2nd IFAC Workshop on Advanced Maintenance Engineering,
Services and Technology
Universidad de Sevilla, Sevilla, Spain. November 22-23, 2012

REFERENCE PROCESS FOR PROBLEM MANAGEMENT MATURITY ASSESSMENT IN THE TELECOMMUNICATION SECTOR

Luca Fumagalli*, Stefano Farina*, Marco Macchi*, Mauro Mancini*, Stefano Sala**

**Department of Management, Economics and Industrial Engineering,*

Politecnico di Milano, P.zza L. Da Vinci 32, 20133 Milano, Italy

(e-mail: luca1.fumagalli@polimi.it, stefano1.farina@mail.polimi.it; marco.macchi@polimi.it; mauro.mancini@polimi.it)

*** Technology Division, Fastweb Spa, Via F. Caracciolo 51, 20155 Milano, Italy (email: stefano.sala@fastweb.it)*

Abstract: Previous empirical research suggests that maturity of maintenance processes in the utility sector is generally high. The research presented in this paper considers this information as a starting point to deepen the analysis in maintenance engineering. The paper specifically focuses on the telecommunication sector, providing an analysis of problem management process and maintenance engineering practices therein. The outcome of the research is a method for maturity assessment of the problem management process. The method is based on a reference process comprising different practices. The method has been implemented in a questionnaire to be delivered through surveys in future researches of the Observatory on Technologies and Services for Maintenance of the School of Management of Politecnico di Milano (www.tesem.net).

Keywords: Telecommunication, Problem management, Maturity assessment, Maintenance Engineering.

1. INTRODUCTION

Network utilities are companies providing services through network infrastructures used for distribution. They comprise, as main industries, electricity distribution, gas distribution, water supply and telecommunications (Gomez et al. (2009)). The goal of this type of companies is to provide customers with an agreed service. The service is delivered through the company's assets, consisting of physical items generally distributed over large geographical areas. Henceforth, the utility sector is characterized by a considerable investment, a high relevance of technical and financial issues, and a strong focus on innovation for both service delivery method and technology used (Dezi et al. (2005)) in wide area networks. The sector is affected by its own specificities; some are related to the Italian context, essentially due to legal requirements.

The Italian energy market has undergone structural changes in recent years both in legislative form and, in substance, in operations, changing from a state monopoly to a liberalized market. Also the natural gas market has witnessed a similar process of liberalization, which allowed a shift from previous monopoly to a competitive system where each actor compete freely. On the contrary, the water supply has a high degree of interdependence between the different assets part of the water supply chain: in dystonia with what happens for the energy and gas sectors, companies still provide a unification of the various segments of management, from water collection to water delivery to the customer, until waste water re-collection (Dallocchio et al. (2001), Cerrato (2004), Ronchi (2008), Kostic (2003)). Eventually, the telecommunication market is characterized by an intense competition among the operators: nowadays, they focus primarily on the ability to innovate the service offering. Furthermore, it is increasingly evident the trend of fixed-mobile convergence: many fixed operators are now also acting as Mobile Virtual Network Operators, in order to deliver integrated fixed-mobile services (Cipolletta et al. (2010)).

In this paper a specific focus on the telecommunication sector is considered. The results of a first empirical analysis, carried out by the Observatory on Technologies and Services for Maintenance of the School of Management of Politecnico di Milano (www.tesem.net), justified this choice. In particular, TeSeM Observatory analyzed information from 108 Italian companies and, amongst other results, the annual research of 2011 highlighted that the maturity of maintenance processes in the utility sector is generally high and the utility sector can be considered as best sector (better than manufacturing and process sectors) for the majority of maintenance processes; see Macchi et al. (2010) for more details about the maturity assessment method used in the research. Besides this first evidence, the information about maintenance engineering issues has been analyzed. This analysis highlighted that the 46% of the sample of companies in the utility sector has a maintenance engineering department, while this is equal to 33% in the manufacturing sector and 67% in the process sector. From this information plus other ones not reported in this paper, the process sector seems giving proper importance to maintenance engineering issues, driven by the request of high availability of production plants, generally influent for the operations of this kind of sector. On the contrary, the network utilities, which have also to guarantee high availability of the network infrastructures, seem not to pay such a high attention to maintenance engineering, notwithstanding the maturity level reached by lots of maintenance processes.

