also cope with training activities. In this respect technology plays a decisive role; should technology turn out to be inadequate, even a didactically very good project could be doomed to failure.

If the administration chooses to use a technology services provider (*ASP - Application Service Provider*, or *LSP – Learning Service Provider*), the adequacy of the service levels provided will need to be checked, interoperability with the existing system is also to be ensured.

4. Roles

In the following all the roles involved in the e-learning process will be examined, a distinction will be drawn between the position of the P.A. - which represents the training demand - and that represented by the potential e-learning providers, which are on the supply side.

As it was stated in the directive, the demand side must provide for a professional profile within one or more administrative structures; the individual in charge has to display a thorough understanding of the environmental context and its related problems. Furthermore they have to be able to manage human contacts thereby being in a position of coordinating the necessary action, interacting with the various components (supply and demand), in a word promoting palpable change in the training process.

The above-mentioned professional will have to carry out the following functions:

- Coordinating and planning action, in order to gauge training needs and take full advantage of human resources. Such tasks are not only to be considered from the vantage point of P.A. but also taking into due consideration the inclination and motivations of all those involved.
- Creating communication between supply and demand, i.e. acting as an interface between the administration and the e-learning providers; in this respect *e-learning* competence is required that enables to capture and convey the needs of the organization and to properly evaluate the proposals put forward by the supply side.
- *Change management*, i.e. gradual fostering and development of *e-learning* culture, not least through a proper planning of training activities (envisaging assessment and, if need be, the updating of information technology competence, for example in *blended* mode.).

As for the supply's side, the fundamental functions of an e-learning process are: planning, production, and service delivery.

In this respect there is need for wide ranging, multifaceted competences (some aspects of the knowledge required have been hinted at in the previous paragraph.)

In the following some functionalities are described that constitute the content of complex roles; such functions can be distributed in various ways and the roles can also partially overlap depending on the size of the territorial unit involved, the project complexity, on whether the project is implemented within the P.A. or one takes advantage of outsourcing.

The functionalities are as follows:

- *Project manager*, who is responsible for the organization and the overall project management; moreover they have to release project related documents; handle system access; update the catalogue of the training offer; create virtual classrooms, coordinate the *tutors* and integrate their *reports*.
- *Instructional designer*, who defines teaching methodologies and works out content and *storyboard* to be translated into the chosen multimedia format.
- *Content expert*,: they have to define and harmonize content units (this function can be carried out by an individual or a group of individuals).
- *Development team*: a set of different professional profiles whose task it is to implement training content and comprises:
 - Technology architecture deviser.
 - The *Content editor*, who has to edit, oversee and approve the contents.
 - The *Multimedia developer*, whose task it is to implement a multimedia version of the content.
- *Teacher/Mentor*, who is involved in overseeing the delivery process of training content; such an individual is also in charge of the learning process that they can structure through various activity types. All such activities aim at providing a support to help dealing with teaching material and its thorough mastering on the part of the learners. More specifically, this professional role entails the following tasks:

- Being responsible for managing and monitoring a virtual classroom throughout the whole learning path (through *live session*, automated quiz type system, verifying and correcting projects and learner's works).
 - Making a contribution to help understand the course content, by swiftly answering questions and requests for clarification using tools such as *forum* and *e-mail*.
 - Putting forward proposals to update the course content taking into account how the class members are faring. By closely observing learners' need and monitoring their activities the responsible person is able to understand plus points as well as the gaps to be dealt with.
 - Evaluating learners both along the learning path and on its conclusion.
- *Methodological Tutor* who carries out the following tasks:
 - Overseeing the training path of each learner representing for them a valuable reference point.
 - Assisting and supporting learners and the virtual classroom by monitoring the various learning stages by resorting, among other tools, to a "tracking" system.
 - Dealing with learners' motivational and emotional sphere.
 - Paying particular attention to *feedback* originating from them formulating, when appropriate, proposal to amend teaching material.
 - Playing a mediating role within the group and providing stimuli for the virtual classroom by prompting learners to interact with each other and with their teacher.
 - *Technical Team*: is made up of all those who are in charge of technical issues (*hardware* and basic *software* and LAN) relating to the *e-learning project*.

5. Guidelines for *e-learning* Project Quality

The e-learning system can widely vary in size: the scope of each system represents an important element to plan the training activities to be carried out. Such activities within P.A. structures should take into account the profile of target learners, the goals to be achieved, the type of content and context in which the project is implemented.

