Application of XAI to the Integrated Quality Management in Public Administration

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Abstract

The Public Administration (PA) role requires the acquisition and application of knowledge and operational tools to perform institutional tasks and regulatory functions under an effective quality framework, providing evidence of these skills to citizens. Tools defined for the PA are generally defined by international standards families, such as ISO 9000, ISO 14000, ISO 17000, ISO 27000, as well as several other systemic rules. All of these, appropriately implemented according to the law in force, allow the application of principles and practices of systemic Quality Management (QM). To reduce conflicts among the norms and increase operational efficiency enforcing synergies among different management functions and avoiding redundancies or duplications, an Integrated Quality Management System (IQMS) approach is generally required for which several ICT tools have been developed and adopted. Nevertheless, these tools generally present a set of common problems s.a. the general lack of direct interconnection with the operative field to foster the automatic feeding of the IMS, as well as, the rigidity of personalization to mention a few. These issues reduce quality management to a mere stylistic exercise, generally aimed at avoiding problems and sanctions. To solve these and other issues, we present an ongoing effort to define an innovative framework made up by core capabilities strengthened by eXplainable AI (XAI), Large Linguistic Models (LLM) and Semantic Technologies to support PAs in the effective adoption of IQMSs principles, simplifying their correct implementation as well as compliance checking and auditing.

Keywords

AI for Public Administration, eXplainable AI, Large Linguistic Models, Integrated Quality Management Systems, Semantic Technologies, Internet of Services

1. Introduction

Both central and peripheral PAs, such as Ministries with their related Technical Bodies, Regions, Provinces, Municipalities, and Local Authorities are called to:

- Protect the needs of quality of their citizens in all the managed fields (health and safety, education, mobility, work, public works, etc.), through their own function of Regulatory Entity for goods and services production, as well as of the overall social life;
- Perform the role of "clients" at their best, ascertaining the quality of the commissioned public works;
- Provide themselves quality, in the role of providers of public utility services such as health, school, transport, energy, environment, as well as several technological and administrative public services.

The PAs are therefore called to carry out the delicate tasks of Quality regulators ("political" function), Quality clients ("administrative"

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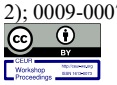

function), and Quality dispensers ("technical" function).

Note that, in PAs these functions are closely interdependent from each other, with particular critical consequences. In fact, the inadequacy of even a single task among the aforementioned ones, or the lack of coordination among them, can seriously compromise the effectiveness of the institutional role played by the PA, already made arduous by cultural inertia and bureaucratic constraints not foreign to them, thus allowing the rise of a perverse degradation mechanism.

On the other hand, the optimal balance among the functions can be the source of a virtuous circle that promotes reaching excellence. The culture and practice of quality (i.e., the ability to identify and satisfy needs) have not remained historically unrelated to the world of PA. They, however, have become more affirmed in terms of "culture and practice of procedures" than "culture and practice of results" and such have remained for long. Nevertheless, the culture of the "certification of conformity of the third party" has not been fully affirmed yet, both as insurance of the quality of acquired goods and services, and above all, as a demonstration of the quality of the works carried out and of the provided services. In this last case, following an understandable self-referentiality deriving from the condition of monopoly in which PAs have historically carried out (and continues to carry out to the large extent) their activities.

Nowadays, the scenario requires PAs to acquire and apply themselves the knowledge and operational tools required to a) perform effectively the quality regulation functions; b) ascertain the quality of works, products and acquired services; c) provide themselves true and substantial quality, while fulfilling institutional tasks, and provide evidence of these skills to citizens. The tools available to the administrations are represented, among the others, by the principles and practices of systemic management for the quality (according to a risk-based management model embedded into the Deming's Cycle) whose requirements are based on the following regulatory references:

- Rules of the ISO 9000 family (specifically, ISO9001) for the aspects more properly connected with the "economic" quality (certification of quality management systems - QMS);
- Rules of the ISO 14000 family (in particular, ISO14001) for the aspects concerning the protection of the environment where the civil and working life of citizens takes place (certification of environmental management systems - EMS);
- Several other systemic rules (e.g., OHSAS 18001, ISO27000, SA8000, etc.) for further important aspects related to the protection of fundamental rights of citizens (work safety, information security, social responsibilities) and relating to the role, both of government and service of the administrations;
- Rules of the ISO/IEC 17000 family (particularly referring the ISO/IEC 17025) for services specifically covered by these rules (e.g., test and analysis services), both acquired and provided by PAs.

