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Industry 4.0 also tackles Digital Documents

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Abstract. In this paper we address the document management process in Industry 4.0. We focus on our collaboration with a company which set up a document management system as an important aspect of their transition to Industry 4.0. The newly implemented standards and poorly calibrated application do not meet the stated objectives. We describe our first observations and we present a hypothesis regarding the identified issues.

Introduction

Industry 4.0 is considered to be the 4th industrial revolution (Devezas, Leitão, Sarygulov, 2018), and is driven by disruptive innovation as a combination of cloud computing applications, i.e Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS), intelligent cyber-physical systems, Industrial Internet and the Industrial Internet of Things (Thames, Schaefer, 2018). To our knowledge, these are the main technologies addressed by academia so far in the Industry 4.0 domain.

However, we argue here that the document management process is also a domain of concern in the Industry 4.0 era. In this position paper, we describe our involvement in an Industry 4.0 project, funded by the French government. The main actor is a gas company with several production sites in the world, and in particular twenty in France. They are aiming at connecting all of these sites and optimizing their production at a national level. In doing so, several technologies have been tested, and some of them have already been deployed, such as sensors to collect production

data, algorithms to simulate and predict production, and support systems for workers in the different sites that host these newly implemented practices (maintenance is becoming the new priority of the workers on site). One of these systems to support users in producing gas and maintaining the sites is document management. This system has been chosen, configured and deployed in some of the production sites, but this system is not used by the employees, who clearly reject it; they stick to their traditional documentation practices: vernacular, private and temporary storage of printed materials in filing cabinets, folders and drawers. Our role in the project is therefore to understand the issues and to propose prototypes and models to ensure that the digital document management practices are adopted. We have just started this research action, and our aim in this paper is to present our first observations and our plan of action, opening a new facet in the Industry 4.0 domain: document management.

Data Collection

The company which we are investigating has set the challenge of centralizing the technical documentation of all its production units and installing a technical office at the national level, in charge of maintaining the coherence with ISO9001 management system. ISO9001[1] system is a quality international management principle geared towards customer satisfaction and efficiency defined by consistent, high quality products and services. In other words, the goal is to establish an organization and a tool for its users to integrate, edit, validate and evaluate technical documents. The objective is to improve the quality control of the documents in the different units of production, and to make it possible to integrate on-site and off-site documents, and to incorporate this process with the equipment management tools that support the maintenance of the sites.

Before asking us to intervene in the project, the company had already chosen the document management system and different methods and technologies to extract metadata. Training sessions have been organized in the different production sites. We started our intervention 2 months ago, and we have interacted with users of the document management system through individual interviews and a focus group (Table I).

Method	Location	Users	Topics
Observation	2 sites	1 manager of DMS[2], 1 assistant manager of DMS, 1 production	

1 Process approach and continuous improvement, interest in motivation, commitment and direction within the company.

2 document management system

		coordinator and 1 technician	
Focus group		1 manager of DMS, 1 assistant manager of DMS, 1 production coordinator and 1 technician	- Daily tasks - Issues related to the DMS
Semi-directive interview		1 reliability technician, R & D technician, 1 manager of DMS, 1 assistant manager of DMS, 1 production coordinator, 1 technician	- Daily tasks - Description of the vernacular document organization - Issues with the DMS - Needs in terms of document management

Table I. Data collection during preliminary investigations

Preliminary findings

The data we have collected has allowed us to identify several issues: Some of them are related to usability (the need to be trained, the extensive use of acronyms that are not explicit, …), and some others are related to the documentation practices.

In fact, the main issue that we have identified is that the definition of "what is a document" is not the same for the workers on site and for the managers of the documentation system. For the first ones, a document is important to make a decision regarding an exploitation or a maintenance task, it is precise, and they were used to find it on paper (with different formats from A4 to A0), in a folder, in a specific page that they may have indexed with a sticky note. For the latter ones, a document is related to a machine, so it is broad and contains a lot of information. Some of these "documents" represent many pages, compiled in a folder. So, after the digitalization, users have to first navigate through the tree structure of the system to find the main document and then scroll to find the intended piece (what *they* call the document).

Another issue is that the users would like to benefit from the digitalization not only to access all the archives organized according to an understandable classification scheme, but also to be able to create a path between different classes of documents (different equipment e.g turbines, fans, compressors, …) and different types of documents (functional analysis, loop schematics, electrical schema, construction drawing, …).

These different visions of what is a document and how it should be indexed to support the users' practices has been addressed in the literature, in particular by Bénel and Lejeune (2009). This work embraces previous work stating that the document is "what proves" (Briet, 1962) and what "talks about" (Buckland, 1997); digital technology displays the document in two states: the unintelligible permanent resource and its perceivable materialization, that is intelligible and ephemeral. In this ephemeral representation, digital technology makes it possible to create new types of content, that is to say, interactive and dynamic content (Bachimont, 2017). The document should be seen as a process, constantly evolving so as its smart bookmarks. For Bénel and Lejeune (2009), a general classification (or ontology) does not make sense for the users, and indexing should be defined as the construction of a personalized thesaurus listing production questions or maintenance questions. What should be offered to the users is a richer experience, a subjective classification that can be edited, enriched and connected to other systems to integrate documents in the whole activity (for example to localize a problem, to contextualize, to define a historical point of view on production components and sensors). The idea is to present the hypertextual intersubjective thesaurus through interactive data visualizations, that will allow intelligibility and comparison to capture commonalities and differences. This is what we plan to try out with the users in the production sites.

Conclusion

In conclusion, Industry 4.0 promotes a new start for the digitalization of technical documents. Our preliminary investigation has led us to understand that offering a document management system for users that is useful to utilize their "factory of the future" is divergent from standardizing and automatically scanning and indexing the existing paper-based documents. This leads us to the proposition of a smart subjective and intersubjective thesaurus to attain the documentation objectives of all users, encouraging their coordination, collaboration and cooperation.

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