Such a training process must be analyzed by taking into account the figure involved; after such a preliminary phase a project planning has to take into consideration not only the teaching material which will be needed, but also the provision of services that users can really take advantage of. Furthermore, the creation of tools should be envisaged capable of supporting interactive and cooperation-based processes involving the various actors. Such tools are to be related to the specific learning environment or one of the platforms available on the market.

It is necessary to analyze various factors in order to devise *on-line* training activities, such factors moreover have to be considered bearing in mind the scope of the training itself and are as follows: the size of the Administration, the size of the territorial unit involved (typically one has to deal either with central or local administrative structure), the sector the Administration is classified in (healthcare, education, etc.), level of technology tools currently available for the Administration – such tools are also dealt with in the above mentioned decree dated April 17, 2003 regarding remote learning, professional level and specific competence of the learners who represent the target of the training project.

On the ground of all these issues a preliminary stage is appropriate in which the training needs within a specific administrative structure are scrutinized by looking at the following aspects: IT basic knowledge level, institutional mission and tasks, availability of infrastructural components (premises, classrooms), IT equipment (*hardware* and *software*.)

The several possibilities to choose from are therefore based on a host of parameters and choice should be made in the light of a series of objective conditions closely related to the training demand in terms of constraints or specific needs.

In any case one should bear in mind that the implementation of training projects calls for some preliminary steps that are crucial to constructive start of the training project itself. Such steps are:

- Preliminary recognition (both at central and decentralized level) of available structure and infrastructures on the ground of the training activities to be implemented, estimates of expenditures that will be incurred to achieve the project targets.
- Basic IT knowledge acquisition, if needed, so that the users are equipped with a modicum of competence needed to take advantage of IT tools. Such preliminary activity has to be devised so as to avoid creating any obstacles to actually entering the training project. A first contact with appropriate tools and to e-learning culture should be promoted. If the user has already overcome the difficulties that arise at the first contact with new technology, a more in-depth familiarity with such instruments can be envisaged; in this respect in many cases the training activities could be carried out in *blended mode*.

On this score it should also be born in mind that the *on-line* training activity doesn't merely consist in disseminating teaching material through a network, but first and foremost, in making a host of services available to the user and working group (virtual classroom – VC.)

In an *e-learning* process attention should be focussed on users who play the main role; to summarize this approach it can be stated that training should be viewed as path users are actively involved in following; it is an interactive cooperation based process encompassing all participating components. This approach is a far cry from previous conceptions that regarded training as a unidirectional process going from teacher to learners.

In order to provide services on the ground of the various interactive modes, the *e-learning* system takes advantage of learning platform/environment that enables users to acquire contents through various tools – which should be considered as early as in the planning stage based on the training project requirements – such as:

- Communication and interaction among individuals (teachers, *tutors*, topic experts, other learners, technical support, etc.), through *live session*, e-mail services, *forum*, bulletin board;

- Interactions with the teaching material: by resorting to *feedback* based workshop or case study;
- Evaluation and self appraisal tools, dealing both with a particular learner and with the whole class. Such tools play a decisive role in carrying out the training process;
- Ongoing monitoring to check efficiency, effectiveness, and more in general the quality of the *e-learning process*.

PHASE	ACTIVITIES
Selecting the trainees and identifying their needs	<ul style="list-style-type: none"> • Gathering staff related data referring to characteristics and competence of trainees
Defining training requirements	<ul style="list-style-type: none"> • Analysing individual requirements as well as role and organizational constraints, in the light of legislation assigning new tasks to the P.A., taking also into account issues such as newly hired civil servants, contract clauses, agreements involving trade unions
Planning based on the following constraints: contract and services legislation, market conditions, technical characteristics of the training, IT equipment and technology to be used	<ul style="list-style-type: none"> • Paying attention to training goals • Focusing on relevant features of the organization involved • Taking into account financial resources • Taking into account number and professional sector the members of staff belong to • Analysing <i>hardware</i> and <i>software</i> tools • Choosing among technology platform and learning environments that enable to acquire content through to various instruments • Defining teaching programs • Defining teaching methodology • Defining content of teaching programs • Choosing delivery modes (<i>blended</i>, <i>on line</i> in synchronous mode, <i>on line</i> in asynchronous mode, <i>off line</i>) • Defining the verification and individual appraisal system • Defining the evaluation and monitoring system for the training project
Services delivery	<ul style="list-style-type: none"> • Providing courses on the ground of the training curriculum
Monitoring and appraising	<ul style="list-style-type: none"> • Evaluating the training activities with respect to learning, enhancement of individual competence and organizational change
Updating the training syllabus	<ul style="list-style-type: none"> • Reshaping training curriculum on the ground of critical aspects detected in the monitoring phase

Tab.1 The e-learning process

5.1 Planning the e-learning Activities

5.1.1. Teaching Methodologies

The methodology approach adopted for a course provided in the *e-learning* mode should always make the most of all of the specific opportunities offered by the network, with special reference to interactivity and multimedia.