These rules must become an integral part of the culture of PAs and be applied substantially and consciously adapting them to the specific needs and characteristics of the multiple activities carried out. Namely, they must be:

- Enhanced and hired as a reference in the adjustment and control work;
- Used for the evaluation/quality insurance (all over field) of the commissioned works and of the acquired goods and services;
- Applied to guarantee the quality of the works carried out and the services provided directly by the PAs.

In particular, referring the guarantee of the "provided" quality, it is important to enhance the progresses already carried out by several administrations with the drafting of the so-called "service cards", reworking them in the framework of a real processes-based approach to quality management.

Several solutions have been developed and adopted that exploit ICT technologies as a facilitator for the application of the numerous regulations and standard. These solutions, however, generally present a set of common problems that can be summarized as follows:

- Solutions are generally focused on functionalities related to document management;
- They are designed for specific applications or domains, and generally aimed at fulfilling a well-defined set of problems thus showing several limits in the applicability to contexts different from those for which they were thought and requesting strong adaptation and reinterpretation efforts;
- They do not provide an integrated solution that allows to relate regulations, procedures and processes that can be connected to issues involving aspects of different nature such as

safety, health and quality. Moreover, they do not generally integrate automatically themselves with the different parts of the field into which they are asserted, thus requesting high manual skills in the management of information and checks for audit processes;

- At least referring the most complete solutions, they generally present high costs and complexity of use that do not favors their adoption, instead making more convenient to contact third parties for the management of these issues.

Most of the time, all these issues result in adopting workarounds focused on the mere formal application of the regulations, as well as oriented to avoid the emergence of violations that can lead to various kinds of sanctions, rather than implementing a more effective approaches that, despite an initial effort, would lead improved efficiency and effectiveness of processes and activities, which should be the implicit purpose of regulatory standards.

The ongoing activities aim to overcome all these limitations by introducing an innovative solution exploiting methodologies and technologies at the state of art that, appropriately integrated, will fully translate the Industry4.0 paradigm and the concept of Smart Factory to the PA Quality management concept. The final result wants to provide a technological infrastructure and service able to provide an innovative contribution to the PA by leveraging the concepts of Internet of Things (IoT), Internet of Services (IoS) and XAI/LLM-enables Smart Services. Here the information, proactively gathered and analysed, can be effectively used for decisions impacting on the management systems, actively integrating in this process models and quality procedures as actors of compliance checking processes.

The aimed infrastructure is characterized by the combined use of a) Integrated Management System (IMS) feeding services; b) semantic approaches to the management and modelling of the PA knowledge; c) XAI/LLM models for the real-time analysis of the information and compliance checking of the IMS; d) support services to define and verify the completeness of the IMS according to current and mandatory regulations; e) IoS proactive integration services.

The remainder of this paper is organized as follows. In section 2 we give an overview of adopted approach and proposed architecture and system, presenting capabilities and expected technological framework. Then, in section 3, we present the reference scenario we selected among the possible ones. Furthermore, this section presents a short overview of the involved processes, together with a selection of the key drivers motivating the initiative and the expected scenario workflow. Finally, section 4 concludes the paper and gives an overview of future work mainstream.

2. The adopted approach

With the introduction of the 2015 schemes, as updated to 2018 release, domains of Health and Safety (OHSAS 18001 replaced by the current UNI EN ISO 45001); Quality (UNI EN ISO 9001) and Environment (UNI EN ISO 14001) share the same basic document structure (ANNEX SL) [5]. All of them have been oriented towards risk/ opportunity management [1] (Figure 1) and focused on the management capabilities of the company leadership, as well as on their ability to quickly identify and manage opportunities and threats, configuring, as quickly as possible, low-risk systems as prerequisite for high opportunities.

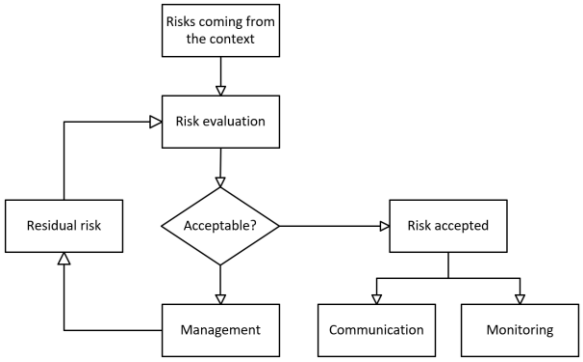

Figure 1: Risk-based management model

Starting from the analysis of the internal and external context as an explicit source to understand the risks/opportunities, in our vision the risk-based approach becomes a permeating element of the IQMS whose definition is based upon the Deming's conceptual model, seen as a "best practice" to promote the culture of quality and aimed at the continuous improvement of processes and the optimal use of resources.