This paper aims at providing more insight on this issue. In particular, it addresses maintenance engineering practices in companies operating in the telecommunication sector. In the telecommunication sector, incident management and problem management are the terms adopted to consider processes endowed with some maintenance engineering practices. This paper proposes a specific dissertation on these topics and presents a maturity assessment method in order to analyze the practices within problem management. Section 2 specifically provides an overview of the telecommunication sector, then focuses on incident and problem management. Section 3 resumes main concepts related to maintenance engineering and then specifically addresses problem management. Section 4 provides a reference model that acts as background for the development of maturity assessment of problem management process and maintenance engineering practices therein. The reference model is, in fact, used for building a questionnaire for maturity assessment, briefly presented in section 5. The questionnaire is envisioned for delivering surveys in next annual researches of TeSeM Observatory: to this regard, see section 6 for the concluding remarks of this paper.

2. TELECOMMUNICATION NETWORKS

2.1 Overview on the sector

Telecommunication networks can be modeled as a set of nodes geographically distributed over a wide area, connected by edges representing the connection links. The nodes are the switching centers which select and route the data traffic along the network infrastructure in order to reach the target customer (Todinov (2011)). Traffic congestion, unacceptable availability and poor performance of the network are often due to the lack of attention and application of maintenance activities. As the backbone of business, the network must be kept operating at peak performance all day, 24 hours a day, 7 days a week. To this end, many companies have begun to realize the O&M integration (Operations and Maintenance), considering the alignment of maintenance activities in the mission of operations as a competitive business strategy.

Some factors that have contributed to this change are herein enlisted, as mentioned from literature (see Kamoun (2005)): cost reduction, strategic importance of telecommunication networks, increased costs due to poor service penalties and loss of customers, additional complexity introduced by fast and intricate network technologies, new applications with stringent security requirements, heterogeneous environments made of multivendor networks, steadily increasing trend of network devices and services offered in real time. Indeed, any failure on the network, which results in total or partial loss of service, may have serious implications from an economic and security point of view for the customer, and this may impact on the telecommunication operator through the loss of revenue or of customers or the creation of lawsuits (Colbourn (1998)).

Maintenance management should be based on an appropriate information system because, as this is an important lever in manufacturing / process sector for maintenance management, it is essential for an efficient and effective maintenance in the telecommunication sector as well. Indeed, like other network utilities, the telecommunication networks are geographically distributed and need a system that can combine the personal details of the structure with spatial data: this is made possible through the use of GIS – Geographical Information System (Hamersma (1992)). Moreover, given the high technology in this field, it is easy to monitor the entire structure: it is, in fact, opportune to exploit the powerful functionality of a management system, grounding on such a kind of monitoring architecture (ITU Buenos Aires Action Plan (1994), Life Cycle Engineering, Inc. (2001)), to improve maintenance management in the sector.

2.2 Incident and Problem Management

The Information Technology Infrastructure Library (ITIL) framework is considered for this research for specifying incident and problem management. The third version of the framework is mainly used, even if information on problem management is still sourced from the second version. The framework began its evolution from 1989, when the first publications were delivered by CCTA (Central Computer and Telecommunication Agency of the British government). The framework is based on the most recent experiences and best practices of IT service management.

ITIL defines the incident as: "*an accident and any event that is not part of standard operations of a service and which causes, or may cause, an interruption and a reduction in the quality of that service*" (ITIL, 2007). Incident management begins when an incident happens, and terminates its activities when the service is restored. This means that the real reason that caused the incident is almost never found and so the cause of the incident is not corrected, thus the repetition of a same failure will be still possible. The problem management process, instead, analyzes the infrastructure with the objective to identify the cause of the incidents occurred in the past and that can potentially occur in the future (ITIL, 2007).

More in details, incident management is the process that manages a series of events called incidents which may cause the interruption or reduction in quality of an IT service. The main objective of this process is to restore the system to the normal operation of the service as soon as possible. The mission, which governs this process, is to ensure the highest levels of quality of the service provided (according to Service Level Agreements (SLA) agreed with the customer): incident management has, then, to be engineered in order minimize the impacts of incidents on the business by restoring the normal level of service within the agreed time frame. So, incident management is more focused on the maintenance execution and it is a process devoted to quickly restore and preserve an existing state of the system.

The basic phases of incident management are: activities of acceptance and registration of the event of failure / imminent