High quality *e-learning* activities should be carried out through planning paths revolving around those training requirements that have emerged during the analysis stage. All participants in the course should be prompted to play an active role; to achieve this aim the availability of multimedia material characterized by high interactivity (finely traceable hypertext structure, explanatory animation, virtual labs and *tests* appropriate linkage enabling to take advantage of all relevant resources available on the network) is of great importance. Moreover all participants should be involved in “socializing interaction” (virtual classrooms), allowing them high-level interaction with teachers, tutors and colleagues.

In this contest the following factors represent particularly important components of any e-learning process:

- The active role played by users.
- Relevance of the virtual classroom: users should be placed in an appropriate common learning environment, which is under the organizational supervision of a teacher/*mentor* who is respect to the content to be conveyed.

As far as learning is concerned, the goals are more easily attained if users are aware at a conscious level of the need to follow a certain path i.e. when the users feel that they are learning something useful and perceive the existing gap between their actual knowledge level and what they could achieve through learning.

It is therefore appropriate that the proposed training path should be structured as follows: *life-centered* (taking into account the context represented by the users’ personal experience), *task-centered* (taking into account operational tasks lying ahead), *problem-centered* (based on problem solving): the learning experience is to be organized in such a way as to be closely related to real world problems and should not merely be confined to the realm of theoretical abstraction. To this end it is important that users should become involved, this can be achieved by presenting them with activities to be carried out and integrated projects taking advantage of high interactivity level teaching material.

In order to both active role and involvement stay at a high constant level over the whole course duration, it can be appropriate to develop some further optional points such as:

- Prompting users to produce material by proposing work shop activities or projects to be developed over a given time interval.
- Planning the activities to be carried out by providing users with weekly schedule, which suggests the most appropriate learning pace by reminding users about the commitments they have to meet. Such a topical moment can be represented by project submission to synchronous interaction opportunities.

Each case requires, of course, a high flexibility degree in managing the learning pace of a given user; using a timetable enables to stimulate their motivations and to synchronize the class members by relying on cooperation based activities. A further plus point is the

possibility to coordinate the activities carried out within various courses if any given user is attending more than a course at the same time.

In order to promote interaction with teaching material it is possible to provide users with some specific tools such as:

- Detailed navigation: i.e. navigating through the content taking advantage of a simple interface, which enables learners to locate the point they are at, see what they have already examined, look at the suggested path ahead etc.;
- Virtual labs (with the possibility to carry out interactive simulations): these are animations simulating the most significant stages of a given process. When simulations are interactive, learners can get involved in the process dynamics and modify some of its parameters;
- Interactive exercises to be carried out in a variety of environments; such activities aim at providing users with in dept knowledge of ways in which theoretical teaching can be put into practice. These exercises can be used to achieve the following: stimulating curiosity, promoting the rehearsal and rationalization of pre-existing knowledge or consolidating what has already been learned;
- Control, strengthening, self appraisal tests: these can be represented by simple multiple choice based questions, analysis of various cases studies and web sites, reports based on specific topics, more structured project (which can be carried out by a group of users.) It is important that those tests shall be scattered over the whole learning path (at the beginning, *at various intermediate stages*, at the end of the learning process), moreover such tests should be properly designed and effectively monitored (see 5.2 for more details);
- Applications: such tools are aimed at strengthening and enhancing the command of the course content by making it concretely applicable in practical situations. Such applications can be represented by: exercises to be carried out, case studies, concrete examples, and “inadequacy” examples. Choosing the proper delivery format depends on the structuring, the application and more suitable medium to reach a high effectiveness level;
- Links and bibliography: in this case material can be integrated by using proper informed selections derived from web sites; such information can facilitate the network based users’ interaction.

For this type of learning to be effective it is vital that users be part of a virtual classroom so as to make them feel active components of a group; furthermore users should be prompted by the tutors to take part in discussions and to draw up their own reports in a spirit of cooperation. It is also very useful to create an informal climate based on mutual respect, cooperation, trust, honesty, open-mindedness, wide spread acceptance.