Referring the iterative recurrence of the phases of the Deming cycle until the achievement of the quality objectives (as evaluated by appropriate KPIs), each functional capability of the foreseen infrastructure will support one or more phases of the Deming cycle.

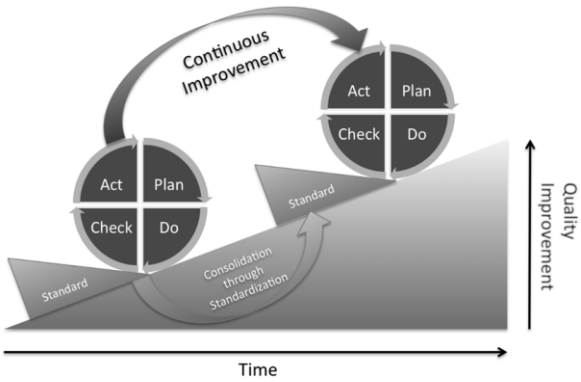

Figure 2: Recurrence of Deming cycle

Through components based on XAI and LLM, once specified the context of the PA (s.a. provided services, implemented processes etc.), in the PLAN phase the user will be supported in defining a) a list of interventions needed to optimize and normalize processes in compliance with current (QHES), mandatory (supranational, national and local) regulations, and taking into consideration specific constraints such as policies, contracts, reference notices and tenders, etc.; b) a set of Regulations-compliant process models reflecting each implemented procedure, together with the information sources to acquire data needed for verification and audit purposes, as well as for performance monitoring and alerts; evaluation KPIs and their aggregation models; compliance monitoring rules and their relationship with the process phases (events, messages, etc.) for the generation of supporting documentation needed to audit activities or to report anomalies deriving from the risks identified for the process.

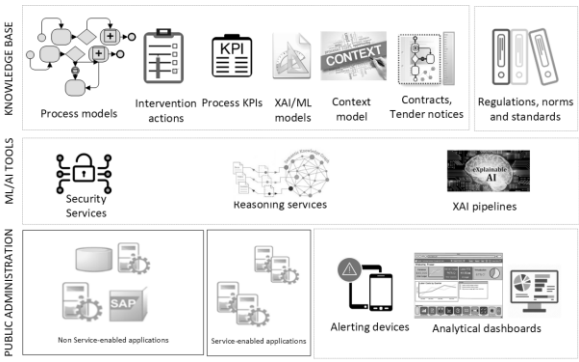

Figure 3: General architecture

As long as the identified corrective or implementation actions are fulfilled, the system will support the configuration of the connectors between information sources and the ML/AI models for the analysis and monitoring of events, as well as review and audit actions.

As part of the DO phase, the models activated by received events will implement real-time and compliance monitoring activities to assess and report to the user alert conditions related to identified risks.

To support of the CHECK phase, xAI models will be applied to evaluate non-compliances (even potential ones) and violations of the standard requirements by simulating evaluation audits, identifying the root-causes of non-compliances, evaluating and suggesting corrective actions to be carried out, and the evaluation of the effectiveness of taken decisions.

The results of all these assessments will be usable through Analytical Dashboards allowing several information drill-down/drill-up feature, which allow to identify involved processes and activities.

3. Referred scenario

The referred scenario is the management of Transparent Administration (AT) procedures.

The principle of transparency, understood as total accessibility to information concerning the organization and the activity of PAs, was affirmed with the legislative decree of 33/2013 (Italy), with the aim of promoting a widespread control by citizens on the work of the institutions and on the use of public resources.

Publication of data held by PAs intends to encourage the participation of citizens to:

- Ensure knowledge about the provided services, their quantitative and qualitative characteristics as well as delivery methods;
- Prevent corruption phenomena and promote integrity;
- Submit each phase of the performance management cycle to a widespread control in order to allow PAs' improvement.

The principle of transparency was reaffirmed and extended by Legislative Decree 97/2016 (Italy), the so-called Freedom of Information Act (FoIA), as "total accessibility" to data and documents managed by public administrations. [10] made several changes to the legislation on transparency, reprogramming data subject to mandatory publication and extending the institution of civic access aimed at further favoring widespread forms of control over the activities of institutions and the use of public resources, promoting participation to

administrative activity by all interested parties and, finally, protecting rights of citizens.

