ASSET LIFE CYCLE MANAGEMENT

Ph.D. RESEARCH PROJECT - R.J.RUITENBURG

INTRODUCTION
Our daily lives rely heavily on all kinds of physical structures, ranging from houses, cars, roads and bridges to many industrial production facilities and infrastructure like the electricity grid. Many of these assets – at least in the Netherlands – were built in the years after the Second World War, and are currently approaching the end of their functional lives (Tinga, 2013). These ageing assets need more intensive maintenance, and modernization or life extension may be worthwhile. The maintenance of these assets is an important – although often undervalued – field, employing around 300.000 people in the Netherlands and with an annual turn-over of around 18 billion euros (Braaksma, 2012).

ASSET MANAGEMENT
In the wide field of maintenance, Asset Management is an important discipline, and one that is receiving growing attention. It takes a holistic perspective of the maintenance of assets. According to Pudney, Asset Management can be defined as “an organisation’s coordinated multi-disciplinary practice that applies human, equipment and financial resources to physical assets over their whole life cycle to achieve defined asset performance and cost objectives at acceptable levels of risk whilst taking account of the relevant governance, geo-political, economic, social, demographic and technological regimes” (2010, p. 8).
This definition shows that Asset Management should fulfill at least five criteria: it should: 1. be a multi-disciplinary practice; 2. take into account the whole life cycle of a physical asset; 3. be with the goal of achieving certain objectives; 4. be within the limits of risk and relevant regimes; and 5. determine the allocation of resources. In the case of the aging of assets, it is especially true that the proactive use of Asset Management practices may yield great value for the asset owner.
However, both in everyday practice and in scientific literature it is usual that one or more of these criteria are not taken into account, and the combination of all five is particularly rare. This reality may lead to suboptimal choices in the maintenance of assets, and to unnecessary costs or missed opportunities for improvement. Asset Management often just focuses on technical and financial aspects of the asset, and is hence not truly multi-disciplinary (e.g. van Dongen, 2011), it only describes a part of the whole life cycle of the asset (e.g. Campbell et al., 2010; Márquez et al., 2012), a connection with the strategic objectives of the company is often lacking (e.g. Komonen et al., 2012) and barely any attention is paid to the changing circumstances (for example legislative regimes) within which the asset has to function (e.g. Komonen et al., 2012).

ASSET LIFE CYCLE MANAGEMENT
Recently, attempts have been made to describe the whole life cycle of the asset and to put more emphasis on the future demands on the asset and its expected performance (e.g. Schuman & Brent, 2005; Haffejee & Brent, 2008; Raghavan & Chowdhury, 2012). As can be concluded from the previous section, this is an important step towards a truly integral approach on Asset Management. This field can be called Asset Life Cycle Management (ALCM), which “refers to the management of assets over their complete life cycle, from before acquisition to disposal, taking into account economic, environmental, social and technical factors and performances” (Haffejee & Brent, 2008, p. 286). The ALCM plan plays a crucial role (Raghavan & Chowdhury, 2012). It is in these plans that the relation is established between the strategic objectives of the company and the maintenance concepts of the asset, including the allocation of resources for the asset. The objective of an ALCM plan could be defined as ‘the support of operational decisions regarding an asset, taking into account its complete life cycle, to ensure the asset creates maximum value for its owner’ (based upon definitions by Haffejee & Brent (2008) and Raghavan & Chowdhury (2012)).
The literature related to ALCM plans shows that there are two issues that receive ample attention. The first is how to estimate the remaining useful lifetime of an asset, to make optimal use of the asset without suffering from an unacceptable increase in risks of failure (e.g. Rouse & Chiu, 2009; Jongen, 2012). Many attempts have been made to answer this question using statistics. Based on an extensive literature review Si et al. (2011) conclude that many quantitative attempts fail because of the quality and availability of data, which is in line with the conclusions of Braaksma (2012) in his study on a quantitative approach in Reliability Centered Maintenance (RCM). Hence Si et al. (2011) conclude that there is need for a method that is suitable for situations in which limited or no quantitative data are available, for example a method based on the knowledge of experts (p. 11).

The second issue is related to the earlier discussion on Asset Management, namely that in most instances only technical aspects of the aging of an asset are taken into account (van Dongen, 2011). However, as Asset Management is a multi-disciplinary practice, an ALCM plan should also be based upon the knowledge from different disciplines, probably including finances and regulation (Haffejee & Brent, 2008).

OBJECTIVES
Hence the objective is to empirically research the aspects that are relevant for Asset Life Cycle Management and the ALCM practices that are used by practitioners. The insights gained from this research will be used to develop a strategic and multidisciplinary ALCM method that assists a company in its Asset Management decision making, by making optimal use of the knowledge and information available to the company. This method will be developed in collaboration with Liander, the research partner funding this research project (see also the section ‘Research Partners’ below). Hence an additional objective is that the method should be useful and applicable for Liander, while being valid in and generalizable to other contexts as well.

PRELIMINARY RESEARCH OUTLINE
The research will be divided into five separate subprojects:

I. A review of the literature on ALCM, including an evaluation of the available methods and their use in practice. Probably this literature review will be extended with a benchmark study on the aspects of ALCM that are used in practice.

II. A study into the (multidisciplinary) identification of lifetime impacts, as an important information input for the ALCM plans.

III. A case study on ALCM planning processes and the use of ALCM methods in practice.

IV. The development and testing of a method for ALCM planning – based on the case study (design based research and/or action research).

V. A study into the possibilities of connecting individual ALCM plans on a higher strategic level to achieve a plan describing the totality of the assets of a company (e.g. a network or a fleet).

Note that this is a preliminary research outline, during the project changes may be expected.

RESEARCH PARTNERS
This research project is carried out by the University of Twente, in close collaboration with Liander N.V. The latter also funds this research. Liander manages and maintains a large part of the Dutch distribution networks for electricity and gas and is responsible for a safe and reliable transportation of these energy sources. It currently experiences two major challenges: 1. many assets in its networks are approaching the end of their expected useful life; and 2. due to new developments like electrical transport and distributed generation of electricity the network has to fulfil new demands. In order to be able to cope with these challenges, Liander and the University of Twente will collaborate to develop Asset Life Cycle Management practices that contribute both to scientific knowledge and the challenges in practice that Liander faces.
CONTACT DETAILS
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