Along side of the theoretical development which regards social interaction as a prime learning stimulus, and taking into account the more and wider spread use of remote learning, the idea of “learning community” takes an ever greater relevance. Such a community is based on mutual information exchange on a common interest topic; such interaction no longer takes place in a given physical location but rather over an assigned time interval which is to be devoted to the topics constituting the object of a specific training path.

Furthermore it is to be pointed out that over the whole unfolding of the learning path the following professionals should always be at end: the teacher/*mentor*, in their capacity as an expert on the content of the training process and the process *tutor* whose professionalism should enable the best possible use of technology and to manage the teaching and communication based dynamics of any *e-learning activity*.

5.1.2 Content

The training content, which is to be translated into material to be part of a platform, should guarantee the following:

- Different delivery modes,
- Use of multimedia, interactivity: hypertext, audio-video, animations, simulations, virtual labs, practical workshops - with or without some sort of evaluation - etc.

The most commonly accepted structure based on *Learning Objects* (LO), "self consistent units" which can be reused in various combinations.

Teaching module (topic) can require to be sub-structured into parts, which in their turn can be made up of several units and organized in a path characterized by various stages. In preparing training content and choosing the methodology approach and tools to be used it is necessary to take into account the specific characteristics of a given content domain, as well as the goal the training seeks to achieve. As a consequence by way of example, the possibility to reuse the above mentioned self-consistent units should take into account the obsolescence phenomenon and the fact that teaching material requires frequent updating and therefore can't be reused indefinitely.

As far as the delivery is concerned, the following two aspects are critically relevant: a combination of delivery channels (synchronous *on line*, asynchronous *on line*, *off line*), the creation of virtual classrooms through which an on going interactivity process can then be put in place. Finally, the possibility of carrying out the so-called learning path tracking process is of special relevance - this refers both to any given user and the class as a whole. In a nutshell, the whole training path for each learner needs to be documented in order to allow the tutor to be aware of the learning status of each user at any given stage.

Once more, we would like to point out that adopting an e-learning system within an organization requires a preliminary training program both on behalf of teachers and of those who are ultimately going to benefit from the training itself. Such a program should revolve around new application and procedures: this represents a key factor to a successful implementation of e-learning process.

The multimedia content of lessons provided through an e-learning platform can take various concrete forms. *Streaming* audio/video based content entails the availability of a *streaming server* and suitable *player* to deal with the streaming format to be delivered to the users work station. The *streaming* technology requires the availability of a large *internet/intranet* bandwidth depending on the number of lessons taking place at the same time. This aspect indirectly impinges on the training programs; it also represents a critical factor in deciding whether or not to acquire one's own system or to use the ASP (*Application Service Provider*) mode.

As a matter of fact, if the number of courses to be held at the same time is not very large, it is preferable to plan training courses involving at any given time small groups of users, or else to go for CBT/WBT (*Computer Based Training/Web Basic Training*) on CD-ROM.

WBT training modules, in particular when they are used within an LMS (*Learning Management System*) system, can take advantage of technology other than the *streaming* system in order to provide audio/video content; usually they entail *downloading* video sequences either as such or “wrapped” in by multimedia *plug-ins* (*Flash Player*). These are in any case digital video sequences (avi, mpeg), which require appropriate codec like the streaming system; also this methodology entails the availability of a sizeable bandwidth.

The *virtual classroom* system is aimed at the synchronous training; they therefore support real time interactions between teachers and users. These systems are based on “communication servers” and entail the use of dedicated applications and *server* architectures. Moreover, they carry no further requirements for the *client workstation*, as they mainly rely on *flash client* technology whereas the broadcasting bandwidth involved is essentially comparable to what is needed by a *streaming live system*.

5.1.3 Technologies

As it has been mentioned before, over the last few years some fundamental change has been taking place in the technology sector. Such evolution has strongly influenced the information system architecture (TBL, *Technology Based Learning*); these systems have reached a stage broadly referred to a third generation, in these systems the reusability and efficiency in system maintenance processes as well as e-learning contents have been optimized. This enables to take full advantage of the investment made in the recent past.

System architecture design has by now reached a codified and broadly shared definition, which is structured into two levels. The technology components of an e-learning system can be described in terms of system modules and communication infrastructure.