Through simple or generalized civic access anyone can acquire data and information held by the administration, in compliance with the limits established for the protection of legally relevant public and private interests. Depending on the peculiarity of the activity carried out by the Department of Public Safety, however, confidentiality criteria have been adopted which exclude the publication of certain categories of data relating to activities related to the functions of public order and safety, which concern situations and realities not accessible to the public, precisely to avoid compromising the correct performance of the same functions and the achievement of objectives.

The main problem in this scenario is the support to the activities of the Responsible for the Prevention of Corruption and Transparency, which carries out control activities on the fulfillment of the publication obligations by the Administration while ensuring completeness, clearness of published information as well as keeping them up to date. Furthermore, he reports to the political guidance body, to the Independent Evaluation Body (OIV), to the National Anti-Corruption Authority (ANAC) and, in the most serious cases, to the Disciplinary Office, evidences of failed or delayed fulfillment of the publication obligations (art. 43 [10]).

Duties of the Responsible for the Prevention of Corruption and Transparency (RPCT) are:

- Monitoring the publication obligations;
- Monitoring the updating obligations;
- Soliciting the transmission of the contents necessary for publication;
- Monitoring the completeness of the contents;
- Requesting the integration of contents necessary for the completeness of information to be published;
- Reporting failed or delayed fulfillment of the publication obligations to the competent bodies.

There are many procedures and regulations directly connected to the decree laws on transparency and civic access. Specific reference is made to [2], [3], [6], [7], [8], [9] and [10].

Furthermore, since pursuant to [6], as amended by [10], PAs pursuant to art. 1, c.2, Legislative Decree [8] adopt the Three-Year Plan for the Prevention of Corruption and Transparency (PTPC) according to the guidelines of the National Anti-Corruption Plan (PNA), art. 1, c 2-bis [6], legislation that is extended to public economic bodies, professional orders, companies under public control, port authorities, associations, foundations and private law entities, even without legal personality, the aforementioned regulations are accompanied by an obligation of transparency as a completion, according to the directives of Legislative Decree [9]. Thus, it is also necessary to consider the PTPC and its annexes, as a binding contract. Finally, basing on the analysis of several public available PTPCs it is possible to consider UNI EN ISO 9001:2015 as a voluntary reference standard to be added to the set of procedures and regulations to consider in the scenario.

From the analysis of the aforementioned regulations, it is possible to consider the reference scenario completely (or almost completely) represented by the list of publication obligations asserted by the aforementioned regulations, as per the first ANAC guidelines containing indications on the implementation of advertisement, transparency and dissemination obligations of information contained in [9], as amended by [10]. All these obligations pertain to a specific content and is bounded to a publication time constraint.

At the present it appears that, in general, apart from procedures and systems strictly related to publication from a technical point of view, none of the activities envisaged by AT (acquisition of information, timeliness of publication, monitoring of obligations and of the envisaged contents, as well as auditing the correct execution of the procedures) are supported in an automated way, except in some very specific realities or limited to sections of particular interest, such as for example for the Call for Tenders section for which specific information systems are envisaged. In particular, everything seems to be delegated to the competences of the RPCT, who is generally guided by the mentioned ANAC guidelines, or by trying to intervene through points of "interception" of the completion of administrative acts, or following indications received from the offices in charge of specific deeds subject to publication obligations. Particularly problematic for the RPCT, in this sense, is the timeliness of publication of documents which, not having a specific periodicity ("Update" column of the ANAC guidelines), require a "Timely" publication, as per related law and which can lead to serious problems such as, for example, invalidation of deeds, reports, if not even sanctions as per the combined provisions of the relevant laws.

4. Conclusions and future works

The paper presents an initiative towards the fulfillment of several drivers of the PA:

- D1: Law-compliant processes:
- D2: Simplification of monitoring activities;
- D3: Support for OIV activities;
- D4: Support to ANAC activities;

All of them are enabled by supporting the design or integration of a QMS through ML/AI tools, aimed at adapting the organization to quality constraints, and rationalizing its management according to an integrated approach that starts from the PA context identification. By means of this action, the set of constraints defined by norms and regulations will be identified and, once fulfilled, exploited to check the compliance of processes' activities, as well as auditing activities. The most challenging task will be the interpretation of the legislative and normative corpus and its correlation with the context of the PA. To face these challenges, we will explore novel approaches to enhance pretrained transformers such as the one described in [12], [13].

The automatism of a solution integrating XAI and LLM-based tools will increase the general efficiency of management processes, while reducing the costs for consultancies and specialized skills, implementing an active and constant prevention promoting the reduction of accidents thus preserving operational continuity, as many of the possible violations involve an interruption of the activities of the PA.

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