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ORIGINAL ARTICLE

Managing legacy system costs: A case study of a meta-assessment model to identify solutions in a large financial services company

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Abstract Financial services organisations spend a significant amount of their IT budgets maintaining legacy systems. This paper identifies the characteristics of legacy systems and explores why such systems are so costly to maintain and support. Three models for the assessment and management of legacy system costs are then examined and a new meta-model that addresses differences between the existing models is proposed. The new meta-model is then applied to a large UK financial services company - FinCo. Input data for the new meta-model are provided by the company's senior business and IT executives and the results compared with the firm's actual legacy system management plans. The paper concludes by identifying improvements the company should make to these current legacy system management plans and its longer-term strategy for managing legacy systems.

1. Introduction

The financial services industry is one of the biggest spenders on IT but the majority of this spend is on maintenance activities required to keep legacy systems operational [1]. By some estimates, seventy-five per cent of the IT budgets of banks and insurance companies are consumed maintaining existing systems [2,3]. Consequently, identifying and implementing appropriate solutions to contain the maintenance cost of legacy systems is a significant requirement for many organisations.

Over fifteen years ago Bennet et al. [4] observed that research into legacy system assessment approached the subject as a technical issue rather than as a broader business problem. More recently Alkazemi et al. [5] recognise this technical "bias", noting the need for tools for senior management to be able to make informed decisions about legacy systems, while Plant [6] identifies the difficulty of engaging senior management in such decisions.

Extant literature proposes a number of models for use in assessing legacy systems and recommending approaches for

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how these systems should be managed to minimise their maintenance costs [5,7,8]. However, while the earlier published models include a wide range of assessment criteria they do not include more contemporary architectural considerations such as extensibility and interoperability. Conversely, a recent model by Alkazemi et al. [5] lacks recognition of detail such as lines of code and control flow as proposed by De Lucia et al. [7]. In an attempt to address these anomalies and unify the positive features of the varying approaches, this paper proposes a new meta-model derived from a range of existing models. The utility of the meta-model is then assessed through its application to FinCo - a large UK financial services company. By using a case study we seek to answer the following research questions: is the meta-model effective for analysing the company's core IT system, Customer Service System (CSS), to assess whether it is a legacy system? And, if so, does the meta-model identify appropriate solutions to contain its maintenance costs? Further details of our research methodology, findings and conclusions are discussed below.

2. What is a legacy system?

In 2001, Brooke and Ramage [9] concluded that no standard definition of a legacy system exists. Some of the current suggestions include the following:

- old information systems that remain in operation within an organisation [10, p. 314].
- any business critical software system that significantly resists modification and their failure can have a significant impact on the business [11, p. 36].
- a legacy application or system may be based on outdated technologies, but is critical to day-to-day operations [12].

Many of today's legacy systems were built in a time when computer processing and storage capacity were far more expensive than they are today [15]. Consequently, efficiency frequently took precedence over a system being understood or maintainable, with the inevitable consequences in terms of degradation [13]. System degradation can also be caused by poor documentation and version control amongst other factors, but as De Lucia et al. [7] observe, whatever the cause such deterioration inevitably increases maintenance costs. This largely explains the high proportion of total IT expenditure organisations commit to system maintenance. Furthermore, Alkazemi et al. [5] contend legacy systems do not reflect contemporary architectural advances such as the emphasis on program reuse and construction of component libraries. These more recent approaches facilitate the constant evolution of systems and help prevent systems becoming legacy with their resultant high maintenance costs.

The definition of a legacy system adopted in this paper is a system that is business critical and demonstrates one or more of the following additional characteristics: old age, obsolete languages, poor if any documentation, inadequate data management, a degraded structure, limited support capability and capacity, change to meet business needs, increasing maintenance costs, and lacking the necessary architecture to evolve [14,10,9,17]. It is this definition of a legacy system that is applied to FinCo to determine whether the company's system can be identified as legacy.

3. Legacy system cost management solutions

A number of solutions to minimise the cost of maintaining legacy systems have been proposed. For example, De Lucia et al. [7, p. 642] refer to "ordinary maintenance, reverse engineering, restructuring, reengineering, migration, wrapping, replacement with commercial off-the-shelf software and discarding". These authors acknowledge that there is confusion in the use of some of these terms in the literature, noting reengineering and migration as examples.

Bennet et al. [4] are more concise in proposing, "discard", "wrap", "outsource", "freeze", "carry on" and "reverse engineering" as potential solutions. As it is unlikely that outsourcing would negate the need to implement one of the other solutions proposed, the suggestion that outsourcing offers a solution for managing legacy systems must be questioned. The viability of carry on as a solution for an indefinite period also seems questionable for a business critical system. Additionally, it is highly likely that even a very stable old system will need some form of remediation at some point. For example, if the availability of people with the skills required to support an obsolete language is in decline this will require some form of corrective action.

Where there is consistency in the legacy system literature is in recognising that a decision on the best option to manage such systems should be based on a structured assessment incorporating economic and quality factors. These decisions must be taken and supported by a broad range of stakeholders within the organisation and not limited to technical considerations alone [14,18–20]. Additionally, research by Khadka et al. [11] suggests that the characteristics of an organisation operating and supporting the legacy system must be considered. It is essential that organisational factors such as resistance to change and/or weakness in systems support be reflected in any proposed system solution.

4. A new legacy system assessment model

Ransom et al. [8], De Lucia et al. [7] and Alkazemi et al. [5] each propose models that assess a legacy system based on defined business and technical attributes and then propose solutions to manage the system. Each model emphasises different attributes. De Lucia et al. provide more detail than the others on business value and technical quality. However, Ransom et al. offer important insights into gaps in organisational capability and culture that must be mitigated in an implementation plan. Alkazemi et al., in turn, add a number of contemporary architectural considerations. Each model therefore incorporates valuable features but without being as comprehensive as it could be. To address this issue our approach is to propose a new meta-model derived from the three existing models which combines business and technical factors with contemporary architecture attributes and organisational considerations to produce a more extensive, unified, approach that recognises the real-world complexity of legacy systems (Fig. 1).

The model output can then be plotted on a decisional matrix [14] that indicates a recommended solution (Fig. 2). In the case of FinCo the model's output was compared with the company's actual legacy system management plans to iden-

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