In the present situation identifying an *e-learning* system with the single monolithic and all encompassing platform no longer makes sense; it is rather more appropriate to view such a system as being made up of several components and subcomponents, software procedures that have been endowed with interoperability by adopting international *standards*; such software is used to manage in a rational way heterogeneous activities which can be spawned by a remote e-learning process via the *internet*.

More specifically, a simplified description of sub-modules that are part of an e-learning system encompasses the following:

1. *Learning Content Management System* (LCMS); this is the module devoted to creating, managing and archiving teaching material; such a module enables all those involved to assemble and share the content through *Digital Repository*. The module can also integrate authoring systems used to create the above mentioned self consistent units and to update them;
2. *Learning Management System* (LMS); this module deals with the following: delivery of courses, tracking training activities and managing administrative tasks (i.e.: enrolling, classroom management, etc.); such a module can integrate *testing system*;
3. *Virtual Classroom* (*virtual classroom* – VC); this module allows to stage live events; the teacher can communicate in real time through video or audio channels, and swap data with the users connected to the system. The module also enables to keep track of events and interaction so that they can be delivered again in an asynchronous mode. Furthermore, the module allows integration with proper tools to create communication and cooperation among teachers and users. Such tools can be of synchronous type

(virtual blackboard, sharing application and documents, *chat*, etc.) and asynchronous one (*e-mail, forum, FAQ*, etc.);

4. Competence Managing System; this module support the following tasks: assessing competence, pinpointing training needs and formulating proposal for relevant training path (such a module can be embedded into the systems listed under the previous points 1 and 2.)

The components can be all or only partially present in an *e-learning* system depending on the project requirements. The modular structure and the existence of broadly shared interoperability standards make it possible to set up a complete *e-learning* system – such a system can be built by using components provided by different firms – which is characterized by specific traits whose most remarkable features are as follows:

1. Dissemination of *Learning Objects* – also referred to as *Reusable Learning Objects* (RLOs) –; such a strategy makes it possible to render reusable one of the most resource consuming components of an *e-learning system*: producing content during a self learning process or *courseware*. Planning and producing teaching material on the ground of this approach is based on the structuring of a given content into a host of small components that can be indexed, such a procedure attains a “granularity” level much more advanced than it was the case in previous systems. This enables to endow the *courseware* tool with the heist reusability and portability throughout various systems and within different training paths.

The author or the producer of contents are free to choose the “granularity” level they wish although it is in general preferable to structure any given content by using a high “granularity” level because this feature plays a vital role in the usability of the content itself. Moreover, a high “granularity” level is conducive to a more extensive tracking *possibility*, and enables to create advanced systems, which support dynamic customization in *sequencing* content components;

2. Interoperability specifications and standards have been created and have since being gaining ever wider acceptance at international level; such specifications and standards are based on XML technology and e-learning dedicated *Web services*, which are acknowledged and shareable among system and content producers at international level.

The set of specifications drawn up by *IMS Global Learning Consortium Organization*, is swiftly taking root as a *de facto* standard. Such an organization encompasses over 50 operators on the international market.

The various specifications released by the above mentioned organization have been adopted as part of several both international and sector related initiatives and have made it possible to customize different application profiles to guarantee interoperability of public information systems and different specific sectors (education, healthcare, defence, etc.)

The interoperability level of an e-learning system can be identified on the basis of the following parameters:

1. Integration of the *Learning Object* approach throughout the whole path characterized by the following steps: creating, achieving, managing, providing and tracking content in self-learning mode. This enables to reach the highest flexibility and content reusability level as well as adaptation to specific path and to wide heterogeneous delivery condition;

2. Using as much as possible XML technology in data description (e.g.: content, personal data, appraisal *test*, profile and competence);
3. Architectural structure characterized by modular components; it should be possible to express such architecture on the ground of open, interoperable formats.

The activities carried out by standardizing organizations in the *e-learning* sector are particularly wide ranging and the objectives that such organizations seek to achieve consist in providing detail specifications on the standard that technology, services and content providers should propose when making an offer. A trend is clearly emerging towards creating specifications for each of the components and of the services that are part of an *e-learning* system, the same holds true for the content format.

This state of affair, along with the fact that several organizations are active in releasing sector related standards, has led over the last few years to the creation of scores of specifications to do with interoperability among all the systems and data involved in an e-learning process; such specifications however are not in general fully applicable. In this heterogeneous situation one than talks of specific application profile that public bodies and organizations use, as a sub set of standard rules, in their own activity realm: an example of such specific profile is provided by SCORM (*Sharable Courseware Object Reference Model*) – that has been adopted by the US Defence and Labour Ministries – and the eGif specifications drawn up by the English government.

In this respect we would like hire to make it known that – following the release of the present guidelines – upon proposal by the Innovation and technology Minister, the National Information technology Centre for the P.A. will be working out and propose to the relevant Ministers an “application profile” to be used within the Italian P.A.

As for the design of a communication infrastructure for an e-learning system the remarks that follow are based on the assumption that the problems to do with switching from a traditional classroom based training method to the e-learning approach have already been solved, the same assumption holds true for the content management related issues (content restructuring, remodelling of courses and training program, etc.).

On these hypotheses three components linked to the vertical infrastructure are identified and examined in the following: *server*, network and individual workstation.

As for the *server* the preliminary decision has to be made on whether to acquire one’s own a LMS, or whether it is preferable to outsource such a service (ASP.) In the former case, a suitable infrastructure will need to be set up - both *hardware* and *software* –, furthermore system expertises for the administration and infrastructure management need to be acquired; in the latter situation, the problems need to be solved to do with the connection to a remote service providing centre, which lies outside the *intranet*; such problems mainly refer to dimensioning the input and output internet band with as well as to routing and security policies management.

The network represents the component that usually creates the most pressing needs in terms of coping with e-learning service requirements. The problems to be dealt with are to do on one hand with managing security policies in allowing external applications to get access to the *intranet*, on the other hand, enabling user access to a wide range of external applications.

A further requirement deserving consideration refers to the following two points: upgrading the band width depending on the increase in information flow generated by *web*

based and multimedia applications and managing the data flow involving a host of non standard protocols that may be used on an intranet.

The requirement to support multimedia application as part of e-learning services relying on a data transport network has an impact on both the geographical network infrastructure and on the local network. Such applications require a group of computer to be able to simultaneously communicate with each other by sending IP packets in *multicast mode*, in a process broadly referred to as multipoint communication.

Moreover, all the problems to do with *hardware* and *software* characteristics of the *client workstation* that enable to take advantage on e-learning content need to be considered. In this respect, as far as *hardware* is concerned, it is necessary to be equipped with a work station capable of handling multimedia contents, which are very demanding in terms of computing power, storage, audio/video peripherals. The *software configuration* will have to be compatible with the chosen e-learning system in terms of the following aspects: basic software characteristic, type and release of navigation software, presence of those components needed to take advantage of multimedia content; this entails the need to envisage the management of a software distribution for those applications who may not be available at present.

5.2 Delivering the e-learning

5.2.1 Services

The delivery stage of an e-learning activity starts when the user needs to take advantage of the content and can take place in various modes, which are listed in the following:

- synchronous *on-line* mode, through the virtual classroom (VC), in this situation users/learners interact with a teacher or *tutor*: during the live session learners can speak, use materials in various format, navigate the *web* under the tutor supervision, write on a blackboard, take *tests*, build supervised work groups;
- asynchronous *on-line* mode, taking advantage of interactive content that promotes active involvement both of individual users and the whole virtual classroom in the learning process; such content may be represented by text, hypertext, voice based information, animations; all such sources are managed by teachers and multimedia editors and can be accessed using the network;
- *off line mode*, by relying on such support media as texts on paper, CD-rom, videos, DVDs, further material that can be downloaded, with the chance of printing the content using text or image formats.

A combination among the previous solutions is also possible.

Moreover, one shouldn't forget *e-learning* activities address users whose characteristics vary widely in terms of roles, competence, and confidence with network-based tools. Therefore the need may arise to integrate in suitable ways remote training and classroom based training, this means creating an *e-learning blended format* in which the classroom based training activities are of paramount relevance; this is all the more true when dealing with users who are still not very familiar with e-learning training practices.

5.3 Monitoring and Assessing e-learning Activities

Monitoring and assessment represent two very important aspects to guarantee quality level of the training in its various stages and with reference to the attained results.

The above-mentioned directive dated 13 December 2001 has already provided the opportunity to stress how important the monitoring and assessment activities are. The directive explicitly provides for the following: “*training will have to be developed through a governance, monitoring and assessment system enabling those in charge to assess its quality and effectiveness*”. Moreover, the same directive points out that monitoring and assessment activities serve the following purposes: gauging content quality, assessing the degree to which the training projects and related activities meet the user needs and the operational and management related quality. The adequacy of training tools to the activities they are used for as well as quality control systems to be used all along the training path are also part of this context.

The document under examination highlights the importance to the competence assessment activity so as to pinpoint the training requirements and to outlined policies and development plans. In this respect not only is it necessary to gage the acceptance of each individual learner but also their level and learning capability and the results each of them has attained: indeed the objective is to evaluate the scope of the change brought about within the administration following specific training activities.

Also the monitoring activities of an *e-learning* process – that envisages both classroom based presence and remote training (blended) – are part of the path outlined and encompass evaluating activities aiming at assessing the following aspects:

- Managing training activities.
- Managing training process result.
- Managing competence, in a word one has to correctly pinpoint training requirements and tailor expected results in relation to such needs.

5.3.1 Evaluating Competence

By "competence" we mean here the capability to integrate knowledge, ability and organizational behaviour that an individual is able to display to achieve the professional results required by the service delivery process, be it internal or external to a given organization.

As a prerequisite to competence evaluation the following need to be defined:

- Fundamental service processes characterizing a given organization.
- Reference professional profiles and their relation to the above mentioned processes.
- Specific professional content to do with each profile (depending on the various stages of processes) and the elements characterizing such professional content.
- Processes enabling to assess the amount and quality of knowledge displayed by given individuals as well as to gage the knowledge level attained.

Evaluating competence – this process always entails a self-appraisal on the part of the individual at the receiving end of the training activities – is a task to be dealt with by the

official in charge of such training activities. Comparing the expected competence profile with what learners have already acquired carries out this evaluation.

5.3.2. Monitoring

Monitoring consists in systematically collecting data on the training activity delivery process. Such data are organizational, managerial and deal with functionalities not least technology related ones. Such data gathering aims at controlling, modifying when appropriate and optimizing the training processes.

During the monitoring action the indicators are assessed and weight needed to match the defined program against its implementation, including the analysis of possible, critical or risk related elements. The indicators can be subdivided into three groups: before, during and after the process completion.

The monitoring process focuses on the following items:

- I. Training delivery process both classroom based and remotes ones, i.e.:
 - a. Content conveying tools (teaching modules in various formats, their quality and completeness, didactical and communicative effectiveness).
 - b. Teaching typology (synchronous and asynchronous one).
 - c. Remote didactical and motivational support.
- II. The system functionalities for the following components: organization/management /logistics (environments, infrastructures, registration, enrolling and *tracking* components).
- III. Management platform functionalities in relation to their impact on training path delivery.

Data collection and processing, this also refers to blended processes, can be completely managed by the system: to this end it is crucial to carry out a check of the traceable data spectrum as well as of designed data processing functions.

5.3.3 Evaluating Training Activities

The evaluation activity aims at stressing the attained results in terms of measurable and verifiable change. Such evaluation is to be viewed as a weighing and interpretation process involving data and all sorts of elements gathered during both the unfolding of training activities and after their completion. Such evaluation that involves both all participating actors and the organization as a whole, is based on one hand on the results yielded by variables under observation whereas, on the other hand, the gap existing between such values and the qualitative and quantitative *standard* as defined at the design stage must also be assessed (each administration has to define its standard and the relevant parameters.)

As for evaluating tools, the following characteristics must be checked:

- Reliability, i.e. the independence of observation of time intervals and context.
- Validity and effectiveness, which shouldn't be adversary affected by external phenomena.

- Usefulness, i.e. the ability to exactly evaluate the object such tools are destined for.

6. Cost Components of an e-learning Project

The cost related elements underpinning a complex project could be represented using various methods; they take into account the following factors depending on the size of the object in question:

1. Its stages;
2. System components and human resources;
3. Relationship with supplier.

In the following the cost components are listed as defined on the ground of the project implementation modes as well as of the project size.

As for its stages, *e-learning* can be viewed as a process encompassing the following sub processes:

- a) Analysis;
- b) Design;
- c) Development;
- d) Implementation;
- e) Evaluation.

As for the system components and human resources the cost structure of an *e-learning* system depends to a great extent on the following factors:

1. Organizational analysis;
2. Services (design, delivery, management and monitoring);
3. Technology (platforms and infrastructure);
4. Content (production and maintenance.)

The last components are the most relevant in terms of resource consumption economically, qualitatively and organizationally. The basic reason is to do with the need to resort to specific professional profile to deal with the teaching material generating process (at least as far as *Project Manager*, the *Instructional Designer*, content expert and development team are concerned.)

This leads to the need of carefully evaluating the choice to make with respect to the following:

1. Acquiring *off-the-shelves* materials;
2. Designing and implementing material:
 - a. On the part of the administration involved;
 - b. On the part of suppliers.

The choice to be made is linked to a comparison, which on one hand takes into account the extent of the content suites and the project training requirement, on the other hand assesses the related economical impact.

As for the further components, there are several available and mutually integrable solutions to device and implement an e-learning system; such solutions can be provided by various products/suppliers.

As for the relationship with the supplier, within the various platforms, one of the most significant economical criteria to be considered when choosing different technology solutions and components is to do with evaluating the licensing model proposed by the supplier. This factor can indeed influence the choice on the ground of an economical evaluation of the various systems; all technical functionalities on offer being equal.

There are several licensing models for the single components, which exhibit different economic characteristics; in this respect the designer will have to identify and get detailed information about the licensing typology adopted for every specific component to be provided.

The licensing models at present in use for the various *e-learning* components (in particular, LMS, LCMS and VC) are:

- a) *Off line licensing*, based on a licensed product installed on each PC: they envisage a work station based cost without interaction/control on central server and are most often used in the case of authoring systems and tools; such licence methods can be name or physical installation based: the latter type is preferable as given a certain number of operating work station any user can get access to the licence product;
- b) *User name based licensing*: they envisage a work station based cost per registered username and such names are not allowed to be changed; the control can either be carried out on the ground of contract clauses or through authentication/verification to be carried out on a central server;
- c) *Seat based licensing*: they are similar to those previously described but they allow for the possibility of reassigning the same licence to different users;
- d) *Concurring user licensing*: they foresee a cost for each user linked at a given time to the central server; this method is very often used in the case of synchronous platform and is also being extended to a release that contains options for asynchronous LMS systems. In order to compare concurring users licensing cost with user name based licensing it is necessary to gage the number of users active at the same time as a fraction of those entitled to take advantage of services;
- e) *server based licensing (CPU)*: they envisage a cost per central *server* which is sometimes higher than what is charged under the previous models; in the case of evaluation other than the non user name based licensing it is necessary to evaluate the number of users that the central server is expected to support;
- f) *ASP services*: it envisages a service provision based on a server installed at third party locations, under a consumption-based licensing whereby the quantifying variable can be the number of courses/months/users. As there are many kinds of ASP services it is advisable to investigate whether the associated cost also includes the connectivity and *housing/hosting* expenditure of the solution, whether there is a maximum number of courses and minimal time duration to subscribe this service.

The Administration intending to start e-learning activities on behalf of its employees has to take into account the following cost components:

- Cost factors distributed over various training activities:
 - Suitable computer and accessories.
 - Suitable installation to cope with network connection.
 - Availability of *hardware* solutions (dedicated *server*, fast links, usage consumption).
 - Technical staff.
 - Time to be devoted to a course by each participant.
 - Support material purchase.
 - General expenditure on office related consumptions (electricity, heating, telephone).
 - Institutional promotion.
- Direct course based costs:
 - Duty travel expenses, for each participant, to do with their possible involvement in classroom based training session.
 - Costs to do with organizing classroom based training sessions (renting suitable premises, travel living allowance on behalf of teaching staff, consumption and teaching material expenditure.).

7. Final Remarks

The issuance of the present guidelines on the part of the P.A. National Information Technology Centre (this document is an integral part of the P.A. e-learning directive) testifies the attention paid to the innovation process, which, over the last few years, is having an impact on training activities in the light of an ever-growing use of information technology.

A sound explanation for this phenomenon lies in the peculiar organizational, methodological, technological aspects specific of the e-learning. This peculiarity holds also true when considering its relevant impact on the work organization as a whole as well as on its various facets.

This document, which falls in line with the series of steps outlined in the directive, is dated 13 December 2001. Such a directive has been followed up by an action plan targeting the whole Italian economic system contained in the guide lines issued in June 2001 by the Innovation and Technology Minister, most recently a decree addressing the Universities has been issued on April 17, 2003.

The present document, along with the just mentioned initiatives, is a concrete proof of the commitment with which the Italian government (together with its EU counter parts) is pursuing over the last few years the objective of providing knowledge widening with momentum by resorting to virtual solutions. These choices were made being fully aware that such an approach aims at ensuring content interoperability ultimately bestowing this most important feature to the user services. The quality level of such services largely depends on the didactical design and the technological architecture.